Università degli studi “Roma Tre”
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Scuola Dottorale in Economia e Metodi Quantitativi

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Green financing at international level

Antonio Mele

Supervisor: Prof.ssa Valeria Costantini

Coordinatore: Prof. Luca Salvatici

GENERAL INTRODUCTION TO THE THREE ESSAYS

1) Green financing at international level
2) CDM, ODA and EU ETS compared
3) Public and private investments for environmental protection: The case of livestock

The global-level powerful threats to world nature caused by climate change make that environmental protection -in turn- can be maximized only if global-level policies are applied within the International Community. The financing of "green" projects aimed at reducing the environmental impacts of climate change and fostering emission reduction is an essential part of those global-level policies.

However, very few data and rigorous analysis exist concerning the actual amount of financing flows for environmental projects across the world and across the years and their breakdown in terms of financing typologies and sectors. As a matter of fact, especially before "Kyoto's System", Scholars did not approach this issue correctly, generally "making generalizations based on only a few cases" (Hicks, Parks, Roberts and Tierney, 2008).

Accordingly, this research aims to investigate the actual amount and the characteristics of green financing flows destined to environmental protection in the last decades and to split the financing according to the different typologies. A quantitative comparison among the different institutional systems underlying green financing is also provided, together with significant examples for two very important green sectors (i.e. the renewable energy sector and the livestock sector).

The research is composed of three essays:

1) The first essay addresses the issue of quantifying the Aid Flows (Official Development Assistance framework, ODA) destined for developing and poor countries for the period 1980-2010. The focus of the essay is set on the estimation of actual Aid Flows financed for environmental protection, the definition of their historical trends and volatile fluctuations and the identification of the main actors in terms of Aid Donors and Aid Recipients.

The quantitative analyses undertaken in the essay permit to better define the perimeter of Green Aid, its main international actors in absolute and normalized terms (both for Donors and for Recipients) and to define interesting "development paths" with respect to Agricultural Aid, Energy Aid and Fuel production.

2) The second essay approaches the interaction between ODA, CDM and EU ETS institutional frameworks both qualitatively and quantitatively. It provides an extensive outline of the existing Literature, that scarcely addresses the interaction between these institutional frameworks with holistic perspectives, and describes the innovative Research Design applied.

An econometric regression is performed in order to assess if the introduction of CDM projects brought positive effects in the field of renewable projects for the period 2005-

2012 in terms of energy efficiency (dependent variable), with specific focus on renewable energy projects.

Yet, a Difference in Differences analysis (DD) is presented in order to estimate the impact of the introduction of the second Phase of the EU ETS System (treatment), on CDM renewable projects (treated group) with respect to ODA renewable projects (control group).

3) The third essay provides a significant example of green financing applied to the livestock sector. The essay has the target of mapping the livestock investments and development strategies of the last decade and connecting them to sustainable outcomes. This target derives from the need to have a clear vision of the current status-quo of the livestock sector by means of assessing the main public and private players operating in it, the most important market trends, the geographical localization of investments and the financial flows connected.

For all the three essays, specific policy recommendations have been defined, taking advantage of the analysis of the main findings and commenting similar recommendations provided by the Literature.

ESSAY 1:

Green financing at international level:
Bilateral and Multilateral Aid Flows aimed at Financing Environmental Protection

Contents

Figures

Tables

Acronyms and abbreviations used in the text and within the tables/figures

Items	Acronyms and abbreviations
Clean Development Mechanism	CDM
Donor countries or Donors	DC
Environmental Policy Index	EPI
European Commission	EC
European Union	EU
Green sectors	GS
Greenhouse gas	GHG
International Development Association	IDA
International Financing Institutions	IFI
International Organisations	IIOO
Least developed countries	LDCs
Non-governmental Organizations	NGO
Recipient countries or Recipients	RC
The World Bank	WB
World Bank Country Policy and Institutional Assessment	CPIA
World Bank environment and natural resource management	ENRM
World Bank Independent Evaluation Group	IEG
World Bank International Bank for Reconstruction and Development	IBRD
World Bank International Finance Corporation	IFC
World Bank Multilateral Investment Guarantee Agency	MIGA
Units of measure	
Million	M
Thousand	000
United States Dollars	US $

1. Research questions and objectives

The issue of quantifying the Aid Flows destined for developing and poor countries has always been on the agenda of the International Community; indeed, the exercise of estimating and sizing the total amount of financial Aid Flows that Bilateral and Multilateral Donor countries[1] allocate to Recipient countries[2] is very important (as well as very complex) for correctly defining the importance that the International Community attributes to world equality and development balance.

If estimating the perimeter of Aid Flows is difficult, the estimation of which part of these Flows is allocated in order to enhance a stronger environmental protection is even more difficult. This is mainly due to three reasons: i) the reluctance of Donors to officially publish (and then tracking) their financial commitments and the consequent arduousness to find good data, ii) the difficulties to identify environment-related projects within total Aid Flows, iii) the complicatedness of determining if a single project has an environmental-component embedded.

Yet, the identification of Aid Flows destined for environmental protections is very difficult due to the fact that "environmental Aid is quite diverse in terms of who benefits from the projects, who is funding them, and at what level projects are funded" (Hicks, Parks, Roberts and Tierney, 2008).

For the reasons stated above, Scholars have approached the quantification of Aid Flows destined for environmental protection only in a partial way. Indeed, as stated by Hicks, Parks, Roberts and Tierney (2008), "despite numerous and substantial promises, little research exists on how much environmental money is new, and whether the promises of previous environmental summits have been met [and] the lack of good data is made worse by the habit among some Scholars of making generalizations based on only a few cases".

Accordingly, this paper intends to answer the following research questions (revised from Hicks, Parks, Roberts and Tierney, 2008):

- Question 1: has Aid designed to address environmental issues increased in last three decades?
- Question 2: have the environmental Aid Flows been stable in the last three decades?
- Question 3: in Green-related fields, which countries received the most and which Bilateral and Multilateral Donors gave the most?

The objective of this paper is to close the gaps in understanding Aid allocation to environmental purposes in the last three decades and to evaluate the consistency of Aid Flows destined for environmental protections and their characteristics in terms of Aid consistency, Flows volatility, Aid concentration, geographical distribution and projects' size.

In order not to blunder in the error of evaluating partial data and/or realize generalizations based on few data, this paper uses the project-level-database AidData 2.1[3], which shows the complete list of financial Flows from Donors to Recipients according to the official communications given by Governments and IIOO.

[1] Donor countries are those countries and/or those international organizations that finance Aid projects with their resources. Hereinafter, and according to the Literature, Donor countries will be also referred as "Donors".
[2] Recipient countries are those countries and/or those international organizations that receive financing in form of Aid projects financed by Donors' resources. Hereinafter, and according to the Literature, Recipient countries will be also referred as "Recipients".
[3] For further information about AidData 2.1 Database, please refer to Paragraph 3.i and to Appendix 1.

2. Literature Review

The Literature has addressed the allocation of Aid for environmental purposes from different point of views, mainly focusing on the characteristics of environmental or Green projects[4], the relation between Green Aid Flows and country environmental performances, Aid evaluation and specialisation, Donors' Greenness, Green Aid volatility, the reasons for donating and the forms of interaction among Donors.

In order to present the main the existing Literature in the same order of the quantitative analyses undertaken within Chapter 3 and the policy recommendations shown within Chapter 4, the following split is used for the Review of the Literature:

a) Qualitative themes addressed by the Literature, shortly presenting the main recent Aid-related global themes and the general "architecture" of the International Aid world and its rationales;
b) Quantitative themes investigated by the Literature in terms of Aid distribution/concentration, Aid volatility, Aid specialization and the relation of Aid Flows with other financial Flows and variables.

The qualitative themes of point a) will be further discussed and integrated within Chapter 4 of this paper, while the qualitative themes of point b) will be deeply investigated in Chapter 3.

A) QUALITATIVE THEMES OF THE LITERATURE

i. Reasons for being generous

While for Multilateral Donors (such as IIOO, IFI and other international institutions) the decision to be "Green" may be a natural part of the institutional activity of the organisation, or even its priority (sometimes even stated in the Constitution act, such as the case of GEF), for Bilateral Donors, the decision to finance and implement environmental projects is a political choice.

Concerning Multilateral Donors, the World Bank is by large the biggest financier of Green projects, providing development assistance in the field of environmental protection through its multiple channels and entities (IBRD, IDA, IFC, MIGA, GEF, etc.).

Indeed, according to the World Bank Independent Evaluation Group (2009), the World Bank Group is "the largest Multilateral source of environment-related financing, including administration of Global Environment Facility (GEF) grants, and an important source of advice to many country and private sector clients"; in particular, according to the Evaluation Group, "total World Bank commitments between fiscal 1990 and 2007 were $401.5 billion in 6,792 projects" and 2,401 projects specifically involved the environment and natural resource management (ENRM), including relevant official commitments on the order of $59 billion[5].

Concerning Bilateral Donors, Hicks, Parks, Roberts and Tierney (2008) tested with a multivariate regression model four sets of possible explanations for why countries give Bilateral environmental Aid. The most interesting explanation is described in the Hypothesis N°1, in which the authors tested if the decision of a Donor of financing Green cooperation projects reflects its broader environmental

[4] Hereinafter, the expression "Green projects" will be meaning the cooperation projects aimed at enhancing environmental protection in the Recipient countries.
[5] For further information of the importance of environmental protection within the World Bank, please refer to Appendix 2-v.

preferences, as revealed in domestic environmental policy, in the ratification of international environmental treaties, and in its compliance with these treaties[6].

The Hypotheses of the authors are formally expressed as[7]:

- Hypothesis 1a: The intensity of a Donor country's domestic environmental policy preferences will be positively reflected in the share of its foreign Aid budget dedicated to environmental issues.
- Hypothesis 1b: The intensity of a Donor country's international environmental policy preferences will positively correlate with the share of its foreign Aid budget dedicated to 'Green' issues
- Hypothesis 1c: Donor national ratification of a series of major environmental treaties implies high share of its foreign Aid budget dedicated to 'Green' issues

The authors found a quite surprising "contradictory effect" for the relation between the Environmental Policy Index[8] (EPI) and the intensification of foreign Aid budget dedicated to environmental issues; indeed, contrarily to Hypothesis 1a, EPI coefficients showed a negative and statistically significant inverse relation between the two phenomena and the authors tended to interpret it as a "strong substitution effect"[9].

ii. Secret reasons for being generous

As (sadly) recognized by the Literature, cooperation Aid Flows are not always probe and straightforwardly oriented to development assistance and/or economic growth.

For example, Fuchs and Vadlamannati (2012) provided a detailed explanation of why poor countries provide foreign Aid (in this particular case, the case of India as a Donor is analysed), summing up that it is for geopolitical and trade interests.

Yet, a working paper of the Inter-American Development Bank (2012) examined the hypothesis that foreign Aid is also affected by geo-strategic interests and emphasized that geostrategic and political interests play a large role in determining American Aid allocations across space and over time.

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[6] Other Hypotheses regarded:

- Hypothesis 2a: The more post-materialist the median voter's preferences, the more environmentally friendly the Donor country's foreign Aid budget.
- Hypothesis 2b: Wealthier countries will be more willing to spend Aid money on environmental Aid.
- Hypothesis 3a: The stronger a country's environmental lobby, the larger the proportion of its Aid budget that will target environmental protection (and less to 'dirty' projects).
- Hypothesis 3b/c: The stronger a country's industrial lobby, the smaller the proportion of its Aid budget that will target environmental protection (and more to 'dirty' projects).
- Hypothesis 4a: The more left governing party seats in the Donor country's legislature, the larger the proportion of its Aid budget that will target environmental protection.
- Hypothesis 4b/c: The fewer checks and balances (or veto players) in the Donor country's government, the larger the proportion of its Aid, budget that will target environmental protection.

[7] One of the most important variable used for these Hypotheses is the Environmental Policy Index (EPI) developed by Nielson and Tierney (2003). For the other variable used and their description and source please refer to Appendix 2 - vi.

[8] Please refer to note 7.

[9] According to the authors, this "substitution effect" may be justified by the fact that "more money is spent locally, less is allocated to international problems". This situation may bring to a "zero-sum game, where some total amount is available in national government accounts for environmental protection, and if more is spent domestically, then less can be sent abroad to address issues there".
The authors also built and tested a statistical model to evaluate which Recipient countries get environmental Aid and why. For further details on coefficients obtained and model results please refer to Appendix 2 - vi.

Similarly, Sobis and de Vries (2010), argued, with specific reference to development Aid to CEE countries in transition, that "the development Aid, unlike technical assistance, is often provided based on political-military factors".

iii. Project characteristics and project outcome

The analysis of the Literature on the causal relation between the characteristics of the project and its outcome "suggests that the effectiveness of environmental Aid is endogenous to allocation decisions" (Hicks, Parks, Roberts and Tierney, 2008).

Yet, various authors, by means of studying the iter of WB Green project evaluation and life-cycle management (and project evaluation procedures), discovered some potential predictors of project final performance (i.e. "early warnings indicator"), such as the comparison of actual disbursements with expected or planned disbursement, the amount of project supervision costs or the sizing of project preparation costs on the total costs (Denizer, Kaufmann and Kraay, 2011)[10].

iv. Project outcome and country performances

The relation between the benefits produced by Green projects and the overall national environmental performances of the Recipient has been addressed by the Literature too, which shows different controversial positions. According to Pedersen (2001), "the impacts of Aid on poverty and income distribution in Recipient countries are extremely difficult to assess" while, according to Buntaine and Parks (2013), "despite this groundswell of support for environmental assistance, there is little evidence that environmental projects funded by Donors have substantially improved environmental outcomes in the developing world".

Buntaine and Parks (2013) also found out that "Recipient countries[11] with strong public sector institutions generally receive higher ratings, while projects seeking to achieve global environmental objectives generally receive lower ratings". The authors also investigated how proactive supervision by World Bank staff also contributes to higher ratings.

Yet, the authors underlined the importance of functioning institutions and showed evidence that "Aid is most effective in fostering development when the Recipient country adheres to the rule of law, protects property rights, and limit corruption and other rent-seeking behaviours"[12].

[10] The rate given to project outcome by the Independent Evaluation Group (IEG RATE) has been used by the authors as a proxy of project outcomes. The official description of IEG activity (retrieved from IEG World Bank (2009) is the following: "the Independent Evaluation Group (IEG) is an independent, three-part unit within the World Bank Group. IEG-World Bank is charged with evaluating the activities of the IBRD (The World Bank) and IDA, IEG-IFC focuses on assessment of IFC's work toward private sector development, and IEG-MIGA evaluates the contributions of MIGA guarantee projects and services. IEG reports directly to the Bank's Board of Directors through the Director-General, Evaluation."

[11] The authors used as sample 157 independent evaluations of environmentally focused World Bank projects implemented since 1994.

[12] Among the hypotheses tested by the authors, the most interesting are the hypotheses N. 1 (Hypothesis 1: Projects that are Implemented in Countries with Strong Public Sector Institutions Achieve Higher Outcome Ratings) and N. 2 (Hypothesis 2: Projects that Are Better Supervised Achieve Higher Outcome Ratings). Actually, indeed, the econometric analysis (realized with an Ordered Logit Model with Three-category Dependent Variable) showed that the predictor variables related with hypotheses N. 1 and N.2 (i.e. government effectiveness and quality of supervision) were significantly correlated with satisfying project outcome ratings.
Table 2 of their paper clearly shows that "the government effectiveness index showed a strong and positive relationship with the outcome ratings in the sample (H1)" and that the quality of supervision (H2) positively influences project results.
For additional information, please refer to Appendix 2 - iv.

Denizer, Kaufmann and Kraay (2011) investigated how country-level "macro" measures of the quality of policies and institutions are correlated with project outcomes, confirming the importance of country-level performances for the effective use of Aid resources[13]. They also found a very strong partial correlation between WB's Country Policy and Institutional Assessment (CPIA) ratings and project performance.

Furthermore, Doucouliagos and Paldam (2013) showed that many developing countries rely on development Aid, which is significantly able to increase country's growth performances, forming a "significant part of the institutional environment in which entrepreneurs, innovators and investors operate".

v. Aid quality and evaluation

The necessity of Donor's continuous monitor and control is a theme amply discussed by the Literature, which gives emphasis on the importance of independent evaluations (ex-ante, middle and ex-post evaluations) all long project life. The main need of control by Donors is that, possibly, "Recipients may not spend in the way Donors intended" (Hadjiyiannis, Hatzipanayotou and Michael, 2013).

Concerning the importance of continuous evaluation of projects, Chianca (2008) deeply explored the several international initiatives for harmonizing and upgrading the evaluation of Aids and analysed the different structures (per Donor) created for this purpose[14], discovering that, even "a number of efforts to improve the situation of the high proportion of low-quality evaluations of international Aid interventions have been put in place by different agencies or consortium of agencies, […] NGOs (and other entities) would need more holistic approaches for improving international Aid evaluation", since they suffer of a "limited capacity to learn from the evaluations they (previously) commission(ed) or conduct(ed)".

Yet, Grigoriadis (2013) investigated the Aid effectiveness of EU development Aid to the economies of former Soviet Union under conditions of imperfect monitoring, while the World Bank Independent Evaluation Group, which was commissioned to realized an independent assessment of World Bank *modus operandi* in the field of environmental protection, discovered that World Bank Aid was not satisfying in terms of Greenness, affirming that "the first Bank-wide environment strategy was approved in July 2001, but it mostly reflected the World Bank's agenda and priorities."

Liverani and Lundgren (2007) dealt with Aid evaluation issues too; in the framework of the policies assessed within the OECD Development Assistance Committee (DAC), the authors[15] discussed the main challenges that Aid agencies' evaluation systems are currently facing.

[13] In order correlate project internal structure with project outcomes the authors studied the following variables: "(1) basic project characteristics such as the size and sector of the project, and the amount of resources devoted to the preparation and supervision of the project, (2) potential early-warning indicators of project success retrieved from the World Bank's institutional processes for monitoring and implementing active projects (the Implementation and Status Results (ISR) reports); and (3) information on the identity of the World Bank task manager associated with the project."

[14] The author particularly focuses on the United Nations Evaluation Group (UNEG), the World Bank's impact evaluation initiatives (comprehending the activity of the World Bank Independent Evaluation Group, IEG and The Global Environmental Facility evaluation procedures) and conducts a survey on the perceptions of International Non-Governmental Organizations (INGOs) about the new InterAction Monitoring and Evaluation (M&E) standards. For example, concerning GEF's criteria for a correct evaluation, the author remembers: (i) impartiality, (ii) transparency, (iii) disclosure, (iv) partnership, (v) credibility, (vi) utility.

[15] The authors work as senior officers for the World Bank and the OEDC respectively.

vi. Interactions and coordination among Donors

The importance that Donors communicate with each other is recognized by the Literature as a necessity in order not to duplicate activities in the same Recipient and, above all, for an anti-volatility reasoning.

Unfortunately, according to a recent IMF Report (2006), the issue of Aid incoordination and uncoordinated Donor practices "has not been addressed in a systematic manner by the Donor community"[16], notwithstanding its importance (Knack, Rogers and Eubank, 2010).

Indeed, even the World Bank Independent Evaluation Group (2009) called for the "need for more strategic and coordinated approaches", mainly because of the fact that "most environmental problems are spatial externalities and involve more than one sector, they are often best addressed in a cross-sectoral and location- specific way".

The Literature also recognizes the coordination among Donors as of a paramount importance for Aid-related themes. For instance, Bourguignon and Platteau (2015) quantified the effects of improved Donor coordination on Aid effectiveness, in terms of reduction of transaction costs and Aid effectiveness. Bigsten and Tengstam (2015) also gave significant contribution to this debate.

vii. Policy context and globalization paradoxes

The topics and the considerations presented in the above items contribute to enrich the recent debate of how Aid Flows play in the current policy context and in which way they are part of the globalization paradoxes of this century.

Without entering into Aid theories and their historical evolution (for this topic please refer to Lancaster, 2009; Akhand and Gupta, 2002; etc.), this paper intends to recall the main foundations of foreign Aid theories and to shortly deal with recent Aid-related global themes and recent policy proposals for increasing the sustainability of globalization.

Recent Aid-related global themes

The use of foreign Aid as a development tool has never found unanimous consensus in the Literature, as shown in the following table (Pankaj, 2005), but, on the contrary, it has always been object of enormous discussions and theoretical debates between Pro-Aid and Anti-Aid supporters.

Perspective	Pro-Aid Views	Anti-Aid Views
Micro Perspective: implications for the Donor and Recipient countries	Foreign Aid promotes growth and development of the underdeveloped countries	Growth and development comes through indigenous efforts not through exogenous efforts
Macro Perspective: Implications for international politics	Foreign Aid promotes peace and prosperity and friendship and goodwill between the developed and developing countries	Foreign Aid is a kind of subtle neo-imperialism; sustains un equal relations between the developed and developing countries

Table 1 – Foreign Aid Perspectives (Pankaj, 2005)

[16] IMF (2006): "These coordination problems of development assistance were identified long time ago—see, for example, Griffin and Enos (1970), Tendler (1975), or Cassen and Associates (1986). Donors fail to communicate with each other, move in herds, pumping money into "trendy" sectors or "star" countries, while neglecting others. Brief periods of substantial increases in the volume of Aid, measured by Oversees Development Assistance (ODA), tend to be followed by secular declines".

Indeed, the main goal of the International Community (i.e. helping developing counties to reach development targets) has always been a core-issue of very complex discussions and approaches, also dealing with possible externalities deriving from Aid Flows (Lee M. M. and Izama M. P., 2015)[17]. However, notwithstanding the existing controversial positions retrieved by the Literature, the large majority of Scholars consider Aid Flows to have a positive effect on aggregate economic growth (Arndt, Jones and Tarp, 2015[18]; Askarov and Doucouliagos, 2015 for transition countries; Gibson, Hoffman and Jablonbbebeneski, 2015 for Technical Assistance in Africa's Transitions; Feeny S. and Fry T.R.L., 2014 for Aid and sustainability; etc.).

Applying these debates to environmental issues is even more difficult, since markets do not exist for many environmental assets, making difficult to ascertain their value, and both developed and developing countries generally fail to properly price their environmental assets (Mabey and McNally, 1999).

Yet, recent global debates concerning environmental protection and "international global architecture" deal with complex issues such as the technology transfer to Southern countries, the need of having a global Green growth, sustained by Green policies and best practices and with the Green-reform of IIOO.

Additionally, from an international trade perspective, the "Pollution heaven effect" (also called Environmental dumping or eco-dumping"), has been studied by the Literature, that arrived to different conclusions.

For example, Mabey and McNally (1999) affirmed that "statistical studies show that this effect cannot be clearly identified" and that, on the contrary, "FDI is often glibly characterized as environmentally beneficial and it increases the demand for environmental quality", being FDI cleaner than domestic investment.

Mabey and McNally (1999) showed up that only in some sectors - particularly those that are Energy intensive or require high technology – "there is support for the pollution halos hypothesis. However, for most industries factors such as age, size and community pressure have been more important in raising environmental standards than foreign investor involvement".

Lim, Menaldo and Prakash (2014) even counter posed to the "Pollution heaven effect" the so-called "California effect", consisting in a Green Race-to-the-Top for attracting investors and capital Flows.

Recent policy proposal for increasing the sustainability of globalization

The above-mentioned themes and issues have been approached by the Literature in an "institutional way" , mainly in terms of a reform of IIOO governing commercial and trade international relations and in in terms of restructuring the Multilateral international financial institutions (IFIs).

For example, as stated by Bulow (2002), "as always when financial crises occur, questions arise about whether first world governments should change their role in the restructuring of third world debt, […]

[17] With respect to Anti-Aid Views, the authors of this paper share Lancaster's words (2009): "[even] Foreign Aid does not guarantee development, too many so-called experts on Aid often dismiss it as having had no positive impact on the lives of the poor. This is both false and irresponsible. There are many areas where Aid has had an identifiable, positive impact on lives and has helped populations gain a better quality of life".

[18] The authors particularly focused on the long-run development effects of Foreign Aid on Growth and Development.

creating an international bankruptcy court, or adopting one of the many other proposals for reforming the international financial architecture."

With this respect, the author designed four policy proposals for increasing the sustainability of globalization (adapted from Bulow, 2002):

1. Multilateral loans should largely, and in some cases completely, be replaced by Aid;
2. Jurisdiction over a sovereign's debts should be in its own courts;
3. The IFIs should be kept out of the international bailout business;
4. The Aid should be disbursed through an International Citizenship Fund for Aid grants;
5. Greater account transparency and not "Alice-in-Wornderland accounting".

The theoretical justification of point 2 (Aid instead of loans) is given by the fact that, according to the author, "loans are taken out by heads of state, who are not always acting in the best interests of their population." This items, indeed, is shared by the large majority of the Literature.

Similarly, Mabey and McNally (1999) elaborated the following recommendations for enhancing environmental protection within global transaction:

1. Increased business responsibility is necessary for the transition to sustainability;
2. International economic agreements must not undermine environmental laws;
3. New international regulation is needed to promote sustainable investment Flows.

Yet, Rodrick (2001), who analysed the global governance of trade from a development perspective with particular emphasis on assessing the relationship between trade, growth and poverty, listed other development-friendly measures such as (adapted from Rodrick, 2001):

1. Restrict the use of anti-dumping (AD);
2. Greater mobility of workers;
3. Additional compensation when a dispute settlement panel rules in favour of a developing country complainant, or (when compensation is not forthcoming) require that other countries join in the retaliation.

Ultimately, according to the author, the international Community shall create an international trade regime that puts development first, able to shift from a market access perspective to a development perspective. This change in the approach could help to solve the so-called "Globalization paradoxes" related to the fact that globalization will work [in the same way] for everyone only if all countries abide by the same set of rules, hammered out and enforced by some form of technocratic global government.

The issue of a global government for international public goods (like global health and protecting the environment) is recalled also by Lancaster (2009) as a necessary pre-condition for the rising of Aid, able to counterbalance the stagnant (or even falling) volume of Aid in the recent years.

B) QUANTITATIVE THEMES OF THE LITERATURE

viii. Data and Databases

The necessity to rely on significant and holistic data for the correct evaluation of Aid Flows aimed at enhancing environmental protection and the fact that "the lack of comprehensive data on Aid projects from both Bilateral and Multilateral Donors leaves analyses incomplete" (Hicks, Parks, Timmons

Roberts and Tierney 2008)[19], brought the Scholars to use global project-level databases for their models.

As a matter of fact, the lack of official data and/or the use of incomplete data in Aid-related analyses and studies brought some uncertainty in the significance and the correctness of some empirical results (for instance, please refer to Lof, Jemaneh Mekasha and Tarp, 2015[20] and to Röttgers and Grote, 2014[21]).

Accordingly, and coherently with the latest indications of the Literature dealing with Aid Flows and development projects, the project-level database AidData 2.1 will be investigated, permitting to reduce those data lacks and to possibly avoid generalisations based on incomplete information.

Indeed, as also recognized by Knack, Rogers and Eubank (2010) the use of a complete database, such as it is the database AidData, can be considered as the optimal choice for this purpose, since AidData includes data on Donors, Recipients and projects obtained directly from Donor agencies and which were not considered in previous studies and researches.

ix. Aid Volatility

The issue of Aid instability is one of the most discussed theme of the Literature dealing with the quantitative themes related to cooperation Flows and official development assistance. The importance of this issue mainly relies on the fact that inconstant Aid Flows risk to hamper the development path of Recipients, which cannot rely on constant amount of financing for their development objectives, rather depending on the erratic Aid disbursements of Donors.

Indeed, according to an IMF Report (2006), "the positive impact of foreign Aid is limited by the erratic behaviour of Aid Flows"[22] and Aid disbursements in general suffer of the deficiency of procyclicality, since Aid tends to be disbursed mostly in periods when output or domestic revenue is high and held back when domestic economic activity is contracting (IMF, 2006). Volatility also makes Aid disbursements difficult to predict, particularly in terms of Donor commitments (Bulíř and Hamann, 2003).

The IMF Report (2006), by means of investigating the time series of Aid-to-GDP ratio as a measure of relative Aid volatility[23], also showed that the development Aid "has been much more volatile than domestic revenue (with its volatility increasing recently)" and it has remained "unpredictable, and has not acted as a buffer against GDP shocks."

The issue of external shock dependency of Recipients is an essential part of Aid volatility discussion; concerning this, the Literature recognizes that "Aid-dependent countries are typically prone to large

[19] The authors based their analyses on the PLAID database (Project-Level Aid) which is the old version of AidData database.
[20] The authors replicated the analyses developed within previous papers, finding significant divergent evidences with respect to their original writers. According to the authors this is due to the fact that "the choices researchers make regarding data transformations, econometric models, estimation methods, and assumptions related to endogeneity or exogeneity are the main underlying reasons behind the observed discrepancies"
[21] The authors transformed CDM project data (in case of multiple project partners, which were not generally considered by previous literature dealing with bilateral relations) to bilateral data by splitting the total amount of the partnership.
[22] The authors addressed the issue of Aid volatility by means of measuring three alternative measures of Aid instability for a sample of 76 Recipient countries: relative volatility vis-à-vis fiscal revenue, unpredictability of Aid disbursement relative to commitments, and failure of Aid to smooth fluctuations in aggregate income.
[23] The authors used a natural logarithms transformation, and de-trended the series using the Hodrick-Prescott filter.

external shocks and are less able to cope with them, owing to their pervasive liquidity constraints and the lack of effective countercyclical policy tools" (IMF 2006).

Furthermore, an in-depth analysis of Aid volatility, its causes and measuring and its consequences on developing countries, realized by Hudson (2015), found that Aid volatility is generally highest in the countries which are most Aid-dependent, which are generally the poorest and most vulnerable[24]. Indeed, as assessed by Addison and Tarp (2015), "it is not just the level of Aid and its trend that are important; fluctuations matter too".

In order to tackle the issue of Aid volatility, the World Bank Independent Evaluation Group (2009) stressed on the significant deficiency of the World Bank Group in providing constant Aid assistance along time, recognizing that, "even if the World Bank has made progress in including environmental concerns in its strategies, lending, and nonlending activities, the operational significance and impact of these efforts have varied over time and across themes, countries, and issues".

x. Aid and historical events (including natural catastrophes)

The relation between Aid and significant historical events (including natural catastrophes) is an additional topic of the Literature that shall be listed.

Lancaster (2009), by recalling that "foreign Aid is something relatively new in relations between states" gave precious contribution to a scarce Literature on this topic. Yet, Akyüz (2004) furnished an historical perspective of the rationale for Multilateral financing and Aids.

Concerning natural catastrophes, few studies exist in the current Literature. Among these, the working paper of the Inter-American Development Bank (2012) "Foreign Aid in the Aftermath of Large Natural Disasters" empirically found that damages caused by the disaster are positively related to subsequent Aid inFlows, but that higher incomes and higher incomes per capita, ceteris paribus, are associated with lower post-disaster Aid Flows[25] (please refer to Appendix 2 - viii for additional details of the analysis).

xi. Donor quality and specialization

The importance of providing specialized Aid and the quality of Donors in providing it is a recurring topic of the Literature, which recognizes the necessity for Recipients to be guided by specialized knowledge during project implementation.

Knack, Rogers and Eubank (2010) gave a precious contribution to this topic, defining an "Overall Index" for Donor ranking, based on Sub-Indexes criteria such as selectivity, alignment, harmonization and specialization; regarding Aid specialization, one of the indicator used by Knack, Rogers and Eubank (2010) for the definition of Aid specialization is the average size of projects in AidData (using 2007 data) on commitments (for further information please refer to Appendix 2.i).

Concerning this topic, and quite surprisingly, a recent Report of the World Bank Independent Evaluation Group (2009) expressed, within the Advisory Panel Statement, its dissatisfaction for World Bank specialization in the environmental field, even assessing that "despite many excellent

[24] The study also found that Aid volatility does indeed vary by sector—Aid for debt relief, industrial development, and program assistance is the most volatile, while Aid for health, education, and the social sectors is relatively less volatile.
[25] The working paper used the Emergency Events Database (EM-DAT) maintained by the Center for Research on the Epidemiology of Disasters (CRED) at the Catholic University of Louvain.

achievements around the world, despite major intellectual accomplishments and many policy innovations, and despite state-of-the-art environmental safeguards, the Bank Group continues to give low de facto priority to the goal of enhancing the environmental sustainability of development"[26].

xii. Aid distribution/concentration

The topic of Green Aid distribution and concentration has been amply analysed by the Literature too. For example, Knack, Rogers and Eubank (2010) used the Herfindahl Index as a measure of Aid concentration by sector for each Donor (using commitments data for 2007 from AidData)[27].

Yet, Costantini and Sforna (2013) and Jung (2005) evaluated the distribution of CDM projects in relation to Bilateral commercial relationships, finding out that the distribution of the CDM investment depends on the attractiveness of host countries for CDM (e.g. in terms of existing commercial relationships) and that a noteworthy concentration exists for the distribution of CDM projects (in terms of host countries)[28].

Regarding Aid distribution, Barthel, Neumayer, Nunnenkamp and Selaya (2014) tested the hypothesis that an increase in Aid by other Donors to a specific Recipient with which the Donor under observation competes in terms of exporting to this Recipient increases the Aid from the Donor to the Recipient[29]. The result of their analysis showed that "large and strategically oriented Donors are more likely to give Aid in trade-related sectors to Recipients where other export competing Donors have done so before", implying a strong Trade-Competition rationale beyond Aid distribution.

Moreover, Boyd, Hultman, Timmons Roberts, Corbera, Cole and al (2009) also faced the issues of the concentration of CDM projects and its effective contribution to sustainable development, even proposing a global reform of CDM's architecture[30].

Furthermore, Hicks, Parks, Timmons Roberts and Tierney (2008) found out that Multilateral environmental Aid is an extremely concentrated sector (in terms of Donors) and that 90 per cent of Aid comes from just five major Multilateral agencies, which are: the World Bank, the Asian Development Bank (ASDB), the Inter-American Development Bank (IADB), the European Union (EU), and the Global Environment Facility (the GEF).

xiii. Aid and external debt of developing countries

The Literature regarding the use of international Aid Flows often intersects another very important topic related to developing countries' growth path, i.e. the topic of how to deal with the unsustainable

[26] In order to tackle this situation, the IEG group furnishes a list of recommendation addressed to World Bank project leaders and staff such as : "Increase the attention to environmental sustainability in the World Bank Group by ensuring that environmental issues enter fully into discussions of its strategic directions and Regional and country assistance programs; Move to more cross-sectorial and spatially oriented approaches to environmental support and strengthen staff skills; etc.".

[27] The authors calculated the "geographic concentration of Aid for each Donor's 2007 ODA disbursements after subtracting out debt relief, humanitarian Aid, and administrative costs". This indicator is equal to the sum of the squared shares of the Donor's Aid going to each of its Recipients.

[28] Costantini V. and Sforna G. (2013) also disclosed that the concentration of CDM projects (measured with the Herfindahl concentration index in terms of number of projects for Host countries) substantially increased from 2005 up to 2011.

[29] The formal wording of this hypothesis if the following: "H1. Export-oriented Donors are likely to increase bilateral Aid in response to increases in Aid by other Donors who compete in terms of exports to the same Recipient country so as not to suffer from trade diversion induced by tied and untied Aid." For this hypothesis, the total Aid as well as sector-specific Aid from the OECD's Creditor Reporting System (CRS) was used as dependent variable.

[30] According to the authors, only 2.5% of CDM projects have been established in Africa, showing an incapacity of CDM to realize the "sustainable development benefits envisaged in its creation" in its current form. The authors conceive possible new structures for the CDM (e.g. its move towards a policy sector program and/or its removal from Kyoto structure).

burden of the external debt stocks own by developing countries. However, the Scholars rarely analysed the relation between debt (and debt relief) and Aid Flows.

With this respect, according to Cassimon and Van Campenhout (2007), the question "to what extent, and under which circumstances, debt relief is a more promising instrument than the more traditional modes of Aid delivery (project Aid, program Aid, technical assistance, etc.)" remains unsolved.

Indeed, the authors rather focalized on the effects of Aid relief on other economic parameters (mainly fiscal response effects, variable expressed as % of GDP), considering that "the general principle that debt relief mobilizes resources for other uses, is only valid to the extent that debt would have been serviced".

A recent part of the Literature, however, is connecting Aid and external debt from a more institutional point of view (rather than a mere economic one), dealing with issues such as climate justice (Timmons Roberts and Parks, 2009) and ecological debt (Rice, 2009; Hackmann, Moser and St. Clair, 2014)".

Main specifically, Rice (2009) affirmed that "the ecological debt constitutes a counter-hegemonic discourse advocating a critical reappraisal of the existing social structural patterns of global capital accumulation and the 'path' forward towards socio-economic development among LDCs as dictated by supranational institutions such as the International Monetary Fund (IMF) and the World Bank." Following this discussion, other authors (Hackmann, Moser and St. Clair, 2014), even proposed a debt relief for climate finance swaps, suggesting to use debt-servicing payments to finance environmental projects for adaptation and mitigation.

The rationale of this proposal is that a "climate finance gap is emerging at a time when the overall level of climate finance is decreasing and adaptation and mitigation efforts in developing countries would have several advantages (Hackmann, Moser and St. Clair, 2014)".

Conclusively, the Literature exploring the link between debt and Aid Flows, rather than focusing on economic and econometric causalities and empirical studies, is focusing of holistic approaches and institutional proposals, such as the presented climate justice, ecological debt and debt relief for mitigation and adaptation measures.

xiv. Aid and inward FDI

The Literature dealing with foreign direct investment (FDI) widely recognizes that FDI provide economic benefits to the Recipient countries by providing capital, foreign exchange, technology and by enhancing competition and access to foreign markets (Mottaleb and Kalirajan, 2010).

However, few studies exist (Pazienza, 2011; Lim, Menaldo and Prakash, 2014) on the causal relation between Aid and FDI, and even less studies are available for the link between Green FDI and Green Aid. Indeed, the large majority of essays and papers dealing with FDI determinants and possible explanations generally leave little space for environmental components.

As a matter of facts, notwithstanding the existence of a strong interdependence between Aid Flows and FDI, the causal relation between those Flows is unexplored. Do FDI attract Aid or vice versa? Which is the dependent variable?

For example, Mottaleb and Kalirajan (2010), explored the determinants of FDI, but their model did not include any Aid component as determinant. Yet, according to Rice (2009), "the identification of

foreign direct investment (FDI) and the deleterious influence of transnational corporations also constitute an explicit warrant offered to account for Southern environmental degradation.

Similarly, the results obtained by the empiric research of Antoci, Borghesi, Russu and Ticci (2015), that explored the relation between FDI, environmental externalities and capital segmentation in a rural economy, suggested that "environmental preservation and protection should be considered by policy makers as a complementary measure to the openness to inFlows of external investment".

The study of the effects of FDI on national environmental performances is another very important issue of the Literature. For example, Pazienza (2011), clustered in three main veins of discussion the studies on the FDI-environment relationship, i.e. 1) the environmental effects of FDI Flows; 2) the competition for FDI and its effects on environmental standards; 3) the cross-border environmental performance). The author concluded his analysis by assessing that "the theme related to the environmental effect of FDI is still largely unexplored and calls for further research".

Yet, Lim, Menaldo and Prakash (2014) explored how trade and FDI condition the effect of foreign Aid on environmental protection in Aid-Recipient countries, examining how exports and FDI inFlows from developed countries condition the association between foreign Aid and the environmental protection. The authors, even if presuming that foreign Aid is generally associated with superior environmental protection (if the Recipient country is not too much dependent on globalization Flows from the North[31]), shared the conclusion of Castro and Hammond (2009) admitting that "the debate on how foreign Aid influences a Recipient's environment remains inconclusive".

Finally, and similarly for the relation between Aid and debt, the Literature exploring the link between FDI and Aid Flows, rather than exploring economic and econometric causalities and empirical studies, is focusing of holistic approaches and institutional proposals.

For example, Bulow (2002) points out that "the ultimate goal [of FDI] is not to increase capital Flows but to foster trade and encourage efficient investment". Similarly, Timmons Roberts and Parks (2009) recall the "logical but radical claim that the wealthier nations owe some kind of remuneration (an 'ecological debt') to poorer nations for the environmental damage 'embodied' in their Energy- and material-intensive products", which shall be considered for evaluating FDI Flows.

xv. Aid and CDM projects

According to the Literature, development Aid approaches and practices cannot be considered as static systems because the exigencies of Recipients (and Donors) vary overtime according to the different institutional, economic and political structure built in within the international Community.

The enforcement of Kyoto Protocol and its related Trade Emission Systems are good examples of this, since CDM projects can be considered as a "new form" of cooperation projects in the field of

[31] With this respect, Lim, Menaldo and Prakash (2014) describe the following hypotheses and findings :

- Hypothesis 1: Foreign Aid has a pro-environmental effect when the Recipient country has low-economic dependence on globalization Flows from the North.
- Hypothesis 2: Foreign Aid has a negative effect on the environment when the Recipient country has high-economic dependence on globalization Flows from the North.
- Findings 1: Foreign Aid has a pollution-reducing effect in countries with no globalization Flows originating in the developed world. This is significant with Hypothesis 1.
- Findings 2: Foreign Aid has a pollution-increasing effect when the Recipient country exhibits a greater dependence on globalization Flows from the North.

environmental protection, even if they do not enter in the classic scheme Donor-Recipient but rather on the Buyer-Seller scheme[32].

Concerning the new relation between Green development Aid and the Kyoto Protocol (which also operates in the framework of private agreements), Sutter and Parreño (2007), even courageously assessed that no UNFCCC registered CDM projects (among the 16 projects analyses by the authors) "are likely to fulfil the Kyoto Protocol's twofold objective of simultaneously delivering Greenhouse gas (GHG) emission reduction and contributing to sustainable development" since "competition among non-Annex I parties in attracting CDM investments could create an incentive to set low sustainable development standards in order to attract more projects with low abatement costs."

xvi. Preamble to the analyses and Caveats

The analysis of the Literature realized in this Chapter is meant to understand which are the general issues that international Aid Literature debates on. The following Chapter applies these issues to the environmental – related fields and gives empirical evidences regarding the trend of international Aid Flows aimed at enhancing environmental protection in the last three decades over the world.

The perimeter of the analysis set in this way permits to compare the findings of the existing Literature with the findings of this paper, realized by using the database AidData 2.1.

This paper does not explore the debated issued of project outcomes and/or ratings and does not present any analysis concerning project success rate. Indeed, the analyses of this paper deal with financial Aid Flows, extrapolate which part of these Flows is destined to environmental protection and parcel out the mail Green Sectors financed. The Aid Flows explored cover the period 1980-2010 in order to be comparable with existing Literature[33].

[32] The quantitative analyses of the next Chapter include only those CDM projects which are financed by the World Bank's Carbon Funds, which can be considered as Aid projects *stricto sensu*.

[33] The authors of this paper are not responsible for the inputs and the primary data shown within database AidData 2.1 and cannot be considered liable for erroneous information may exist within this database.

3. Stylized facts and findings

i. Description of the database

AidData database 2.1

This paper relies on the information provided by the database AidData 2.1 and its User's Guide 2.0 (Research Release 17 November 2011)[34]; as recognized by the Literature, the main advantage of using a new project-level database such as AidData is that it incorporates previous databases[35] and it permits a better disaggregation of sectors and activities[36] than previous analyses.

For example, Hicks, Parks, Timmons Roberts and Tierney, basing their analyses on PLAID database[37], disaggregated Aid Flows according the following project categories: Environmental Strictly Defined (ESD), Environmental Broadly Defined (EBD) projects, Green projects, Brown projects, Neutral projects, Dirty Broadly Defined (DBD) projects and Dirty Strictly Defined (DSD) projects, while AidData 2.1 allows a much more detailed disaggregation for Green categories. Additionally, AidData 2.1 contains World Bank's Carbon Fund data (i.e. Donor World Bank Carbon finance Unit), which are very important for the purpose of this analysis.

ii. Population

The entire information provided by the database AidData 2.1 contains a very large number of data, comprising 93 Bilateral and Multilateral Donors, 178 Recipients, 37 Sectors and years ranging from 1947 to 2012, as shown in the following table (the full lists of each items is provided in the Appendix 1).

Items	Description
Full list of Donors	93 Donors
Donors type	Multilateral/Bilateral
Full list of Recipients	178 Recipients
Full list of Sectors	37 Sectors
Full list of Years	From 1947 to 2012

Table 2 – Items provided by AidData 2.1

The entire set of data contained in the database AidData 2.1 permits to extract specific and focused groups and/or samples, which allows to better investigate the research questions stated in the previous Chapter. Unfortunately, the database does not permit to differentiate between grants and loans; accordingly, the generic category of "Aid" is used for both[38].

iii. Sample selection

The need to extrapolate a sample rises from two main reasons: first, the analyses undertaken in this paper regard environment-related sectors and fields, so that the selection of Green Sectors among the others sectors is a fundamental step for this work; second, in order to be manageable and representable, the perimeter of the analysis shall be set on limited number of reliable strings/observations.

[34] The authors of this paper are aware of the fact that a new edition of AidData exists (i.e. AidData 3.0).
[35] For example Knack S., Rogers F. H. and Eubank N. (2010) point out that AidData incorporates the DAC's CRS database used by Easterly and Pfutze in calculating sectorial fragmentation, adding information from other Donor sources.
[36] For a more holistic description of AidData 2.1, please refer to Appendix 1.
[37] Please refer to footnote 19.
[38] This impossibility is one of the main limitation of the database AidData 2.1 and derives from incomplete observations for a certain number of strings. This limitation will be further addressed within the Conclusions of this paper.

As a matter of fact, indeed, some analyses are even more straightforward if applied on a limited context; similarly, some phenomena can be better identified (and isolated) if analysed from Donors' perspective or, alternatively, from Recipients' one.

Years: Time series from 1980 up to 2010

Years selected for the sample range from 1980 to 2010; this range permits to compare the findings obtained with the existing Literature. The commitment amount is always expressed in terms of constant USD2009, i.e. at 2009 constant prices and exchange rates.

Green Sectors

As expressed by Hicks, Parks, Timmons Roberts and Tierney, "there is no generally accepted definition of an environmental project or of the environmental component of an integrated development/environment project", and the identification of Green projects is generally quite difficult within Aid Flows. However, the disaggregation level permitted by AidData 2.1 allows isolating and selecting the following six Green Sectors, which are used for the definition of the sample:

Green Sector (GS)	Purpose Code in AidData 2.1
I.4. Water Supply and Sanitation	14000-14082
II.3. Energy	23000-23082
III.1.a. Agriculture	31100-31191
III.1.b. Forestry	31205-31291
III.1.c. Fishing	31300-31391
IV.1. General Environment Protection	41000-41082

Table 3 – Green Sectors extracted from AidData Database 2.1

According to the authors of this paper, these sectors significantly enclose possible projects linked with the protection of the environment. Indeed, the purpose code is univocally associated with Green activities and components.

Donors

When possible, the analyses undertaken in this paper will consider the Flows from All Donors to All Recipients. However, being these Flows very numerous and not always showing the related sector[39], the authors decided to delimit the analyses to completed Flows only. For example, the Flows from All Donors to All Recipients is available only for the Green Sectors shown in Table 3[40].

For this reason, the authors decided to select a bunch of Selected Donors for which the split for each sector (Green Sectors and Other Sectors) is always available. Accordingly, 15 Bilateral and Multilateral Donors have been selected as Donors for the sample, as shown in the following table and figure:

Selected Donors (SD) - 15	Initials
Asian Development Bank	ASDB
Denmark	Denmark
European Communities	EC
Global Environment Facility	GEF
International Fund for Agricultural Development	IFAD
Ireland	Ireland
Islamic Development Bank	ISDB

[39] This is mainly due to missing data for particular Sector-related columns of the database AidData 2.1. On the contrary, for Green Sectors observations, the authors of this paper populated missing data by means of using the Purpose Code (refer to Table 3) which is available for all observations.

[40] Refer to footnote 39.

Selected Donors (SD) - 15	Initials
Italy	Italy
Netherlands	Netherlands
United Kingdom	UK
World Bank - Carbon Finance Unit	WB - Carbon Fin.
World Bank - International Bank for Reconstruction and Development	WB - IBRD
World Bank - International Development Association	WB - IDA
World Bank - International Finance Corporation	WB - IFC
World Bank - Managed Trust Funds	WB - T. F.

Table 4 – Selected Donors extracted from AidData Database 2.1

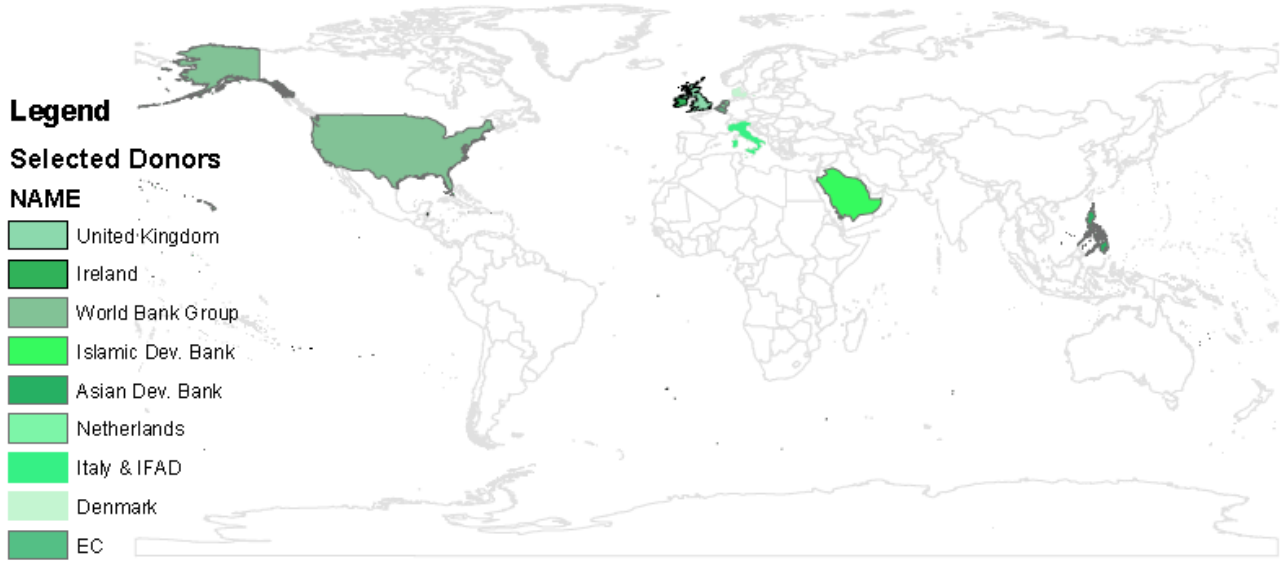


Figure 1 – Selected Donors extracted from AidData Database 2.1
For Multilateral Donors, the country hosting the Headquarter is indicated.

Why these Donors?

Donors countries and IIOO belonging to the sample were selected choosing the Top 10 Donors among the list of Top-performers Donors (in terms of Aid selectivity, specialization, alignment, harmonization and Overall Index) realized in Knack, Rogers and Eubank (2010), which based their analysis on AidData too (please refer to Appendix 2.i[41]). Yet, these Donors represent those countries and IIOO which the Literature recognizes as belonging to the bunch of Top Donors.[42]

Recipients

The selection of Recipients countries is more complex because there is a potential risk to underestimate Aid Flows and not to correctly consider some phenomena. In order not to commit this error, the authors of this paper decided as a general rule to include in the analyses all the Recipients financed by the Donors. However, in particular cases, a selected bunch of Recipients will be chosen in order to deal with particular analysis and elaborations based on the intrinsic characteristics of Recipients.

[41] With respect to Knack, Rogers and Eubank (2010), IMF (8th position) was not selected because it was not considered as Green-oriented Donor; the World Bank (2nd position) was classified according to its agencies; Italy (28th position) and the European Union (23th position) have been added as Donors to the sample by the authors for research reasons.

[42] Other Donors, notwithstanding being very important provider of financial Aids for development purposes, have not been selected for the list of Selected Donors because their activity is generally out from environmental schemes and logics. For example, the IMF, which is a very important provider of financial Aid to developing and poor countries, has not been included in the Selected Donors list because its activities mainly consist in mere financial and economical supports, which do not have any Green component embedded.

iv. General trends of Aid Flows

The general trend of Aid Flows, in the period 1980-2010, shows that the amount of Flows (in terms of US $) destined for environmental projects did not increase in the period, passing from about 20 Billion of US $ in 1980 to about 10 Billion of US $ in 1999 and returning to about 20 Billion of US $ in 2010. Furthermore, the ratio of Green Flows on total Flows has significantly decreased too, from about 45% in 1980 to less than 25% in 2010.

The following figure illustrates these two dynamics, showing, for the period 1980-2010 and for the Flows related to the Selected Donors to All Recipients, the amount of Green financing Aid (Green line), the amount of Aid destined to Other Sectors (brown line) and the percentage of Green Flows on total Aid Flows (Green dotted line, second axis).

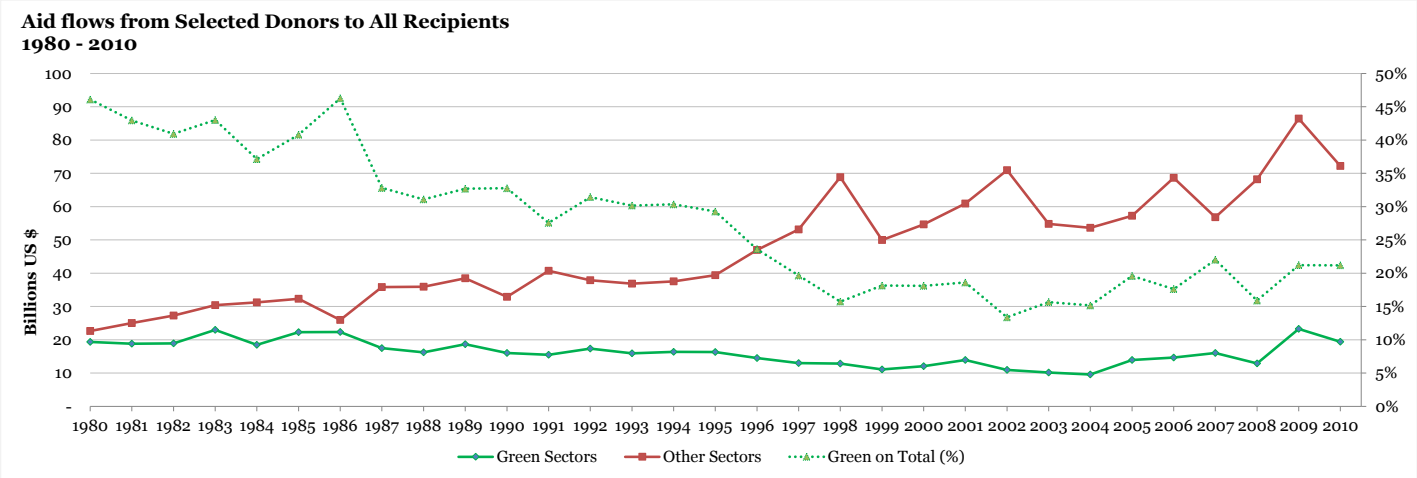


Figure 2 – Aid Flows from Selected Donors to All Recipients, 1980-2010

Trends of Aid Flows

Figure 2 gives interesting evidences to the trends of Aid Flows of the period 1980-2010, showing positive and negatives peaks in particular years. For instance, in terms of percentage of Green Flows on total Aid Flows, 1986 is the year in which the maximum percentage of Aid Flows (i.e. 45% out of total Flows) is destined to environmental purposes; on the contrary, 2002 is the negative peak.

Regarding the consistencies of Flows, 1983, 1985, 1986 and 2009 are the years that record the maximum amounts of Flows for Green Sectors (with more than 20 billion of US $ each) while 2003 and 2004 are the negative peaks (less than 10 billion of US $). Other Sectors Flows record constant growth (even if they are characterized by volatile patterns), up to the about 90 billion of US $ in 2009.

Yet, during the 1990ies, trends related to Green Sectors and to Other Sectors start to be misaligned, and the distance between Flows (in terms of Aid consistencies) progressively increase, especially from 1996 onwards.

To connect Aid trends (and the positive and negative peaks of three lines of Figure 2) with historical events (and even natural catastrophes) in not an easy exercise; yet, the Literature does not provide sufficient scientific methodologies to accomplish that task.

However, it is noteworthy to underline that the first part of the misalignment of the trends related to Green Sectors and to Other Sectors (i.e. approximately 1990-2001) is characterized by the presence of

the first severe global financial and economic crisis[43] that most likely contributed to the increase of Aid Flows destined to Other Sectors, mainly to pure financial ones.

Similarly, the second part of the misalignment (i.e. approximately 2002 onward) is characterized by the presence of some particular historical events that may affect the trends considered. For example, the 2009 seems to be a turning point of the analysis, recording that year the "renaissance" of Green Flows (+81% with respect to the previous year) and the new alignment with the trend of Other Sectors in terms of yearly percentage increases. This "renaissance" also coincides with particular events related to oil price and Energy prices, such as the climax of oil and CER prices (2008) and the beginning of the 2nd phase of EU ETS (2008-2012).

The following table shows the details of Green Aid Flows in the period considered for the Top 20 main Recipients. In the table, details are provided on the Green Aid Flows financed by All Donors and by the Selected Donors (including the percentage of Selected Donors on the total Flows).

Top 20 Recipient M of US $ for Green Sectors	Other Donors A	Selected Donors B (ranking)	All Donors T=A+B	Selected Donors on Total *B/T*
India	29,159.59	67,355.22	96,514.81	70%
China	22,846.80	44,965.68	67,812.48	66%
Indonesia	23,883.64	32,134.23	56,017.87	57%
Brazil	5,294.16	25,273.41	30,567.58	83%
Mexico	3,496.95	19,332.10	22,829.05	85%
Pakistan	10,982.69	18,500.77	29,483.46	63%
Turkey	5,759.84	16,942.17	22,702.02	75%
Philippines	13,954.35	15,599.92	29,554.26	53%
Bangladesh	6,339.48	12,377.10	18,716.58	66%
Egypt	15,687.48	11,902.29	27,589.77	43%
Bilateral, unspecified	11,985.04	10,209.15	22,194.19	46%
Thailand	7,938.69	8,437.46	16,376.15	52%
Argentina	629.17	8,391.00	9,020.18	93%
Morocco	7,278.83	8,258.95	15,537.78	53%
Colombia	1,964.41	7,787.88	9,752.29	80%
Nigeria	691.86	7,752.00	8,443.86	92%
Viet Nam	10,000.28	7,348.88	17,349.15	42%
Tanzania	4,712.75	5,974.99	10,687.74	56%
Ethiopia	2,000.45	5,636.03	7,636.48	74%
Kenya	5,618.93	5,309.21	10,928.13	49%

Table 5 – Top 20 Recipients for Green Flows, 1980-2010

From the above table one can infer that bigger countries (India, China, Indonesia, Brazil, etc.) are the main Recipients of Green Flows (in absolute terms) in the period considered. Additionally, the table underlines how the percentage of Green Aid Flows financed by the Selected Donors is a very significant part of total Green Aid Flow.

On average, the Selected Donors contributed to 59% of the total Green Flows received by All Recipients; moreover, the Top 20 Recipients received 63% of all Green Flows aimed at financing environmental protection all over the world (by All Donors), as shown by the following table.

[43] 1990-91: Russian disintegration, 1991: Indian economic crisis, 1994: Peso crisis; 1997: Asian financial crisis and 1998-2002 Argentina crisis.

Recipient M of US $ for Green Sectors	Other Donors *A*	Selected Donors *B*	All Donors *T=A+B*	Selected Donors on Total *B/T*
All Recipients	342,633.04	501,362.83	843,995.86	59%
Top 20 Recipients for Green Flows (% of All Recipients)	56%	68%	63%	65%

Table 6 – All Recipients, Green Flows, 1980-2010

Amount of Green Aid Flows

As previously described, Figure 2 also underlines that the Selected Donors have been progressively reducing the amount of resources destined to Recipients for environmental protection during the last three decades. Moreover, it seems that these Green Aid Flows have been significantly underestimated by previous Literature, which failed in correctly sizing the financial resources that Donors allocated for the protection of the environment.

These two phenomena (i.e. the negative trend of Green financing and the underestimation of the Flows) were not correctly recognized in the previous Literature which approached the quantification of Greening Aid. For example, Hicks, Parks, Timmons Roberts and Tierney (2008, please refer to Appendix 2. vi – Figure 2.1) showed an incremental trend for the total Flows of environmental Aid (from 1980 up to 1999) which is not confirmed by the data analysed.

Indeed, differently from Hicks, Parks, Timmons Roberts and Tierney (2008, time series stop in 1999), the Aid Flow dedicated to Green projects is not increasing with respect to Aid Flows destined to Other Sectors[44].

Regarding the correct estimation of the amount of the Green Flows, Hicks, Parks, Timmons Roberts and Tierney (2008) significantly underestimated the total Aid Flow destined to environmental protection; for example, as shown in the Appendix 3. vii – Table 3.1, according to the authors, the Top environmental Aid Recipient in the 1980ies was Brazil, with about 2.79 Billion of US $ (2.02 Billion of US $, i.e. 73%, form the World Bank); however, according to calculation realized in this paper, Brazil received about 16.5 Billion of US $ of Green Aid from All Donors in the period 1980-1989. Furthermore, concerning the specific relationship World Bank – Brazil in that period, the World Bank Group financed about 15.4 Billion of US $ (i.e. 93% of the total environmental Aid of Brazil) in that period.

Another example of the underestimation of the environmental Aid Flows concerns China, which, according to Hicks, Parks, Timmons Roberts and Tierney (2008), received in the 1990ies a global amount of 10 Billion of US $ for environmental Aid (Please refer to Appendix 3. vii – Table 3.1). According to calculation of the authors of this paper, instead, China received about 33 Billion of US $ of Green Aid from All Donors in the period 1990-1999. Yet, the specific relationship China-World

[44] Please refer to Appendix vi for further information about the results obtained by the authors. In particular, it seems that authors labeled as "neutral Aid" a significant amount of Aid Flows with rather have environmental-related objectives and/or modules.

Bank in that period was not worthy of 3.7 Billion of US $, as stated by the authors, but at least 17 Billion of US $[45].

Additional example of this erroneous underestimation of Green Flows can be found in the work of Hicks, Parks, Timmons Roberts and Tierney (2008); this underestimation is probably due to the use of incomplete project-level databases (such it was PLAID database, which has been substituted and integrated by database AidData 2.1).

Volatility of Green Aid

Figure 2 also irrevocably shows another aspect of the Aid Flows destined to environmental protection which was already identified by the Literature (IMF Report 2006, IEG 2009[46] and al.): the amount of Aid financing for Green projects has been very volatile in the last three decades, with continuous up and down such as a rollercoaster.

The aspect of Aid volatility, which is common to all cooperation world, negatively affects the final aim of the financial Flows destined to environmental protection since it does not permit to establish a constant annual amount of financial resources to rely upon for the implementation of Green policies.

Greenness Degree of Aid Flows

As already stated, the percentage of Green Flows on total Aid Flows (Figure 2, Green dotted line, second axis) has been significantly reducing in the last three decades, showing a progressive de-escalation of the percentage of Green Flows on total Aid Flows. In order to understand which Donors and Recipients are more Green-oriented, the Greenness Degree per Donor (Figure 3) and per Recipient (Figure 4) have been calculated.

GEF and the WB Carbon Fund are obviously the Donors with higher Greenness Degrees (respectively 93% and 89% of the total Aid allocated to the Selected Donors is represented by Green Flows in the period 1980-2010); IFAD, Denmark, WB IDA, WB IBRD and ASDB follow (with Greenness Degrees in the range 30% - 56%).

The less-Green Donor is Ireland (with a Greenness Degree of only 10% on total Flows) and Irish Aid does not seem so environment-oriented at all (notwithstanding its very good Aid Overall Index, as investigated by Knack, Rogers and Eubank, 2010)[47]. Collectively, 26% of the total Aid Flows going from the Selected Donors to All Recipients is financed for environmental purposes, as shown by the following figure.

[45] This underestimation is even made more evident consulting the World Bank Project Database, which shows very large projects such as the "Grain Distribution and Marketing Project" (490 Million of US $), the "Henan (Qinbei) Thermal Power Project" (440 Million of US $) or other very big projects.

[46] Please refer to Appendix 2. v – Table 3.1 and Figure 3.3 for additional details.

[47] According to the authors, Ireland was in the first position for the Sub-Indexes concerning the Alignment of Aid Flow and its Harmonization; Overall Index ranked Ireland in the 4th position. For further details, please refer to Appendix 2.i – Appendix Table 3.

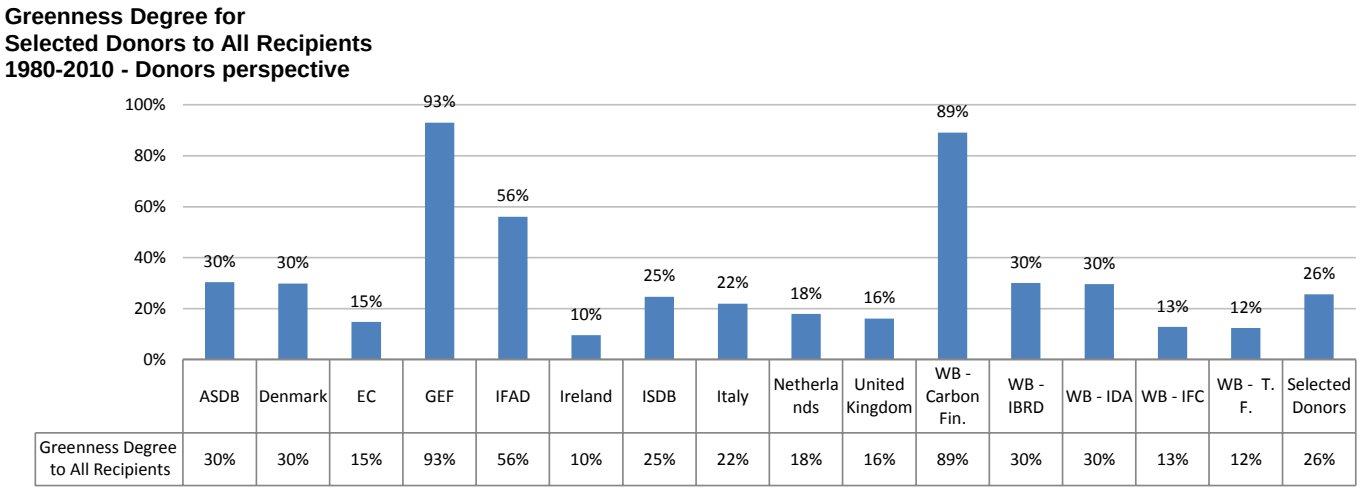


Figure 3 – Green Sectors in percent of Total Aid Flow 1980-2010 – Donors' perspective

Concerning the Greenness Degree of the Selected Recipients, on average, medium and small countries have higher Greenness Degrees with respect to big countries (with some exceptions such as China), as shown in the following table, ranking the Top 20 Green Recipients financed by the Selected Donors in terms of Greenness Degree.

Recipient **M of US $ constant 2009 from Selected Donors**	**Green Sectors** ***A***	**Other Sectors** ***B***	**Greenness Degree** ***A/(A+B) (ranking)***
Niue	7.86	1.13	87%
Mayotte	55.83	9.87	85%
Arab Countries	3.84	0.89	81%
Macao	0.60	0.46	57%
Far East Asia, regional	356.45	340.61	51%
Iran	1,731.52	1,787.75	49%
Malaysia	4,710.58	5,445.11	46%
GLOBAL[48]	2,100.64	2,494.52	46%
Samoa	196.12	241.97	45%
Syria	1,173.11	1,476.81	44%
Belarus	474.34	609.19	44%
Micronesia, Federated States of	37.76	49.17	43%
Botswana	942.03	1,268.72	43%
South Africa	4,893.90	6,684.03	42%
South & Central Asia, regional	258.93	388.30	40%
Palau	9.59	14.82	39%
Belize	307.32	478.35	39%
Egypt	11,902.29	18,582.32	39%
Nauru	6.17	9.74	39%
China	44,965,683,451.06	71,000,473,678.22	39%

Table 7 – Top 20 Green Recipients from Selected Donors

As shown by the above table, China, which ranks number two in terms of Green Aid from Selected Donors (please refer to Table 5), has a Greenness Degree of 39% for Aid Flows financed by the Selected Donors, while smaller countries tend to have higher Greenness Degrees.

[48] It indicates general projects or programs that are implemented at IIOO headquarter level.

This aspect is also shown by the following figure, illustrating the Greenness Degrees of All Recipients financed by Selected Donors (the blue line is the average Greenness Degree for this Flow, which corresponds to 26%, as from Selected Donors perspectives, as show in Figure 3).

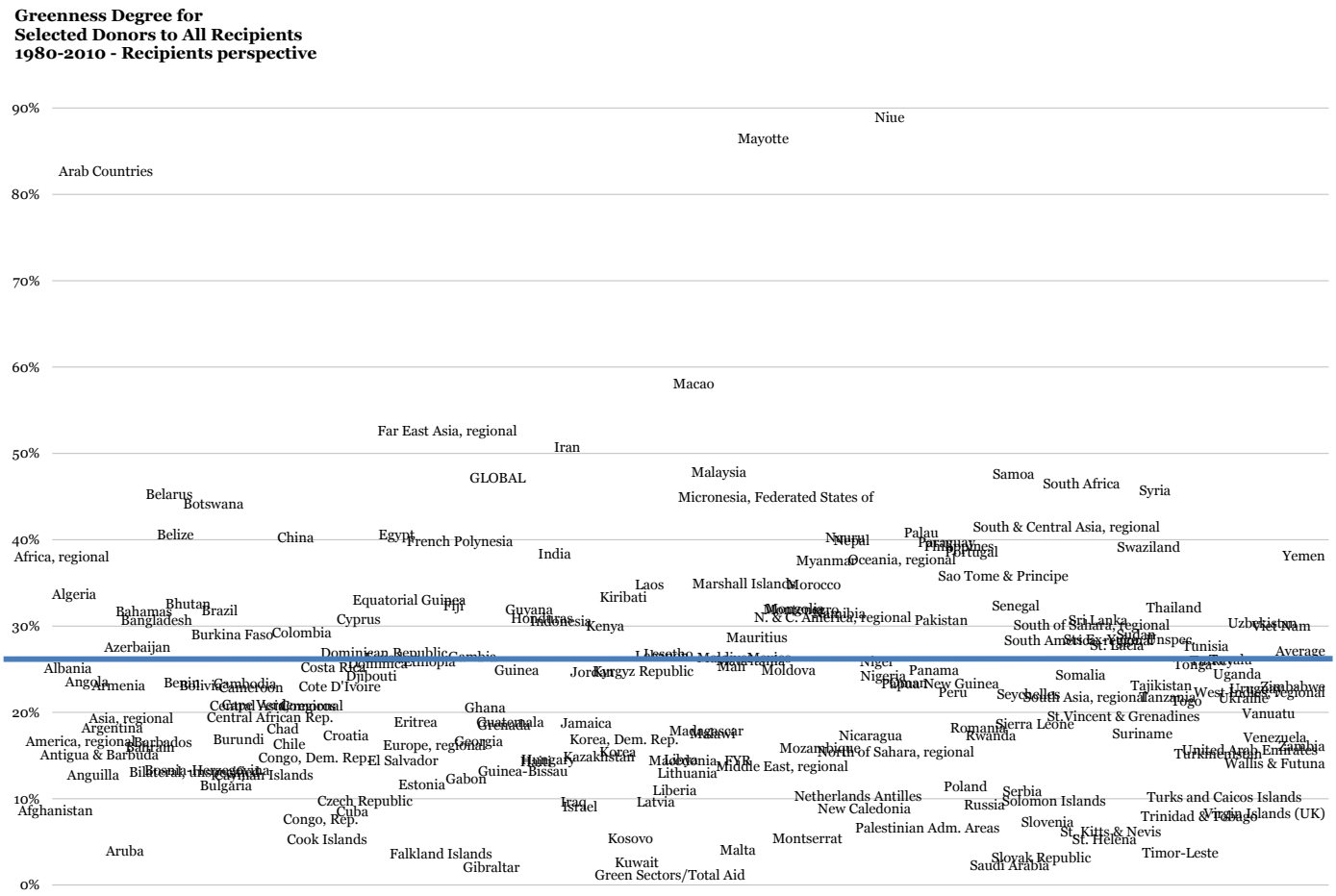


Figure 4 – Green Sectors in percent of Total Aid Flow 1980-2010 – Recipients' perspective
N.B. Blue line is the average Greenness Degree for the Aid Flow from Selected Donors to All Recipients (i.e. 26%)

As shown by the above figure, the large majority of countries has a Greenness Degree between 10% and 40%. It is interesting to note that islands generally have higher Greenness Degrees (as expected) while East-European and Balkan countries (Kosovo, Poland, Serbia, Russia, Slovenia, etc. – placed at the right of the figure) have very low Greenness Degrees (around 10%).

Repartition of Green Aid - Donor perspective

The repartition of Green Aid Flows financed by the Selected Donors sees Energy and Agricultural projects playing a very important role (with 37% and 33% of the Flow in terms of US $ respectively)[49]. Water and general environmental protection follow (with 18% and 8% of the Flow in terms of US $ respectively). Minor importance in terms of financial Flows is given to fishery and forestry projects. As stated, 74% of the commitment of Selected Donors goes to Other Sectors, as shown in the following figure.

[49] As investigated in the next paragraphs of this paper, agricultural Aids, that were predominant during 80ies, were replaced by energy Aids after 1990/1991.

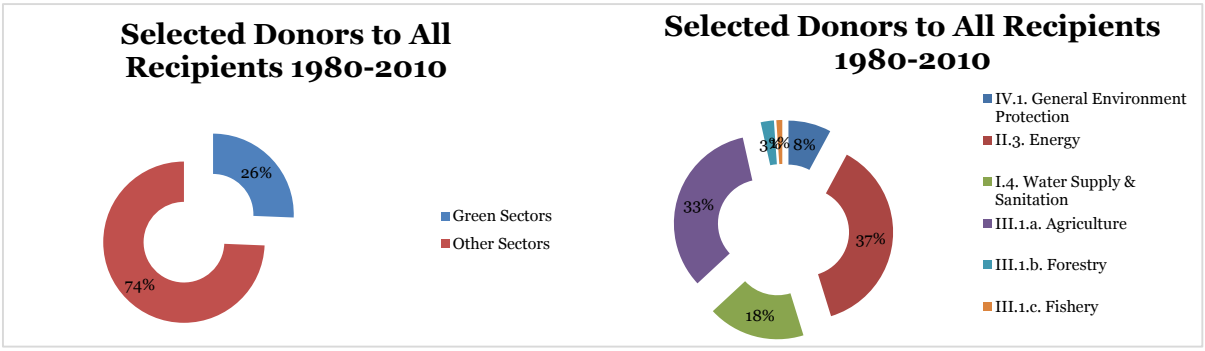


Figure 5 – Composition of Aid Flows from Selected Donors to All Recipients

Within the period considered, about 500 billion of dollars were financed by the Selected Donors for environmental projects while the equivalent financial Flow for Other Sectors is almost three times bigger (amounting to about 1.400 billion of dollars).

Both for Green Sectors and for Other Sectors, the World Bank Group is the most important player with about 220 billion of dollars financed by the WB – IBRD alone for Green Sectors. European Commission and the Asian Development Bank complete a framework where Multilateral Donors guarantee the majority of (Total and Green) Aid to Recipients counties. Among Bilateral Donors selected, the United Kingdom, the Netherlands and Italy tend to be the Greenest financers as shown by the following figure.

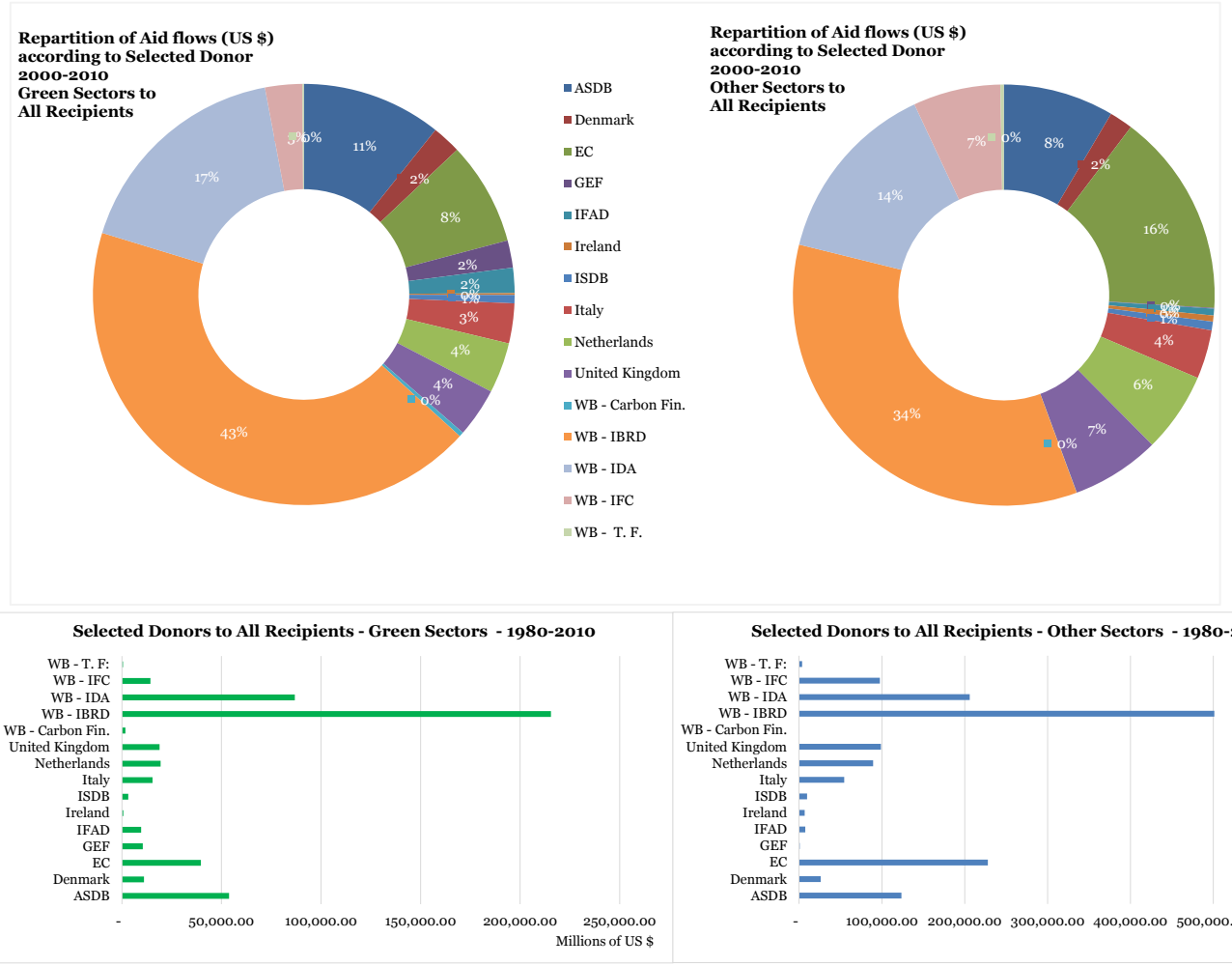
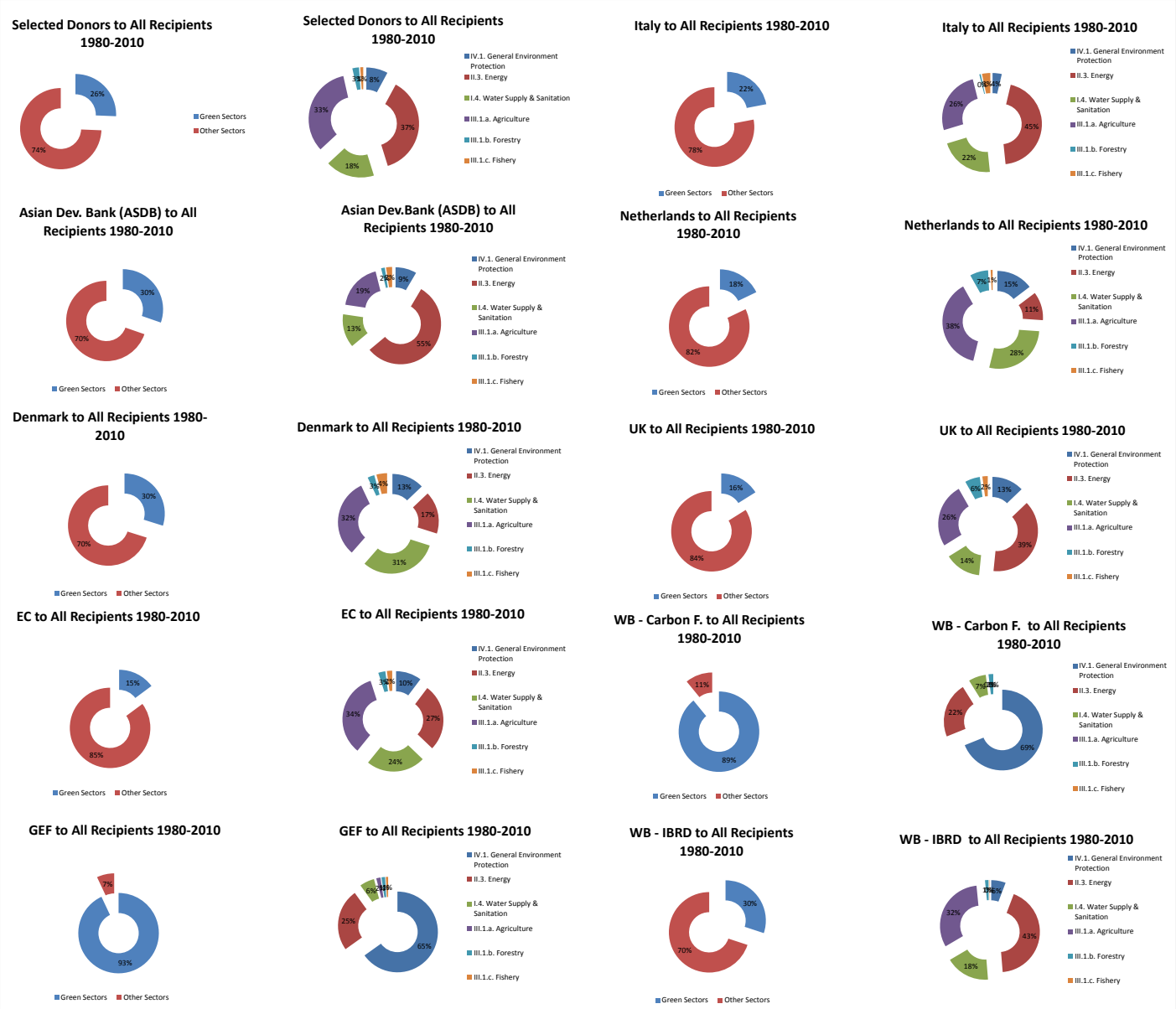


Figure 6 – Repartition of Aid Flows commitments according to Selected Donor, Total of the period 1980-2010

On yearly average basis, she Selected Donors destined about 16.7 billion of US dollars to environmental projects per year. 63% of this Flow is financed by the World Bank Group while Italy, the Netherlands and the United Kingdom collectively contribute for about 1.7 billion of US dollars per year on average. The European Commission and the Asian Development Bank collectively finance projects for about 3 billion of US dollars per year (1.3 by EC and 1.7 by ASDB).

The analysis of the split of Green Flows per Donors (Figure 7, next page) confirms the institutional vocation of some Multilateral Donors. For example, the GEF, which has a Greenness Degree of 93%, allocates 65% of its financing for general environmental protection projects and 25% for Energy projects. IFAD, which Greenness Degree is 56%, uses 97% of its finance for Agricultural projects. Yet, the World Bank Carbon Fund, with a Greenness Degree of 89%, allocates 69% of Flows for general environmental protection projects.

Among major Bilateral Donors, there are similarities concerning the split of Green Sectors, with Energy and Agricultural projects financed for more than half of the Bilateral Flows. The following figure intends to give a snapshot of the repartition of Aid Flows commitments for the Selected Donors.



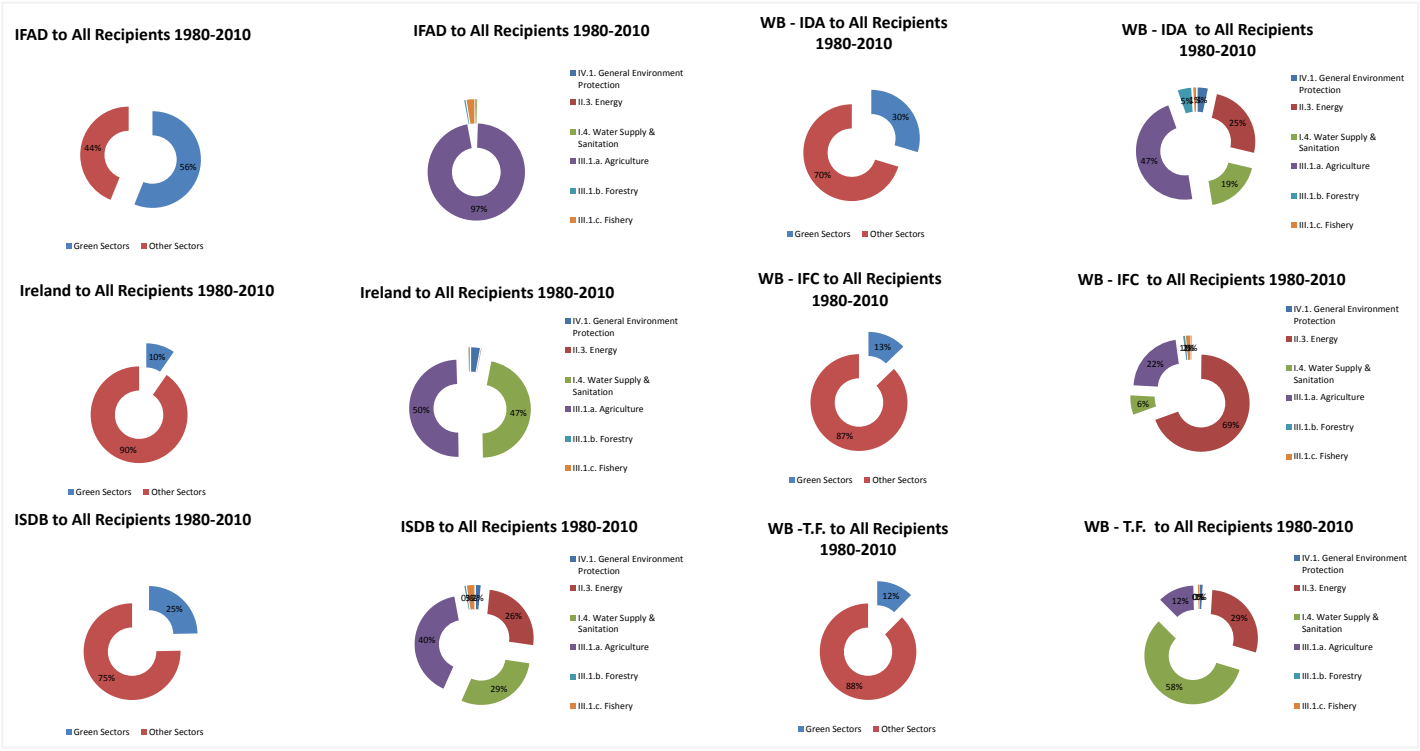


Figure 7 – Repartition of Aid Flows commitments per Selected Donor

v. Average Project size

One of the indicator used by Knack, Rogers and Eubank (2010) for the definition of Aid specialization is the average size of project commitments in AidData (using 2007 data).

Following this approach, the average project size in terms of Donor commitment, for the Aid Flows financed by the Selected Donors and destined to All Recipients has been obtained, in terms of average project size for All Sectors, for Green Sectors, for Other Sectors and for each Green Sectors, as shown in the following table.

Donors	Average project size (M of US $)								
				Split of Green Sectors					
	All Sectors	Other Sectors	Green Sectors	I.4. Water Supply & Sanitation	II.3. Energy	III.1.a. Agriculture	III.1.b. Forestry	III.1.c. Fishing	IV.1. General Environment Protection
ASDB	22.49	25.32	19.65	17.79	48.74	15.11	9.29	12.38	14.61
Denmark	2.50	0.42	4.59	6.21	7.13	4.45	2.92	4.30	2.52
EC	13.38	19.46	7.30	10.19	16.83	6.18	4.57	1.84	4.16
GEF	5.45	5.85	5.06	6.75	7.33	3.62	4.30	4.84	3.48
IFAD	9.82	14.84	4.79	3.81	-	11.44	2.57	6.89	4.05
Ireland	0.16	0.19	0.12	0.25	0.04	0.23	0.03	0.09	0.09
ISDB	5.24	4.75	5.73	7.32	10.59	5.66	2.34	3.96	4.51
Italy	2.17	0.33	4.01	2.82	15.36	1.46	1.22	2.47	0.73
Netherlands	1.39	0.56	2.23	3.02	3.48	2.48	1.93	1.23	1.20
UK	2.48	1.51	3.45	2.64	9.25	3.05	2.09	1.82	1.83
WB - Carbon Fin.	22.06	8.62	35.51	3.73	5.68	-	1.51	-	202.16
WB - IBRD	158.56	184.54	132.57	127.91	257.01	148.88	70.30	53.04	138.29
WB - IDA	58.87	61.38	56.35	70.25	78.23	65.56	55.98	34.39	33.68
WB - IFC	30.77	29.60	31.94	77.12	71.27	15.41	15.08	5.71	7.04
WB -T. F.	7.32	9.82	4.81	8.57	10.92	4.60	-	2.05	2.69
Simple Average	22.84	24.48	21.21	23.23	36.13	19.21	11.61	9.00	28.07

Table 8 – Average project size for Selected Donors Aid to All Recipients, Donors' perspective, 1980-2010
N.B. Categories aggregated with simple averages.

From the analysis of the above table, the first indication that can be undertaken is that the Selected Donors recognized as the biggest ones in the previous paragraph in terms of total commitment tend to finance big projects both for Green Sectors and for Other Sectors. That also reversely means that Recipient countries supported by biggest Donors, that have big projects in All Sectors, have big projects in Green Sectors too (tendency to be big).

Secondly, the table shows that Green Sectors projects tend to be slightly smaller than projects in Other Sectors with an average financing amounting to about 21 million of dollars for Green Sectors and about 24 million of dollars for Other Sectors. However, if each single Green Sector is analysed separately, it is possible to infer that average Energy project size is much bigger than average project size for All Sectors, with 36 million of dollars for Energy project on average. General environmental protection projects and water projects are very important in terms of project size too, recording 28 million of dollars and 23 million of dollars of average project size respectively.

Consequently, there is a big difference in term average project size among Green projects, with Energy, water and general environmental protection projects obtaining much larger average commitment than fishery, forestry and Agricultural projects. More important, this theme has never been investigated by the previous Literature, which generally focused on Green projects as a single block.

vi. Concentration analysis

The distribution of Aid Flows is another very important theme of the Literature as shown by Knack, Rogers and Eubank (2010) and within Costantini and Sforna (2013). Accordingly, the Herfindahl index of the financial Flows allocated by the Selected Donors in the Green Sectors has been elaborated both in terms of commitment amount and in terms of number of projects, as shown in the following table and figure.

Herfindahl index (for Green Sectors)	In terms of commitment (US $)	In terms of N of projects
ASDB	0.13	0.06
Denmark	0.04	0.03
EC	0.03	0.03
GEF	0.04	0.02
IFAD	0.02	0.03
Ireland	0.09	0.08
ISDB	0.04	0.03
Italy	0.03	0.02
Netherlands	0.05	0.04
United Kingdom	0.09	0.07
WB - Carbon Fin.	0.41	0.04
WB - IBRD	0.06	0.03
WB - IDA	0.08	0.03
WB - IFC	0.06	0.02
WB - T. F.	0.21	0.11

Table 9 – Herfindahl Index for Selected Donors to All Recipients, Green Sectors 1980-2010

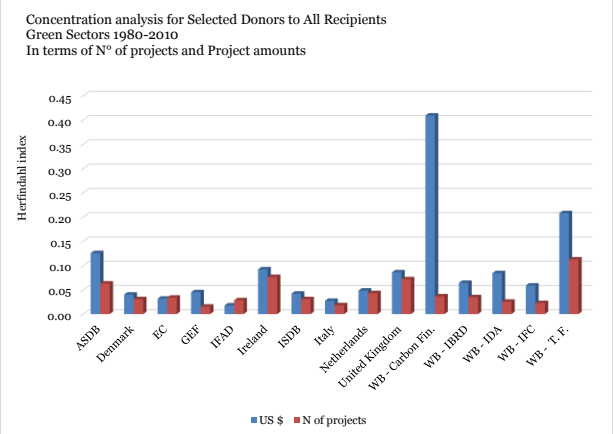


Figure 8 – Herfindahl Index for Selected Donors to All Recipients, Green Sectors 1980-2010

The first finding given of the table and by the figure above is that there is only one Donor (WB – Carbon Fin.) which has a Herfindal index superior than 0.25 (in terms of US dollars) which indicates a high concentration (Costantini and Sforna, 2013). That means that, generally, the Selected Donors have Aid activities quite jeopardized among Recipients and this is in line with the true spirit of international Aid assistance.

The reason why the World Bank carbon finance unit shows such concentration is that the underlying institutional vocation of the Unit is to give specific support to those very poor (selected and concentrated) countries which cannot enter into carbon markets because of their poverty trap; accordingly, the results is well empirically justified and expected by the authors of this paper.

Another very important finding is that, apart from just one exception (IFAD), the concentration index in terms of commitment is bigger than the concentration index in terms of number of projects, which is the general index used by the Literature. This means that in order to investigate the concentration index and the geographical distribution of Aid Flows it would be better to track financial Flows and their distribution rather than counting the number of projects, as done by the Literature (this reasoning is also valid for the WB – Carbon Finance Unit).

On average, and quite surprising, in terms of project commitment, Bilateral Donors seem to be less concentrated than Multilateral ones (Herfidahl Index is 0.06 for Bilaterals and 0.11 for Multilaterals, 0.08 if WB – Carbon Finance Unit is not considered). On the contrary, in terms of number of projects, respective Herfidahl Indexes are very similar (0.05 for Bilaterals and 0.04 for Multilaterals).

This finding may be explained by the fact that Bilateral Donors tend to be linked to a greater number of Recipient countries for diplomatic and business reasons, while the activity of Multilateral Donors may be concentrated only within poor countries and developing ones. However, further investigation is surely needed in this field, which has not been sufficiently studied by the Literature so far.

vii. Aid Flows normalizations

The analysis undertaken in the previous paragraphs were set on absolute terms and amounts, retrieved by database AidData 2.1. However, in order to better understand the dynamic of financial Aid Flows aimed at enhancing environmental protection, it is this important to normalize Flows in a way to reflect the size (and the economic volume) of the Recipient countries and to evaluate countries performances in relative terms[50].

Normalization by GDP

The normalization of Aid Flows in terms of GDP per year is a common tool used by the Literature (IMF, 2006)[51]. However, no Scholar has never investigated the Aid-to-GDP ratio for the Green Sectors, which is very useful in order to understand how much of the national GDP per annum is financed by Green Aid Flows and to normalise those Flows according to country economic volume, as shown in the following figure[52], describing the average Aid-to-GDP ratio for the Green Sectors for each Recipients and the minimum and maximum annual ratios of the period 1980-2010.

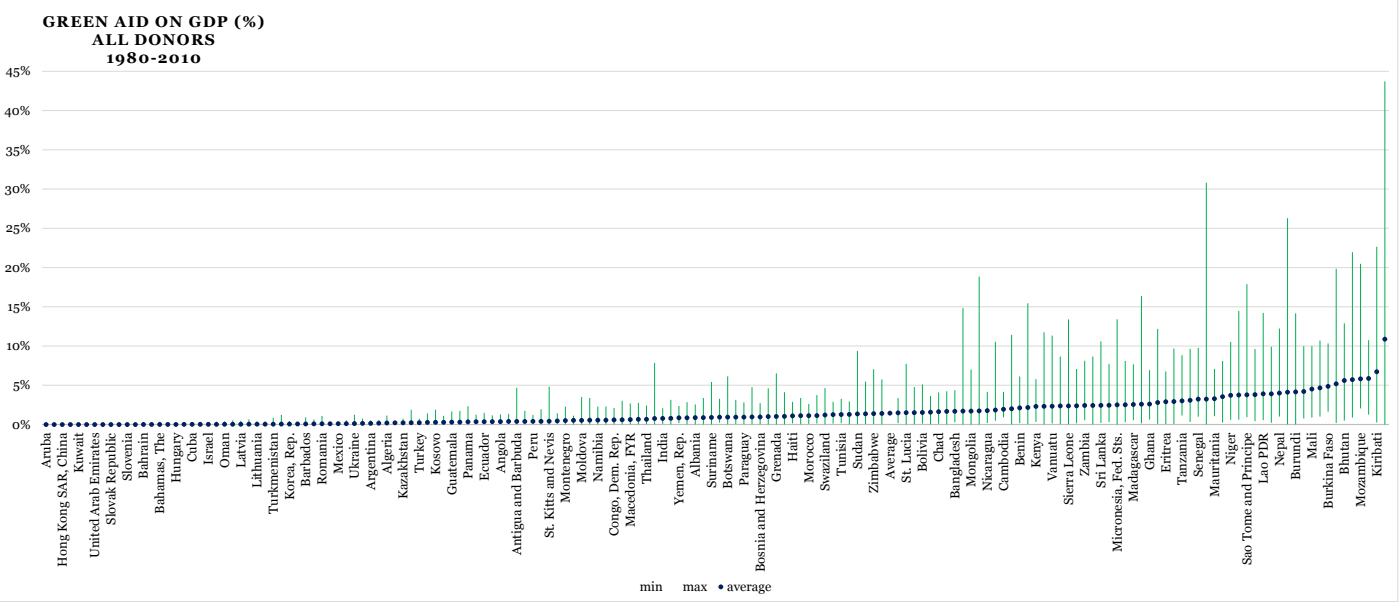


Figure 9 – Aid Flows from All Donors to All Recipients in percent of GDP – Green Sectors only, 1980-2010
N.B. Min, Max and Average of the period.
GDP data from World Development Indicators, World Bank 2015.

On average[53], the Aid-to-GDP ratio for the Green Sectors for All Recipients countries (financed by All Donors) is 1.52% on the period 1980-2010. Minimum and maximum yearly average[54] peaks of the Aid-

[50] Findings and elaboration presented in this paragraphs and in the next ones combines data and information retrieved from AidData 2.1 and from the World Bank Development Indicators 2015.
[51] Please refer to Appendix 2.ii for additional information.
[52] In order to be correct this GDP-based analysis must necessarily deal with the total Flows of Aids received by Recipient countries. Accordingly, the Flows analyzed in this paragraph consider Green projects financed by all Donors and destined to all Recipients.
[53] Averages for all Recipient countries considered together.

to-GDP ratio range from 0.81% of 2003 to 2.54% of 1983 (1983 and 2003 are also two years in which the Green Flows reached a positive and a negative peak respectively also in absolute terms, please refer to paragraph iv of this Chapter).

The analysis of case-by-case Recipients performances shows that, similarly to the considerations concerning the Greenness Degree, small and medium size countries, which generally receive less Aid in absolute terms, have a higher Aid-to-GDP ratio for the Green Sectors with respect to big countries. This is also shown in the following figure which compares the average Aid-to-GDP ratio for the Green Sectors (blue line) and the total Green Aid Flow from All Donors per each Recipient (Green line – second axis).

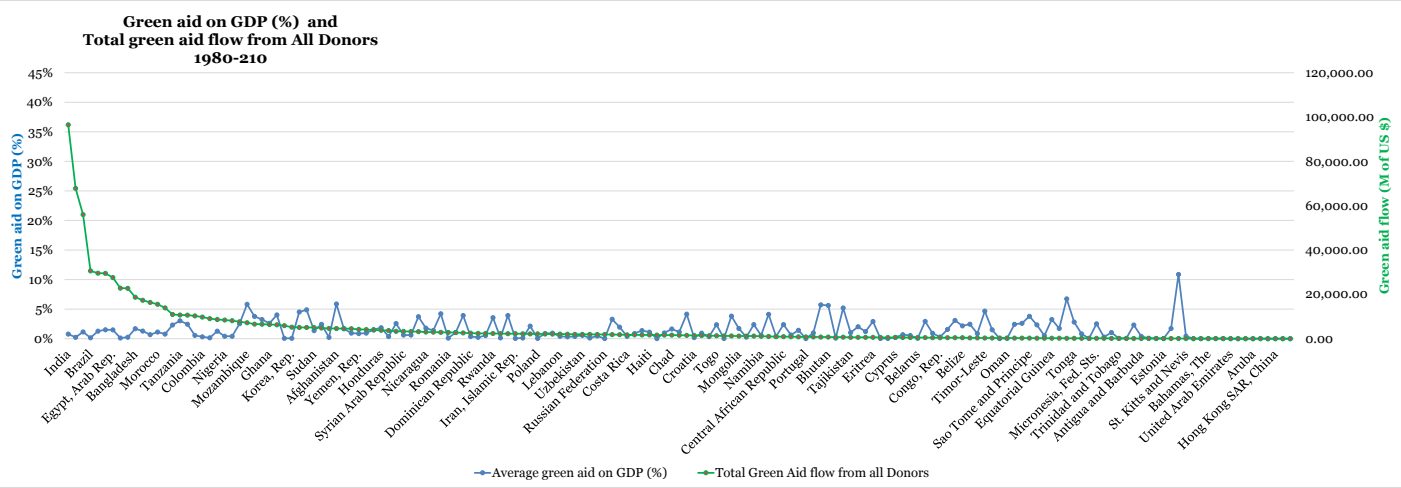


Figure 10 – Aid Flows from All Donors to All Recipients and Green Aid in percent of GDP, 1980-2010
N.B. Min, Max and Average of the period.
GDP data from World Development Indicators, World Bank 2015.

As shown in the previous figure, big countries such as India, Brazil, Egypt, Morocco, Colombia, etc., which received significant amount of Green Aid Flows in terms of absolute commitment, have a very low Aid-to-GDP ratio for the Green Sectors. On the contrary, small and medium size countries, which received much less in terms of absolute commitment show higher Aid-to-GDP ratios for Green Sectors.

Normalization by Aid per capita

The normalization of financial and economic variables with respect to the population of the Recipient country is a common practice of the Literature concerning the analysis of macroeconomic variables and financial transactions and Flows. Similarly, the normalization of Green financial Aid Flows with respect to the population of the Recipient countries is a necessary step to parameterize international Aid Flows with respect to the population of the Recipient countries. Accordingly, Table 10 shows the Aid per capita of the period 1980-2010 for the Top 20 Recipient countries in absolute terms, while Table 11 shows the Top 20 Recipient countries in terms of Aid per capita.

[54] See footnote 53.

Top 20 Green Aid Recipients	Green Aid from All Donors (1980-2010) (M of US $) *AID*	Rank Green AID	GDP constant 2009 (M of US $)	Pop 2009 (M)	Green Aid per capita ($) (1980-2010) *AID/Pop*	Rank Green AID/Pop	GDP per capita 2009 ($) *GDP/Pop*
India	96,515	1	1,226,157	1,190.14	81	132	1,030
China	67,812	2	3,778,795	1,331.26	51	145	2,839
Indonesia	56,018	3	386,732	237.49	236	84	1,628
Brazil	30,568	4	1,108,720	193.49	158	108	5,730
Philippines	29,554	5	132,440	91.89	322	63	1,441
Pakistan	29,483	6	138,568	170.09	173	101	815
Egypt	27,590	7	125,119	76.78	359	57	1,630
Mexico	22,829	8	985,680	116.42	196	98	8,466
Turkey	22,702	9	562,762	71.24	319	64	7,899
Bangladesh	18,717	10	83,301	149.50	125	119	557
Vietnam	17,349	11	79,962	86.03	202	96	930
Thailand	16,376	12	211,837	66.28	247	80	3,196
Morocco	15,538	13	79,214	31.28	497	40	2,533
Iraq	13,879	14	68,409	30.16	460	43	2,268
Kenya	10,928	15	23,996	39.82	274	74	603
Tanzania	10,688	16	20,027	43.64	245	81	459
Sri Lanka	10,627	17	33,466	20.45	520	34	1,636
Malaysia	10,276	18	180,804	27.79	370	53	6,506
Colombia	9,752	19	191,223	45.80	213	91	4,175
Argentina	9,020	20	292,542	40.02	225	88	7,309

Table 10 – Top 20 Green Recipients from All Donors in terms of Aid commitment, 1980-2010
GDP and Population data from World Development Indicators, World Bank 2015.

Top 20 Green Aid/Pop Recipients	Green Aid from All Donors (1980-2010) (M of US $) *AID*	Rank AID	GDP constant 2009 (M of US $)	Pop 2009 (M)	Green Aid per capita ($) (1980-2010) *AID/Pop*	Rank Green AID/Pop	GDP per capita 2009 ($) *GDP/Pop*
Tuvalu	69	148	27	0.01	7,085	1	2,713
Palau	92	142	190	0.02	4,512	2	9,320
Dominica	242	126	476	0.07	3,403	3	6,701
Samoa	416	118	524	0.18	2,253	4	2,838
Seychelles	177	135	1,165	0.09	2,023	5	13,349
Kiribati	186	133	121	0.10	1,932	6	1,256
St. Vincent and the Grenadines	199	132	663	0.11	1,821	7	6,065
Tonga	184	134	283	0.10	1,775	8	2,731
St. Lucia	306	123	1,141	0.18	1,748	9	6,511
Cabo Verde	751	100	1,384	0.49	1,546	10	2,849
Micronesia, Fed. Sts.	158	137	261	0.10	1,523	11	2,513
Marshall Islands	74	147	153	0.05	1,419	12	2,915
Grenada	146	139	726	0.10	1,403	13	6,962
Sao Tome and Principe	239	128	175	0.17	1,380	14	1,008
Belize	415	119	1,331	0.30	1,379	15	4,423
Guyana	1,023	93	957	0.78	1,310	16	1,225
Mauritius	1,558	81	8,171	1.28	1,222	17	6,409
Bhutan	726	101	1,253	0.70	1,031	18	1,779
Antigua and Barbuda	88	143	1,185	0.09	1,025	19	13,729
Maldives	327	121	1,542	0.32	1,022	20	4,825

Table 11 – Top 20 Green Recipients from All Donors in terms of Green Aid per capita, 1980-2010
GDP and Population data from World Development Indicators, World Bank 2015.

As easily expectable, no Recipient country is simultaneously in Table 10 and Table 11. This means that, similarly to the cases of Greenness Degree and Aid-to-GDP ratio for Green projects, big counties, which receive large amounts of Green Flows in absolute terms, are not so "Green" if one considers their Aid per capita index, which, vice versa, is very high for small and medium size countries.

For instance, among the Top 5 Recipients of Green financing from all Donors (India, China, Indonesia, Brazil and Philippines), only the Philippines has an Aid per capita index superior than 300 dollars for the entire period 1980-2010 (i.e. about to 10 dollars p.y. per capita)[55].

On the contrary, small and medium size countries show very high Green Aid per capita indexes, which reflect their capacity to attract Green Flows notwithstanding their reduced populations and economic values.

Finally, this additional comparison between small countries and big countries further shows that the capacity of big countries to manage Green Aid Flows and their general "Green attitude" is less performant than small and medium size countries' ones. Small and medium size countries, indeed, have higher Greenness Degrees, higher Green-Aid-to-GDP-ratio and higher Green Aid per capita, almost producing the counter – spill over effect of attracting Green Aid (in relative terms) inversely proportional to their (economic and population) dimensions.

viii. Development paths

The analyses presented so far permit to underline the historical trends of Green Aid Flows with respect to other Aid Flows in terms of Greenness Degrees, to define Aid-to-GDP ratios, to investigate the Aid per capita and to realize other quantitative analyses on Green Aids for a period of thirty years (1980-2010).

Yet, additional analyses related to the composition of Green Flows (with a particular focus on Energy Flows) and their relation to FDI and other variables are very interesting in terms of development perspectives, since they allow to better link Aid Flows with other macroeconomic phenomena and to identify certain "development paths" followed by some countries, as investigated in the following paragraphs.

Agriculture to Energy path

The composition of Green Aid Flows in the selected period shows interesting trends for Energy and Agriculture Aid Flows, especially if compared with Energy use per capita (in terms of use of kg of oil equivalent per capita), as shown in the following figure.

[55] US 2009 constant $.

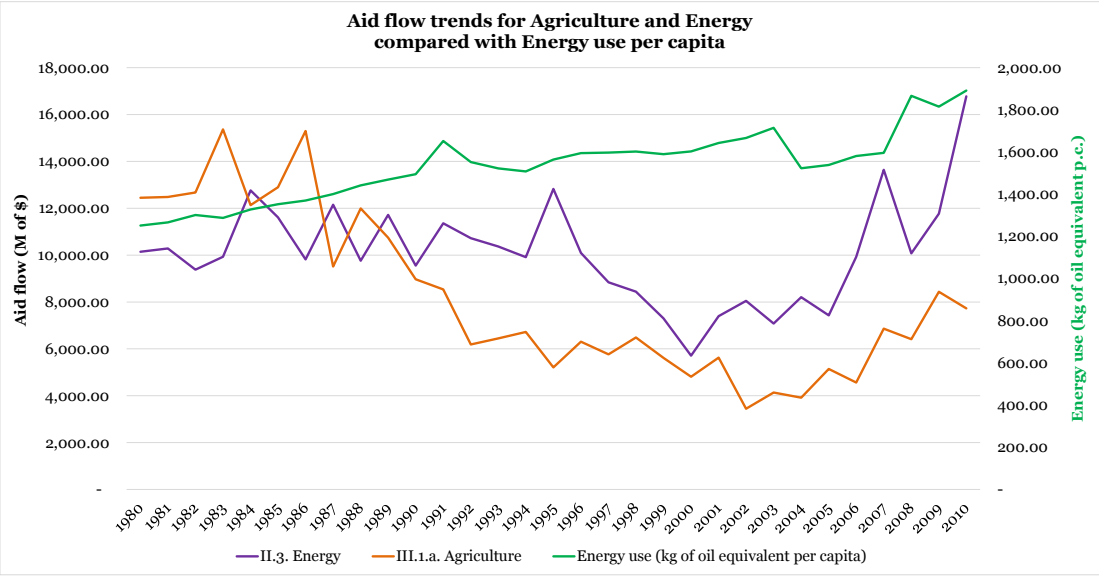


Figure 11 – Aid Flows trends from All Donors to All Recipients for Agriculture and Energy with respect to Energy use per capita
Energy use data from World Development Indicators, World Bank 2015.

As illustrated by the above figure, the first decade of the considered period (i.e. 1980-1989) records the prevalence (in terms of Aid commitment) of Agriculture Aids with respect to Energy Aids. From about 1989/90 on, there is an inversion of trends, with a relative stability for Energy Flows up to 1995/96 (and a subsequent fall up to 2000) and a sharp fall for Agricultural Aids, up to the first part of 2000ies; the Agricultural fall was also almost contemporary to the negative world peak of Agricultural commodities prices in 2006. Both Aid Flows, however, seem to have largely benefited from the Kyoto Protocol and its relative policy measures, recording positive trends from 2005/06 onwards.

On the contrary, the trend of Energy use per capita in the considered period shows a positive trend, with a CAGRG of +1.39% and a net variation of +51% from 1980-2010, which is in line with expectations concerning Energy demand increases for Recipient countries.

Energy-oriented Recipients

In order to investigate which Recipient countries have larger Energy-oriented Flows, the percentage of Energy Aid Flow on Green Aid Flows has been calculated, together with a similar percentage with respect to total Aid Flow as shown in the following table.

Top 20 Recipients for Energy Aid	Green Aid from All Donors (1980-2010) (M of US $)	Total Aid from All Donors (1980-2010) (M of US $)	Energy Aid from All Donors (1980-2010) (M of US $)	Energy Aid on Green Aid (%) *Ranking*	Energy Aid on Total Aid (%)
Cayman Islands	3.39	29.94	3.39	100.00%	11.31%
Hong Kong, China	1.95	53.88	1.95	100.00%	3.62%
Czech Republic	549.11	6,832.88	539.03	98.16%	7.89%
South Africa	5,883.21	12,567.24	4,501.04	76.51%	35.82%
Tokelau	2.65	2.65	2.02	76.16%	76.16%
Libya	33.09	74.55	24.37	73.65%	32.69%
Georgia	1,698.99	5,683.89	1,178.90	69.39%	20.74%
Estonia	77.96	906.90	52.65	67.54%	5.81%
Ukraine	2,304.04	28,032.33	1,525.57	66.21%	5.44%

Top 20 Recipients for Energy Aid	Green Aid from All Donors (1980-2010) (M of US $)	Total Aid from All Donors (1980-2010) (M of US $)	Energy Aid from All Donors (1980-2010) (M of US $)	Energy Aid on Green Aid (%) *Ranking*	Energy Aid on Total Aid (%)
Nauru	59.96	69.70	38.44	64.11%	55.16%
Belarus	517.17	2,361.13	313.99	60.71%	13.30%
Iraq	13,879.32	24,306.14	8,376.05	60.35%	34.46%
Lithuania	172.50	2,004.18	103.97	60.27%	5.19%
Bahrain	19.74	135.90	11.84	60.00%	8.72%
Syria	3,283.55	4,760.36	1,963.21	59.79%	41.24%
Malaysia	10,275.82	15,720.93	5,923.98	57.65%	37.68%
Serbia	2,324.88	15,769.25	1,305.20	56.14%	8.28%
Pakistan	29,483.46	80,035.69	16,067.99	54.50%	20.08%
Singapore	12.43	125.51	6.67	53.68%	5.32%
India	96,514.81	224,767.47	51,728.01	53.60%	23.01%

Table 12 – Top 20 Energy Recipients from All Donors in terms of Energy Aids on Green Aid, 1980-2010.

As shown by the table, very interesting results can be drown: indeed, a part from few exceptions (i.e. inlands and small countries), many medium size countries are in the list of Top 20 Energy-oriented Recipients, such as South Africa, Ukraine, Pakistan, etc. . Among the Top 20 Recipients countries in terms of Green Aid, listed in Table 10, only four countries (i.e. Iraq, Malaysia, Pakistan and India) are present in the above table, meaning that, only a small part of big Recipients in terms of Green Sectors are Energy-oriented Recipients.

Table 12 also shows that some particular medium size countries have strong Energy-oriented attitude even in with respect to Total Aid Flow. For instance, South Africa Total Aid is constituted by 35.82% of Energy Aid; Iraq's Energy Aid is 34.46% of Total Aid, while Syria's and Malaysia's Energy Aid are respectively 41.24% and 37.68% of the Total Aid of the selected period. Considerations regarding the remaining Energy-oriented Recipients, such as Tokelau, Nauru, etc. can be borrowed from the findings related to Table 11.

Fuel vs Green Energy path

A deeper analysis of Energy Aid Flows needs to take into consideration the behaviour of its main "antagonists", among which oil takes the most important place. Accordingly, and from a Recipient perspective, a random bunch of oil producers Recipients countries has been selected ("Oil-producer Group of Recipients", following table) and compared with the Other Recipients in terms of Energy Aid on Green Aid Ratio, as shown in the following figure.

Oil-producer Group of Recipients
Algeria
Argentina
Brazil
Egypt
Indonesia
Malaysia
Mexico
Nigeria
Senegal
South Africa
Sudan

Table 13 – Oil-producer Group of Recipients

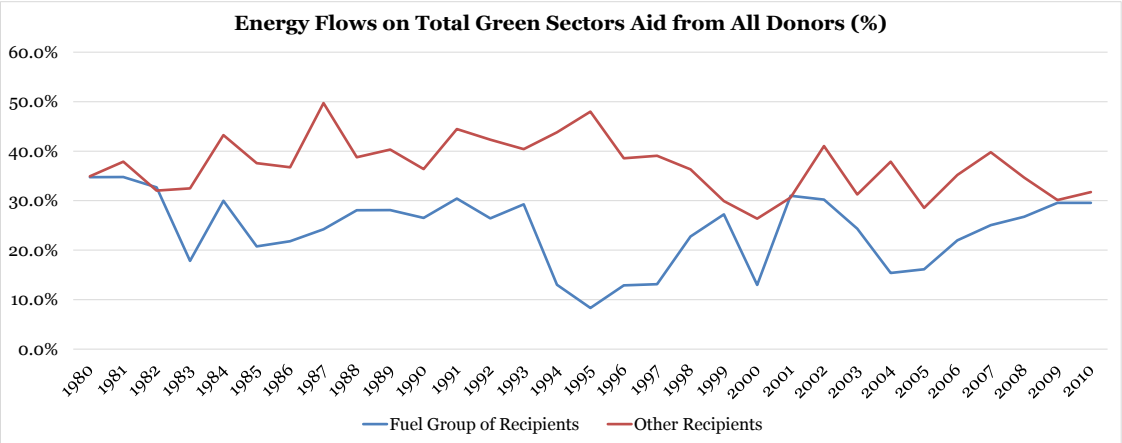


Figure 12 – Energy Aid Flows on Green Aid (%) for Oil-producer Group and Other Recipients, 1980-2010.

As shown in the above figure, within the period 1980-2010, the Energy Aid on Green Aid Ratio is always lower for the Oil-producer Group, testifying that, on average, countries that base their economic growth on oil production tend to be less active in terms of Energy Aid reception.

Yet, coherently with Table 12, Oil-producer countries investigated are not in the list of Top 20 Energy-oriented Recipients, but for Malaysia and South Africa, which experimented very volatile Energy Aid on Green Aid Ratio during the years of the selected period and which economies most likely relies both on oil production and alternative Energy use.

FDI vs Aid path

More broadly, and as amply described by the Literature, the relation between Aid Flows and Inward FDI is recognized to be a positive relation, although the causal relation between those Flows still remains unexplored (especially in terms of Green Aid and inward FDI causalities).

Indeed, Aid Flows appear to be a positive determinant of FDI Inward Flow (and vice versa), and the data investigated confirm this reciprocal positive relations for the considered period, as shown by the following figure, comparing the trend of Inward FDI (in % of GDP) for All Recipients and the Aid Flows allocated by the Selected Donors to Recipients for All Sectors.

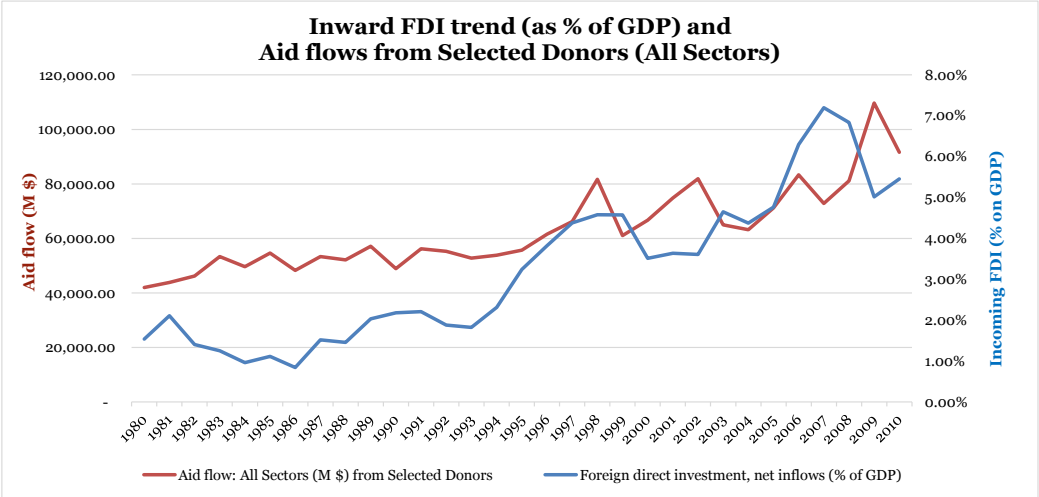


Figure 13 – Inward FDI trend (as % of GDP) and Aid Flows from Selected Donors and for All Sectors to all Recipients, 1980-2010
FDI data from World Development Indicators, World Bank 2015.

4. Policy recommendations and Conclusions

Notwithstanding the fact that a large amount of Literature has approached the issue addressed by this paper, the authors consider that no sufficient reliable quantitative studies and analyses have been elaborated by the Scholars so far, mainly because of the use of unsufficient information and partial databases. Yet, especially regarding Green Aid Flows, the Literature seems to be very scare and vague, principally failing in sizing the correct amount of Aid Flows and in obtaining a reliable repartition of Green Flows among the Green Sectors.

In order to partially reduce this lack in the existing Literatures, the authors of this paper have addressed a set of research questions, which have been investigated and answered by means of quantitative analyses and elaborations based on the data retrieved by AidData database 2.1.

i. Main findings

Answers to the research questions

The analyses undertaken in the previous Chapter permit to answer the research questions stated within Chapter 1 of this paper, as following:

- Question 1: has Aid designed to address environmental issues increased in last three decade?

As shown in Figure 2, the amount of Aid Flows (in terms of US $) destined to environmental projects did not increase in the period 1980-2010, passing from about 20 Billion of US $ in 1980 to about 10 Billion of US $ in 1999 and returning to about 20 Billion of US $ in 2010.

Yet, the percentage of Green Flows on total Aid Flows (i.e. the Greenness Degree of Aid Flows, Figure 2, Green dotted line, second axis) has been significantly reducing in the last three decades, showing a progressive de-escalation of the percentage of Green Flows on total Aid Flows.

Accordingly, on the basis of the elaborations retrieved, the authors of this paper consider that Question 1 has a negative answer, notwithstanding different results obtained by previous Scholars and despite their underestimation of the amount of Green Aid Flows actually allocated for environmental protection in the same period; this two errors (i.e. no increasing trend of Green Aid and underestimation of Flows) are probably due to the use of incomplete project-level databases, that have been substituted and integrated by database AidData 2.1, used for the purposes of this paper.

- Question 2: have the environmental Aid Flows been stable in the last three decades?

Figure 2 also irrevocably shows that the amount of Aid financing for Green projects has been very volatile in the last three decades, with continuous up and down such as a rollercoaster. This appears to be an aspect of the Aid Flows destined to environmental protection which was already identified by the Literature (IMF Report 2006, IEG 2009[56] and al.) and that can be extended to Green Sectors too.

- Question 3: in Green-related fields, which countries received the most and which Bilateral and Multilateral Donors gave the most?

[56] Please refer to Appendix 2. v – Table 3.1 and Figure 3.3 for additional details.

The answer to Question 3 needs to be split into many answers reflecting numerous perspectives. In absolute terms (millions of US $ allocated), and from a Selected Donors'[57] perspective, the World Bank Group is the most important player with about 220 billion of dollars financed by the WB – IBRD alone for the Green Sectors. The European Commission and the Asian Development Bank complete a framework where Multilateral Donors guarantee the majority of (Total and Green) Aid to Recipients counties. Among Bilateral Donors selected, the United Kingdom, the Netherlands and Italy tend to be the Greenest financers as shown by Figure 6 and Figure 7. Always in absolute terms and from a Recipients' perspective, the Top 20 Green Recipients from All Donors in terms of Green Aid commitment for the period 1980-2010 are big countries such as India, China, Indonesia, Brazil, Philippines, etc. (please refer to Table 10 for the full list).

However, the elaborations undertaken in terms of Aid Greenness Degree and Aid normalisation reveal that big Donors are "averagely Green" while big Recipients are "not-so-Green" in relative terms. For instance, from a Selected Donors' perspective, the Greenness Degree (i.e. the percentage of Green Flows on total Aid Flows) of the WB – IBRD (which is 30%) is in line with the average Greenness Degree of the Selected Donors (i.e. 26%, as shown in Figure 3). Symmetrically, from a Recipients' perspective, both Table 7 and Figure 4, investigating the Greenness Degree of Recipients from Selected Donors, underline that, on average, small and medium size countries have higher Greenness Degrees with respect to big countries (with some exceptions such as China, which Greenness Degree is 39% from Selected Donors).

Furthermore, the normalisation of Green Aid Flows shown in Chapter 3.vii, gives evidence of how small and medium size countries also have higher Aid-to-GDP ratio for the Green Sectors with respect to big countries, as shown in Figure 9 and Figure 10. Also in terms of Green Aid per capita ratios, small and medium size countries appear to be "Greener" than big countries. For instance, as shown in Table 10, among the Top 5 Recipients of Green financing (India, China, Indonesia, Brazil and Philippines), only the Philippines has an Aid per capita index superior than 300 dollars for the entire period 1980-2010 (i.e. about to 10 dollars p.y. per capita)[58]. On the contrary, small and medium size countries show very high Green Aid per capita indexes, which reflect their capacity to attract Green Flows notwithstanding their reduced populations and economic sizes.

Synthetically, the combined answers to the three research questions define a picture in which the amount of Aid Flows destined to enhance environmental protection did not experiment any increasing trend in the last three decades, but rather a volatile and erratic one, dominated by large commitments in favour of big Recipient Countries that, however, have less performing Greenness Degrees, lower Aid-to-GDP ratios for the Green Sectors and less important Green Aid per capita ratios than small and medium size countries.

The considerations deriving from the answers to the three research questions, together with the additional quantitative findings listed in the next paragraphs, help defining a set of policy recommendations and suggestions that are explored in the paragraph ii of this Chapter.

[57] Please refer to Chapter 3.iii for further details on the selection of Donors.
[58] US 2009 constant $.

List of additional findings

A part from the findings described in the previous paragraph, which were functional for answering the three basic research questions of this paper, additional analyses have been undertaken in order to better investigate the dynamics of Green Aid Flows of the last three decades.

For instance, the average project size in terms of Donor commitment, for the Aid Flows financed by the Selected Donors and destined to All Recipients, has been obtained, in terms of average project size for All Sectors, for Green Sectors, for Other Sectors and for each Green Sectors, as shown in Table 8. The main results of this analysis are that Donors that have big projects in All Sectors also have big projects in Green Sectors, but Green Sectors projects tend to be slightly smaller than projects in Other Sectors. However, if each single Green Sector is analysed separately, it is possible to infer that average size of Energy projects is much bigger than the average project size for All Sectors, with 36 million of dollars for Energy project on average[59].

Furthermore, an analysis of the Aid concentration was produced within Chapter 3.vi, by means of calculating the Herfindahl index of the financial Flows allocated by the Selected Donors in the Green Sectors both in terms of commitment amount and in terms of number of projects. This analysis underlines how, in terms of project commitment, Bilateral Donors seem to be less concentrated than Multilateral ones. On the contrary, in terms of number of projects, respective Herfidahl Indexes are very similar (0.05 for Bilaterals and 0.04 for Multilaterals)[60]. Another very important evidence is that, apart from just one exception (IFAD), the concentration index in terms of commitment is bigger than the concentration index in terms of number of projects[61], which is the general index used by the Literature. This means that, in order to investigate the concentration index and the geographical distribution of Aid Flows, it would be better to track financial Flows and their distribution rather than counting the number of projects, as done by the Literature.

A deeper study of the trends of Green Sector Aid Flows also allows to better link Aid Flows with other macroeconomic phenomena and to identify certain "development paths" followed by some countries, as investigated in the paragraphs of Chapter 3.viii. For instance, the initial prevalence of the Agricultural Flows with respect to Energy Flows in the first decade of the considered period (i.e. 1980-1989), and the following inversion of trend, with a relative stability for Energy Flows up to 1995/96 and a sharp fall for Agricultural Aids, permit to design an "Agriculture to Energy path", as shows in Figure 11, which is coherent with the trend of Energy use per capita.

Yet, elaborations regarding the Energy-orientation of Recipient countries, illustrated in Table 12, shows that only a small part of big Recipients in terms of Green Sectors are Energy-oriented Recipients, while some particular medium size countries have strong Energy-oriented attitude even in with respect to Total Aid Flow.

In addition, the analysis concerning the trend of Energy Aid for a random Group of Oil-producers Recipients (illustrated in Figure 12), shows that the Energy Aid on Green Aid Ratio is always lower for the Oil-producer Group, testifying that, on average, countries that base their economic growth on oil production tend to be less active in terms of Energy Aid reception.

[59] Please refer to paragraph v of Chapter 3 for further details on these calculations.
[60] Please refer to Table 9 and Figure 8.
[61] As above.

Conclusively, the additional findings illustrated in this paragraph permit to complete the picture drawn in the previous paragraph, that sees small and medium size countries more performant actors in terms of average "Green vocation".

Best practices

A lateral interpretation of the results of certain analyses undertaken in this paper permits to draw additional considerations in terms of the possible existence of Best practices and examples in terms of Green attitude to Aid financing.

From a Donors' perspective, it appears clear that those Donors who have the institutional mission of delivering Green Aid are effectively doing so. Indeed, the analysis of Donors' Greenness Degree, shown in Figure 3, univocally underlines that the GEF, the IFAD and the WB – Carbon F. are by far the Greenest Donors, with respective Greenness Degrees amounting to 93%, 56% and 89%. In addition, the repartition of Green Aid Flows for these Donors (Figure 7) shows that their institutional vocation is fully respected, with the GEF allocating 65% of its budget for General Environmental Protection and 25% for Energy projects, with IFAD using 97% of its Aid for Agricultural projects and with the WB – Carbon F destining 69% of its budget for General Environmental Protection and 23% for Energy projects.

Other Multilateral Donors and Bilateral Donors do not seem to have very high Green attitude in relative terms, even though the commitments allocated by Multilateral Banks (such as the WB and the ASDB) and by the EC are very significant in absolute terms.

From a Recipients' perspective, as stated in the previous paragraphs, small and medium size countries are more performant actors in terms of average "Green vocation", intended in terms of Greenness Degrees, Aid-to-GDP ratios for the Green Sectors and Green Aid per capita ratios. Quite surprising, China is a partial exception to this reasoning, being China in the last position of Top 20 Green Recipients (in terms of Greenness Degree from Selected Donors, Table 7).

Yet, and quite surprising too, the analysis of the Energy-orientation of Recipient countries (Table 12) shows that some particular medium size countries have strong Energy-oriented attitude with respect to Green Flows (and even with respect Total Aid Flow). This phenomenon, which may allow drawing a picture of Recipients' specialization, also indicates that, in the global context of Aid Flows, some medium size countries are strongly specializing for attracting Energy Aid Flows.

Conclusively, the analyses of Green Aid Flows of the last three decades permit to state that those IIOO institutionally committed to environmental protection are fully respecting their institutional vocation and may be a Best practice to follow. For Recipients countries, the analyses show that big countries, which received large amount of Green Aid Flows in absolute terms, failed in reaching significant Green ratios and have been overcome by small and medium size countries in relative terms. Additionally, medium size countries are generally getting specialized in receiving a particular kind of Green Aid, such as the Energy field.

ii. Policy recommendations

The analysis of Best practices shown in the previous paragraphs directly inspires the definition of a set of possible policy recommendations and suggestions based on the existing virtuous examples in the global context of Green Aid Flows.

Indeed, and according to the Literature, the definition of better Aid practices and better Institution functioning could help to enhance that "Green Growth, that constitutes one of the most serious challenges affecting people's well-being around the globe" (IEG World Bank, 2009).

Better Aid

The results of the analyses shown in this paper underline how small and medium size countries play a very important role (in relative terms) in the enhancement of Green Aid projects, appearing more Green-oriented than bigger Recipient countries. An extensive interpretation of this finding may lead to believe that, in relative terms, small and medium size Green Aid Flows work better than giant ones and that small and medium size country are more "mature" and apt to receive Green Aid Flows than big Recipient countries.

Yet, and according to the Literature presented, the importance of Aid quality and the necessity of Donor's continuous monitor and control shall be enhanced even within the Green Aid Flows. In addition, the so-called "Grant versus Loans debate" shall be much more discussed and studied. Indeed, as underlined in Knack, Rogers and Eubank (2010), the "grants category" is an additional indicator of Aid quality, as already explored in Mosley (1985), in White and Woestman (1994), and Bulow and Rogoff (2005).

In agreement with these authors, the authors of this paper consider that development banks should give Aid in the form of grants instead of loans, in order to increase the effectivity of Aid, to inspire transparency (and good project quality) and to permit to avoid non-repayment issues and the related consequences.

For these reasons, the authors of this paper share the global visions of Bulow (2002), Mabey and McNally (1999) and Rodrick (2001) regarding the replacement of Multilateral loan by Grants, the assignment of Recipient's jurisdiction over its sovereign's debts, the prohibition of IFIs to enter into sovereign bailout business and the other policy proposals presented in Chapter 2.vii of this paper. These approaches, based on greater transparency on accounting instead of "Alice-in-Wornderland" accounting (Bulow, 2002), shall be applied to Green Aid Flows above all.

The authors of this paper also share the visions of those Scholars calling for a stronger coordination among Donors (IMF Report, 2009; WB Independent Evaluation Group, 2009; Knack, Rogers and Eubank, 2010; Bourguignon and Platteau, 2015; Bigsten and Tengstam, 2015; etc.) since greater Donor coordination will permit optimal Aid allocation among multiple Recipients and to achieve "the alignment goal" (Carter, Postel-Vinay and Temple, 2015; Addison and Tarp, 2015).

Better Institutions

The analyses undertaken intensely underline that the GEF, the IFAD and the WB – Carbon F. are by far the Greenest Donors in relative terms but dispose of limited budgets with respect to other big Donors (such as IFIs) in absolute terms. Yet, the concentration analysis realized in Chapter 3.vi shows that the World Bank Carbon Finance Unit is the only Donor which has a Herfindal index superior than 0.25 (0.41 in terms of US dollars), indicating high concentration of Green Aid, fully respecting the institutional vocation of the Unit to give specific support to those very poor (selected and concentrated) countries which cannot enter into carbon markets because of their poverty trap.

Consequently, according to the authors of this paper, since it appears that the above mentioned Donors are fully respecting their institutional vocation and oaths to protect Global commons[62], a significant increase in their budget allocation shall be provided for them by the International Community.

Furthermore, certain lateral considerations arisen within the analyses undertaken for the elaboration of this paper show that the introduction of Kyoto Protocol's dispositions and measures had positive effect in the Aid Flows destined to environmental protection. Yet, for particular sectors, such as Energy and Agricultural sector, Kyoto Protocol seem to have largely supported the increase of the commitment trends of Aid Flows (please refer to Figure 11); moreover, the Kyoto protocol (and the related EU ETS system) also supported the "Renaissance" of Green Aid Flows after 2008 onwards, as shown within Figure 2.

In this sense, as recognized by the Literature, Kyoto Protocol and its related Trade Emission Systems are examples of how a "new form" of cooperation projects in the field of environmental protection exists, even if they do not enter in the classic scheme Donor-Recipient but rather on the Buyer-Seller scheme.

Conclusively, the authors of this paper consider that, in the global context of Aid Flows aimed at financing environmental protection, Kyoto system has a big role to play, especially for the future generations. Indeed, as affirmed by Hicks, Parks., Timmons Roberts and Tierney in 2008, while "we discuss the future of environmental Aid, focusing on the surge in funding for developing countries to adapt to climate change […], the Kyoto Protocol's special funds for climate change adaptation and mitigation activities are just beginning to function, and the core questions of this book [i.e. the future of Green Aids, authors' note] remain very relevant to that debate".

Similarity, the authors of this paper consider that current negotiations on global climate regime and Kyoto's Protocol future, which will necessarily involve the new concept of ecological debt (Timmons Roberts and Parks, 2009), will significantly affect the new way of Green Aid financing.

The reform of other Institutions towards a greater importance to the protection of the environment (the so-called "Greening of Institutions") is another very important theme of any future policy structure aimed at increasing environmental protection worldwide. For instance, UK's proposal to create an International Finance Facility able to sterilize Aid Flow volatility and unpredictability (IMF, 2006) could help for a better coordination among Donors and for Aids' harmonization.

Surely, the Greening of IFIs (Hicks, Parks, Timmons Roberts and Tierney, 2008) and trade institutions, such as the WTO (Petersmann, 1995; Charnovitz, 2001; Pearce, 2006) is needed, as well as, maybe, the creation of a new "World Environmental Organisation" (WEO) (MacMillian, 2001), able to work as a counterbalance to WTO. Yet, the formation of a "new specialized environmental organisation of the United Nations (UNEO, able to "replace" UNEP) could be useful, with specific and almost exclusive competences in the environmental field. In addition, as assessed by some Scholars (Fuentes-Albero and Rubio, 2010), International Environmental Agreements (IEAs) should be "designed in such a way that they will be not only profitable, but also self-enforcing, i.e. there must be incentives for countries, while acting in their own self-interest, to join or to remain part of an agreement."

[62] Global commons are "are those areas of the planet that are shared international space and are not owned by particular countries", definition retrieved by Rice J. (2009).

The use of alternative instruments for environmental protection shall also be taken into consideration. For instance, the adoption of new Soft-Law Instruments for Non-State Actors, such as Code of Conducts for International Corporations, shall be further implemented, as well as the control (and the Greening) of FDI.

Moreover, and quite surprisingly, the recent Literature is showing how financial instruments could significantly help to further enhance the protection of the environment and to finance Green Aid projects. For example, the release of World Bank Green bonds[63] goes to that direction, as well as the decision of some Sovereign Wealth Funds to invest in Climate protection (Reiche, 2008).

Ecological (or climate) debt

More broadly, the debate on reforming the International Institutions shall also take into due consideration the so-call Ecological Debt, as presented by the Literature in Chapter 3.iii. For instance, Hackmann, Moser and St. Clair (2014) proposed to use debt-servicing payments to finance climate change actions (i.e. a particular form of climate finance swaps).

Significantly, Timmons Roberts and Parks (2009), state that "global climate change is a particularly important area in which ecologically unequal exchange appears to be in effect" consider that the issue of ecological debt shall be part of the post-2012 global climate regime. Other authors (Rice, 2009) believe that "a reconceptualization of North–South political-economic relations and viable sustainable development policies", that takes the responsibilities of the historical dimension, is needed. Rice (2009) even quotes Torras's researches (2003) to attempt to calculate the monetary value of ecological debt obligations of the past 60 years.

According to the authors of this paper, the above mentioned considerations on Ecological debt shall find a place within future world negotiations on climate change and debt relief and, more important, these two paramount themes shall be treated simultaneously by the International Community, in order to put on the same balance past, current and future credits and liabilities own both by developing countries and by developed ones.

iii. Conclusions and further possible research

AidData Development

As stated in Chapter 2 of this paper, the difficulties of the Scholars in correctly assessing and sizing the actual commitment that the International community destined to the Environmental protection have been tackled by mean of using a comprehensive project level database (i.e. the database AidData 2.1).

However, as stated in Chapter 3.iii, concerning the selection of Donors, even that database needs improvements for certain columns. The authors of this paper have faith that the next version of AidData (i.e. version 3.0), which is also expected to contain FDI strings, will be able to minimize missing variables and to present reliable information regarding Loan/Grant differentiation.

[63] http://treasury.worldbank.org/cmd/htm/WorldBankGreenBonds.html.

Kyoto system versus classical Aid Flows

In the previous paragraphs, the authors of this paper underlined the importance of the Kyoto protocol ad its destiny for the new forms of Green Aid financing, recognizing the big role that Kyoto system has to play in the future, especially for particular sectors, such as Energy and Agricultural sectors.

However, which is the actual support that the introduction of the Kyoto protocol has generated to the cause of a Greener world in quantitative terms and with respect to "standard" Green Aid Flows? Have CDM projects worked better than similar Aid projects in particular fields (such as for example the Energy field)? Which is the impact of Kyoto's policies on the Energy performances of Recipients countries? The Literature Review analysed for the realisation of this paper does not provide answers to these questions.

In other words, which is the effective support that the Kyoto system has given to the enhancement of worldwide environmental protection? Is it possible to quantify this support? In which terms? Is there any possible way to investigate Kyoto's effective support to the "Green world cause" dividing by Green sectors split?

According to the authors of this paper, further research is possible in this domain, which has not been satisfactorily addressed by the Literature so far and which may constitute a very import theme to deal with in order to identify the best possible institutional organisations of the global system of international cooperation for the International Community.

5. Reference list

Publications/Working papers of International Organisations (IIOO)

1. Climate Policy Initiative (2012). The landscape of Climate Finance.
2. Climate Policy Initiative (2013). Climate Policy Presentation.
3. IDA (2007). Selectivity And Performance: IDA's Country Assessment and Development Effectiveness. International Development Association Development Economics, Office of the Chief Economist (DECVP).
4. IEG World Bank (2009). Environmental Sustainability: An Evaluation of World Bank Group Support. The World Bank, Washington DC.
5. IMF (2006). Volatility of Development Aid: From the Frying Pan into the Fire? IMF Working Paper prepared by Aleš Bulíř and A. Javier Hamann. International Monetary Fund.
6. Inter-American Development Bank (2012).Working Paper: Foreign Aid in the Aftermath of Large Natural Disasters. Inter-American Development Bank. Department of Research and Chief Economist.
7. The European Union (2009). Emission Trading Scheme. EC, Bruxelles.
8. The European Union (2013a). ETS fact sheets. EC, Bruxelles.
9. The European Union (2013b). European Environment Agency - Towards a Green economy in Europe, EU environmental policy targets and objectives 2010–2050. EC, Bruxelles.
10. The World Bank (2010a). Community Development, Carbon Fund. World Bank Group, Washington DC.
11. The World Bank (2010b). Handbook Environmental Finance. World Bank Group, Washington DC.
12. The World Bank (2011a). Environment Department, State and trends of the Carbon market. World Bank Group, Washington DC.
13. The World Bank (2011b). Innovative financing, Financial Intermediary Funds. World Bank Group, Washington DC.
14. The World Bank (2013a). Green Bond Fact Sheet, August 2013. World Bank Group, Washington DC.
15. The World Bank (2013b). Green Bond fifth annual investor, update 2013. World Bank Group, Washington DC.
16. The World Bank (2013c). Mapping Carbon Pricing Initiatives – Development and Prospects. World Bank Group, Washington DC.
17. UNDP (2011a). Building climate finance through national climate funds: A guidebook for the design and establishment of national funds to achieve climate change priorities. New York, USA.
18. UNDP (2011b): Blending Climate Finance Through national Climate Funds.
19. UNDP (2011c): Catalyzing Climate Finance.
20. UNFCCC (1998). Kyoto Protocol.
21. UNFCCC (2008). Investment and financial Flows to address climate change: an update (FCCC/TP/2008/7). Bonn: United Nations Framework Convention on Climate Change Secretariat.

Official Web Sites

22. EU "Linking EU – Australia Project" : http://ec.europa.eu/clima/news/articles/news_2012082801_en.htm
23. The International Carbon Action Partnership (ICAP): https://icapcarbonaction.com/ets-map
24. UNFCCC: https://unfccc.int/kyoto_protocol/mechanisms/items/1673.php
25. WB Carbon Fund : https://wbcarbonfinance.org/Router.cfm?Page=Funds
26. WB Green Bonds: http://treasury.worldbank.org/cmd/htm/WorldBankGreenBonds.html

Academic publications and papers

27. Abdiweli M. A. and Hodan S. I. (2006). An Empirical Analysis of the Determinants of Foreign Aid: A Panel Approach. International Advances in Economic Research.
28. Addison T. and Tarp F. (2015). Aid Policy and the Macroeconomic Management of Aid. World Development, Volume 69, May 2015, Pages 1-5.
29. Akhand h. A. and Gupta K. L. (2002). Foreign Aid In The Twenty-First Century. Published by Springer.
30. Akyüz Y. (2004). The rationale for Multilateral lending a critical assessment. UNCTAD.
31. Antoci A., Borghesi S., Russu P. and Ticci E. (2015), Foreign direct investments, environmental externalities and capital segmentation in a rural economy, Ecological Economics, Volume 116.
32. Arndt C., Jones S. and Tarp F. (2015). Assessing Foreign Aid's Long-Run Contribution to Growth and Development. World Development, Volume 69.
33. Askarov Z. and Doucouliagos H. (2015). Development Aid and Growth in Transition Countries. World Development, Volume 66.

34. Ballesteros A., Nakhooda S., Werksman J. and Hurlburt K. (2010). Power, responsibility, and accountability: Re-thinking the legitimacy of institutions for climate finance (Final Report). Washington, DC: World Resources Institute.
35. Barthel F., Neumayer E., Nunnenkamp P. and Selaya P. (2014). Competition for Export Markets and the Allocation of Foreign Aid: The Role of Spatial Dependence among Donor Countries. World Development, Volume 64.
36. Bauer A. and Illing G. (1992). Debt-for-Nature Swaps: Axing the Debt instead of the Forests. Intereconomics, January/February 1992.
37. Bigsten A. and Tengstam S. (2015). International Coordination and the Effectiveness of Aid. World Development, Volume 69.
38. Bourguignon F. and Platteau J.-P. (2015). The Hard Challenge of Aid Coordination. World Development, Volume 69.
39. Boyd E., Hultman N., Timmons Roberts J., Corbera E., Cole J. and al (2009). Reforming the CDM for sustainable development: lessons learned and policy futures. Elsevier Ltd.
40. Bulow J. (2002). First World Governments and Third World Debt. Brookings Institution Press.
41. Buntaine M. T. and Parks B. C. (2013). When Do Environmentally Focused Assistance Projects Achieve their Objectives?: Evidence from World Bank Post-Project Evaluations. Published by The MIT Press.
42. Burnside C. and Dollar D. (2000). Aid, Policies, and Growth. The American Economic Review, Vol 90. N°. 4.
43. Carter P., Postel-Vinay F. and Temple J. (2015). Dynamic Aid allocation. Journal of International Economics, Volume 95, Issue 2.
44. Cassimon D. and Van Campenhout B. (2007). Aid Effectiveness, Debt Relief and Public Finance Response: Evidence from a Panel of HIPC Countries. Kiel Institute.
45. Charnovitz S. (2001). Exploring the Environmental Exceptions in GATT Article XX. Oxoford Press.
46. Chianca T. K. (2008). International Aid Evaluation: An Analysis And Policy Proposals. Western Michigan University Press.
47. Costantini V. and Sforna G. (2013). Do Bilateral commercial relationships influence the distribution of CDM projects?. Departmental Working Papers of Economics – University of Roma Tre 0176. Department of Economics - University Roma Tre.
48. Culas R. J. (2006). Debt and Deforestation. A Review of Causes and Empirical Evidence. Published by SAGE.
49. Denizer C., Kaufmann D. and Kraay A. (2011). Good Countries or Good Projects? Macro and Micro Correlates of World Bank Project Performance. The World Bank Development, Research Group, Washington DC.
50. Doucouliagos H. and Martin Paldam M. (2013). Explaining development Aid allocation by growth. Journal of Entrepreneurship and Public Policy, Vol. 2 Iss 1 pp. 21 – 41.
51. Dynarski S., Scott-Clayton J. (2013). Financial Aid Policy: Lessons from Research. Princeton University.
52. Feeny S. and Fry T.R.L. (2014). How sustainable is the macroeconomic impact of foreign Aid?. Journal of Policy Modeling, Volume 36, Issue 6, November–December 2014.
53. Fenton A., Wright H., Afionis S., Paavola J and Huq S. (2014). Debt relief and financing climate change action. Nature Climate Change.
54. Fuchs A. and Vadlamannati K. C. (2012). The Needy Donor: An Empirical Analysis of India's Aid Motives. University of Heidelberg Discussion Paper Series No. 532 . Department of Economic.
55. Fuentes-Albero C. and Rubio S. J. (2010), Can international environmental cooperation be bought?. European Journal of Operational Research, Volume 202, Issue 1.
56. Gibson C. C., Hoffman B. D. and Jablonbbebeneski R. S. (2015). Did Aid Promote Democracy in Africa? The Role of Technical Assistance in Africa's Transitions. World Development, Volume 68.
57. Glemarec Y. (2011). Catalyzing climate finance: A guidebook on policy and financing options to support Green, low-emissions, and climate resilient development. New York, NY: United Nations Development Programme.
58. Gomez-Echeverri L. (2010). national funding entities: Their role in the transition to a new paradigm of global cooperation on climate change. London: Climate Strategies. Retrieved from: http://www.climatestrategies.org/component/reports/category/55/266.html
59. Gomez-Echeverri L. (2013). The changing geopolitics of climate change finance. Publisher: Taylor and Francis.
60. Grigoriadis T. (2013). Aid effectiveness and imperfect monitoring: EU development Aid as a Prisoner's Dilemma. Published by SAGE.
61. Hackmann H., Moser S. C. and St. Clair A. L. (2014). The social heart of global environmental change. Macmillan Publishers Limited.
62. Hadjiyiannis C., Hatzipanayotou P. and Michael M. S. (2013). Competition for environmental Aid and Aid fungibility. Journal of Environmental Economics and Management, Volume 65.
63. Herve´-Mignucci M., Falconer A. and Trabacchi C. (2012). The landscape of climate finance. CPI Webinar. Venice: Climate Policy Initiative. Retrieved from http://climatepolicyinitiative.org/wp-content/uploads/2012/12/Lanscape-of-Climate-Finance-2012-webinar-presentation.pdf
64. Hicks R. L., Parks B. C., Timmons Roberts J. and Tierney M. J. (2008). Greening Aid? Understanding the Environmental Impact of Development Assistance. Oxford University Press.
65. Hudson J. (2015). Consequences of Aid Volatility for Macroeconomic Management and Aid Effectiveness. World Development, Volume 69.

66. Jung M. (2005). Host country attractiveness for CDM non-sink projects. Hwwa Discussion Paper.
67. Knack S., Rogers F. H. and Eubank N. (2010). Aid Quality and Donor Rankings. The World Bank Development, Research Group, Washington DC.
68. Kono D. Y. and Montinola G. R. (2012). The Uses and Abuses of Foreign Aid: Development Aid and Military Spending. Published by SAGE.
69. Lancaster C (2009). Sixty years of foreign Aid. What have we learned? International Journal.
70. Lee M. M. and Izama M. P. (2015). Aid Externalities: Evidence from PEPFAR in Africa. World Development, Volume 67.
71. Lim S., Menaldo V. and Prakash A. (2014). Foreign Aid, economic globalization, and pollution. Published by Springer.
72. Lim S., Mosley L. and Aseem P. (2015). Revenue Substitution? How Foreign Aid InFlows Moderate the Effect of Bilateral Trade Pressures on Labor Rights. World Development, Volume 67.
73. Liverani A. and Lundgren H. E. (2007). Evaluation Systems in Development Aid Agencies. The World Bank, Washington DC.
74. Lof M., Jemaneh Mekasha T. and Tarp F. (2015). Aid and Income: Another Time-series Perspective. World Development, Volume 69.
75. Mabey N. and McNally R. (1999). Foreign Direct Investment and the Environment: From Pollution Havens to Sustainable Development. WWF Working Paper.
76. MacMillian, F. (2001). WTO and the Environment. London: Sweet & Maxwell.
77. Mbengue M. M. and Boisson de Chazournes P. (2002). La déclaration de Doha de la conférence ministérielle de l'Organisation mondiale du commerce et sa portée dans le relations commerce/environnement. Revue de droit international.
78. Mottaleb K. A. and Kalirajan K. (2010). Determinants of Foreign Direct Investment in Developing Countries: A Comparative Analysis. Published by SAGE.
79. Myšiak J., Brown J.D., Jansen J.M.L. and Quinn N.W.T. (2008). Chapter Six Environmental Policy Aid Under Uncertainty, In: A.J. Jakeman, A.A. Voinov, A.E. Rizzoli and S.H. Chen, Editor(s). Developments in Integrated Environmental Assessment, Elsevier, Volume 3.
80. Nafo S. (2012). Defining 'Mobilized' climate finance: Solving a fractal conundrum (Discussion document prepared for the Climate Change Expert Group (CCXG) Global Forum on the New UNFCCC Market Mechanism and Tracking Climate Finance). Paris: Climate Change Expert Group.
81. Nwaogu U. G. and Ryan M. J. (2015). FDI, Foreign Aid, Remittance and Economic Growth in Developing Countries. Review of Development Economics.
82. Pankaj A. K. (2005).Revisiting Foreign Aid Theories. INTERNATIONAL STUDIES.
83. Pazienza P. (2011).The Impact of the FDI InFlow in the "Agriculture and Fishing" Sector of OECD Countries on CO2: Some Empirical Evidence. MDPI, Basel, Switzerland.
84. Pearce, D. W. (2006). Should The GATT Be Reformed for Environmental Reasons ?, in. CSERGE Working Paper GEC 92-06.
85. Pedersen K. R. (2001). The Samaritan's Dilemma and the Effectiveness of Development Aid. Kluwer Academic Publishers. Printed in The Netherlands.
86. Petersmann E.-U. (1995). International and European Trade and Environmental Law after the Uruguay Round. London: Kluwer Law International.
87. Porter G., Bird N., Kaur N. and Peskett, L. (2008). New finance for climate change and the environment. Washington, DC: World Wildlife Fund/Heinrich Boll Foundation North America. Retrieved from: www.povertyenvironment.net/files/PEP13New_Finance_for_Climate%20Change_and_the_Environment%20.pdf
88. Ransom E. and Bain C. (2011). Gendering Agricultural Aid: An Analysis of Whether International Development Assistance Targets Women and Gender . Published by SAGE.
89. Reiche D. (2008). Sovereign Wealth Funds as a New Instrument for Climate Protection Policy: Study of Norway as a Pioneer of Ethical Guidelines for Environmental Protection. Wupperal Papers.
90. Rice J. (2009). North–South Relations and the Ecological Debt: Asserting a Counter-Hegemonic Discourse. Critical Sociology 35(2) 225–252.
91. Riddel R. C. (2008). Does Foreign Aid Really Work?. Oxford University Press.
92. Rodrick D. (2001a). The Global Governance of Trade As If Development Really Mattered. UNDP.
93. Rodrik, D. (2001b). The Globalization Paradox: Democracy and the Future of the World Economy. Laterza.
94. Röttgers D. and Grote U. (2014). Africa and the Clean Development Mechanism: What Determines Project Investments?. World Development, Volume 62.
95. Sander K. and & Cranford M. (2010). Environmental Strategy of the World Bank: Financing Environmental Services in Developing Countries. The World Bank Group.
96. Sobis I. and de Vries M. S. (2010). Technical cooperation within the context of foreign Aid: trends for the CEE countries in transition (1991--2004). Published by SAGE.
97. Stadelman M., Timmons Roberts J. and Michaelowa A. (2011). Accounting of private climate finance: Types of finance, data gaps and the 100 billion dollar question (Working Paper). London: Climate Strategies.
98. Steckhan U. (2009). Financial Flows for Environment: World Bank, UNDP, UNEP. The World Bank.

99. Stewart R. B., Kingsbury B. and Rudyk, B. (2009). Climate finance for limiting emissions and promoting Green development: Mechanisms, regulation, and governance. In R.B. Stewart, B. Kingsbury, and B. Rudyk (Eds.), Climate finance: Regulatory and funding strategies for climate change and global development (pp. 3–34). New York, NY: New York University Press.
100. Stiglitz J. and Meier, G. (2000). Frontiers on Development Economics. Oxford Press.
101. Sutter C. and Parreño J. C. (2007). Does the current Clean Development Mechanism (CDM) deliver its sustainable development claim? An analysis of officially registered CDM projects. Published by Springer Science.
102. Tarp F. (2000). Foreign Aid and Development; Lessons Learnt and Directions for the Future. Published by Routledge.
103. Timmons Roberts J. and B. C. Parks (2009). Ecologically Unequal Exchange, Ecological Debt, and Climate Justice. The History and Implications of Three Related Ideas for a New Social Movement. International Journal of Comparative Sociology.

6. Appendixes

Appendix 1. Full structure of AidData 2.1

Full list of Donors – 93 Donors – Bilateral and Multilateral
African Capacity Building Foundation (ACBF)
African Development Bank (AFDB)
African Development Fund (AFDF)
Andean Development Corporation (CAF)
Arab Bank for Economic Development in Africa (BADEA)
Arab Fund for Economic & Social Development (AFESD)
Asian Development Bank (ASDB)
Asian Development Fund (ASDF)
Australia
Austria
Belgium
Bill & Melinda Gates Foundation
Brazil
Canada
Caribbean Development Bank (CDB)
Chile
Colombia
Congo Basin Forest Fund (CBFF)
Cyprus
Czech Republic
Denmark
Estonia
European Bank for Reconstruction & Development (EBRD)
European Communities (EC)
Fast Track Initiative Catalytic Fund (FTI)
Finland
France
Germany
Global Alliance for Vaccines & Immunization (GAVI)
Global Environment Facility (GEF)
Global Fund to Fight Aids, Tuberculosis and Malaria (GFATM)
Greece
Hungary
Iceland
India
Inter-American Development Bank (IADB)
International Fund for Agricultural Development (IFAD)
International Monetary Fund (IMF)
Ireland
Islamic Development Bank (ISDB)
Italy
Japan
Joint United Nations Programme on HIV/AIDS (UNAIDS)
Korea
Kuwait
Latvia
Liechtenstein
Lithuania
Luxembourg
Monaco
Multilateral Fund for the Implementation of the Montreal Protocol
Netherlands
New Zealand
Nigerian Trust Fund (NTF)
Nordic Development Fund (NDF)
North American Development Bank (NADB)
Norway
OPEC Fund for International Development (OFID)
OSCE
Portugal
Qatar
Romania
Saudi Arabia
Slovak Republic
Slovenia
South Africa
Spain
Sweden
Switzerland
Taiwan
Thailand
United Arab Emirates
United Kingdom
United Nations Children s Fund (UNICEF)
United Nations Democracy Fund (UNDEF)
United Nations Development Programme (UNDP)
United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)
United Nations Economic and Social Commission for Western Asia (UNESCWA)
United Nations Economic Commission for Europe (UNECE)
United Nations Peacebuilding Fund (UNPBF)
United Nations Population Fund (UNFPA)
United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA)
United States
WFP
WHO
World Bank - Carbon Finance Unit
World Bank - Debt Reduction Facility
World Bank - International Bank for Reconstruction and Development (IBRD)
World Bank - International Development Association (IDA)
World Bank - International Finance Corporation (IFC)
World Bank - Managed Trust Funds
World Trade Organization (WTO)
World Trade Organization (WTO) - International Trade Centre

Full list of Recipients - 178 Recipients
Afghanistan
Africa, regional
Albania
Algeria
America, regional
Angola
Anguilla
Antigua & Barbuda
Argentina
Armenia
Asia, regional
Azerbaijan
Bangladesh
Barbados
Belarus
Belize
Benin
Bhutan
Bilateral, unspecified
Bolivia
Bosnia-Herzegovina
Botswana
Brazil
Burkina Faso
Burundi
Cambodia
Cameroon
Cape Verde
Central African Rep.
Central Asia, regional
Chad
Chile
China
Colombia
Comoros
Congo, Dem. Rep.
Congo, Rep.
Cook Islands
Costa Rica
Cote D'Ivoire
Croatia
Cuba
Cyprus
Djibouti
Dominica
Dominican Republic
Ecuador
Egypt
El Salvador
Equatorial Guinea
Eritrea
Ethiopia
Europe, regional
Far East Asia, regional
Fiji
French Polynesia
Gabon
Gambia
Georgia
Ghana
Grenada
Guatemala
Guinea

Full list of Recipients - 178 Recipients
Guinea-Bissau
Guyana
Haiti
Honduras
India
Indonesia
Iran
Iraq
Israel
Jamaica
Jordan
Kazakhstan
Kenya
Kiribati
Korea
Kosovo
Kyrgyz Republic
Laos
Lebanon
Lesotho
Liberia
Libya
Macao
Macedonia, FYR
Madagascar
Malawi
Malaysia
Maldives
Mali
Marshall Islands
Mauritania
Mauritius
Mayotte
Mexico
Micronesia, Federated States of
Middle East, regional
Moldova
Mongolia
Montenegro
Montserrat
Morocco
Mozambique
Myanmar
N. & C. America, regional
Namibia
Nauru
Nepal
Netherlands Antilles
Nicaragua
Niger
Nigeria
Niue
North of Sahara, regional
Northern Marianas
Oceania, regional
Oman
Pakistan
Palau
Palestinian Adm. Areas
Panama
Papua New Guinea
Paraguay
Peru

Full list of Recipients - 178 Recipients
Philippines
Rwanda
Samoa
Sao Tome & Principe
Saudi Arabia
Senegal
Serbia
Seychelles
Sierra Leone
Singapore
Solomon Islands
Somalia
South & Central Asia, regional
South Africa
South America, regional
South Asia, regional
South of Sahara, regional
Sri Lanka
St. Helena
St. Kitts & Nevis
St. Lucia
St.Vincent & Grenadines
Sts Ex-Yugo. Unspec.
Sudan
Suriname
Swaziland
Syria
Tajikistan
Tanzania
Thailand
Timor-Leste
Togo
Tokelau
Tonga
Trinidad & Tobago
Tunisia
Turkey
Turkmenistan
Turks and Caicos Islands
Tuvalu
Uganda
Ukraine
Uruguay
Uzbekistan
Vanuatu
Venezuela
Viet Nam
Wallis & Futuna
West Indies, regional
Yemen
Zambia
Zimbabwe
Tokelau
Tonga
Trinidad & Tobago
Tunisia
Turkey
Turkmenistan
Turks and Caicos Islands
Tuvalu
Uganda
Ukraine
Uruguay
Uzbekistan
Vanuatu
Venezuela

Full list of Recipients - 178 Recipients
Viet Nam
Wallis & Futuna
West Indies, regional
Yemen
Zambia
Zimbabwe

Full list of Sectors - 37 Sectors
I.1.a. Education, Level Unspecified
I.1.b. Basic Education
I.1.c. Secondary Education
I.1.d. Post-Secondary Education
I.2.a. Health, General
I.2.b. Basic Health
I.3. Population Pol./Progr. & Reproductive Health
I.4. Water Supply & Sanitation
I.5.a. Government & Civil Society-general
I.5.b. Conflict, Peace & Security
I.6. Other Social Infrastructure & Services
II.1. Transport & Storage
II.2. Communications
II.3. Energy
II.4. Banking & Financial Services
II.5. Business & Other Services
III.1.a. Agriculture
III.1.b. Forestry
III.1.c. Fishing
III.2.a. Industry
III.2.b. Mineral Resources & Mining
III.2.c. Construction
III.3.a. Trade Policies & Regulations
III.3.b. Tourism
IV.1. General Environment Protection
IV.2. Other Multisector
IX. Administrative Costs of Donors
VI.1. General Budget Support
VI.2. Dev. Food Aid/Food Security Ass.
VI.3. Other Commodity Ass.
VII. Action Relating to Debt
VIII.1. Emergency Response
VIII.2. Reconstruction Relief & Rehabilitation
VIII.3. Disaster Prevention & Preparedness
X. Support to NGO's
XI. Refugees in Donor Countries
XII. Unallocated / Unspecified
I.1.a. Education, Level Unspecified

Full list of Sectors - 37 Sectors
I.1.b. Basic Education
I.1.c. Secondary Education
I.1.d. Post-Secondary Education
I.2.a. Health, General
I.2.b. Basic Health
I.3. Population Pol./Progr. & Reproductive Health
I.4. Water Supply & Sanitation
I.5.a. Government & Civil Society-general
I.5.b. Conflict, Peace & Security
I.6. Other Social Infrastructure & Services
II.1. Transport & Storage
II.2. Communications
II.3. Energy
II.4. Banking & Financial Services
II.5. Business & Other Services
III.1.a. Agriculture
III.1.b. Forestry
III.1.c. Fishing
III.2.a. Industry
III.2.b. Mineral Resources & Mining
III.2.c. Construction
III.3.a. Trade Policies & Regulations
III.3.b. Tourism
IV.1. General Environment Protection
IV.2. Other Multisector
IX. Administrative Costs of Donors
VI.1. General Budget Support
VI.2. Dev. Food Aid/Food Security Ass.
VI.3. Other Commodity Ass.
VII. Action Relating to Debt
VIII.1. Emergency Response
VIII.2. Reconstruction Relief & Rehabilitation
VIII.3. Disaster Prevention & Preparedness
X. Support to NGO's
XI. Refugees in Donor Countries
XII. Unallocated / Unspecified

Appendix 2. Selected references retrieved from the Literature

i. Donor scores and rankings (by sub-index and overall, for 2007).

Source: Knack S., Rogers F. H. and Eubank N. (2010).
Appendix Table 3. p. 24.

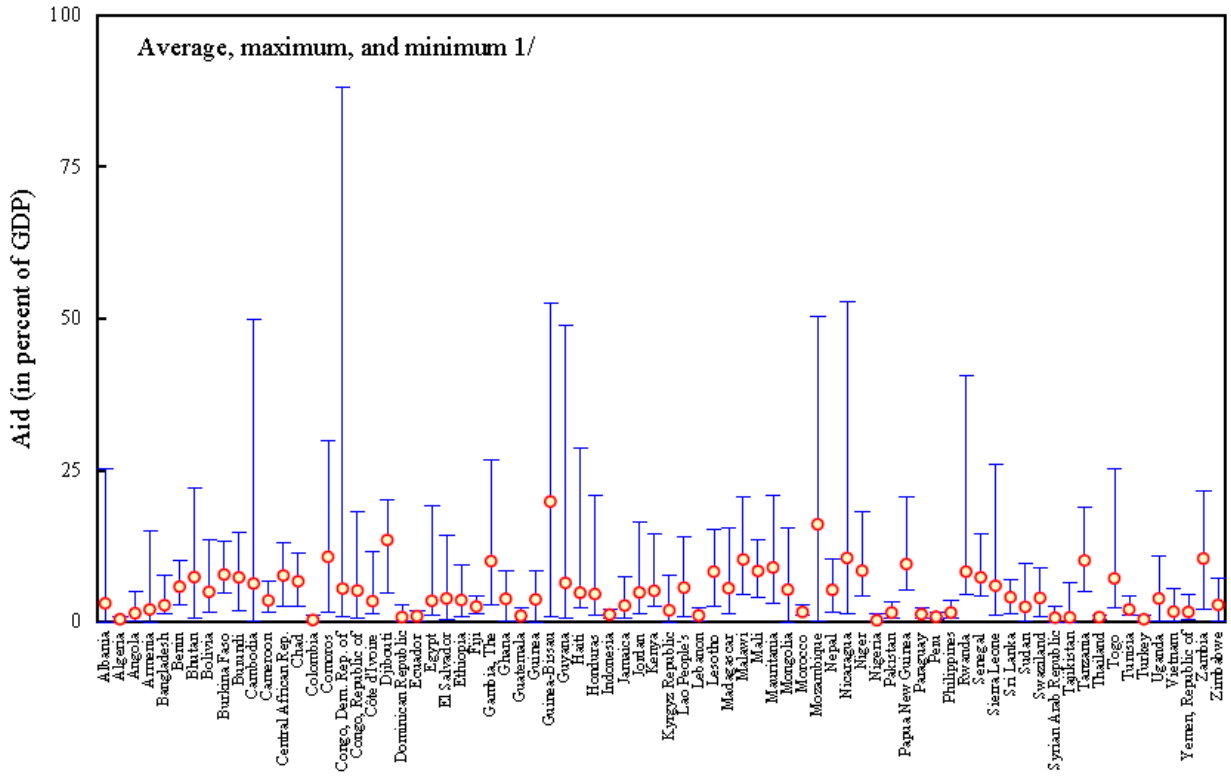
Donor name	Sub-Indexes								Overall Index		Avg rank difference of sub-indexes	No. of indicators with data
	Selectivity		Alignment		Harmonization		Specialization					
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
African Dev. Bank	0.505	11	-0.359	28	-0.193	26	1,095	5	0.31	13	14	15
Asian Dev. Bank	1,837	2	0.8	2	0.305	14	2,382	1	1,784	1	6.5	15
Australia	0.122	13	-0.042	22	0.708	5	0.253	8	0.348	12	9.3	18
Austria	-0.307	21	-0.654	33	-0.484	31	-0.317	28	-0.641	34	6.5	18
Belgium	0.104	14	0.161	17	-0.191	25	-0.416	29	-0.13	21	8.8	18
Canada	-0.357	23	-0.241	26	-0.416	29	-0.187	21	-0.421	29	4.5	18
Czech Republic	-0.727	28	-0.754	36	-1,150	36	-1,016	38	-1,283	37	5	14
Denmark	1,158	5	0.711	4	1,015	2	0.064	14	0.985	3	6.2	18
EBRD	0.96	6	-0.077	23	0.129	18	-0.555	34	0.083	16	14.8	15
EC	-0.612	26	-0.466	31	0.384	13	0.212	10	-0.16	23	12.7	17
Finland	0.035	17	0.447	9	0.574	9	-0.419	30	0.233	15	11.8	18
France	-0.908	33	0.18	15	-0.2	27	0.116	12	-0.226	24	12.5	18
GAVI Alliance			0.752	3	0.862	3	0.145	11	0.861	5	5.3	9
Germany	-0.452	24	0.407	11	0.205	17	-0.198	22	0.026	17	7.3	18
Global Fund	-0.652	27	0.213	14	-0.094	22	0.019	16	-0.137	22	7.5	15
Greece	-0.828	31	-0.535	32	-0.859	34	-0.602	35	-0.975	35	2.3	18
Hungary	-0.753	30	-1,623	38	-0.604	32	1,492	2	-0.558	31	18.3	17
IDB	0.007	18	0.044	20	0.263	16	0.873	6	0.412	9	7.3	15
IFAD	0.886	7	0.676	5	0.669	6	0.232	9	0.831	7	2.2	15
IMF	1,161	4	0.099	18	0.089	19	1,114	4	0.787	8	9.8	12
Ireland	0.099	15	1,453	1	1,145	1	-0.238	23	0.919	4	13.3	17
Italy	-0.486	25	-0.403	29	-0.159	23	-0.115	20	-0.406	28	4.8	18
Japan	-0.349	22	0.475	8	-0.894	35	-0.278	24	-0.333	27	13.8	18
Korea	-1,128	36	-0.035	21	-1,409	37	-0.768	36	-1,114	36	8	15
Luxembourg	0.675	9	-0.427	30	0.552	10	-0.517	33	0.024	18	15.3	18
Netherlands	1,332	3	0.655	6	0.605	8	-0.022	18	0.838	6	7.8	18
New Zealand	0.573	10	0.07	19	-0.459	30	-0.311	27	-0.09	20	11.3	18
Norway	0.38	12	0.387	12	0.28	15	-0.298	25	0.247	14	7	18
Poland	-1,098	35	0.161	16	-0.843	33	1,441	3	-0.046	19	18.8	14
Portugal	-1,018	34	-1,562	37	-2,208	38	-0.044	19	-1,718	38	10	17
Spain	0.086	16	-0.289	27	-0.066	21	-0.308	26	-0.233	25	6.3	18
Sweden	0.691	8	0.356	13	0.061	20	0.088	13	0.383	11	6	18
Switzerland	-0.063	19	-0.122	25	-0.187	24	-0.495	32	-0.317	26	6.7	18
Turkey	-1,447	37	-0.101	24	0.388	12	-0.887	37	-0.64	33	14.7	13
United Kingdom	-0.143	20	0.421	10	0.765	4	0.023	15	0.396	10	8.8	18
United Nations	-0.833	32	-0.7	34	0.621	7	-0.484	31	-0.479	30	13.7	15
United States	-0.751	29	-0.731	35	-0.331	28	-0.004	17	-0.634	32	9.2	18
World Bank	2,301	1	0.6	7	0.522	11	0.623	7	1,291	2	5	15

ii. Aid Flows in percent of GDP

Source: IMF (2006). Volatility of Development Aid: From the Frying Pan into the Fire? IMF Working Paper prepared by Aleš Bulíř and A. Javier Hamann. International Monetary Fund.

Figure 2 – Countries Receive Unstable Aid Flows, 1975 – 2003 (In percent of GDP).

Circles indicate sample averages of individual countries (mean of 4.9 percent) and the upper and lower bars indicate sample maxima and minima (whose averages are 10.5 percent and 3.6 percent, respectively). N=76.



iii. Aid Evaluation standards from Bilateral and Multilateral agencies

Source: Chianca T. K. (2008). International Aid Evaluation: An Analysis And Policy Proposals. Western Michigan University Press.

Table 3 and 3-continued, Summary of evaluation standards from Bilateral and Multilateral agencies

Group of standards	Standards	Organizations								
		DAC	ALNAP	CPPB	USAID	UNEG	EUAID	I EG	MDB	GEF
for Evaluands	Relevance	X	.	.	.	X	X	X	X	X
	Relevance/ Appropriateness	.	X	X	.	.	.	.	.	.
	Client satisfaction	.	.	.	.	X	.	.	.	.
	Community value added	.	.	.	.	.	X	.	.	.
	Efficiency	X	X	X	X	X	X	X	X	X
	Value for money	.	.	.	.	X	.	.	.	.
	Effectiveness	X	X	X	X	X	X	X	X	X
	Impact	X	X	X	X	X	X	X	X	X
	Scalability or expansion of impact	.	.	.	X	.	.	.	.	.
	Coverage	.	X	X	.	X	.	.	.	.
	Sustainability	X	.	X	X	X	X	X	X	X
	Replicability	.	.	.	X	.	.	.	.	.
	Connectedness	.	X	.	.	X	.	.	.	.
	Linkages	.	.	X	.	.	.	.	.	.
	Coherence/complementarity	.	.	.	.	.	X	.	.	.
	Innovation	.	.	.	X	.	.	.	.	.
	Coherence	.	X	.	.	X	.	.	.	.
	Governance & management	.	.	.	.	.	.	X	.	.
	Resources mobilization & mgmt	.	.	.	.	.	.	X	.	.
	Process[47]	.	X	X	X	.	.	.	.	.

Group of standards	Standards	Organizations								
		DAC	ALNAP	CPPB	USAID	UNEG	EUAID	I EG	MDB	GEF
for Evaluation processes and products	Consistent/valid/balanced conclusions	X	.	.	.	X	.	X	.	X
	Actionable recommendations/lessons	X	.	.	.	X	.	X	.	X
	Systematic data analysis	X	.	.	.	X	.	.	.	.
	Focused executive summary	X	.	.	.	.	.	.	.	.
	Description program logic	X	.	.	.	.	.	.	.	.
	Discussion of context	X	.	.	.	.	.	.	.	.
	Discussion of methodology	X	.	.	.	.	.	.	.	.
	Reliability of info sources	X	.	.	.	X	.	.	X	X
	Incorporate stakeholders' comments	X	.	.	.	X	.	.	.	X
	Metaevaluation	X	.	.	.	.	.	.	.	.
	Timely & within budget	X	.	.	.	.	.	X	.	X
	Stakeholder participation	.	.	.	X	X	.	X	.	.
	Sound program design	.	.	.	X	.	.	.	.	.
	Transparency of ToR & reports	.	.	.	.	X	.	.	.	X
	Clear reports, appropriate language	.	.	.	.	X	.	.	.	X
for Evaluators	Competence	X	.	.	.	X	.	X	.	X
	Ethicality	X	.	.	.	X	.	X	.	X
	Independence from all stakeholders	X	.	.	.	X	.	X	.	X
	Disclosure of disagreements	X	.	.	.	.	.	.	.	.
	Respect for people	X	.	.	.	X	.	.	.	.
	Conduct evaluability assessment					X				
	Capacity to develop clear/rigorous design					X		X		
	Diversity of evaluation team	X	.	.	.	X	.	.	.	.
for Evaluation commissioners and other stakeholders	Provision of clear direction	X	.	.	.	X	.	.	.	.
	Ensuring free and open process	X	.	.	.	X	.	X	.	X
	Ensuring evaluation use and learning	X	.	.	X	X	.	X	X	X
	Provision of adequate resources	.	.	.	.	X	.	.	.	.
	Hiring capable evaluators	.	.	.	.	X	.	.	.	.
	Ensure partnership w/ other agencies	.	.	.	.	.	.	X	.	X
	Implementing agency (Bank) performance	.	.	.	.	.	.	X	X	.
	Partner (Borrower) performance	.	.	.	.	.	.	X	X	.

iv. Hypotheses testing for explaining project outcome ratings

Source: Buntaine M. T. and Parks B. C. (2013). When Do Environmentally Focused Assistance Projects Achieve their Objectives?: Evidence from World Bank Post-Project Evaluations. Published by The MIT Press.

Table 2, Results from Ordered Logit Model with Three-category Dependent Variable[64]

Hypothesis/Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*
H1: Government effectiveness	1.48 (0.59)**	1.51 (0.48)**	1.21 (0.48)**	1.13 (0.42)**
H2: Quality of supervision	2.10 (0.33)**	2.04 (0.33)**	2.00 (0.32)**	2.02 (0.32)**
H3a: Percent environmental	−1.03 (1.29)		−0.59 (1.24)	−0.43 (1.23)
H3b: Global outcome proportion	−0.03 (0.02)**	−0.03 (0.02)**	−0.03 (0.02)*	−0.03 (0.02)*
H4a: Environmental damages	−0.08 (0.20)		0.02 (0.18)	
H4b: Proportion concessional	0.95 (0.45)**	0.81 (0.40)**		
H5a: Civil liberties	−0.15 (0.16)			
H5b: ENGOs/million population	−0.05 (0.05)		−0.03 (0.05)	
H6: Size of project	0.00 (0.00)		−0.00 (0.00)	−0.00 (0.00)
C1: Evaluation type	−0.54 (0.43)		−0.47 (0.42)	−0.52 (0.42)
Sample size	152	152	152	154
Residual deviance	227.6	231.3	233.6	239.1
Null deviance	303.0	303.0	303.0	310.8

N.B. Coefficient estimates with (standard errors).
** p-value 0.05, * p-value 0.1.

[64] The authors obtained comparable results with a Binary Partial-odds Logit Model (Cfr. Table 3).

v. World Bank Group and the Environment

Source: IEG World Bank (2009). Environmental Sustainability: An Evaluation of World Bank Group Support. The World Bank, Washington DC.

Figure 1.2, World Bank Group Environment-Related activities

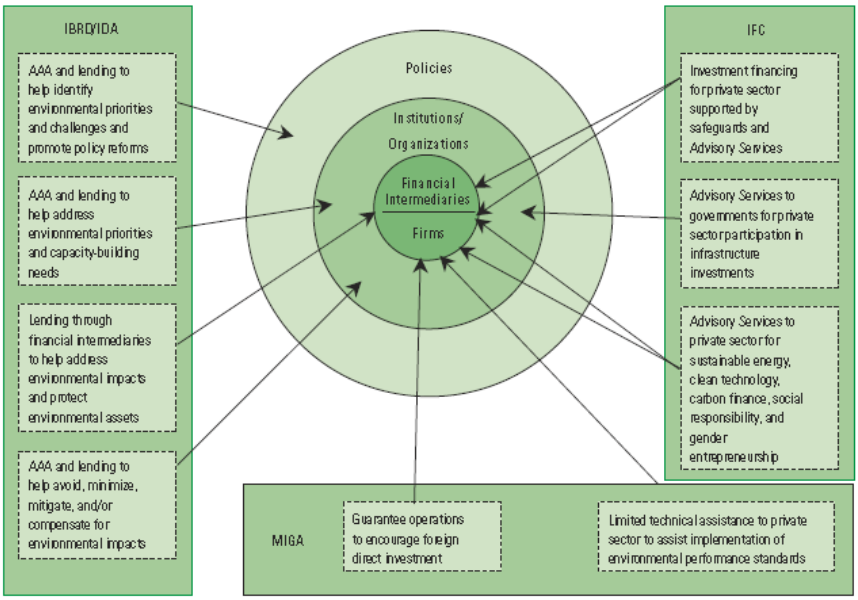


Table 3.1: Portfolio by Region, Fiscal 1990–2007 (official figures based on thematic coding)

Region	Total number of projects[a]	Total commitment amount ($ million)	Projects with ENRM content	ENRM (% of total projects)	Total commit-ment amount in ENRM projects ($ million)	ENRM commit-ment (% of total commitment)	Environment commitment amount ($ million)
Sub-Saharan Africa	1,907	61,742.30	555	29.1	20,950	33.9	6,737.30
East Asia and Pacific	1,064	85,472	449	42.2	39,676.50	46.4	19,687.98
Europe and Central Asia	1,266	70,539.30	419	33.1	18,658.30	26.5	8,356.83
Latin America and the Caribbean	1,373	98,445.10	559	40.7	27,703.50	28.1	11,482.04
Middle East and North Africa	540	23,359.00	193	35.7	9,451.20	40.5	4,059.00
South Asia	636	61,923.80	223	35.1	23,635.40	38.2	8,757.63
World	6	29.50	3	50.0	29.00	97.3	20.75
Total (all World Bank)	**6,792**	**401,511.30**	**2,401**	**35.4**	**140,103.40**	**34.9**	**59,101.52**

a. The numbers cited here are based on the exact numbers for all individual commitments.

Figure 3.3: ENRM Portfolio Commitment Amounts (official figures) and Number of Projects, by Fiscal Year

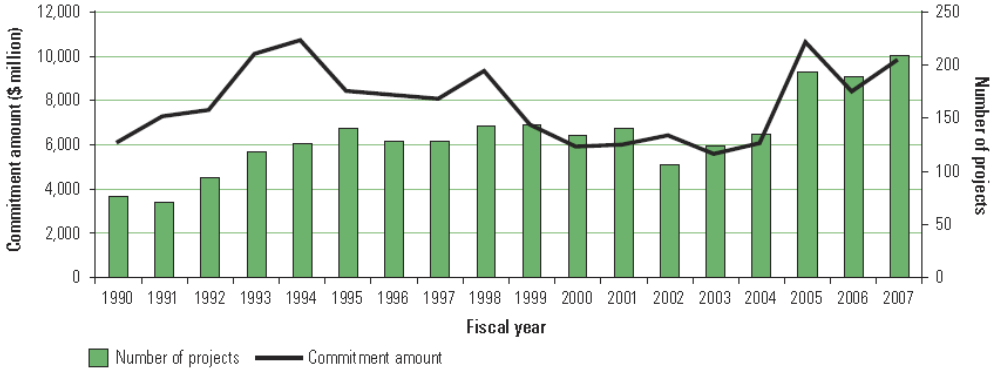
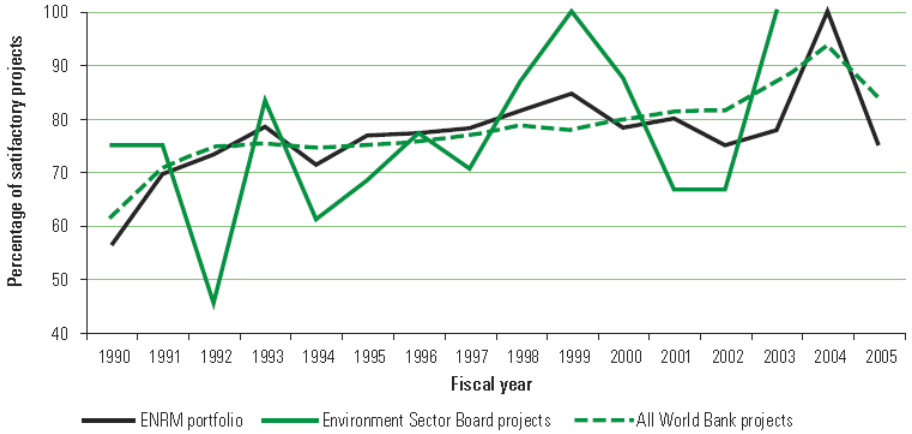


Figure 3.4: Shares of Environment, ENRM, and All Completed Bank Projects Rated Satisfactory, by Fiscal Year of Approval, 1990–2005



Note: Satisfactory projects are all those that received an IEG project outcome rating of highly satisfactory, satisfactory, or moderately/marginally satisfactory. ENRM = environmental and natural resource management.

vi. Greening Aid Flows

Source: Hicks R. L., Parks B. C., Roberts J. and Tierney M. J. (2008). Greening Aid? Understanding the Environmental Impact of Development Assistance. Oxford University Press.

Figure 2.1 - Total Flows of environmental Aid, 1980–1999, comparing all Multilateral and Bilateral Donors.

Figure 2.2. Total Aid Flows, Bilateral and Multilateral agencies combined, 1980–1999, comparing total funding for projects with likely positive environmental impacts, likely negative impacts ('dirty'), and those neutral or uncertain in impacts.

Table 3.1. Top ten Recipients and their top five Donors, 1980s (3.1a) and 1990s (3.1b)

Donor	Environmental Aid	Donor	Environmental Aid
(a) 1980s			
1. BRAZIL	$2,790,000,000	6. PHILLIPPINES	$1,480,000,000
World Bank	$2,020,000,000	World Bank	$472,000,000
IADB	$742,000,000	Japan	$448,000,000
West Germany	$21,000,000	ASDB	$414,000,000
Canada	$2,980,000	United States	$135,000,000
Japan	$1,200,000	Denmark	$6,230,000
2. EGYPT	$2,220,000,000	7. S. KOREA	$1,440,000,000
United States	$1,760,000,000	ASDB	$550,000,000
World Bank	$134,000,000	Japan	$474,000,000
EU	$119,000,000	World Bank	$412,000,000
West Germany	$52,300,000	OPEC	$6,780,000
United Kingdom	$46,800,000	Canada	$138,000
3. INDIA	$2,180,000,000	8. ALGERIA	$1,200,000,000
World Bank	$1,500,000,000	World Bank	$1,100,000,000
The Netherlands	$326,000,000	EU	$90,200,000
Denmark	$97,500,000	ISDB	$10,700,000
United States	$87,800,000		
Sweden	$77,100,000		
4. INDONESIA	$2,160,000,000	9. BANGLADESH	$1,170,000,000
World Bank	$1,050,000,000	United States	$362,000,000
Japan	$277,000,000	World Bank	$249,000,000
ASDB	$261,000,000	ASDB	$241,000,000
The Netherlands	$186,000,000	Japan	$105,000,000
United States	$144,000,000	West Germany	$79,900,000
5. PAKISTAN	$2,030,000,000	10. TURKEY	$1,093,945,354
ASDB	$1,250,000,000	World Bank	$869,172,495
World Bank	$257,000,000	W. Germany	$210,656,560
Japan	$184,000,000	France	$7,655,395
United States	$132,000,000	Italy	$3,619,361
United Kingdom	$68,200,000	UK	$2,778,871
(b) 1990s			
1. CHINA	$10,100,000,000	Japan	$464,000,000
World Bank	$3,710,000,000	Germany	$161,000,000
ASDB	$2,440,000,000	GEF	$139,000,000
Japan	$2,070,000,000		
Germany	$546,000,000	4. MEXICO	$5,210,000,000
Montreal Protocol	$314,000,000	World Bank	$2,090,000,000
		IADB	$1,650,000,000
2. INDIA	$6,590,000,000	Japan	$1,170,000,000
World Bank	$1,620,000,000	GEF	$103,000,000
Japan	$1,480,000,000	NADB	$101,000,000
ASDB	$1,440,000,000		
United Kingdom	$646,000,000	5. INDONESIA	$4,860,000,000
Germany	$394,000,000	Japan	$1,110,000,000
		ASDB	$1,020,000,000
3. BRAZIL	$6,540,000,000	Australia	$126,000,000
World Bank	$2,970,000,000	United States	$116,000,000
IADB	$2,660,000,000	Italy	$110,000,000
6. PHILIPPINES	$3,930,000,000	EU	$122,000,000
Japan	$1,930,000,000	Japan	$95,400,000
World Bank	$676,000,000	Italy	$47,800,000
ASDB	$631,000,000		
United States	$291,000,000	9. TURKEY	$2,550,000,000
Italy	$88,100,000	Japan	$936,000,000
		Germany	$597,000,000
7. EGYPT	$3,200,000,000	World Bank	$524,000,000
United States	$1,430,000,000	EU	$297,000,000
World Bank	$262,000,000	France	$84,800,000
France	$255,000,000		
Germany	$243,000,000	10. BANGLADESH	$1,950,000,000
Japan	$208,000,000	World Bank	$647,000,000
		ASDB	$447,000,000
8. ARGENTINA	$2,920,000,000	United States	$275,000,000
IADB	$1,570,000,000	Denmark	$127,000,000
World Bank	$980,000,000	Germany	$115,000,000

Appendix B – Aid Flows to Recipients

Table B.1. Allocation of environmental Aid to All Recipients, as categorized by the PLAID research project, 1980–1999; 1980–1989; 1990–1999

	1980–1999		1980–1989		1990–1999	
	Recipient	Env. aid	Recipient	Env. aid	Recipient	Env. aid
1	CHINA	$10,994,597,489	BRAZIL	$2,790,257,955	CHINA	$10,100,336,643
2	BRAZIL	$9,325,450,243	EGYPT	$2,219,912,022	INDIA	$6,586,701,797
3	INDIA	$8,767,285,419	INDIA	$2,180,583,622	BRAZIL	$6,535,192,288
4	INDONESIA	$7,016,344,275	INDONESIA	$2,158,424,088	MEXICO	$5,212,238,543
5	MEXICO	$6,140,244,290	PAKISTAN	$2,026,999,142	INDONESIA	$4,857,920,186
6	EGYPT	$5,420,420,251	PHILIPPINES	$1,480,211,532	PHILIPPINES	$3,931,269,817
7	PHILIPPINES	$5,411,481,349	SOUTH KOREA	$1,436,609,961	EGYPT	$3,200,508,229
8	PAKISTAN	$3,673,259,052	ALGERIA	$1,200,729,566	ARGENTINA	$2,917,609,204
9	TURKEY	$3,643,655,298	BANGLADESH	$1,174,240,175	TURKEY	$2,549,709,943
10	ARGENTINA	$3,335,977,768	TURKEY	$1,093,945,354	LEAST DEV.	$2,513,471,694
11	BANGLADESH	$3,128,224,658	KENYA	$990,700,686	BANGLADESH	$1,953,984,484
12	LEAST DEV.	$2,744,107,311	MEXICO	$928,005,747	VIETNAM	$1,717,587,142
13	THAILAND	$2,335,723,237	CHINA	$894,260,845	THAILAND	$1,683,753,259
14	SOUTH KOREA	$2,002,903,359	COLOMBIA	$823,575,815	PAKISTAN	$1,646,259,909
15	MOROCCO	$1,960,217,990	THAILAND	$651,969,978	MOROCCO	$1,412,159,347
16	COLOMBIA	$1,891,102,531	NIGERIA	$573,621,342	PERU	$1,186,105,733
17	VIETNAM	$1,773,648,436	EL SALVADOR	$556,011,119	TUNISIA	$1,128,497,380
18	ALGERIA	$1,735,074,158	MOROCCO	$548,058,642	RUSSIA	$1,124,888,610
19	KENYA	$1,729,547,480	TUNISIA	$445,773,894	COLOMBIA	$1,067,526,716
20	TUNISIA	$1,574,271,273	DOM. REPUBLIC	$431,185,277	SRI LANKA	$967,758,909
21	PERU	$1,435,339,266	SRI LANKA	$424,959,196	BOLIVIA	$851,733,926
22	NIGERIA	$1,403,154,982	ARGENTINA	$418,368,564	NIGERIA	$829,533,640
23	SRI LANKA	$1,392,718,105	ETHIOPIA	$408,671,880	GHANA	$797,699,790
24	RUSSIA	$1,124,888,610	CONGO, DEM. R.	$389,713,922	JORDAN	$792,397,100
25	JORDAN	$1,096,189,021	TANZANIA	$369,392,685	KENYA	$738,846,793
26	TANZANIA	$1,060,889,730	HONDURAS	$360,129,056	TANZANIA	$691,497,045
27	GHANA	$1,034,893,977	ECUADOR	$336,976,568	GLOBAL	$684,882,940
28	ECUADOR	$959,659,299	JORDAN	$303,791,921	POLAND	$672,928,908
29	BOLIVIA	$952,656,475	HAITI	$297,751,116	LEBANON	$667,191,005
30	HONDURAS	$914,781,969	YUGOSLAVIA	$293,548,539	MOZAMBIQUE	$666,994,562
31	AFRICA	$855,203,255	COSTA RICA	$285,643,257	AFRICA	$665,403,144
32	SENEGAL	$854,356,014	SENEGAL	$283,800,354	GERMANY	$664,012,330
33	EL SALVADOR	$837,953,143	CHILE	$281,502,614	ECUADOR	$622,682,731
34	NEPAL	$810,278,024	MALAYSIA	$279,756,000	UGANDA	$588,916,077
35	ZIMBABWE	$775,125,837	NIGER	$273,561,600	NEPAL	$576,874,927
36	MOZAMBIQUE	$748,579,689	VENEZUELA	$268,533,181	SENEGAL	$570,555,660
37	UGANDA	$721,407,611	SUDAN	$260,868,043	SOUTH KOREA	$566,293,398
38	ETHIOPIA	$718,460,119	PERU	$249,233,533	BURKINA FASO	$557,802,370
39	LEBANON	$716,578,436	ZAMBIA	$242,591,729	HONDURAS	$554,652,913
40	BURKINA FASO	$711,390,499	GHANA	$237,194,188	NICARAGUA	$542,016,153
41	MALAYSIA	$706,776,679	ZIMBABWE	$237,080,111	ZIMBABWE	$538,045,726
42	GLOBAL	$690,714,658	YEMEN	$233,739,599	ALGERIA	$534,344,592
43	POLAND	$672,928,908	NEPAL	$233,403,097	PALESTINE	$522,991,562
44	WEST GERMANY	$664,012,330	LEAST DEV.	$230,635,617	MALAWI	$502,882,918
45	VENEZUELA	$656,971,193	SYRIA	$229,676,257	CYPRUS	$480,025,182
46	YEMEN	$643,671,388	MALI	$207,944,263	ASIA AND THE PACIFIC	$433,704,069
47	NICARAGUA	$615,411,632	RWANDA	$204,240,778	MALAYSIA	$427,020,680
48	MALAWI	$591,134,090	CÔTE D'IVOIRE	$203,834,464	MADAGASCAR	$421,434,425
49	DOMINICAN REPUBLIC	$587,600,287	AFRICA	$189,800,110	YEMEN	$409,931,789
50	COSTA RICA	$585,510,395	CAMEROON	$188,656,441	C. AND E. EUROPE	$404,321,376
51	CHILE	$578,307,533	LESOTHO	$180,423,606	PARAGUAY	$395,209,937
52	ZAMBIA	$574,811,105	URUGUAY	$174,084,337	FRANCE	$394,517,786

	1980–1999		1980–1989		1990–1999	
	Recipient	Env. aid	Recipient	Env. aid	Recipient	Env. aid
53	MALI	$574,556,654	GUATEMALA	$166,303,018	VENEZUELA	$388,438,012
54	HAITI	$564,634,669	PARAGUAY	$155,926,022	IRAN	$374,481,612
55	MADAGASCAR	$555,687,316	GUINEA	$155,656,722	MALI	$366,612,391
56	NIGER	$551,872,067	BURKINA FASO	$153,588,129	CZECH REPUBLIC	$362,337,824
57	PARAGUAY	$551,135,959	MADAGASCAR	$134,252,891	ZAMBIA	$332,219,376
58	CYPRUS	$546,099,294	JAMAICA	$133,802,565	CÔTE D'IVOIRE	$321,925,105
59	CÔTE D'IVOIRE	$525,759,568	UGANDA	$132,491,535	LESOTHO	$316,864,623
60	PALESTINE	$522,991,562	BENIN	$129,523,460	GUINEA	$313,746,897
61	LESOTHO	$497,288,229	BOTSWANA	$129,039,774	ETHIOPIA	$309,788,238
62	ASIA AND THE PACIFIC	$491,776,185	BURUNDI	$118,389,443	GUATEMALA	$306,103,448
63	GUATEMALA	$472,406,466	TOGO	$112,882,677	COSTA RICA	$299,867,138
64	GUINEA	$469,403,620	BOLIVIA	$100,922,549	CHILE	$296,804,919
65	CONGO, DEM. REP.	$453,256,379	SOMALIA	$97,831,048	BULGARIA	$287,211,020
66	C. AND E. EUROPE	$404,321,376	MYANMAR	$91,495,930	MAURITIUS	$283,147,553
67	URUGUAY	$401,963,179	MALAWI	$88,251,173	EL SALVADOR	$281,942,025
68	FRANCE	$394,517,786	DJIBOUTI	$83,104,742	NIGER	$278,310,467
69	BENIN	$394,225,635	MOZAMBIQUE	$81,585,127	LATIN AM. AND CARIB.	$272,898,924
70	IRAN	$374,481,612	NICARAGUA	$73,395,480	SOUTH AFRICA	$267,337,041
71	CZECH REPUBLIC	$362,337,824	PANAMA	$69,763,549	HAITI	$266,883,554
72	CAMEROON	$360,282,069	MAURITANIA	$67,116,253	BENIN	$264,702,175
73	BOTSWANA	$358,248,800	CYPRUS	$66,074,111	UKRAINE	$247,222,806
74	JAMAICA	$339,009,396	GAMBIA	$63,280,149	BOTSWANA	$229,209,026
75	MAURITIUS	$337,050,226	ISRAEL	$62,768,431	URUGUAY	$227,878,842
76	SUDAN	$335,596,801	ASIA/PACIFIC	$58,072,116	CAMBODIA	$222,755,219
77	SYRIA	$324,358,250	VIETNAM	$56,061,294	ROMANIA	$218,899,372
78	RWANDA	$322,609,003	MAURITIUS	$53,902,673	JAMAICA	$205,206,831
79	LATIN AM. AND CARIB.	$320,018,652	OMAN	$51,494,024	LAOS	$201,596,922
80	YUGOSLAVIA	$293,548,539	SIERRA LEONE	$50,407,457	CROATIA	$199,977,731
81	BULGARIA	$287,211,020	CAPE VERDE	$49,406,304	HUNGARY	$192,329,389
82	SOUTH AFRICA	$267,337,041	LEBANON	$49,387,430	MONGOLIA	$187,543,069
83	BURUNDI	$257,863,115	LATIN AM./CARIB.	$47,119,728	CHAD	$174,358,838
84	UKRAINE	$247,222,806	PORTUGAL	$41,430,000	ISRAEL	$173,752,382
85	MAURITANIA	$236,909,002	CHAD	$40,265,731	UZBEKISTAN	$172,614,765
86	ISRAEL	$236,520,813	GABON	$38,077,192	CAMEROON	$171,625,628
87	PANAMA	$228,332,479	BAHAMAS	$37,265,310	NAMIBIA	$169,933,959
88	HUNGARY	$226,210,645	CONGO	$36,804,983	MAURITANIA	$169,792,749
89	CAMBODIA	$226,109,456	LIBERIA	$35,217,291	PANAMA	$158,568,931
90	ROMANIA	$218,899,372	HUNGARY	$33,881,256	DOM. REPUBLIC	$156,415,010
91	LAOS	$215,774,414	BELIZE	$33,255,167	GREECE	$155,584,479
92	CHAD	$214,624,569	C. AFRICAN REP.	$32,120,287	TRINIDAD AND TOBAGO	$148,781,296
93	CROATIA	$199,977,731	MALDIVES	$29,373,631	SPAIN	$148,087,048
94	TOGO	$194,303,975	GUINEA-BISSAU	$26,777,298	BURUNDI	$139,473,672
95	MONGOLIA	$187,543,069	SEYCHELLES	$25,914,002	GUYANA	$139,467,935
96	UZBEKISTAN	$172,614,765	THE NETHERLANDS ANTILLES	$24,863,972	ANGOLA	$123,581,604
97	NAMIBIA	$170,582,362	ST LUCIA	$24,389,499	PAPUA NEW GUINEA	$122,586,517
98	SOMALIA	$158,445,819	CAYMAN IS.	$22,621,335	RWANDA	$118,368,225
99	GREECE	$155,584,479	BARBADOS	$20,351,769	AZERBAIJAN	$117,141,042
100	DJIBOUTI	$154,273,055	BHUTAN	$19,769,638	ALBANIA	$108,452,334
101	TRINIDAD AND TOBAGO	$149,214,231	PAPUA NEW GUINEA	$16,527,257	LITHUANIA	$104,335,158
102	SPAIN	$148,087,048	FIJI	$14,717,971	ARMENIA	$97,259,754
103	GUYANA	$141,886,962	ANTIGUA AND BARB.	$14,404,576	C. AFRICAN REP.	$96,882,881
104	PAPUA NEW GUINEA	$139,113,774	LAOS	$14,177,491	ITALY	$96,208,135
105	ANGOLA	$135,715,814	SWAZILAND	$12,650,977	KAZAKHSTAN	$95,625,963
106	C. AFRICAN REP.	$129,003,167	ANGOLA	$12,134,210	SYRIA	$94,681,992
107	CAPE VERDE	$128,128,145	ST KITTS-NEVIS	$11,949,200	LATVIA	$94,127,608
108	AZERBAIJAN	$117,141,042	SAMOA	$10,297,369	FINLAND	$92,609,809
109	GAMBIA	$116,986,591	AFGHANISTAN	$9,615,365	BARBADOS	$88,744,940
110	SIERRA LEONE	$112,631,117	KIRIBATI	$9,177,372	EUROPE UNSPEC.	$87,764,993
111	BARBADOS	$109,096,710	N. MARIANAS	$8,843,381	ERITREA	$81,983,252
112	ALBANIA	$108,452,334	SOLOMON IS.	$8,796,772	TOGO	$81,421,298
113	GABON	$104,661,003	TONGA	$8,585,069	CAPE VERDE	$78,721,841
114	LITHUANIA	$104,335,158	COMOROS	$8,128,221	SUDAN	$74,728,758
115	BAHAMAS	$101,444,109	MIDDLE EAST	$6,994,113	DJIBOUTI	$71,168,313
116	ARMENIA	$97,259,754	SOUTH YEMEN	$6,776,251	BHUTAN	$67,948,440
117	ITALY	$96,208,135	SÃO TOMÉ AND PR.	$6,684,792	ESTONIA	$67,641,855
118	KAZAKHSTAN	$95,625,963	DOMINICA	$6,058,497	MOLDOVA	$67,074,790
119	LATVIA	$94,127,608	GLOBAL	$5,831,718	GABON	$66,583,811
120	BELIZE	$93,561,019	GRENADA	$5,014,554	BAHAMAS	$64,178,800
121	FINLAND	$92,609,809	NEW CALEDONIA	$4,578,139	CONGO, DEM. REP.	$63,542,457

1980–1999		1980–1989		1990–1999	
Recipient	Env. aid	Recipient	Env. aid	Recipient	Env. aid
122 MYANMAR	$92,541,614	MAYOTTE	$4,519,018	SIERRA LEONE	$62,223,661
123 EUROPE UNSPECIFIED	$87,764,993	ANGUILLA	$4,310,030	GUINEA-BISSAU	$60,946,884
124 GUINEA-BISSAU	$87,724,182	EQ. GUINEA	$4,200,761	SOMALIA	$60,614,770
125 BHUTAN	$87,718,078	CAMBODIA	$3,354,237	BELIZE	$60,305,852
126 ERITREA	$81,983,252	TUVALU	$3,253,131	SURINAME	$56,750,818
127 ESTONIA	$67,641,855	LIBYA	$3,211,628	GAMBIA	$53,706,442
128 MOLDOVA	$67,074,790	VANUATU	$2,942,482	SLOVENIA	$53,180,512
129 MALDIVES	$62,714,809	GUYANA	$2,419,028	GEORGIA	$48,406,275
130 CONGO	$61,358,948	MONTSERRAT	$2,144,282	TURKMENISTAN	$43,296,769
131 ST LUCIA	$59,014,942	IRAQ	$1,371,118	SWAZILAND	$41,915,158
132 SURINAME	$56,794,370	ARUBA	$1,327,691	SLOVAKIA	$37,884,348
133 SWAZILAND	$54,566,135	ST VINCENT AND GR.	$1,022,554	ST LUCIA	$34,625,443
134 SLOVENIA	$53,180,512	REUNION	$887,134	BOSNIA-HERZ.	$33,711,364
135 OMAN	$51,940,586	US VIRGIN IS.	$870,932	MALDIVES	$33,341,178
136 GEORGIA	$48,406,275	NAMIBIA	$648,403	SOLOMON ISLANDS	$32,333,694
137 TURKMENISTAN	$43,296,769	COOK ISLANDS	$638,740	KIRIBATI	$31,169,172
138 SEYCHELLES	$42,318,744	NIUE	$468,971	SAUDI ARABIA	$31,147,015
139 PORTUGAL	$41,430,000	TRINIDAD AND TOB.	$432,935	SAMOA	$31,048,073
140 SAMOA	$41,345,441	FR. POLYNESIA	$377,032	DOMINICA	$30,145,221
141 SOLOMON ISLANDS	$41,130,466	TURKS AND CAICOS	$169,211	MICRONESIA	$28,494,482
142 KIRIBATI	$40,346,544	SINGAPORE	$113,102	MARSHALL ISLANDS	$26,909,227
143 FIJI	$40,029,259	SURINAME	$43,552	FIJI	$25,311,288
144 SLOVAKIA	$37,884,348			CONGO	$24,553,965
145 LIBERIA	$36,637,681			BAHRAIN	$22,591,072
146 DOMINICA	$36,203,718			MIDDLE EAST	$20,113,127
147 BOSNIA-HERZEGOVINA	$33,711,364			COMOROS	$19,097,763
148 SAUDI ARABIA	$31,147,015			FRENCH POLYNESIA	$18,057,537
149 MICRONESIA	$28,494,482			CUBA	$17,385,740
150 NETH. ANTILLES	$28,001,157			EQUATORIAL GUINEA	$17,033,053
151 COMOROS	$27,225,983			SEYCHELLES	$16,404,742
152 MIDDLE EAST	$27,107,240			MACEDONIA	$16,134,916
153 MARSHALL ISLANDS	$26,909,227			SÃO TOMÉ AND PR.	$15,961,566
154 CAYMAN ISLANDS	$24,905,867			GRENADA	$15,399,336
155 SÃO TOMÉ AND PRÍNCIPE	$22,646,357			BELARUS	$13,540,807
156 BAHRAIN	$22,591,072			VANUATU	$11,923,714
157 EQUATORIAL GUINEA	$21,233,814			N. MARIANAS	$11,778,388
158 NORTHERN MARIANAS	$20,621,769			MAYOTTE	$11,593,561
159 GRENADA	$20,413,891			ST VINCENT AND GR.	$10,993,906
160 ANTIGUA/BARBUDA	$20,057,146			TONGA	$10,138,967
161 TONGA	$18,724,037			TURKS AND CAICOS	$9,025,255
162 FRENCH POLYNESIA	$18,434,569			PALAU	$8,265,221
163 CUBA	$17,385,740			KOSOVO	$7,429,395
164 MACEDONIA	$16,134,916			MONTSERRAT	$6,540,094
165 MAYOTTE	$16,112,579			NEW CALEDONIA	$6,062,977
166 ST KITTS-NEVIS	$15,917,176			SOUTH YEMEN	$5,789,623
167 VANUATU	$14,866,196			ANTIGUA AND BARBUDA	$5,652,570
168 BELARUS	$13,540,807			SERBIA AND MONT.	$4,575,308
169 AFGHANISTAN	$13,165,963			ANGUILLA	$4,493,435
170 SOUTH YEMEN	$12,565,874			TUVALU	$4,190,246
171 ST VINCENT AND GR.	$12,016,460			ST KITTS-NEVIS	$3,967,976
172 NEW CALEDONIA	$10,641,116			NORTH KOREA	$3,874,020
173 TURKS AND CAICOS IS.	$9,194,466			KYRGYZSTAN	$3,598,288
174 ANGUILLA	$8,803,465			AFGHANISTAN	$3,550,598
175 MONTSERRAT	$8,684,376			NETH. ANTILLES	$3,137,186
176 PALAU	$8,265,221			TAJIKISTAN	$2,754,029
177 TUVALU	$7,443,376			EAST TIMOR	$2,659,161
178 KOSOVO	$7,429,395			COOK ISLANDS	$2,407,798
179 SERBIA AND MONT.	$4,575,308			CAYMAN ISLANDS	$2,284,533
180 NORTH KOREA	$3,874,020			ST HELENA	$2,193,089
181 KYRGYZSTAN	$3,598,288			LIBERIA	$1,420,389
182 LIBYA	$3,291,418			US VIRGIN ISLANDS	$1,403,196
183 COOK ISLANDS	$3,046,538			SINGAPORE	$1,388,650
184 TAJIKISTAN	$2,754,029			NIUE	$1,350,122
185 EAST TIMOR	$2,659,161			GIBRALTAR	$1,067,058
186 US VIRGIN ISLANDS	$2,274,128			MYANMAR	$1,045,683
187 ST HELENA	$2,193,089			MALTA	$931,594
188 IRAQ	$1,888,821			BRUNEI	$853,459
189 NIUE	$1,819,093			IRAQ	$517,703
190 ARUBA	$1,786,384			ARUBA	$458,693
191 SINGAPORE	$1,501,752			KUWAIT	$448,649
192 GIBRALTAR	$1,067,058			OMAN	$446,562
193 MALTA	$931,594			MACAO	$395,108
194 REUNION	$887,134			CZECHOSLOVAKIA	$211,922
195 BRUNEI	$853,459			QATAR	$155,851
196 KUWAIT	$448,649			TOKELAU	$120,822
197 MACAO	$395,108			LIBYA	$79,790
198 CZECHOSLOVAKIA	$211,922			NAURU	$61,969
199 QATAR	$155,851			TAIWAN	$42,705
200 TOKELAU	$120,822				
201 NAURU	$61,969				
202 TAIWAN	$42,705				

Econometric model

Table 6.1. Summary table of hypotheses, Bilateral Donor models

Hypothesis	Variable	Description, source
H1a: The intensity of a donor country's environmental policy preferences will positively correlate with the share of its foreign aid budget dedicated to environmental issues	Environmental policy index EPI	Environmental policy index: donor percentiles in twenty-two measures of domestic and international environmental policy outcomes. Nielson and Tierney 2003.
H1b: The intensity of a donor country's *intemotional* environmental policy preferences will positively correlate with the share of its foreign aid budget dedicated to 'green' issues	Ln (percentage of treaties ratified)	Percentage of environmental treaties ratified by donor in a given year (calculated over Vienna, Kyoto, Heritage, UNFCC, Ramsar, Law of the Sea, CITES, Cartagena, Biodiversity)
H1c: The intensity of a donor country's *intemotional* environmental policy preferences will positively correlate with the share of its foreign aid budget dedicated to 'green' issues	Compliance with enviro. treaties (Wefagr)	Government compliance with international environmental agreements (z-score). Environmental sustainability index 2001/World Economic Forum Global Compet. Report
H2a: The more post-materialist the electorate's preferences, the more 'environmental' the donor country's foreign aid budget	Ln (world values)	International survey of four items on attitude to consumption, Inglehart, World Values Survey
H2b: Wealthier countries will be more willing to spend taxpayer money on environmental foreign aid	Ln (GDP per capita)	GDP measured in purchasing power parity divided by population. World Bank World Development Indicators
H3a: The stronger a country's environmental lobby, the larger the proportion of its aid budget that will target environmental protection	Ln (relative size of enviro. lobby)	(Number of environmental NGOs/population) times (size of the environmental technology market/size of the economy). Neumayer and Binder 2005; OECD 2001
H3b: The stronger a country's 'dirty lobby,' the smaller the proportion of its aid budget that will target environmental protection (and more to 'dirty' projects)	Ln (IGC—industrial lobby)	Industrial lobby strength (Henisz and Zelner 2006)
H4a: The more left governing party seats in the donor country's legislature, the larger the proportion of its aid budget that will target environmental protection	Ln (LEFTS)	Measures the number of left governing party seats as a percentage of all legislative seats. Swank (2002) Comparative Parties Data Set
H4b: The fewer checks and balances in the donor country's government, the larger the proportion of its aid budget that will target environmental protection	Checks	Checks and balances that restrain government behavior: 1 indicates few veto players; 18 indicate many veto players. Beck et al. 2001
H4c: The fewer veto players in a donor country's government, the larger the proportion of its aid budget that will target environmental protection	Veto players	Number of veto players in political system. Tsebelis 2002.
H4d: Corporatist states will spend proportionally more of their aid budget on environmental protection than non-corporatist states	Corporatism	Corporatist/pluralist nature of the policy-making process: centralization in the wage-bargaining process. Kenworthy 2001.

Table 6.2. 'Dirty' Aid (projects likely to have negative environmental impacts) as a share of Bilateral Donor portfolios

Hyp.	Variables	Dirty aid			
		1 OLS	2 OLS	3 fixed effects	4 fixed effects
H1	Donor environmental policy index [ln(EPI)]	—	−0.35** (−5.25)	—	0.51 (1.45)
	Percentage of environmental treaties ratified [ln(Treaty %)]	0.09 (0.67)	0.08 (0.56)	0.11 (0.71)	0.03 (0.21)
	Compliance with environmental treaties (WEFAGR)	0.01 (0.15)	—	—	—
H2	National wealth [ln(GDP per Capita)]	−0.33** (−2.18)	−0.35** (−3.95)	−0.49** (−2.50)	−0.21 (−1.04)
	Post-materialist values [ln(World Values)]	−0.80) (−1.47)	−0.46 (−1.13)	−1.56 (−1.39)	−2.29** (−2.58)
H3	Strength of environmental lobby [Ln(Enviro Lobby)]	−0.07 (−1.97)	−0.03 (−1.57)	−0.29** (−2.25)	−0.19* (−2.06)
	Strength of industrial lobby [ln (IGC)]	0.03 (0.16)	0.15 (0.95)	0.10 (0.08)	−0.88 (−1.02)
H4	Power of left in legislative branch [ln(LEFTS)]	−0.06 (−1.11)	0.02** (7.25)	−0.05 (−0.81)	−0.05 (−0.91)
	Checks and balances [ln(Checks)]	—	0.20** (2.73)	—	0.14** (2.26)
	Corporatism	—	−0.05 (−1.31)	—	0.06 (0.62)
	Veto players	0.07 (1.57)	—	−0.03 (−1.02)	—
	Time trend	−0.04** (−2.98)	−0.03** (−2.50)	−0.03 (−1.59)	−0.04** (−2.62)
	Constant	83.84** (3.16)	59.1** (2.60)	58.70* (1.81)	78.15** (2.82)
	R^2	0.39	0.51	0.59	0.65
	N	160	160	160	160

Notes: OLS and fixed effect models, 17 donor countries, 1988–1999 (** and * denote significance at the 5% and 10% levels respectively).

Table 6.3. Environmental projects as a share of Bilateral Donor portfolios

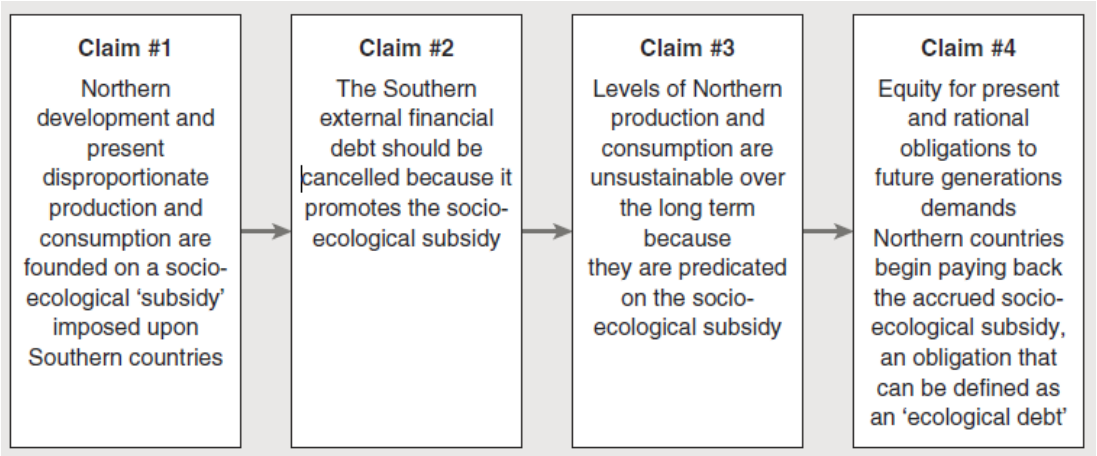
Hyp.	Variable	Environmental aid				Green aid	Brown aid
		1 OLS	2 OLS	3 Fixed effects	4 Fixed effects	5 OLS	6 OLS
H1	Donor enviro. policy index (ln)	—	−0.31** (−5.98)	—	0.18 (0.41)	—	−0.36* (−2.15)
	Ln percentage of environmental treaties rat'd.	0.27 (1.74)	0.29** 2.42	0.15 (0.89)	0.16 (0.81)	0.31 (1.47)	0.23 (−.94)
	Compliance w/environmental treaties (wfagr)	0.17** (2.32)	—	—	—	0.08 (0.65)	—
H2	National wealth [ln(GDP/cap)]	−0.06 (10.45)	−0.08 (−0.79)	0.01 (0.05)	0.02 (0.05)	0.40** (2.24)	0.30** (2.48)
	Post-materialist values (ln)	0.16 (0.30)	0.65 (1.31)	−0.72 (−0.42)	0.20 (0.12)	−1.32 (−1.47)	−0.13 (−0.17)
H3	Strength of environmental lobby (ln)	−0.62** (−2.32)	0.01 (0.35)	−0.02 (−0.11)	−0.04 (−0.18)	0.24** (2.98)	0.26** (2.88)
	Strength of industrial lobby (IGC)	−0.31 (−1.28)	−0.36 (−1.21)	−1.60 (−1.56)	−0.76 (−0.50)	0.35 (0.96)	0.11 (0.27)
H4	Left party strength (ln)	−0.01 (−0.18)	−0.00 (−0.30)	0.04 (0.37)	0.06 (0.47)	0.13* (1.84)	−0.02** (−2.83)
	Checks and balances (ln)	—	0.17 (1.38)	—	0.06 (0.58)	—	−0.14 (−0.83)
	Veto players	0.06 (1.62)	—	−0.18** (−3.16)	—	0.10 (0.96)	—
	Corporatism	—	0.06 (1.04)	—	−0.08 (−0.65)	—	0.08 (0.68)
	Time trend	−0.00 (−0.03)	0.00 (0.02)	−0.00 (−0.08)	0.00 (0.02)	−0.02 (−0.97)	−0.02 (−0.75)
	Constant	−1.55 (−0.05)	−3.24 (−0.12)	0.03 (0.00)	−4.65 (−0.11)	38.30 (0.84)	30.2 (0.64)
	R^2	0.18	0.17	0.37	0.36	0.28	0.25
	N	160	160	160	160	160	160

Notes: OLS and fixed effects models, 17 donors, 1988–1999 (** and * denote significance at the 5% and 10% levels respectively).

vii. Ecological Debt

Source: Rice J. (2009). North–South Relations and the Ecological Debt: Asserting a Counter-Hegemonic Discourse. Critical Sociology 35(2) 225–252.

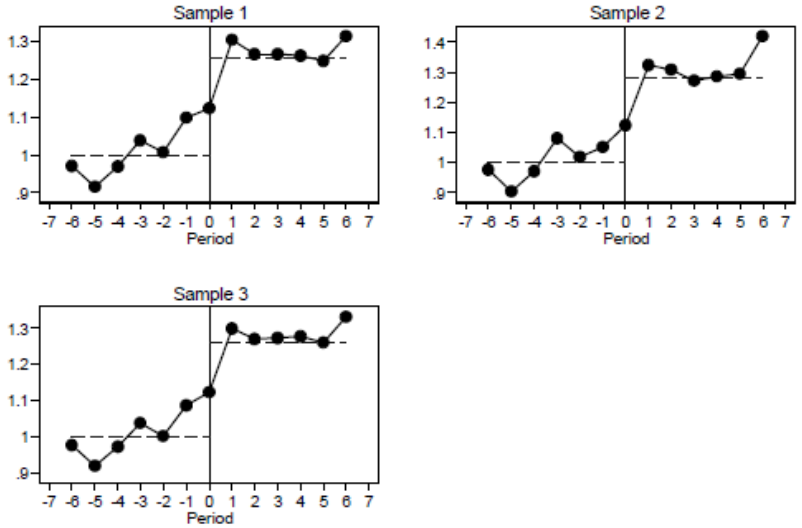
Figure 6 Ecological debt: interrelated claims advanced in the discourse



viii. Foreign Aid and Natural Disasters

Source: Inter-American Development Bank (2012).Working Paper: Foreign Aid in the Aftermath of Large Natural Disasters. Inter-American Development Bank. Department of Research and Chief Economist.

Figure 1 Before-After Aid Flows



Description by the authors: Figure 1 presents the data on Aid Flows in the years before and after the disasters. The figures are standardized so that the average of pre-disaster Aid inFlows is equal to 1. When examining the averages, Aid Flows already appear to increase in the year of the disaster (by 8 percent for Sample 1) and then increase further in the year after the disaster by about 20 percent. Aid Flows dip somewhat in the second year after the disaster, depending on the sample, but they do not revert to their pre-disaster levels in the six years we track following the disaster.

ESSAY 2:

CDM, ODA and EU ETS compared

Econometric analysis of Renewable Energy projects and Difference-in-Differences analysis of the policy impacts of EU ETS Phase II

Contents

Figures

Tables

Acronyms and abbreviations used in the text and within the tables/figures

Items	Acronyms and abbreviations
Clean Development Mechanism	CDM
Donor countries or Donors	DC
Environmental Policy Index	EPI
European Commission	EC
European Union	EU
Gigawatt	GW
Green sectors	GS
Greenhouse gas	GHG
Institute for Global Environmental Strategies	IGES
International Development Association	IDA
International Financing Institutions	IFI
International Organisations	IIOO
Kilowatt	KW
Least developed countries	LDCs
Megawatt	MW
Non-governmental Organizations	NGO
Recipient countries or Recipients	RC
The World Bank	WB
United Nations Framework Convention on Climate Change	UNFCCC
World Bank Country Policy and Institutional Assessment	CPIA
World Bank environment and natural resource management	ENRM
World Bank Independent Evaluation Group	IEG
World Bank International Bank for Reconstruction and Development	IBRD
World Bank International Finance Corporation	IFC
World Bank Multilateral Investment Guarantee Agency	MIGA
Units of measure	
Million	M
Thousand	000
United States Dollars	US $

1. Research questions and objectives

The legal implementation[1] of the Clean Development Mechanism (CDM), foreseen by the Kyoto Protocol, and the projects realized under its aegis (referred as CDM projects by the Literature) have to be analysed with respect to the previously existing projects performed under the "hat" of the Official Development Assistance (historically called ODA projects by the Literature).

Indeed, from 2005 on, CDM projects address the objectives of mitigation and adaptation in parallel with similar ODA projects that – in turns – have a different underlying institutional system, that started far before Kyoto and continues acting after Kyoto legal implementation[2].

As a matter of fact, CDM and ODA projects, rather than being different with respect to final outcomes (e.g. the construction of a Solar plant of a given MW capacity in a given country), mainly distinguish each other for their different underlying institutional systems (i.e. the Kyoto System for CDM projects and the International Assistance world for ODA projects), that make any comparison between them a difficult exercise.

For this reason, ODA projects and CDM projects are often separately analysed by the existing Literature, that generally deals with a project type (ODA or CDM) independently from the other, not simultaneously considering ODA and CDM underlying institutional systems.

This paper intends to fulfil this comparison-gap existing in the Literature by simultaneously comparing ODA and CDM projects (and their respective underlying institutional systems) with an econometric model, with a specific focus on renewable energy projects.

In addition, being the EU ETS system linked to the CDM system, this paper has the objective of quantifying the impact of the introduction of the EU ETS Phase II on CDM renewable energy projects, with a Difference in Differences Model (DD Model).

Accordingly, the following research questions are stated:

- Question 1: which is the impact of CDM renewable projects with respect to ODA projects for the period 2005-2012?
- Question 2: which is the impact of EU ETS Phase II on CDM renewable energy projects with respect to EU ETS previous Phase from 2008 on?

These two research questions define a sub-sequential Research Design, that is based on the existing relations between CDM, ODA and ETS institutional frameworks, that simultaneously exist in the International Community, as shown in the following figure.

[1] Kyoto Protocol, signed in 1997, came into force in 2005 after the signature of Russia.

[2] The use of foreign Aid as a development tool has never found unanimous consensus in the Literature but, on the contrary, it has always been object of enormous discussions and theoretical debates between Pro-Aid and Anti-Aid supporters. For a comprehensive analysis of ODA aims and perspective please refer to Pankaj (2005), Lee M. M. and Izama M. P. (2015), Arndt, Jones and Tarp (2015), Askarov and Doucouliagos (2015), Gibson, Hoffman and Jablonbbebeneski (2015), etc.

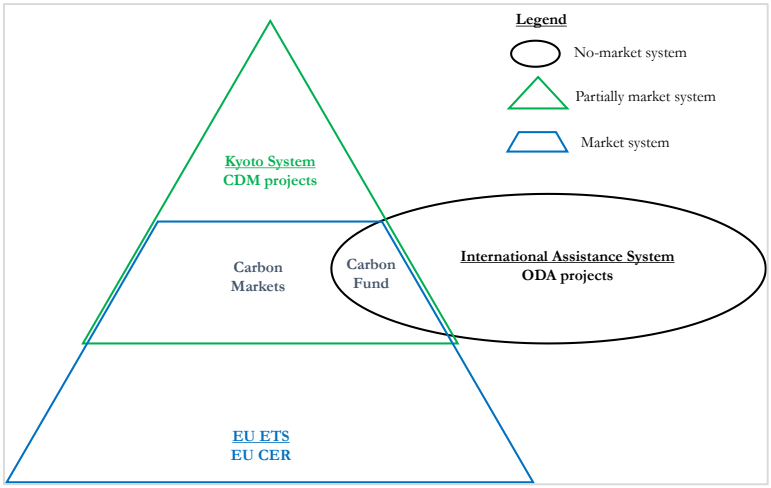


Figure 1 – The relations between Kyoto, ODA and EU ETS institutional systems

As shown in the picture above, the historical no-market based International Assistance System (set-up in its current form after Bretton Woods) stands together with "newly entered" Kyoto System (partially market based by means of CDM projects) and EU ETS System (market-based system through CER marketability in the carbon markets), which interaction generated European carbon markets.

Notwithstanding these different institutional structures and logics (market, partially-market, no-market), the development aims of the three systems in the field of energy are the same (i.e. mitigation and adaptation) and similar projects/programmes are carried out concerning renewable energies[3].

In other words, CDM projects can be considered as a "new form" of cooperation projects in the field of environmental protection, even if they do not enter in the classic scheme Donor-Recipient but rather on the Buyer-Seller scheme. For instance, as better analysed within the following Chapters of this paper, World Bank's Carbon Fund projects, that operated under the aegis of Kyoto system, can be considered also as ODA projects *stricto sensu*.

According to the above-mentioned structure and relations, this paper intends to compare how these three systems interact with each other by applying coherent statistical analyses. For the research question 1, a database creation is performed, in order to retrieve the energy cost ratio (project cost/MW installed) for a set of ODA projects in the field of renewable resources (Solar power, Wind power, Hydro power) to be econometrically compared with a set of alike CDM projects for the period 2005-2012.

For the research question 2, the impact of the EU ETS Phase II is determined on the identified group of renewable energy projects with a DD Model having the following structure:

Sample	**Pre-treatment**	**Post-treatment**
CDM projects – treated group	CDM projects <_ 2008	CDM projects > 2008
ODA projects – control group	ODA projects <_ 2008	ODA projects > 2008

Table 1 – DD Model logical structure

In order not to blunder in the error of evaluating partial data and/or realize generalizations based on few data, this paper uses the project-level-database AidData 2.1[4] for ODA projects, which shows the

[3] For additional information of the interaction between these systems, please refer to Wettestad (2009).

complete list of financial Flows from Donors to Recipients according to the official communications given by Governments and IIOO, and the CDM project database as officially published by the UNFCCC[5] and elaborated by Institute for Global Environmental Strategies (IGES)[6].

After a comprehensive analysis of the existing literature regarding ODA, CDM and EU ETS Systems, environmental and Climate Changes issues, recent policy orientations and DD Model methodologies (Chapter 2), this paper defines the Research Design conceived (Chapter 3), presents the Descriptive Statistics obtained (Chapter 4) and shows the results of the Econometric Model (Chapter 5) addressing the Research Question 1 and of the DD Model (Chapter 6) proving an answer to the Research Question 2. The paper ends with possible Policy Recommendations and Conclusions (Chapter 7).

[4] For further information about AidData 2.1 Database, please refer to Paragraph 3.i.
[5] For additional information please refer to Chapter 3.
[6] For additional information please refer to Chapter 3.

2. Literature Review

The Literature has addressed ODA, CDM and EU ETS Systems from different perspectives, but rarely providing holistic visions and approaches. On the contrary, in terms of quantitative analyses, the Literature provides robust methodology for the DD and valid examples. Accordingly, the following split is used for the Review of the Literature:

a) Qualitative themes addressed by the Literature, shortly presenting the relation between Environmental and Climate Change, the concept of Climate Debt, recent Aid/ODA theories, Kyoto System and CDM projects, ODA and CDM projects, Carbon Finance and recent Policy implications;
b) Quantitative themes investigated by the Literature in terms of the DD Model of Angrist and Pischke, other approaches for the DD Model, including graphical representations.

The qualitative themes of point a) will be further discussed and integrated within Chapter 7 of this paper, while the quantitative themes of point b) will be deeply investigated in Chapters 4, 5 and 6.

A) QUALITATIVE THEMES OF THE LITERATURE

i. Introduction: Environment & Climate change

Climate change is for the 21st century world a similar phenomenon then it was the Great Depression for the 20th century world. Both phenomena are denied by some and feared by others and, most important, they constitute the two main treats to the Capitalist idea of never-ending progress and market auto-regulation capacity.

According to Goodman (2012), "Climate change expresses, on a world scale, the fundamental contradiction between capitalist development and ecological sustainability", while Schwartz and Randall (2003) considers that "Climate Change poses a profound challenge to the continued sustainability of capitalist accumulation". Differently from the Great Depression, that was tackled on a national basis, Climate change cannot be limited to a specific region, moving border-less across the continents, posing the "greatest threat and challenge for the survival of the humanity and other life forms in the good earth" (Sarkar and Leal, 2010).

The issue of Climate change uneven distribution of policy benefits and costs across space and time (Sarkar and Leal, 2010) brought the International Community to "think globally" in approaching environmental issues. As a matter of fact, indeed, the global commons nature of Climate Change implies that international cooperation among nations will likely be necessary for meaningful action at the global level (Aldy and Stavins, 2012).

For all its specificities and complexities, Climate change issues present a unique challenge for economists necessitating in-depth economic analysis in order to draw future policies (Sarkar and Leal, 2010). Indeed, the widespread attention to Climate Change of recent years (Pinksea and Kolka, 2012), that is mostly linked to the ongoing attempts to realise a successor to the 1997 Kyoto Protocol, brought the Literature to intensively deal with Climate Change issues, causalities and financing[7].

[7] The extensive analysis of the specific tools for Mitigation and Adaptation financing performed by Sarkar and Leal (2010), identifies the following financial tools:
- Revenues from Auctioning
- Funding Mitigation

ii. Climate Debt

The asymmetrical liability structure set by Kyoto (i.e. Annex-1 and non-Annex-1 countries) is connectable to the concept of "Climate Debt", that has been recently explored by the Literature. Within this framework, a recent part of the Literature is indeed dealing with the issue of climate justice (Timmons Roberts and Parks, 2009) and ecological debt (Rice, 2009; Hackmann, Moser and St. Clair, 2014)".

According to Rice (2009), for example, "the ecological debt consists of the obligations industrialized countries owe for the disproportionate acquisition of the undervalued natural resource assets of LDCs and inequitable utilization of the global commons without suitable recompense or, indeed, even recognition of such obligations". Following this assumption, the North of the World would have an ecological debt with respect to the developing countries that has never been accounted in treaties or within international organizations[8].

According to this approach, "the Southern external financial debt is oppressive and illegitimate and should be cancelled because it is much lower than the historical, cumulative ecological debt and constitutes a structural impediment to genuine development" (Rice, 2009).

The rationale of this proposal is that a "climate finance gap is emerging at a time when the overall level of climate finance is decreasing and adaptation and mitigation efforts in developing countries would have several advantages (Hackmann, Moser and St. Clair, 2014)". Notwithstanding the increase importance of associating Climate Change issues with Delopping concepts, the view of Climate Change as a sustainable development issue (rather than an environmental issue[9]) is "still in its infancy and leads to the question of how to effectively deal with both simultaneously" (Pinksea and Kolka, 2012).

iii. Kyoto System and CDM projects

Kyoto System differs from ODA System in two main terms; first, emission limits are set for a bunch of countries (Annex-I countries); second, at project level, private schemes (and then market criteria) are introduced within Flexibility Mechanisms[10]. CDM[11], that is the most important of Kyoto Mechanism, permits the realisations of mitigation and adaptation projects meant to reduce emissions according to preliminary approved methodologies. CDM projects shall respect the "additionality criteria" and are entitle to produce certified-emission-reductions (CER), marketable on international carbon (primary and secondary) markets.

- Funding Adaptation
- Public vs. Private Financing for Mitigation & Adaptation Projects
- Financing Mechanisms for Climate Projects
- Public Finance Mechanisms to Mobilize Investment in Climate Change Mitigation
- Carbon Offsets and Voluntary Carbon Markets"

[8] Rice presents this approach by means of the examination of eight documents from NGOs working to advance awareness of the ecological debt.

[9] In relation to the "mere environmental nature" of Climate change issues, please refer to Van der Ploeg and Withagen (2010). The authors analyse the optimal path for the carbon tax depending on "the cost of renewables versus the cost of extracting fossil fuel". The authors also explores the possible consequences of different regimes of energy use (i.e., only oil, only renewables or both).

[10] For a comprehensive description of the Kyoto Flexibility Mechanisms please refer to UNEP (2007) and to Appendix 1.

[11] For additional information of CDM and its phases please refer to Aldy and Stavins (2012) and Karani and Gantsho (2006).

The following figure shows the functioning of Kyoto Flexibility Mechanisms.

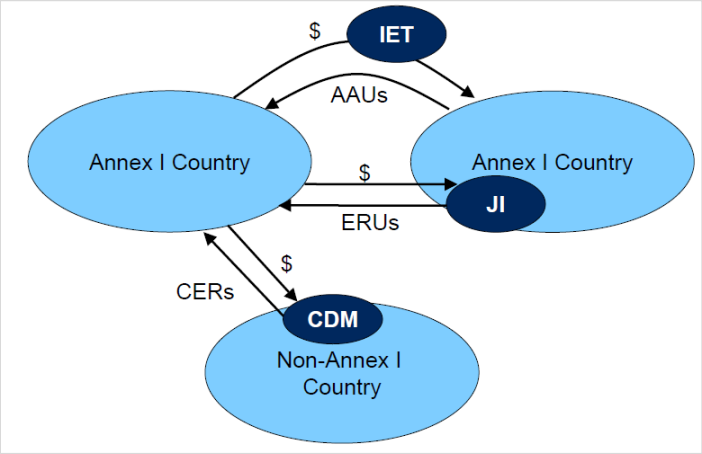


Figure 2 - The Kyoto Flexibility Mechanisms
Source: UNEP (2007)

As shown by the above figure, the flexibility mechanisms created under the UNFCCC framework, describe innovative features and structures[12], completely different with respect to previous ODA approaches (Figueres and Streck, 2009).

CDM: favourable and unfavourable views

Kyoto CDM has found favourable and unfavourable views. Indeed, first "historical" concern regarding Kyoto regards the distinction between Anne-1 and non-Annex-1 countries and "much of the controversy about the Kyoto process centred on its historic compromise between Annex 1 countries and the rest" (Timmons Roberts and Parks, 2009).

Zhange and Wang (2010)[13] consider that Kyoto's most serious challenge is its "environmental integrity", since there are no emission caps for developing countries. Additionality clause is questioned too, both in terms of project-level wrong registration and in terms of the achievement of environmental goals.

Yet, Karani and Gantsho (2006) consider that the CDM has brought about a "shift towards investments in services and products that reduce carbon dioxide emissions", encouraging investments in environmentally friendly technologies and that the carbon market and emerging carbon funds are some of the "main drivers enabling DFIs to play an increasingly important role in promoting the CDM in Africa."

ODA and CDM projects

According to the Literature, ODA approaches and practices cannot be considered as static systems because the exigencies of Recipients (and Donors) vary overtime according to the different institutional, economic and political structure built in within the international Community.

[12] Aldy and Stavins (2012) describe this innovative approach in the following terms: "Under the CDM, certified emission reduction (CER) credits are awarded for voluntary emission reduction projects in non-Annex I countries (largely, developing countries) that ratified the Protocol, but are not among the Annex I countries subject to the Protocol's emission limitation commitments—also known as the Annex B countries".
[13] Within their work, the authors estimate the effect of the CDM in reducing SO2 emissions at China's prefecture level.

The enforcement of Kyoto Protocol and its related Trade Emission Systems are good examples of this, since CDM projects can be considered as a "new form" of cooperation projects in the field of environmental protection, even if they do not enter in the classic scheme Donor-Recipient but rather on the Buyer-Seller scheme.

iv. Energy & Emission Trading Systems (ETS)

Kyoto Protocol and its Flexibility Mechanism also gave indirect birth to new Emissions Trading System (ETS)[14]. Among them, the European Union one (EU ETS, created in 2005) is the world's first and largest multinational cap-and-trade program to limit global warming pollution (Environmental Defense Fund, 2012).

The EU-ETS carbon market is one that is "new and unique" (Hua Fan, Roca and Akimov, 2014), because the underlying commodity in this market – carbon (represented by EUA - a unit of emission allowance), is very different from those in the other financial markets (e.g. price fundamentals, nature and level of regulation).

EU ETS Phases[15]

The EU ETS created a Carbon market[16] in which CER, EER and Allowances are currently traded on European level, rapidly becoming the European Union's flagship for climate policy and by far the largest carbon market in the world (Carbon Trade Watch, 2011).

Commencing its operation in January 2005, three phases were set out in the EU-ETS: Phase I (2005–2007), Phase II (2008–2012) and Phase III (2013–2020). Phase I was an experimental scheme that started with six key industrial sectors: energy activities production, processing of ferrous metals, mineral industries and pulp, paper and board activities. In Phase II, coverage was broadened, so that in addition to Phase I, CO2 emissions from glass, mineral, wool, gypsum, flaring from offshore oil and gas production, petrochemicals, carbon black and integrated steel works were included. In Phase III, an EU-wide cap is proposed to replace the current system of NAPs set by each member state, and the overall cap will be further tightened on an annual basis (Hua Fan, Roca and Akimov, 2014).

The "structural breaks" created by each EU ETS Phase with respect to the previous policy options brought the Literature to amply discuss about the effectivity of each Phase and the pro and counter of the entire European cap-and-trade program.

EU ETS: favourable and unfavourable views

[14] The almost direct connection between Kyoto Protocol entrance into force and the establishment of EU ETS is almost unanimous within the Literature. For instance, Wettestad (2009) considers that "the Kyoto Protocol exerted considerable pressure in the direction of establishing an effective EU-wide climate policy instrument, and in 1998 there was not a wide range of politically feasible instruments to choose from". Convery (2009) also connects the birth of EU ETS with previous European environmental policy unsuccesses, affirming that the "EU ETS was a product of two failures; first, the European Commission failed in its initiative to introduce an effective EU-wide carbon energy tax in the nineties. Secondly, the Commission fought unsuccessfully against the inclusion of trading as a flexible instrument in the Kyoto Protocol in 1997".

[15] For an extensive description of EU ETS Phases, please refer to Hua Fan, Roca and Akimov (2014), Martin, Muûls and Wagner (2012) and Convery (2009).

[16] The current functioning of the Carbon markets connected to the EU ETS is based on the following markets: the BlueNext, Nordpool and the European Climate Exchange (ECX).

By bringing an ad-hoc cap-and-trade system, ETS surely had impacts of all the European energy-related markets and prices (Stocking, 2010) such as electricity market[17] (Fischer and Newell, 2007) and energy commodities (Martin, Muûls and Wagner, 2012).

Part of the Literature believes that, in a world "where there is no coordinated global program to regulate carbon emissions" (Pizer and Yates, 2015), EU ETS constituted an exception climate policy able to design market tools for carbon offsets from unregulated sectors (Bento, Kanbur and Leard, 2014).

Some authors even underline that the use of EU ETS as an environmental tool gave good results (Juez, Gonzalez Molinos and Ruiz de Arbulo, 2014) and that the entire system is working, appearing to be on target and ahead of schedule for achieving the ambitious emission reduction target set for the years 2008–2012 (Environmental Defense Fund, 2012).

The following figure shows the volatility of European Union Allowances (EUAs) with respect to the trend of various commodities for the period 2008–2012.

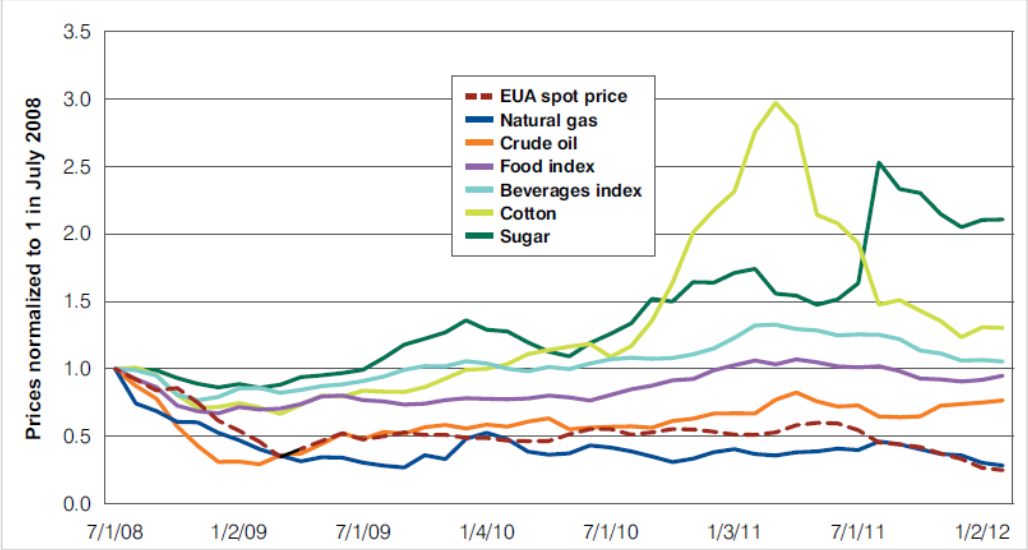


Figure 3 - Comparing the price volatility of European Allowances (EUAs) with various commodities, 2008–2012
Source: Environmental Defense Fund (2012)
Source: All commodities indexed relative to their value in July 2008. Source: EAU spot price data from Point Carbon. Other commodity data accessed from IMF Commodity Price Index, available at www.imf.org/external/np/res/commod/index.aspx.

As shown by the above figure, EUAs volatility is lower than other commodities, implying that the ETS has significantly reduced European emissions above and beyond the contractive effects of the recession or other possible factors (Environmental Defense Fund, 2012).

On the contrary, the unfavourable views of EU ETS consider that the ETS was unsuccessful in bringing the innovative environmental results which were promised.

[17] Lise, Sijm and Hobbs (2010) show that a significant part of the costs of (freely allocated) CO2 emission allowances is passed through to power prices, resulting in higher electricity prices for consumers and additional ('Windfall') profits for power producers, even in cases of full auctioning.

For instance, Röttgers and Grote (2014) believe that in the second phase of the EU ETS from 2008 to 2012, when demand was scare, the price of certificates too low. Yet, they consider that the potential for emission reduction partnerships in most developing countries was largely untapped.

Yet, the Carbon Trade Watch (2011) considers the ETS as a "subsidy scheme for polluters, with the allocation of permits to pollute more closely reflecting competition policy than environmental concerns"[18] and that the first two phases of the ETS clearly showed that it has "subsidised polluters whilst failing to limit emissions".

Martin, Muûls and Wagner (2012) summarise the literature on ex-post evaluation of the effectiveness of the EU ETS in driving abatement of greenhouse gases by industrial firms, finding evidence that the impact of the EU ETS on participating industrial firms' GHG emissions is not conclusive, and that "the transition from Phase I to Phase II triggered emission reductions in a few industrial sectors and that the firm-level allocation of permits influenced this effect"[19].

Yet, according to the authors, it is difficult to give "robust and precise estimates of EU ETS induced emissions reductions based on aggregate data." Similar conclusions are described by the Centre for Climate Change Economics and Policy (2013), assessing that "the lack of flexibility in the structure of the EU ETS cap, and its inability to adjust to radically altered wider economic conditions in the shape of the financial crisis, threatens to undermine its efficacy in providing incentives for abatement".

v. Carbon Finance

The interaction between ODA, EU ETS and CDM worlds, presented within Figure 3, also shows that a common area exists. This area, indicated as Carbon Fund within the figure, is constituted by the institutional structure underlying Carbon fund projects, which the Literature generally refer as Carbon Finance.

Carbon Finance is a new form of Climate Finance based on Market-oriented assistance for small-scale energy projects in developing and poor countries which are conceived in the framework of Kyoto mechanisms. It is needed in order not to exclude developing and poor countries from carbon markets, which are becoming more and more competitive and demand-driven.

The discussion related to Carbon Finance is very complex and articulated. Röttgers and Grote (2014) point out that the "a lack of development comes together with a very specific lack of capability to start CDM partnerships"[20].

Karani and Gantsho (2006) addressing the issue of CDM project in Africa, consider that carbon project development in Africa require CDM financing and that Carbon Funds (such as the World Bank Carbon Fund) can:

- Enhance investment in infrastructure;

[18] The Carbon Trade Watch (2011) even believe that the EU ETS have not worked and that the European Commission claims that the second phase, from 2008 to 2012, would usher in genuine reductions where unfulfilled.
[19] According to the authors, "there was no conclusive evidence about whether the effectiveness of the EU ETS could be jeopardized by adverse impacts on the economic performance of the regulated firms. Some studies found negative effects on employment, profits, or productivity, but these findings were not confirmed in other studies that relied on different statistical models".
[20] The author identifies the constraints for CDM project investments in Africa, showing that the small number and/or size of CDM projects in Africa is not straightforward.

- Promote partnerships; and,
- Catalyze development of the carbon market in Africa"

Far from reaching consensus on the applicability of Carbon Fund, the Literature is unanimous on the fact that the complexity of integrating the CDM with sustainable development requires innovation and entrepreneurship (Karani and Gantsho, 2006).

vi. Policy Orientations

For all these complexities, Climate change governance has become one of the most important and transversal topic within the Agenda of the International Community and Climate change is one of the most important issues in contemporary politics (Sarkar and Leal, 2010).

Indeed, Climate change policy is now considered by the Literature as a matter of international governance for which global strategies involving a wide range of policy options and varied engagement by multiple levels of governance systems are needed (Sarkar and Leal, 2010). Additionally, according to the Literature, Climate change presents a unique challenge for economists necessitating in-depth economic analysis to draw future policies (Sarkar and Leal, 2010).

Yet, the decade of experience following the 1997 signing of the Kyoto Protocol underlines as more and more complex process and negotiations are taking place. For instance, Goodman (2012) provides an extensive description of Climate Change negotiations and their underlying historical backgrounds.

CDM and EU ETS: the way forward

The Literature points out that the interaction between the three systems shall be better managed at international level, even calling for "institutional interaction" among systems. For instance, Wettestad (2009) considers that, although there are clear differences between the EU ETS and the UNFCCC/Kyoto Protocol with regard to institutional architecture, there is also "significant present or future overlap with regard to targeted actors and activities".

In particular, the author discusses the developing interaction and cross-scale effects between the company-focused EU emissions trading (ETS) and the country-focused international climate regime, in particular the Kyoto Protocol, distinguishing for four types of interaction:

Interaction ID	Short description
1	The interaction between the Kyoto Protocol as source and the ETS as target which started after the adoption of the Protocol in late 1997.
2	The second phase of interaction started in 2004 when the EU states started to develop national allocation plans (NAPs) where bringing in credits/allowances developed under the Clean Development Mechanism (CDM) became one compliance strategy.
3	The ETS as the source and the Kyoto Protocol institutions as targets.
4	A separate case of interaction deals with the possible role the ETS plays and could play for an emerging global carbon market.

Table 2 – Interaction between Kyoto System and ETS
Source: adapted from Wettestad (2009)

Yet, Goodman (2012) considers that the entering into a post-Kyoto paradigm will involve emissions reductions for 'all Parties' to the UN Climate Change convention and that may give birth to three possible scenarios, shown in the following table.

Scenario	Short description
Adaptation approach	Climate change is accepted as inevitable: the priority is to fund a new model of development that is 'climate-resilient'.
Technological mitigation	Two pathways: • one seeking to adapt non-renewables (such as through biofuels, carbon sequestration or nuclear power), • the other seeking to promote renewables. Whether renewables or non-renewables are favoured, the approach implies and requires significant transfers of resources from North to South in order to under-write a new global low emissions model of development.
Eco-sufficiency approach	Reduction in energy consumption and increased conservation as the principal means of reducing GHG emissions.

Table 3 – Future Climate change post-Kyoto Scenario (1)
Source: adapted from Goodman (2012).

In terms of legal enforcement, the Centre for climate research (2012) considers that a legal commitment out to 2030 with an early deadline to set the post-2030 cap (e.g. by 2020), "would provide much greater visibility and reassurance to investors than a short-term solution".

The survival of Kyoto Mechanism after post-2012 climate regime is not questioned by the Literature, that consider that the CDM has strong conceptual underpinnings and that it will most likely survive in the post-2012 climate regime (Figueres and Streck, 2009) as long as the efforts to contribute to global emission reductions will be shared with developing countries.

Together with CDM, EU ETS will most probably continue too, even if, among the industrialized nations, only "the EU has been clear about its intended post-Kyoto mitigation level" (Figueres and Streck, 2009).

Finally, as stated by Figueres and Streck (2009), the achievements of the past 10 years cannot be underestimated since the CDM has in fact established a "benchmark for a carbon market by defining the standards and processes for creating tradable emission reductions, consolidating methodologies, streamlining procedures, and reducing global mitigation costs." Conclusively, according to the major part of the Literature, the challenge of solving the climate crisis would pass through a multipolar world, where solutions cannot be implemented only by a few (Figueres and Streck, 2009) and where the globalization paradoxes of this century shall be resolved.

B) QUANTITATIVE THEMES OF THE LITERATURE

vii. The Difference in Differences Model of Angrist and Pischke (A&P DD Model)

The Literature considers the Difference in Differences Model (DD Model) as one of the most effective methodology for identifying the policy impacts of a determined treatment on a determined treated group (Angrist and Pischke, 2008; Flores and Shepherd 2014; Bharadwaj, 2010; Raju and Trias, 2010; Galiani, 2006; Lee and Izama, 2015; etc.). One of the main feature of the DD lies in the fact that the control group (i.e. a group similar to the treated group but independent from it that has not received the treatment) constitutes the natural counterfactual to the DD Model.

For the purposes of this paper, the Difference in Differences Model approach illustrated by Angrist and Pischke (A&P DD Model) will be used[21]. The authors considers the DD Model as a version of fixed-effects estimation using aggregate data.

As example for the DD Model, the authors cite Card and Krueger (1994) that used their data set to compute DD estimates of the effects of the New Jersey minimum wage increase, comparing the change in employment in New Jersey to the change in employment in Pennsylvania around the time New Jersey raised its minimum, finding that the increase in New Jersey minimum salary had positive effect on average full-time equivalent (FTE) employment (at restaurants).

In this case the dependent variable (Y) is:

(Y_{1ist}) = fast food employment at restaurant $_i$ and period $_t$ if there is a high state minimum wage

(Y_{0ist}) = fast food employment at restaurant $_i$ and period $_t$ if there is a low state minimum wage

According to the authors, the "hearth of the DD setup is an additive structure for potential outcomes in the no-treatment state", assuming that

$$\mathbf{E\,(Y_{0ist} \mid s,\, t) = y_s + \lambda_t}$$

where *s* denotes state (New Jersey or Pennsylvania) and *t* denotes period (February, before the minimum wage increase or November, after the increase). This equation says that in the absence of a minimum wage change, employment is determined by the sum of a time-invariant state effect and a year effect that is common across states. For this example, the econometric declination of the DD Model given Angrist and Pischke is the following, assuming that $E\,[(Y_{1ist}) - (Y_{0ist} \mid s, t)]$ is constant over time:

$$\mathbf{y_{ist} = y_s + \lambda_t + \beta\, D_{st} + \varepsilon_{ist}}$$

where:

- y_{ist} is the dependent variable,
- subscript *i* indexes sample units, subscript *t* indexes time in years,
- β is the coefficient on treatment (DD estimator),
- D_{st} is a dummy for high-minimum-wage states,
- ε_{ist} is the error term, where $E\,(\varepsilon_{ist} \mid s, t) = 0$

Together with the econometric estimation of the DD coefficient (β) on the population, the DD coefficient can be estimated using the sample analogue of the population means (Conditional sample means DD method):

$$\mathbf{[E\,(Y_{ist} \mid s = PA,\, t = Nov) - [E\,(Y_{ist} \mid s = PA,\, t = Feb)]}$$

$$\mathbf{- [E\,(Y_{ist} \mid s = NJ,\, t = Nov) - [E\,(Y_{ist} \mid s = NJ,\, t = Feb)]} = \beta$$

[21] The DD approach of the two authors is retrieved by Chapter 5.2 (Difference – in – Differences: Pre and Post, Treatment and Control) of Angrist and Pischke (2008).

As shown above, the β coefficient on treatment (DD estimator) is calculated by using the population means for the treated group (New Jersey) and for the control group (Pennsylvania).

viii. Other approaches for Difference in Differences Model (DD Model)

Other approaches to the DD Model have been provided by the recent econometric Literature dealing with the estimation of policy impacts. Flores and Shepherd (2014) examine with a DD Model the effects of tuition deregulation on the enrolment of racial/ethnic minority and low-income students at public research universities in Texas (in 2003 the state legislature gave tuition-setting authority to institutional governing boards). The Difference in Differences estimator (i.e. β3, TEXASi *AFTERit) permitted to find out that Hispanic students have been most negatively affected by tuition deregulation while black students results are largely mixed.

Bharadwaj (2010) explores the Mississippi 1957 amended to its marriage law[22] in terms of delaying of fertility and increasing education, using nearby states as control group.

Raju and Trias (2010) provides examples for DD models for the extension of education services in Indonesia and the water services in Argentina (retrieved by Galiani, 2006).

Galiani (2006) cites the work performed by Di Tella and Schargrodsky (2005) concerning the impact of Police agents to reduce crime after a terrorist attack (break point), finding no effect of observable police presence on car theft in the immediate surrounding area.

Lee and Izama (2015) use a DD Model to investigate if PEPFAR Program (President's Emergency Plan for AIDS Relief in Africa) had negative externality, founding statistical evidence that the influx of massive amounts of target aid damages broader public health systems in countries that receive PEPFAR funds.

Their DD Model is designed as following:

$$y_{it} = \alpha_i + \kappa_t + T_{it}\beta + X_{it}\chi + \varepsilon_{it}$$

where:

- subscript $_i$ indexes countries, subscript t indexes time in years,
- y is the annual percentage change in neonatal mortality rate,
- α is the country-specific intercept,
- K is the year-specific intercept
- X is a vector of covariates,
- ε is the error term,
- T β is the coefficient on treatment (DD estimator).

Chabé-Ferret and Subervie (2012) estimate the additional and Windfall effects of five Agro-environmental schemes (AESs) for a representative sample of individual farmers using Difference-In-

[22] Amendments concerned:
- Raised minimum age for men and women
- Introduced parental consent laws
- Proof of age, blood tests, other restrictions

Difference (DID) matching. The authors also describe the standards hypotheses for DD Model assumptions in the following terms (adapted from the authors):

- H1: the absence of diffusion of the treatment on the control group;
- H2: the existence of control group units similar to treated group units in terms of observed covariates;
- H3: in the hypothetical absence of the treatment, the difference in practices between treated group and control group would be constant over time.

The Literature regarding DD Models, agrees on the importance of the counterfactual to DD estimation (i.e. the control group). For instance, Raju and Trias (2010) point out that "the quality of the comparison group determines the quality of the evaluation".

The World Bank (2011a) considers that the use of a counterfactual for the change in outcome for the treatment group by calculating the change in outcome for the comparison group "allows to take into account any differences between the treatment and comparison groups that are constant over time."

Finally, the Literature analysis of the most important methodologies for realizing a DD Model univocally follows the approach given by Angrist and Pischke, focusing on the importance of the control group as the counterfactual and providing standards hypotheses for DD Model assumptions.

ix. Difference in Differences Model graphically explained (DD Model)

Graphically explained, the DD Model approach consists in the identification of the treatment effect on time-bases Cartesian axes (pre and post treatment), where the variable of interest (the dependent variable) is collocated in Y axes, as shown by the following figure.

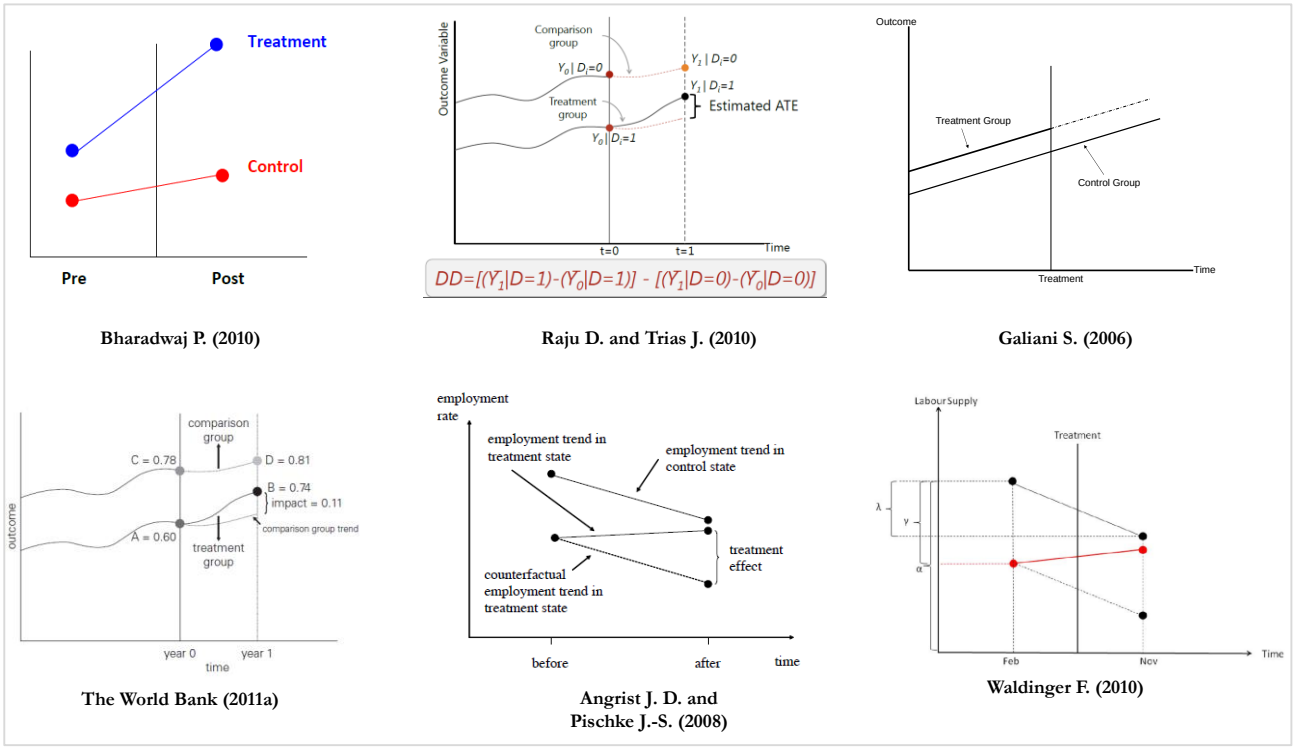


Figure 4 – Graphical explanations of DD Model approach according to the Literature Sources stated in parentheses.

As shown in the figure above, DD Model approaches presented in accordance to the Literature are very similar, providing pre and post treatment time reference and presenting the trend on the dependent variable for the treated group and the control group.

As correctly indicated by Angrist and Pischke (and sometimes omitted by others), the effect of the treatment lies in the distance between the trend in treatment state with respect to counterfactual.

Finally, for the purposes of this paper, the Angrist and Pischke Model will be applied, being by far the most complete and robust both econometrically and graphically.

x. Preamble to the analyses and caveats

The analysis of the Literature realized in this Chapter is meant to understand which are the general qualitative and quantitative issues that international ODA, CDM and ETS Literature debates on and to compare them with the findings of this paper and to provide sufficient robust examples for DD Methodologies, that will be applied for evaluating the policy impacts of EU ETS Phase II.

The authors of this paper are not responsible for the inputs and the primary data extrapolated by the database used and cannot be considered liable for erroneous information may exist within project documentation.

3. Research design:

i. Description of the database

The correct quantitative and qualitative comparison of the three institutional systems described in Figure 1 needs the creation of a comprehensive database, able to address the Research Questions stated in Chapter 1. To this aim, the merge of CDM and ODA project databases for renewable energy projects has been performed, according to the technical specifications stated below.

CDM database

As shown in the Literature Review Chapter, the CDM system is active from 2005 under the aegis of the Kyoto Protocol and the UNFCCC. Accordingly, the data concerning CDM projects have been retrieved using the official CDM primary data source[23]. The following table shows the specifications used for the database consultation:

Items	Selection
Sectoral Scopes	Energy industries
Scale	All
Methodologies	any
Host country	No selection
Annex-1 countries	No selection
Status	Registered (Issued projects only)
Registration date	2005-2012

Table 4 – Specification for UNFCC project interrogation

In addition to the CDM primary data, a consultation of the secondary data provided by the Institute for Global Environmental Strategies (IGES[24]) has been performed, in order to integrated CDM projects data with the following variables:

- MW installed (MWel);
- Emission reductions by 2030 (tCO2);
- Project investment (in M US $);
- Project type: Renewable energies (Hydro power, Wind power, Solar power)

These variables are very important because they permit to integrate CDM project database with additional quantitative information that will be of paramount importance for the research objectives stated in Chapter 1.

CDM primary data combined with IGES secondary data are useful to identify the following information, which will be better analyzed in the next Chapter of this paper.

ID Items	Items	Selection
1	Project ID	CDM ID
2	Starting Year	2005-2012
3	Name	Project Name
4	Host	Non – Appendix I Host country - (84 countries)

[23] The official CDM Project database has been accessed on 16/06/2015: https://cdm.unfccc.int/Projects/projsearch.html
[24] The official IGES Project database has been accessed on 16/06/2015: http://pub.iges.or.jp/modules/envirolib/view.php?docid=968

ID Items	Items	Selection
5	Party(ies)	Project Party(ies) – (78 countries or group of countries[25])
6	Project type	Renewable energies
7	Investment	In terms of M US $
8	Project scale	Large, Small
9	Methodology	7 Official Methodologies[26]
10	Emission reductions by 2030	In terms of tCO2
11	Installed capacity	In terms of MW installed

Table 5 – Specification for CDM project database

ODA database creation

In relation to ODA projects, this paper relies on the information provided by the database AidData 2.1 and its User's Guide 2.0 (Research Release 17 November 2011)[27]. The AidData database provides information concerning the first 7 items[28] provided by Table 5, but gives no details on the remaining items (from 8 to 11).

In order to fulfil this gap, a project-level research is performed within project documentation (mainly project technical information documents) in order to retrieve the missing information. To this aim, the web sites of the bilateral and multilateral agencies have been accessed, together with the main official existing project level databases.

The following figure furnishes an example of this process of research, showing how the information furnished by AidData database has been integrated with additional information deriving by the project technical fiche (or PID, project information document)

[25] As correctly remembered by Röttgers and Grote (2014), while the project Host country is unique, the Project Partners country string can show more than one countries, sometimes provoking particular issues in case of the need to translate project information into bilateral relations. For the purposes of this paper, Partners countries are left as a group. This provokes no alteration. Partnership-based analyses are not presented in this paper and are not useful for the purpose of the analyses.

[26] For an extensive description of the officially accepted methodologies under the UNFCCC please refer to UNFCCC (2015). The official methodologies are:

Code	Name of the Methodology
ACM0002	Grid-connected electricity generation from renewable sources
AMS-I.D.	Grid connected renewable electricity generation
AMS-I.F.	Renewable electricity generation for captive use and mini-grid
AM0026	Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid
AMS-I.A.	Electricity generation by the user
ACM0006	Consolidated methodology for electricity and heat generation from biomass
AMS-I.C.	Thermal energy production with or without electricity

[27] As recognized by the Literature, the main advantage of using a new project-level database such as AidData is that it incorporates previous databases and it permits a better disaggregation of sectors and activities than previous analyses.
The authors of this paper are aware of the fact that a new edition of AidData exists (i.e. AidData 3.0).

[28] The AidData database uses different names with respect to the CDM database. AidData project code for Renewable Energy projects is 23000-23082 (II.3. Energy).

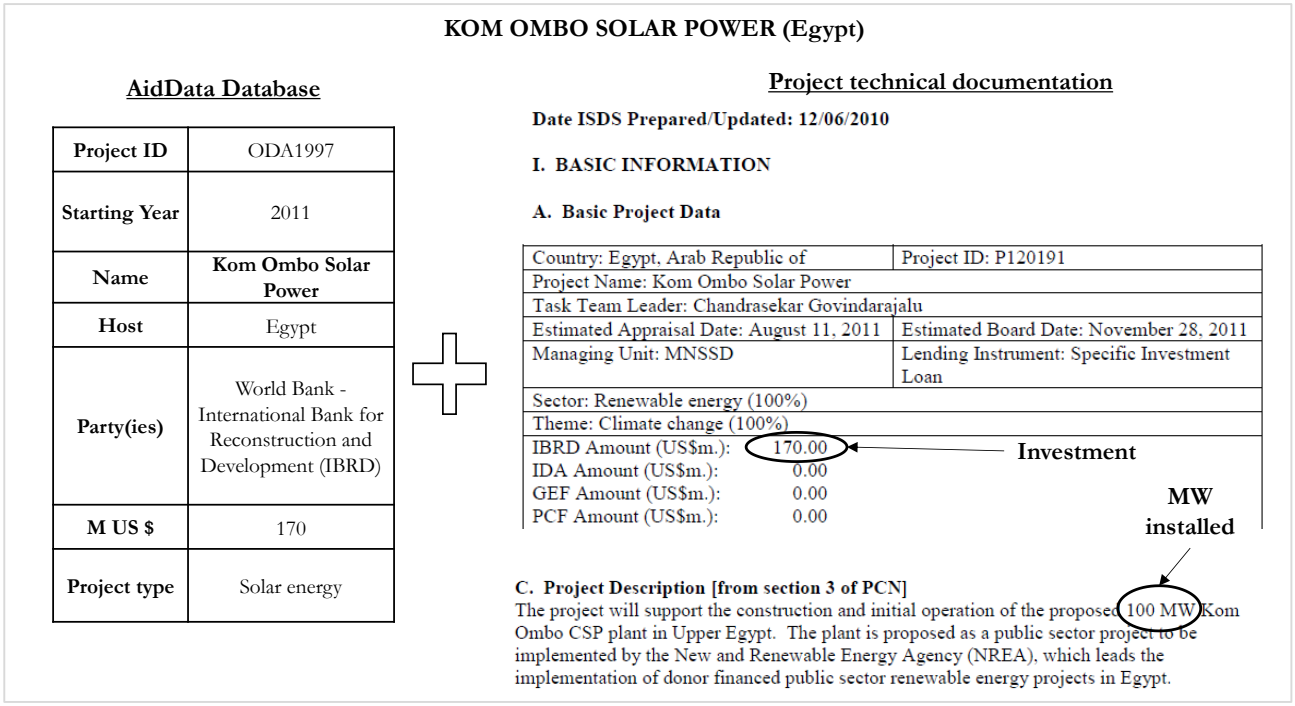


Figure 5 – Example of project-level data research for the ODA database creation

As shown in the above figure, the information retrieved from the AidData database has been integrated with additional energy-related information (e.g. MW installed), by means of analysing the Project technical documentation, available at Donor's official website.

This process of database creation for the ODA projects permits to have a final database completely comparable with the CDM database. Accordingly, ODA final database, created with consistent information regarding the missing items of Table 5, has been merged with the CDM database, obtaining a unique database for both ODA and CDM projects, with the same variables and a comparable information structure[29].

This database will constitute the quantitative reference of the analyses performed within the following Chapters. The following paragraphs specify the most important variables of such comprehensive database.

Years: Time series from 2005 up to 2012

Years selected for the sample range from 2005 to 2012[30]; this range permits to compare the findings obtained with the existing Literature regarding the effects and the policy implication of the CDM projects. In addition, this period covers the EU ETS Phase I (2005-2007), and Phase II (2008-2012), in a way to permit the definition of the DD Model assessing the effect of Phase II on CDM Projects (shown in Chapter 6).

[29] In few cases, elaborations are performed by the authors of this paper for calculating the MW installed within a given project. Such is the case for rural electrification projects by means of mini-Solar panels.
[30] The investment amount is always expressed in terms of constant USD2009, i.e. at 2009 constant prices and exchange rates.

ii. Sectors

The comparison between ODA projects and CDM projects is possible for a short number of project types. The two main reasons for this is that CDM projects mainly concern emission reductions generated by renewable energy projects[31], the second reasons is that the "quantitative link" between ODA world and CDM systems is not easy to be found.

On the contrary, renewable energy projects provide a very straightforward "quantitative link" (i.e. the amount of MW installed in the power plant) that permits doable comparisons. Accordingly, the following renewable energies have been selected:

Renewable energies selected
Hydro power
Wind power
Solar power

Table 6 – Renewable energies selected

Other forms of renewable energies have been excluded, because of intrinsic difficulties to get reliable information on MW installed[32]. Nuclear power projects are not considered. Sector specification was a primary data within CDM database, while it has been derived for ODA database by deep investigation within project documentation (shown within Figure 5). Only investments larger than 10 thousand USD have been considered, since they are likely to have infrastructural and/or mini-infrastructural (such as mini-grids) investments for renewable plans.

Obviously, projects analysed only deal with renewable energy plant construction. No technical assistance and/or consultancy services are considered nor feasibility studies and other analyses. Similarly, projects concerning greeds and transmission of energy are excluded as well as education/training projects and policy capacity building in the field of renewable energies.

This strategy permits to have a homogeneous database with 4,292 observations, presenting renewable energy projects only and to determine how the main quantitative variables investigated, presented in the following table[33], have changed per each sectors in the period 2005-2012.

Variable	Acronym
Installed plant capacity in MW	MW or MWel
Project investment	M US $
Cost ratio (M US $ / MW)	M US $ on MW

Table 7 – Main quantitative variables investigated

[31] Other project type are addressed by CDM projects (such as Agriculture, Livestock, Transport, etc.). However, the large majority of CDM projects (and Methodologies) deal with renewable energies.

[32] The list of the main renewable energies excluded includes: tidy, biomass, multiple source of energies (renewables and not renewables), gas and similar.

[33] For ODA projects, the investment amount considers the total amount of fund allocated within the project. If the project has additional components with respect to the plan-construction (e.g. plant design), the investment has been attributed to the plant-construction component only. On the contrary, if the project has been financed by additional funding with respect to the Partner Party(ies), for which the investment is known, the additional investment has not been considered. According to the authors of this paper, these two effects compensate each other, having opposite signs with respect to investment amount (- for additional component, + for additional funding).

4. Descriptive statistics

The homogeneous database for ODA and CDM renewable energy projects described in the previous Chapter can be analysed by means on using descriptive statistics techniques and methods, that are the object of this Chapter.

i. Trends and volatility for Renewable Energies

The first analysis to be performed when financial flows move from developed to developing countries is the volatility of flows, since ODA projects volatility is unanimously recognized by the Literature as one of the bigger problems for international cooperation[34].

The trend analysis of CDM & ODA renewable energy projects for the period 2005-2012 (2005=100) shows that the volatility for the main quantitative variables of Table 7 is not relevant for CDM projects, with quite stable increasing trends (but for 2008 mini-negative peaks), while it is absolutely volatile for ODA projects.

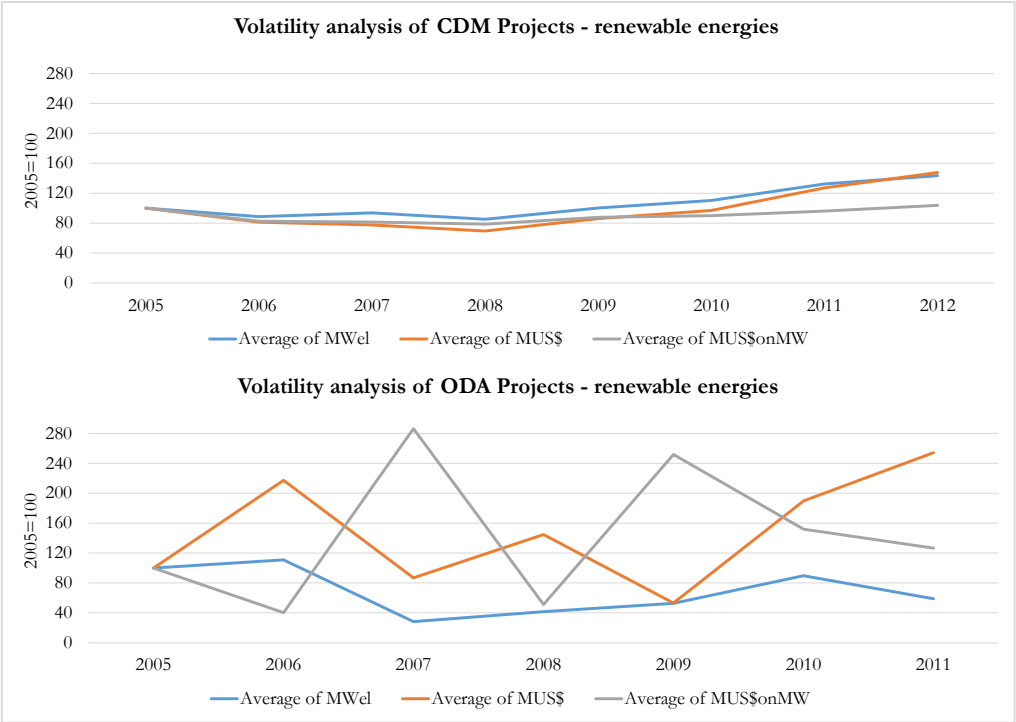


Figure 6 – Volatility analysis of CDM&ODA Projects - Renewable energies

ODA projects volatility, already identified within previous studies applied to environmental financing in the field of international cooperation, is then confirmed for renewable projects and for the quantitative variables investigated. The following table shows the average values for plant capacity, project investment and cost ratio for ODA projects, CDM projects and all projects for the period 2005-2012.

Average values	ODA (2005-2012)	CDM (2005-2012)	All (2005-2012)
MWel	185.11	46.81	51.03
MUS$	64.83	62.05	62.14
MUS$onMwel	3.11	1.34	1.40

Table 8 – Average values for plant capacity, project investment and cost ratio, 2005-2012

[34] Please refer to IMF (2006), Hudson (2015), Addison and Tarp (2015) and the World Bank Independent Evaluation Group (2009).

The table unquestionably shows that the CDM projects have lower averages for plant capacity and, more important, much lower average cost ratio (i.e. average 1.34 M US $ per each installed MW vs a 3.11 cost for ODA projects). This means that CDM projects have recorder higher energy efficiency ratios, that can be considered as the inverse element of cost ratio (i.e. (M US $ / MW)$^{-1}$).

Main findings

1. ODA projects are much more volatile (for the 3 variables), while CDM project have a stable trend;
2. CDM have much lower average cost ratio with respect to ODA projects;
3. On average, ODA are much bigger in terms of MW and expensive in relative terms (cost ratio 3.11 vs 1.34) than CDM projects. Project average investment is the same.

ii. Trends and volatility for specific Renewable Energy Types

The detailed analysis of the trends for installed capacity, project investment and cost ratio shows that all these variables recorder very volatile trends for ODA project with respect to CDM projects, as shown in the following figure.

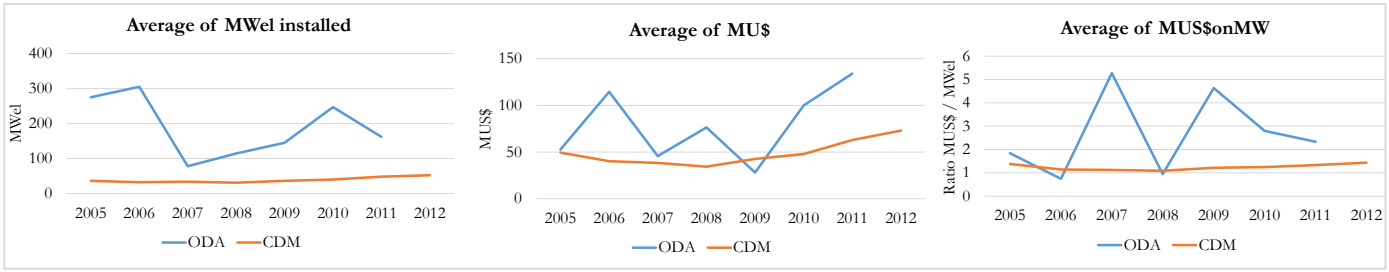


Figure 7 – Average values for Renewable energies

A deeper analysis of the trends of the three quantitative variables investigated according to renewable project types (i.e. Hydro power, Solar power and Wind power) reveals that Solar projects intrinsically have the higher cost ratios (and this characteristic will be very relevant in the next Chapters of this paper), with cost ratio amounting to 4.14 M US $ per each MW on the entire sample analyzed, while cost ratios for Hydro and Wind projects are much lower (i.e. 1.18 and 1.33 M US $ per each MW respectively).

However, Solar projects benefited from Kyoto Protocol more than other renewable project types, recorderding bigger average reduction in the cost ratio with respect to ODA projects (i.e. an average 5.08 M US $ reduction per each MW installed), as shown in the following table.

Average cost ratios (M US $ per each MW)	ODA	CDM	CDM Reduction vs ODA	ALL	N of observations
Hydro	0.90	1.19	0.29	1.18	1,873
Solar	8.23	3.16	-5.08	4.14	202
Wind	1.02	1.33	0.31	1.33	2,217
All	**3.11**	**1.34**	**-1.77**	**1.40**	**4,292**

Table 9 – Average cost ratios according to Renewable Project Type

As shown by the table above, while Solar CDM projects were much more efficient with respect to ODA projects (in terms of average cost ratio), Wind and Hydro projects recorded alike cost ratios for ODA and CDM projects, implying that the major part of the overall CDM cost ratio reduction investigated within Table 8 is attributable to Solar projects, while Wind and Hydro projects have no relevant role, even recording higher cost ratio for CDM projects with respect to ODA projects.

The following figure shows the detailed picture of the trends for average plant capacity, project cost and cost ratio for each project type for the period considered[35].

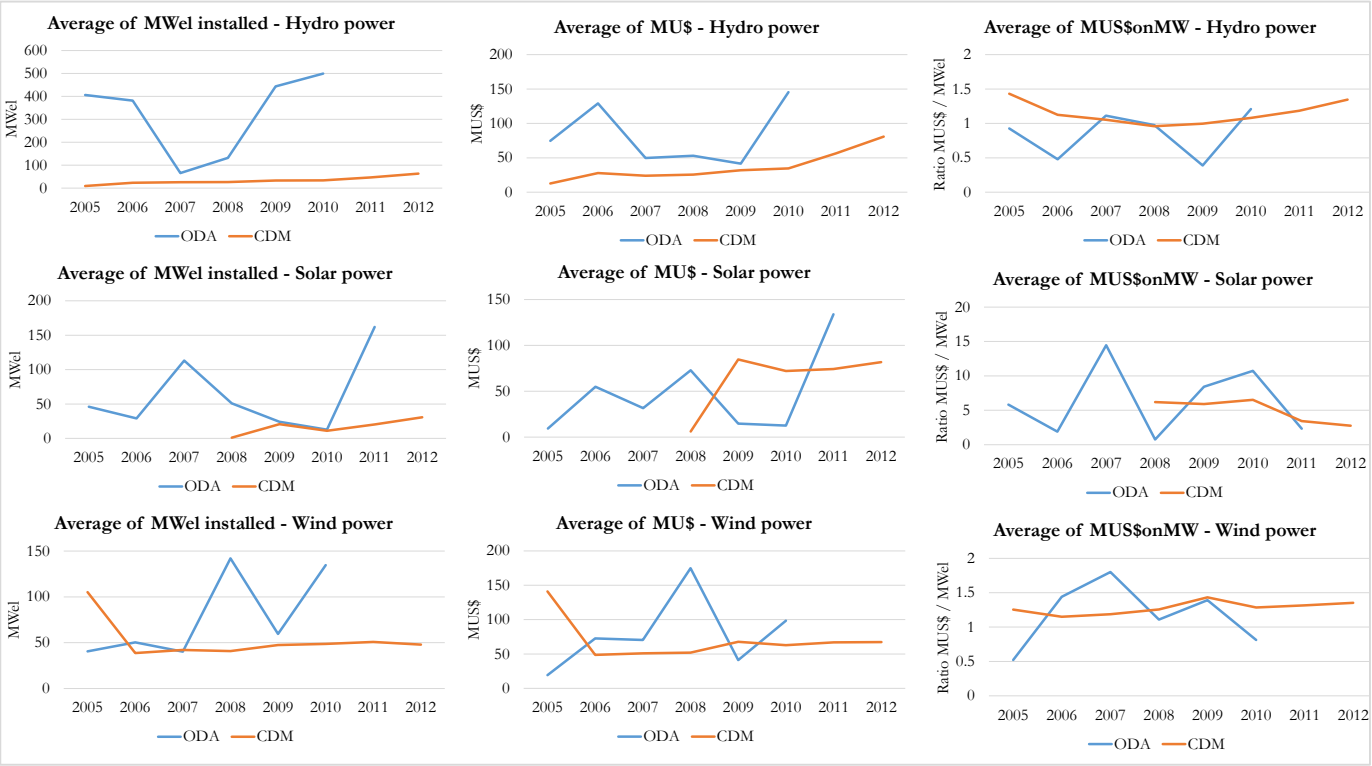


Figure 8 – Average values for Renewable Energy Types

As shown by the above figure, yearly trends for Solar, Wind and Hydro power CDM project are much less volatile with respect to ODA projects and generally, CDM projects have lower volumes for installed capacity (left graphs) and project cost (middle graphs).

It is worthy to underline that Figure 8 shows a different set of information with respect to Table 9; indeed, Figure 8 presents yearly averages[36], while Table 9 deals with overall averages. Accordingly, Solar cost ratio benefit from CDM projects implementation is inferable from Table 9 but not from Figure 8. In turns, Figure 8 shows that Solar CDM projects were not performed before 2008.

This information is very important because it preliminary underlines the fact that private companies investing in CDM projects were not available to back the intrinsic higher cost ratio for Solar projects before 2008 - i.e. the Phase I of EU ETS - while they started doing do after 2008 – i.e. the adoption of

[35] Missing observation for some years do not substantially modify the findings of the analysis performed.
[36] Yearly averages presented obviously consider the relevant observation for each year and, consequently, the weight of each year on the overall averages depends on the number of yearly-observations available.

Phase II of EU ETS - that ensured private operators with easier marketability of CER and carbon market existence certitude[37].

Main findings

1. Solar projects intrinsically have the higher cost ratios with respect to Wind and Hydro projects for the sample analysed.
2. However, Solar projects benefited from Kyoto Protocol more than other renewable project types, recording bigger average reduction in the cost ratio with respect to ODA projects.
3. Yearly trends for Solar, Wind and Hydro power CDM project are much less volatile with respect to ODA projects and generally, CDM projects have lower volumes for installed capacity and project cost.
4. Solar CDM projects were not performed before 2008, probably because private companies investing in CDM projects were not available to back the intrinsic higher cost ratio for Solar projects before 2008 - i.e. the Phase I of EU ETS.

iii. Renewable Energy Cost Ratios for EU ETS members

In order to better preliminary explore the importance of ETS in relation to the quantitative variables investigated[38], the averages for plant capacity, project investment and cost ratio are analysed for the period considered, as shown in the following figure.

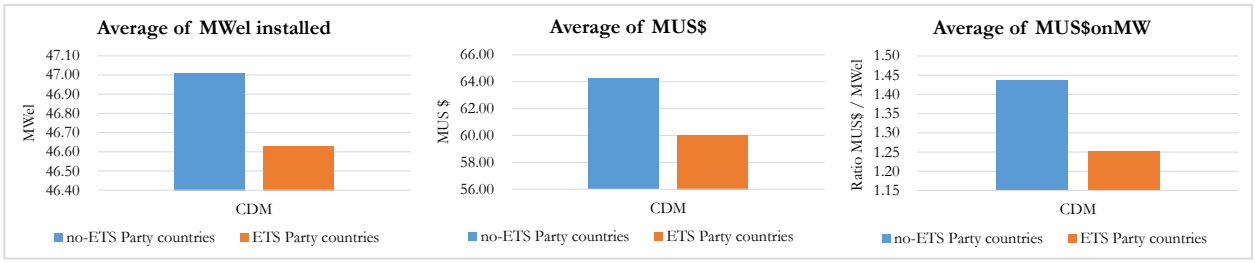


Figure 9 - Average values for Renewable Energies, ETS detail

As shown in the above figure, averages for plant capacity, project investment and cost ratio are lower if at least one ETS party country is present within the CDM renewable project structure, testifying that the appurtenance to a competitive carbon market as EU ETS contributes in downsizing plant capacity and project investment together with the increase of efficiency ratio.

The following figure shows how this reasoning can be applied to all the renewable energy project types (but for Wind project investment). Obviously, the most important dimension is the cost ratio, that is significantly lower for ETS Party countries.

[37] After 2008, the number of Solar CDM projects constantly increased:

Year	2008	2009	2010	2011	2012
CDM Solar projects	1	7	7	22	126

[38] A specific analysis of the impact of EU ETS Phase II will be performed within Chapter 6 by means of a DD Model.

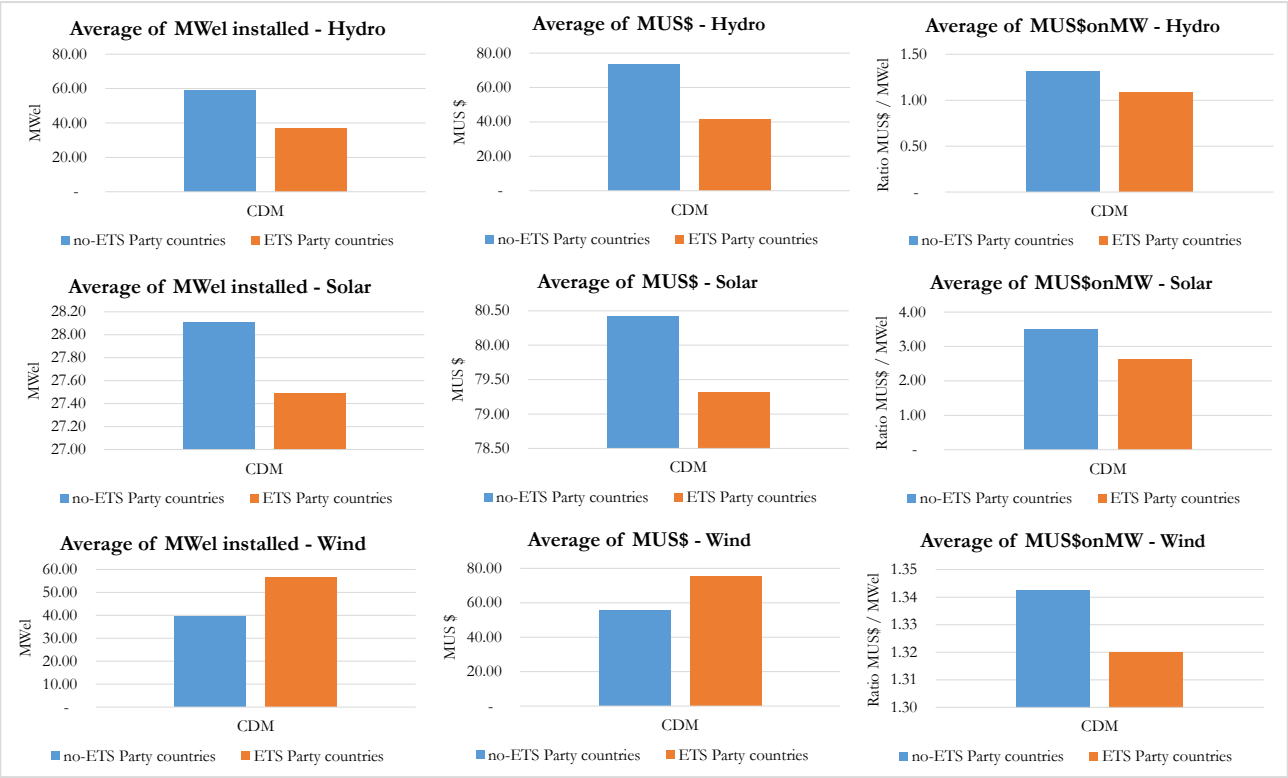


Figure 10 - Average values according to Renewable Energy Types, ETS details

As shown by the above figure, ETS membership by at least one country involved in the project structure is particularly significant for Solar projects, where CDM projects cost 2.63 M US $ per MW for ETS Party Counties versus the 3.49 M US $ per MW for no-ETS Countries.

Main findings

1. In general CDM renewable related projects where at least on Party Country belongs to EU ETS are lower than no-ETS Party Country ones in terms of MW, MUS$ and cost ratio.
2. Yet, it is evident that Solar project type are more efficient if at least one ETS Member is involved.

iv. Carbon Fund Projects

As briefly described within Chapter 2 and Figure 1, Carbon Fund projects are hybrid projects embracing both CDM and ODA framework. The main idea underlying Carbon Funds (that are all coordinated by the World Bank Finance Unit) is to use money contributed by governments and companies in OECD countries to purchase project-based greenhouse gas emission reductions in developing countries and countries with economies in transition.

This structure is based on the fact that carbon markets are becoming more and more dynamics and complex and this technicality may risk to exclude developing and poor countries from markets. Yet, due to possible risks of falling prices, carbon markets are more and more demand oriented and the contractual strength of poor countries could not be adequate. For these reasons, the emission reductions are purchased through one of the CFU's carbon funds or facilities on behalf of the contributor, and within the framework of the Kyoto Protocols Clean Development Mechanism (CDM) or Joint Implementation (JI).[39]

The following figure gives a synthetic recap of this rationale, by presenting the main interaction between World Bank Carbon Funds, Developing Countries and Donor countries.

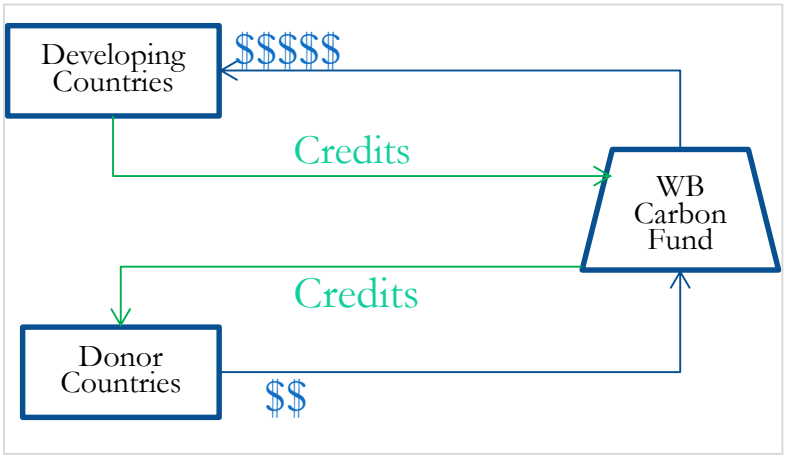


Figure 11 – Carbon Fund project structure

As shown within the above figure, the Carbon Funds finances (and technically assists) the developing countries to produce green credits (CER or ERR) that are purchased at higher prices and with shorter credit emission times (with respect to normal CDM project approval timing). Credits are then sold to Donor countries at market prices. This structure also implies that the Carbon Fund sterilizes market risks (i.e. drop of prices) that generally causes high uncertainties for developing countries and for small-scale projects.

In such a way, the Carbon Funds help to build a market for emission reductions, thereby expanding the reach of carbon finance and the benefits of the Clean Development Mechanism to developing countries that may otherwise be excluded.

[39] For additional information on World Bank Carbon Finance Unit, please refer to http://www.worldbank.org/en/topic/climatefinance .

Due to their hybrid nature cited above, Carbon Fund projects are recorded as CDM projects or, alternatively, as ODA projects by Donors/Parties and their identification can be obtained by means of interrogating the Carbon Fund Unit database of the World Bank, that disposed of a permanent list of projects financed by Carbon Funds.[40]

Quantitatively, Carbon Fund projects are small-scale projects that develop efficient projects in terms of cost ratios, by applying micro-technologies such as micro-Hydro, micro-Wind and Solar home systems, that are easily controllable and installable in case of limited amount of technological supply.

Main findings

1. CDM projects financed by means of Carbon Funds, coordinated by the World Bank Carbon Finance Unit, permit to include into carbon markets those countries that may otherwise be excluded;
2. Risk sterilization and shorter credit emission times, together with the technical assistance provided, permits to apply micro-technologies with good energy efficiency ratios;
3. The identification of Carbon Fund projects is not univocal within project-level-databases (recording as Partner the World Bank Carbon Finance unit or, alternatively, the financing Donor Country). Accordingly, their identification is to be made by searching within Carbon Finance Unit database.

[40] https://wbcarbonfinance.org/

5. Linear regression econometric Model

i. The Regression Model

The variables used for this Model respect the specifications shown in the Chapter 3 in terms of currencies, units of measure and nomenclature[41]. A linear regression econometric model has been conceived in order to investigate the causal relation of the introduction of Kyoto Protocol (and CDM projects) on renewable energy projects cost ratios in the period 2005-2012 and hence determining if the findings provided by means of the descriptive statistics presented in the above Chapter can be supported at inferential level. This model is able to investigate the research question N°1, as presented within Chapter 1.

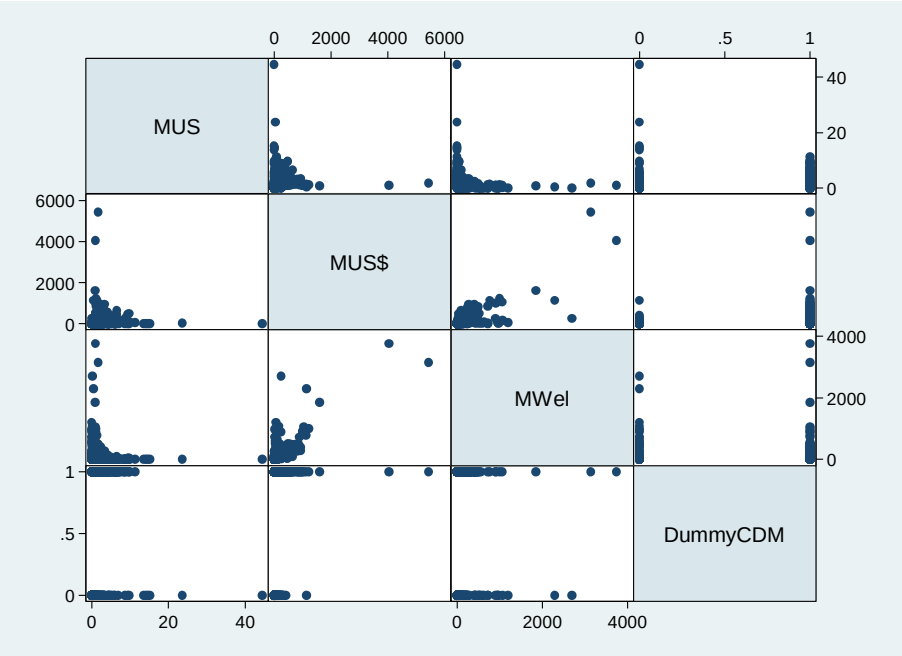
Variables

The dependent variable investigated is the cost ratio (M US $ on MWel) of the installation of renewable energy plants for each project observed. The trend of this dependent variable can be expressed in terms of a linear relationship between other explicative variables linked with project characteristics. A CDM dummy has been added for indicating if the projects belongs to CDM framework. Other variables indicate the year of construction of the plant, the project type (Hydro, Wind, Solar), the project Host country and the project Party(ies).

Correlations

The starting point for the regression analysis is to look at the possible correlations between the dependent variable and the chosen regressors, indicating a possible common (linear) trend between the variables observed.

The correlation matrix among the dependent variable and its non-categorical predictors gives the following result (obviously, dummyCDM polarizes correlations in 0 and 1).



[41] With respect to the Database presented within Chapter 3.i, four observations have been dropped, because of their misalignment in terms of cost ratios (by far exceeding the 99% percentile).

	DummyCDM	MWel	MUS	MUSonMW
DummyCDM	1.0000			
MWel	-0.1960	1.0000		
MUS	-0.0035	0.8062	1.0000	
MUSonMW	-0.1377	-0.0550	0.0807	1.0000

Figure 12 – (Partial) correlation matrix

As shown above in the correlation matrix, the CDM introduction had impacts in reducing the project cost, the project size (in terms of MW installed) and the cost ratios for producing energy from renewable resources. Accordingly, the next paragraph intends to better explore these relations, by using econometric strategies.

The Regression equation (model 1)

The following model has been investigated:

$$r_i = \beta_0 + \beta_1 W_i + \beta_2 \$_i + \beta_3 K_i + \beta_{4t} T_{it} + \beta_{5y} Y_{iy} + \beta_{6p} P_{ip} + \beta_{7h} H_{ih} + e_i \text{ (model 1)}$$

Where:

- the r is the dependent variable, indicating the cost ratio (M US $ on MW) and subscript i indexes each project observed;
- β_0 is the intercept;
- W indicates the installed plant capacity (MW);
- $ indicates the project investment (M US $);
- K is a dummy indicating Kyoto membership;
- T_{it} is a categorical variable based on project type and subscript t indexes the type of plant (Hydro, Wind, Solar);
- Y_{iy} is a categorical variable based on year and subscript y indexes years from 2005 to 2012 that shall capture (eventual) time effects;
- P_{ip} is a categorical variable based on project Party(ies) and subscript p indexes each Party(ies);
- H_{ih} is a categorical variable based on project Host and subscript h indexes each Host observed;
- e_i is the error term for each observation.

It is worthy stating that for each of the categorical variables, we have N-1 (with N being the total number of modalities for each variable) dummies. The specification of the model shows how the dependent variable (r_i), standing for the cost ratio of plants is a quantitative continuous variable investigated in relations to quantitative and qualitative regressors, whose coefficients can be interpreted as the ceteris paribus effects of the situation represented by a change in the variable itself. A robust command has been added within the model, in order to have the regression set with robust standard errors so controlling for heteroskedasticity (Torres-Reyna, 2007).

In order to include additional considerations regarding the project dimension, a second version of the model has been structured (**model 2**) by considering plant capacity (W) and project investment ($) as dummy variables expressing if each project installed capacity and investment are above (MWLarge and MUSLarge are 1) or below their respective sample means.

Another structure for the model has been investigated (**model 3**), without including coefficients β_1 and β_2 within the equation, in a way to avoid possible distortion caused by the relevance of MW installed and project investment in explaining the behaviour of the dependent variable. Finally, the following

table recaps the three econometric models that are be investigated in the next paragraph, providing information on their structure.

Model	Structure
Model 1	Equation Model 1 pag 32
Model 2	Model 1 with MWLarge and MUSLarge instead of MW and MUS
Model 3	Model 1 without MW and MUS

Table 10 – Structure of the econometric model investigated

ii. Regression Results

Main results

The following table shows the results of the models cited above. For an easily reading, β_{5y}, β_{6p} and β_{7h} coefficients, respectively linked to project Year with Y numerosity, project Party(ies) with P numerosity and to the project Host with H numerosity, have not been presented.

VARIABLES	(1) MUSonMW	(2) MUSonMW	(3) MUSonMW
MWel	-0.00634***		
	(0.00123)		
MUS	0.00610***		
	(0.00102)		
DummyCDM	-1.713***	-1.013*	-1.019*
	(0.585)	(0.591)	(0.594)
dumTypeHydro	-1.654***	-1.828***	-1.899***
	(0.179)	(0.195)	(0.196)
o.dumTypeSolar	-	-	-
dumTypeWind	-1.464***	-1.692***	-1.614***
	(0.163)	(0.181)	(0.184)
MWLarge		-0.280***	
		(0.0599)	
MUSLarge		0.343***	
		(0.0519)	
Constant	-1.624	-1.782	-1.615
	(1.785)	(1.753)	(1.763)
Observations	3,042	3,042	3,042
R-squared	0.646	0.615	0.605

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11 – Results of the econometric models

As shown in the above table, regression results confirm the fact that the introduction of the Kyoto protocol had a very positive impact on the energy efficiency of renewable energy projects for all the three models investigated. Indeed, the dummy for CDM projects (β_3) shows a negative and statistically significant coefficient, contributing in reducing the dependent cost ratio (r_i). Other quantitative variables investigated within Model 1 (MWel and MUS) have statistically significant coefficients end their sign is as expected (negative for MWel - β_1 and positive for MUS - β_2).

The other categorical variables investigated in the Model 1 show no significant effects but for type coefficients [42] (β_{4t}), confirming lower ratios for renewable Hydro and Wind projects.

The sample is restricted to 3,042 observations because the P_{ip} regressor is present only for this number of statistical units (total observations are 4,292) since not all observations have the project Party(ies) specified. Formulated in this way, R-squared is 0.646 and errors are robustly estimated, with no risk of heteroschestaticity (Torres-Reyna, 2007).

Similar results exist for Model 2 and Model 3. Model 2, which structure reflects if project installed capacity and investment are above or below their respective sample means (MWLarge and MUSLarge are 1 in the first case), provides consistent and statistically significant results for β_1 and β_2, while the β_3 (CDM dummy) is less explicative and les statistically significant with respect to Model 1.

Model 3, conceived in a way to avoid possible distortion caused by the relevance of MW installed and project investment, shows very similar results with respect to Model 1, with a slightly lower R-squared and less strong and statistical significance for β_3 (CDM dummy).

Finally, for the combined presence of the strongest and most statistically significant regressors (especially for DummyCDM, i.e. β_3) and the best R-squared obtained, Model 1 results have been selected as most representative of the relation investigated.

With respect to the entire set of available regressors, some exclusions have been decided in order not to incur in possible interaction specification problems, that would have altered the nature of the model and the independency of each regressor. For instance, EU ETS membership has not been used in the model, because its interaction with Dummy CDM (β_3) may be plausible. Likewise, no information on pre and post EU ETS Phase II years (i.e. pre and post 2008) have been used in the model, in order to have no interaction with year categorical variable (β_{5y}).

These two possible regressors (i.e. pre and post EU ETS Phase II years and EU ETS membership) will be further investigated in the next Chapter with a DD methodology.

The Robustness checks controls, control variables and other tests

The Breusch-Pagan / Cook-Weisberg test for heteroskedasticity (null hypothesis is that residuals are homoscedastic) has been conducted on Model 1, with *ipso facto* positive results since the robust control have been used within model specification. The same applies for F-test. As a matter of fact, the robust control permits to obtain robust standard errors and to avoid heteroskedasticity.

To check for normality, the Kernel density estimate has been obtained on Model 1, and residuals appears to follow a normal pattern implying that model specification is correct, as shown in the following figure.

[42] Solar coefficient is omitted.

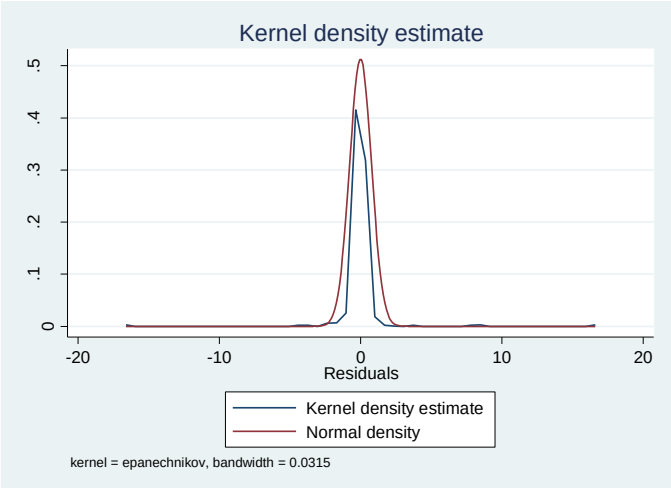


Figure 13 – Kernel density test for normality of residuals

As shown in the above figure, the estimated Kernel density line does not show significant gap with respect to the Normal density line, permitting to conclude in favour of the normality of the observations residuals.

iii. General comments on the Regression results

The regression results presented above show that there is a statistically significant relation between the introduction of Kyoto CDM and the increase in energy efficiency production of energy from renewable sources, providing a significant answer to Research Question N°1.

Furthermore, as remarked in commenting model results, no interaction among regressors exist and some available variables have been excluded from the model: EU ETS membership because of its possible interaction with Dummy CDM (β_3) and pre-post EU ETS Phase II for its likely interaction with year categorical variable (β_{5y}). However, an additional fine-tuning of the model may bring to insert these interactions within the regression and to evaluate the significance of interaction coefficients.

Main findings

1. The Kyoto protocol has a very positive impact on the energy efficiency of renewable energy projects. Indeed, the dummy for CDM projects (β_3) shows a negative and statistically significant coefficient, contributing in reducing the dependent cost ratio (r_i).
2. Other quantitative variables investigated (MWel and MUS) have statistically significant coefficients end their sign is as expected (negative for MWel - β_1 - and positive for MUS - β_2-).
3. The categorical variables investigated in the model show no significant results but for type coefficients[43] (β_{4t}), confirming lower ratios for renewable Hydro and Wind projects.

[43] Solar coefficient is omitted.

6. Difference in Differences econometric model (DD Model)

To continue the reasoning presented in the previous paragraphs, the impacts of the EU ETS Phase II has been assessed by applying the DD methodology according to Angrist and Pischkle approach on conditional sample means (please refer to Chapter 1). This analysis intends to give an answer to the research question number 2.

Indeed, the structure of our problem is a typical example of policy evaluation program. The task is to identify the net effect given by the introduction of a program or a policy. In order to do so, the DD methodology according to Angrist and Pischkle has been used.

The variables used for this Model respect the specifications shown in the Chapter 3 in terms of currencies, units of measure and nomenclature and in Chapter 5 in terms of dependent and independent variable definition and dummies attribution.

i. DD Model Design

As already stated within the definition of the research question 2, the impact of the EU ETS Phase II is determined on the identified group of renewable energy projects with a DD Model having the following structure:

Sample	Pre-treatment	Post-treatment
CDM projects – treated group	CDM projects <_ 2008	CDM projects > 2008
ODA projects – control group	ODA projects <_ 2008	ODA projects > 2008

Table 12 – DD Model logical structure

This structure permits to identify the impact of EU Phase II on CDM projects and to verify if Phase II provokes a "structural break" (Hua Fan, Roca and Akimov, 2014) for carbon markets. The first post-treatment year is set as 2009 because CDM project definition by private parties was possible from that date on[44].

The methodology applied within this Chapter follows Angrist and Pischkle Methodology for DD, presented within Chapter 2, both for DD coefficient estimation with conditional sample means and for the DD econometric Model.

Respecting the standards hypotheses for DD Model (retrieved by Chabé-Ferret and Subervie, 2012), we consider:

- H1: the absence of diffusion of the treatment on the ODA group;
- H2: ODA units are similar to CDM units in terms of observed covariates;
- H3: in the hypothetical absence of the treatment, the difference in practices between CDM group and ODA group would be constant over time.

The H3 of Chabé-Ferret and Subervie correspond to the following DD Model hypothesis formulated by Angrist and Pischkle: $[(Y1ist) - (Y0ist|s, t)]$ is constant over time.

[44] This "lag" is due to the fact that the allocation of Emission Allowances is peformed before formally opening the secondary markets where CER are marketable.

The treatment coefficient has been estimated with a Dummy variable having the following structure.

(Y_{1ist}) = Renewable energy project $_i$ and year $_t$ in case of treatment;

(Y_{0ist}) = Renewable energy project $_i$ and year $_t$ in case of no-treatment.

ii. DD coefficients with conditional sample means

The following figure shows the cost ratio for CDM (treated group) and ODA (control group) renewable energy projects realized before and after EU ETS Phase II.

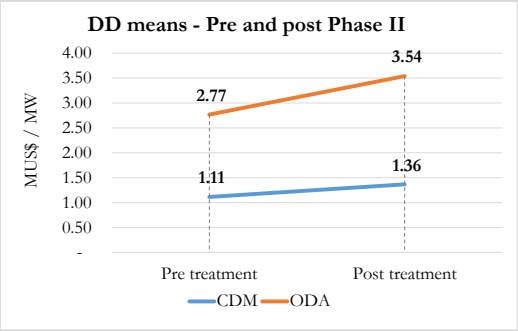


Figure 14 – DD conditional sample means, Renewable Energies

As shown by the above figure, the cost ratio for CDM renewable projects passed from 1.11 to 1.36 M US $ per MW after the introduction of the EU ETS Phase II. On the contrary, ODA cost ratio for renewable projects passed from 2.77 to 3.54 M US $ per MW after Phase II implementation.

By applying A&P DD Model, the following calculation are made:

$$\mathbf{DD = [(Y_1|T=1)-(Y_0|T=1)] - [(Y_1|T=0)-(Y_0|T=0)] =}$$

$$\mathbf{DD\ (cost\ ratio) = [1.36 - 1.11] - [3.54 - 2.77] = -\ 0.52}$$

Where:

- DD represent the treatment impact on dependent variable (known as the DD coefficient);
- Y_1 is the post-treatment mean;
- Y_0 is the pre-treatment mean;
- T=0 indicate no treatment;
- T=1 indicates the treatment.

As shown above, the DD causal effect of the EU ETS Phase II on CDM renewable projects is negative, testifying that the introduction of Phase II provokes a reduction of cost ratio within the sample.

Similar considerations can be made for each renewable energy project type, as shown in the following figure.

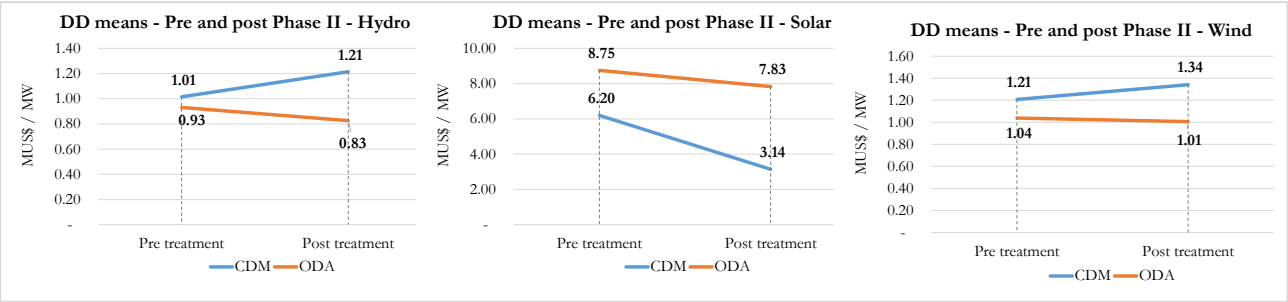


Figure 15 - DD means, Renewable Energy Types

As shown in the above picture, as for descriptive statistics consideration on CDM project benefit, Solar power is the sector where the introduction of EU ETS Phase II brought major benefits (with a DD coefficient of -2.14), while Hydro and Wind sectors show less significant values (respective DD coefficients are 0.30 and 0.17). The DD coefficients retrieved by means of conditional sample means will be econometrically explored within next paragraph.

iii. The DD Regression

The DD Equation

Basically, a regression with an interaction term indicating the (eventual) effect of being contemporaneously treated and in the ex post status should give the same (numerical) results as those given by the DD with conditional means, presented above.

Of course, the regression model, from an inferential perspective is more robust. P values assigned to each coefficient should tell us if the given causal relation (the beta) is just a matter of randomness (that is, sample specific) or is always valid.

Following Angrist and Pischkle scheme, the following DD Model has been investigated:

$$r_i = \beta_0 + \beta_1 K_i + \beta_2 T_i + \beta_3 I_i + e_i$$

Where:

- the r is the dependent variable, indicating the cost ratio (M US $ on MW) and subscript i indexes each project observed;
- β_0 is the intercept;;
- K is a dummy indicating Kyoto membership (determining the membership to the treated group or to the control group);
- T_i is a dummy indicating the treatment (i.e. post or pre EU ETS Phase II)
- I_i indicates the DD interaction (CDM group, POST 2008). It combines the two dummies K and T, and will be present only in case of both being in 1 modality;
- e_i is the error term for each observation.

The DD Model formulated in such a way permits to identify the DD coefficient, β_3, as a result of the interaction between β_1 and β_2. A robust command has been added within the model, in order to have the regression set with robust standard errors so controlling for heteroskedasticity (Torres-Reyna, 2007).

Regression results

The following table shows the results of the model described above.

VARIABLES	(1) MUSonMW
DummyCDM	-1.654
	(1.522)
treatement	0.774
	(1.781)
interaction	-0.521
	(1.781)
Constant	2.766*
	(1.521)
Observations	4,292
R-squared	0.024

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13 – Results of the DD model

As shown in the above table, the interaction between CDM Dummy and EU ETS Phase II introduction (treatment) has a negative coefficient of -0.52, as already correctly identified with the DD method of conditional sample means shown in the previous paragraph.

However, the beta for DD coefficient is not significant (not event at 10%), implying that a better definition and specification of the samples (both treated group and control group) is needed[45].

iv. General comments on the Regression results

Finally, the DD Model performed on the impact of the introduction of EU ETS Phase II with respect to previous Phase I shows positive impacts in terms of cost ratio reduction, but no statistical significance for DD coefficient. Accordingly, the Research Question N° 2 does not have a positive answer and further research is definitely needed.

Finally, as partially analysed by the Literature on the impact of EU ETS (Martin, Muûls and Wagner, 2012), the quantitative analysis on EU ETS Phase II impacts on cost ratio is not conclusive from an inferential perspective.

Main findings

1. The cost ratio for CDM renewable projects passed from 1.11 to 1.36 M US $ per MW after the introduction of the EU ETS Phase II. On the contrary, ODA cost ratio for renewable projects passed from 2.77 to 3.54 M US $ per MW after Phase II implementation;
2. The DD causal effect of the EU ETS Phase II on CDM renewable projects is negative (-0.52), additionally testifying that the introduction of Phase II provokes a reduction of cost ratio;
3. However, the econometric estimation of the DD Model testifies that the DD coefficient is not statistically significant, implying that Research Question N° 2 do not have a positive answer at inferential level.

[45] The DD model performed without the "robust" command shows statistically significant results but potential heteroskedastic issues, resulting in the same need of sample specification. The application of the model to other sub-samples (e.g. both treated group and control group pondered on EU-ETS members only) gives similar results.

7. Policy recommendations and Conclusions

This paper approaches the interaction between ODA, CDM and EU ETS institutional frameworks both qualitatively and quantitatively. Chapter 1 presents the Research questions and objectives, providing an extensive outline of the existing Literature, that scarcely address the interaction between these institutional frameworks with holistic perspectives. After a precise presentation of the Research Design (Chapter 3), this paper deals with the main findings deriving from Descriptive statistics (Chapter 4), Econometric analysis (Chapter 5) and DD Modelling (Chapter 6).

The following paragraphs furnish the main results of the analyses performed in terms of main findings, possible policy recommendations and possible future research.

i. Main findings

Answers to the research question

The analyses performed allow to precisely answering to both Research questions stated within Chapter 1. In particular,

- Question 1: which is the impact of CDM renewable projects with respect to ODA projects for the period 2005-2012?
- Question 2: which is the impact of EU ETS Phase II on CDM renewable energy projects with respect to EU ETS previous Phase from 2008 on?

The analyses realized by means of Descriptive Statistics show that the introduction of CDM projects brought positive effects in the field of renewable projects for the period 2005-2012.

First, Figure 6 show that the CDM projects were much less volatile with respect to similar ODA projects in terms of MW installed, project cost and cost ratio. Second, CDM have much lower average cost ratio with respect to ODA projects, which definitely appear less energy efficient. Third, on average, ODA are much bigger in terms of MW and expensive in relative terms (cost ratio 3.11 vs 1.34) than CDM projects, while project average investment is the same.

These 3 findings are partially shareable at renewable project type level (i.e. Solar, Wind and Hydro power). In particular, yearly trends for Solar, Wind and Hydro power CDM project are much less volatile with respect to ODA projects and generally, CDM projects have lower volumes for installed capacity and project investment.

In addition, it is inferred that, notwithstanding Solar projects intrinsically have the higher cost ratios with respect to Wind and Hydro projects for the sample analysed, they benefited from Kyoto Protocol more than other renewable project types, recording bigger average reduction in the cost ratio with respect to ODA projects.

Furthermore, Solar CDM projects were not performed before 2008, probably because private companies investing in CDM projects were not available to back the intrinsic higher cost ratio for Solar projects before 2008 - i.e. the Phase I of EU ETS.

The relation between the EU ETS and the quantitative variables investigated is highly positive, testifying a positive and statistical significant answer to Research Question N°1. Indeed, CDM renewable related projects where at least on Party Country belongs to EU ETS are lower than no-ETS

Party Country ones in terms of MW, MUS$ and cost ratio. Yet, it is evident that Solar project type are more efficient if at least one ETS Member is involved.

From an econometric perspective, the regression confirms the fact that the introduction of the Kyoto protocol has a very positive impact on the energy efficiency of renewable energy projects. Indeed, the dummy for CDM projects (β_3) shows a negative and statistically significant coefficient, contributing in reducing the dependent cost ratio (r_i). Other quantitative variables investigated (MWel and MUS) have statistically significant coefficients end their sign is as expected (negative for MWel - β_1 - and positive for MUS - β_2-).

The application of DD Econometric Model shows that, notwithstanding the fact that the DD causal effect of the EU ETS Phase II on CDM renewable projects is negative (-0.52), the econometric estimation of the DD Model testifies that the DD coefficient is not statistically significant, implying that Research Question N° 2 does not have a positive answer at inferential level.

ii. Policy recommendations

As shown within the analyses presented in this paper, the interaction between ODA, CDM and EU ETS systems is very complex and the need to increase the Literature on this regard definitely arise.

Yet, prior to the definition of the interaction between, the authors of this paper consider that the "Market attitude" accepted by the three systems shall be discussed and approved by the International Community. In order to better explain this concept, the following picture synthetize the main historical steps (horizontal axes) of the three systems in terms of market orientation (vertical axes).

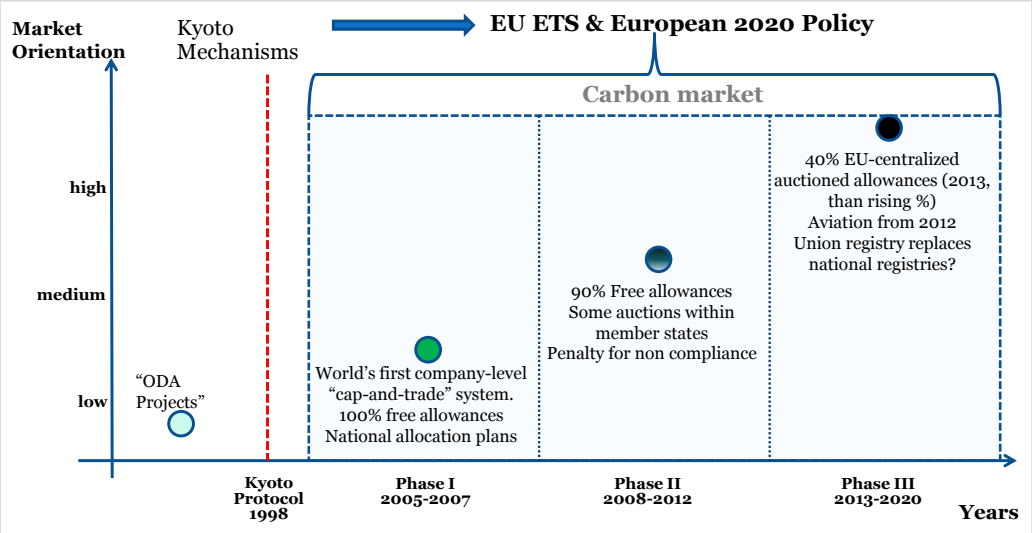


Figure 16 – Green Financing Evolution (Focus EU ETS)

As shown in the above figure, prior to 2005 (Kyoto entrance into force), only ODA projects existed, which were based on low/nihil market orientation (low in case of institutional loans, nihil in case of grants). The beginning of Kyoto Mechanism implementation gave birth to EU ETS systems[46], while ODA projects continue applying their no-market logics.

[46] This causal effect, even not institutionally and/or legally stated, is recognized by a large part of the Literature as presented within Chapter 2.

EU ETS Phase I (2005-2007) was based on low market attitude, with 100% free allowances for national companies. The EU ETS Phase II (investigated within this paper) made the first step to medium market attitude, introducing auctions for allowances distribution and penalties for non-compliance. EU ETS Phase III significantly increased the market attitude, with centralized allowances auctions and new sectors.

From this representation is it evident that EU ETS is going much faster in terms of market attitude than other similar Carbon market and even faster than Kyoto Protocol itself (which persecution on post-2012 regime has been analyzed within the Literature review and discussed during recent days). This increased market attitude, however, implies increased market risks too, as shown in 2012 when the price of CER dramatically drop, negatively impacting the entire EU ETS system credibility.

So, according to the authors of this paper, a better coordination shall be enhanced between ODA, CDM and EU ETS systems, in order to avoid such important misalignment in terms of market attitude and a form of risk-clearance shall be added within EU ETS world.

This provision would also serve to avoid that carbon markets were seen as speculative private-only complex markets, especially by Poor countries operators, that were marginalized by CDM world in the period considered, calling for a no-market Aid by international institutions (i.e. Carbon Fund).

As a matter of fact, indeed, Carbon Funds can be considered as tentative answers to reduce the complexity of the market-attitude above presented, providing free assistance to Poor countries operators.

Indeed, within the structure designed by Carbon Fund projects, the World Bank sterilize risks and shorten credit emission times, together with providing the technical assistance needed, permitting to apply micro-technologies with good energy efficiency ratios.

iii. Conclusions and further possible research

This paper shows that the introduction of CDM projects brought positive effects in the field of renewable projects for the period 2005-2012. These positive effects have also been confirmed by the regression results, showing that the dummy for CDM projects (β_3) has a negative and statistically significant coefficient, contributing in reducing the dependent cost energy ratio (r_i). On the contrary, the results of the DD Model investigated, assessing the impact of EU ETS Phase II with respect to Phase I in terms of energy efficiency, show that no statistical significant relation can be put in place.

Possible further research on this dualism could be done, in order to better explore which impacts EU ETS Phase II actually brought to the biggest carbon market of the world. In doing so, Scholars shall definitely take into account the importance of no-market Carbon Fund for poor countries and the need to find consensus on the International Community with respect to the market orientation of post-Kyoto carbon markets and legal binding frameworks.

8. Reference list

Publications/Working papers of International Organisations (IIOO) and Research Centers

1. Carbon Trade Watch (2011). EU Emissions Trading System: failing at the third attempt. Carbon Trade Watch, Barcelona.
2. Centre for Climate Change Economics and Policy (2013). Working Paper No. 126: Assessing the effectiveness of the EU. Centre for Climate Change Economics and Policy.
3. Centre for climate research (2012). The EU ETS carbon price: To intervene, or not to intervene? Climate Brief 2012.
4. Climate Policy Initiative (2012). The landscape of Climate Finance.
5. Climate Policy Initiative (2013). Climate Policy Presentation.
6. Environmental Defense Fund (2012). The EU Emissions Trading System Results and Lessons Learned. Washington DC.
7. IDA (2007). Selectivity And Performance: IDA's Country Assessment and Development Effectiveness. International Development Association Development Economics, Office of the Chief Economist (DECVP).
8. IEG World Bank (2009). Environmental Sustainability: An Evaluation of World Bank Group Support. The World Bank, Washington DC.
9. IMF (2006). Volatility of Development Aid: From the Frying Pan into the Fire? IMF Working Paper prepared by Aleš Bulíř and A. Javier Hamann. International Monetary Fund.
10. Inter-American Development Bank (2012).Working Paper: Foreign Aid in the Aftermath of Large Natural Disasters. Inter-American Development Bank. Department of Research and Chief Economist.
11. The European Union (2009). Emission Trading Scheme. EC, Bruxelles.
12. The European Union (2013a). ETS fact sheets. EC, Bruxelles.
13. The European Union (2013b). European Environment Agency - Towards a Green economy in Europe, EU environmental policy targets and objectives 2010–2050. EC, Bruxelles.
14. The World Bank (2010a). Community Development, Carbon Fund. World Bank Group, Washington DC.
15. The World Bank (2010b). Handbook Environmental Finance. World Bank Group, Washington DC.
16. The World Bank (2011a). Impact Evaluation in Practice. World Bank Group, Washington DC.
17. The World Bank (2011b). Innovative financing, Financial Intermediary Funds. World Bank Group, Washington DC.
18. The World Bank (2013a). Green Bond Fact Sheet, August 2013. World Bank Group, Washington DC.
19. The World Bank (2013b). Green Bond fifth annual investor, update 2013. World Bank Group, Washington DC.
20. The World Bank (2013c). Mapping Carbon Pricing Initiatives – Development and Prospects. World Bank Group, Washington DC.
21. UNDP (2011a). Building climate finance through national climate funds: A guidebook for the design and establishment of national funds to achieve Climate Change priorities. New York, USA.
22. UNDP (2011b): Blending Climate Finance Through national Climate Funds.
23. UNDP (2011c): Catalyzing Climate Finance.
24. UNEP (2007). Guidebook to Financing CDM Projects.
25. UNFCCC (1998). Kyoto Protocol.
26. UNFCCC (2008). Investment and financial Flows to address Climate Change: an update (FCCC/TP/2008/7). Bonn: United Nations Framework Convention on Climate Change Secretariat.
27. UNFCCC (2015). CDM Methodology Booklet. Seventh edition. Information updated as of EB 85. UN.

Emissions Trading System

28. EU "Linking EU – Australia Project" : http://ec.europa.eu/clima/news/articles/news_2012082801_en.htm
29. The International Carbon Action Partnership (ICAP): https://icapcarbonaction.com/ets-map
30. UNFCCC: https://unfccc.int/kyoto_protocol/mechanisms/items/1673.php
31. WB Carbon Fund : https://wbcarbonfinance.org/Router.cfm?Page=Funds
32. WB Green Bonds: http://treasury.worldbank.org/cmd/htm/WorldBankGreenBonds.html

Academic publications, papers and lectures

33. Addison T. and Tarp F. (2015). Aid Policy and the Macroeconomic Management of Aid. World Development, Volume 69, May 2015, Pages 1-5.

34. Aldy J. E. and Stavins R. N. (2012). The Promise and Problems of Pricing Carbon: Theory and Experience. Journal of Environment & Development 21(2) 152–180.
35. Angrist J. D. and Pischke J.-S. (2008). Mostly Harmless Econometrics: An Empiricist's Companion. Published by Princeton University Press.
36. Bento A. M., Kanbur R. and Leard B. (2014). Designing efficient markets for carbon offsets with distributional constraints. Journal of Environmental Economics and Management.
37. Bertrand M., Duflo E. and Mullainathan S. (2003). How much should we trust Differences-in-Differences estimates? The Quarterly Journal of Economics (2004).
38. Bharadwaj P. (2010). Quasi-experimental methods: Difference in differences. University of California, San Diego.
39. Chabé-Ferret S. and Subervie J (2012). How Much Green for the Buck? Estimating Additional and Windfall Effects of French Agro-Environmental Schemes by DID-Matching. Toulouse School of Economics, France.
40. Convery F. J. (2009). Origins and Development of the EU ETS. Springer Science+Business Media B.V. 2009.
41. Costantini V. and Sforna G. (2013). Do Bilateral commercial relationships influence the distribution of CDM projects?. Departmental Working Papers of Economics – University of Roma Tre 0176. Department of Economics - University Roma Tre.
42. Fan J. H., Roca E. and Akimov A. (2013). Estimation and performance evaluation of optimal hedge ratios in the carbon market of the European Union Emissions Trading Scheme. Australian Journal of Management 2014, Vol. 39(1) 73–91.
43. Fenton A., Wright H., Afionis S., Paavola J and Huq S. (2014). Debt relief and financing Climate Change action. Nature Climate Change.
44. Figueres C. and Streck C. (2009). The Evolution of the CDM in a Post-2012 Climate Agreement. The Journal of Environment & Development. Sage Publishing 2009.
45. Fischer C. and Newell R. G. (2007). Environmental and Technology Policies for Climate Mitigation. Resource for the future, Washington DC.
46. Flores S. M. and Shepherd J. C. (2014). Pricing Out the Disadvantaged? The Effect of Tuition Deregulation in Texas Public Four-Year Institutions. ANNALS, AAPSS, 655, September 2014.
47. Galiani S. (2006). Difference in Differences & panel data. The World Bank.
48. Glemarec Y. (2011). Catalyzing climate finance: A guidebook on policy and financing options to support Green, low-emissions, and climate resilient development. New York, NY: United Nations Development Programme.
49. Gomez-Echeverri L. (2010). National funding entities: Their role in the transition to a new paradigm of global cooperation on Climate Change. London: Climate Strategies. Retrieved from:
50. Gomez-Echeverri L. (2013). The changing geopolitics of Climate Change finance. Publisher: Taylor and Francis.
51. Goodman J. (2012). Climate Change and Global Development: Towards a Post-Kyoto Paradigm?. The Economic and Labour Relations Review Vol. 23 No. 1.
52. Hackmann H., Moser S. C. and St. Clair A. L. (2014). The social heart of global environmental change. Macmillan Publishers Limited.
53. Hicks R. L., Parks B. C., Timmons Roberts J. and Tierney M. J. (2008). Greening Aid? Understanding the Environmental Impact of Development Assistance. Oxford University Press. http://www.climatestrategies.org/component/reports/category/55/266.html
54. Hua Fan J., Roca E. and Akimov A. (2014). Estimation and performance evaluation of optimal hedge ratios in the carbon market of the European Union Emissions Trading Scheme. Published by SACE.
55. Hudson J. (2015). Consequences of Aid Volatility for Macroeconomic Management and Aid Effectiveness. World Development, Volume 69.
56. Juez J. M., Gonzalez Molinos C. and Ruiz de Arbulo K. P. (2014). The EU ETS as an Environmental Instrument. Published by Springer.
57. Juez J. M., Molinos C. G. and Ruiz de Arbulo K. P. (2014). The EU ETS as an Environmental Instrument. Published by Springer Science.
58. Jung M. (2005). Host country attractiveness for CDM non-sink projects. Hwwa Discussion Paper.
59. Karani P. and Gantsho M. (2006). The role of development finance institutions (DFIS) in promoting the clean development mechanism (CDM) in Africa. Springer 2006.
60. Lancaster C (2009). Sixty years of foreign Aid. What have we learned? International Journal.
61. Lee M. M. and Izama M. P. (2015). Aid Externalities: Evidence from PEPFAR in Africa. World Development, Volume 67.
62. Lise W., Sijm J. and Hobbs B. F. (2010). The Impact of the EU ETS on Prices, Profits and Emissions in the Power Sector: Simulation Results with the COMPETES EU20 Model. Springer Science+Business Media B.V. 2010.
63. Martin R., Muûls M. and Wagner U. (2012). An evidence review of the EU emissions trading system, focussing on effectiveness of the system in driving industrial abatement. London School of Economics and Political Science (LSE). Department of Energy & Climate Change.
64. Pinksea J. and Kolka A. (2012). Addressing the Climate Change–sustainable development Nexus: the role of multi-stakeholder partnerships. Business and Society 51, 1 (2012).

65. Pizer W. A. and Yates A. J. (2015). Terminating links between emission trading programs. Journal of Environmental Economics and Management.
66. Porter G., Bird N., Kaur N. and Peskett, L. (2008). New finance for Climate Change and the environment. Washington, DC: World Wildlife Fund/Heinrich Boll Foundation North America. Retrieved from: www.povertyenvironment.net/files/PEP13New_Finance_for_Climate%20Change_and_the_Environment%20.pdf
67. Raju D. and Trias J. (2010). Difference in Differences & panel data - Technical track session III. The World Bank.
68. Reiche D. (2008). Sovereign Wealth Funds as a New Instrument for Climate Protection Policy: Study of Norway as a Pioneer of Ethical Guidelines for Environmental Protection. Wupperal Papers.
69. Rice J. (2009). North–South Relations and the Ecological Debt: Asserting a Counter-Hegemonic Discourse. Critical Sociology 35(2) 225–252.
70. Rodrick D. (2001a). The Global Governance of Trade As If Development Really Mattered. UNDP.
71. Rodrik, D. (2001b). The Globalization Paradox: Democracy and the Future of the World Economy. Laterza.
72. Röttgers D. and Grote U. (2014). Africa and the Clean Development Mechanism: What Determines Project Investments?. World Development, Volume 62.
73. Sander K. and & Cranford M. (2010). Environmental Strategy of the World Bank: Financing Environmental Services in Developing Countries. The World Bank Group.
74. Sarkar A. N. and Leal W. (2010). Economics of Climate Change Responses and Mode of International Funding of Climate Projects. Asia-Pacific Business Review. Vol. VI, No. 3, July - September 2010.
75. Stiglitz J. and Meier, G. (2000). Frontiers on Development Economics. Oxford Press.
76. Stocking A. (2010). Unintended Consequences Of Price Controls: An Application To Allowance Markets. Working Paper Series, Congressional Budget Office. Washington, D.C. .
77. Sutter C. and Parreño J. C. (2007). Does the current Clean Development Mechanism (CDM) deliver its sustainable development claim? An analysis of officially registered CDM projects. Published by Springer Science.
78. Timmons Roberts J. and B. C. Parks (2009). Ecologically Unequal Exchange, Ecological Debt, and Climate Justice. The History and Implications of Three Related Ideas for a New Social Movement. International Journal of Comparative Sociology.
79. Torres-Reyna O. (2007). Linear Regression using Stata (v. 6.3). Princeton University.
80. Van der Ploeg F. and Withagen C. (2010). Is There Really A Green Paradox? Tinbergen Institute Discussion Paper.
81. Waldinger F. (2010). Difference-in-Differences Lectures. University of Warwick
82. Wettestad J. (2009). Interaction between EU carbon trading and the international climate regime: synergies and learning. Springer Science+Business Media B.V. 2009.
83. Zhange J. and Wang C. (2010). Co-benefits and additionality of the clean development mechanism: An empirical analysis. SSRN Electronic Journal, November 2010.

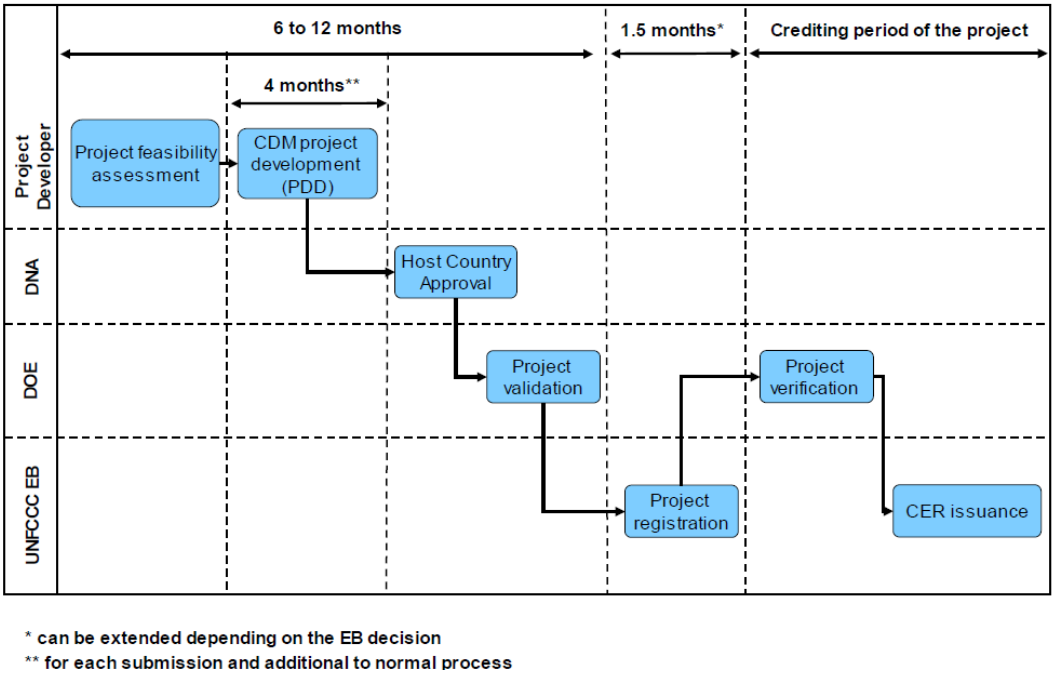
9. Appendixes

Appendix 1. CDM Projects and the Kyoto System

i. Increase of minimum salary in New Jersey

Source: UNEP (2007). Guidebook to Financing CDM Projects

Figure 2: The CDM project cycle

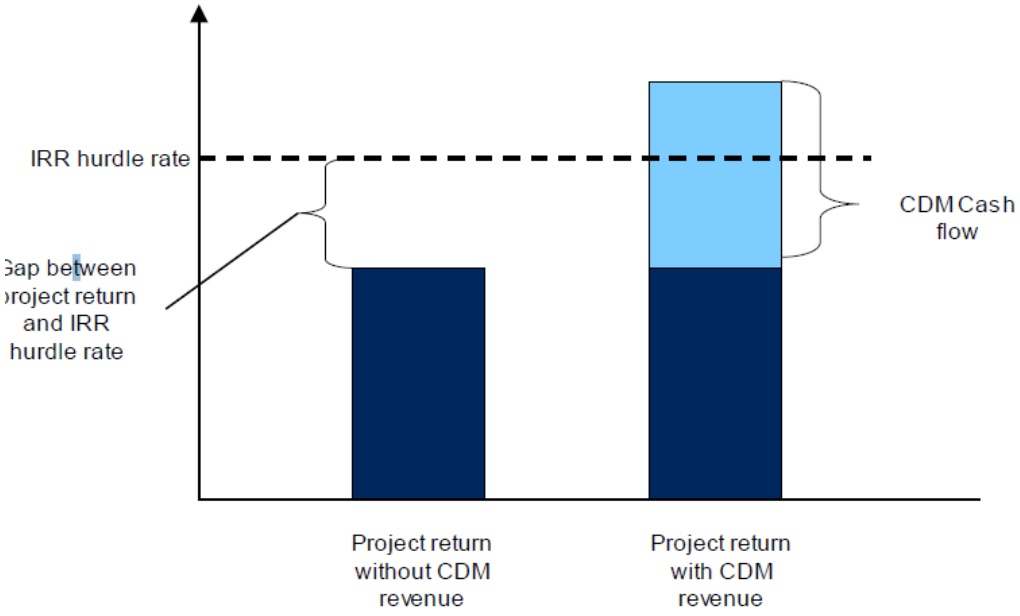


* can be extended depending on the EB decision
** for each submission and additional to normal process

Table 2: Methodology categories and their characteristics

Approved large-scale methodologies (AM)	Approved consolidated methodologies (ACM)	Approved small-scale methodologies (SSC)
• Largest group of methodologies; • Initially developed by project proponents for a specific project, but may then be used for other similar projects meeting specified applicability conditions; • Generally no upper limit on size and capacity of installations and emission reductions; • Comprehensive in comparison to small-scale; • Stronger emphasis placed on monitoring in comparison to small-scale.	• Consolidation of a number of large-scale methodologies for similar or related project types into a single methodology; • Consolidation by UNFCCC Methodology Panel, rather than by project proponents; • Broader focus/ less project-specific.	• Applicable small-scale projects may not exceed certain defined thresholds (for example, defined in terms of electricity generation capacity, energy savings, or emission reductions). In comparison to large-scale methodologies, SSC methodologies have the following advantages: • Identical project components may be bundled under one project activity; • PDD requirements are reduced; • Baseline calculation and monitoring procedures are simplified to reduce costs; • Same DOE may validate and verify the same project.

Figure 3: Demonstrating financial additionality



ii. Origins and Development of the EU ETS

Source: Convery F. J. (2009). Origins and Development of the EU ETS

Table 1: Sequence of events in development of the European Union Emissions Trading Scheme (EU ETS) and Linking Directive.

Date	Action	Implications
1986	Single European Act	Single Market for the economy makes single market for the environment both feasible and necessary
1990	Publication of *"1992" The Environmental Dimension. Task Force Report on the Environment and the Internal Market*	This study re-enforced both the significance of the Single Market for environmental policy, and advocated the use of market based instruments
1992	1. Rio Summit—EU argues for quantitative restrictions 2. Commission proposes Community-wide carbon energy tax	Once quantitative restrictions are accepted, then the logic of trading quantities flows therefrom. But the Commission proposes a tax
1997	Carbon energy tax proposal withdrawn	
July	Byrd Hagel resolution in US Senate	The Kyoto Protocol as agreed by US Clinton Administration—7% reduction by 1990—could never be ratified by Congress
December	Kyoto Protocol agreed	Commission disappointed—aimed for greater reductions and opposed emissions trading
1998		
May	1. Council welcomes measures with emphasis on market based instruments 2. Burden sharing agreement	Burden sharing sets quantitative targets for each Member State. Council endorses a market based approach. The logic of trading begins to crystallise
June	1. Commissioner Bjerregaard (Environment) support 2. Commission *Communication*—post Kyoto strategy—	Commissioner argues for Europe to lead on trading. Commission argues for Community wide approach, with 'demonstrable progress' to be achieved by 2005
1999		
May	*Communication*—Preparing for Implementation of the Kyoto Protocol	'Best preparation might be to develop our own trading experience'
May	First GHG and energy trading simulations (GETS)	Utilities get experience, and (probably) realise that rent capture is in prospect for some if there is free allocation
June	Council urges Commission to submit further proposals for common measures and Green Paper	Trading is the most obvious 'common measure.' Commission has green light to develop and promote its trading agenda
October	COP Buenos Aires fails to define trading rules	Provides further impetus for Europe to 'do its own thing' as regards trading
2000		
March	Green paper on EU ETS launched	This sets out all the issues and the Commission's preferences, most of which ultimately prevail
March	Support from Green MEP Hiltrud Breyers But only if stringent conditions, monitoring and penalties for non-compliance	This support was helpful in muting the antagonism in some NGO quarters and encouraging the (reluctant) German government
June	European Climate Change Programme launched[a]	This was the main vehicle—via Working Group 1—for progressing discussions and identifying key blockages and opportunities
July	First meeting of ECCP WG1 (flexible instruments)	All key stakeholders engage for the first time
October	German Working Group on emissions trading started	Germany was late in establishing its own domestic group, a reflection of reluctance and divided interests

Table 1 Continued

2001		
January	Commission starts to draft proposal	
March	Bush Administration rejects Kyoto	This triggers major effort to secure sufficient votes to bring Kyoto into effect, and also adds impetus to develop EU ETS
May	Draft proposal complete	
June	European Council determined to meet their commitments under the Kyoto Protocol	See above
September	1. Consultation meetings 2. Germany submits separate paper	German commitment to voluntary agreements with industry inhibits support for trading, especially the obligation to participate in pilot phase
October	EU ETS proposal adopted by the Commission—based on Article 175 (1) which provides for qualified majority	Qualified majority voting meant that no small group of countries could exercise a veto
October	COP Marrakech agrees rules for international trading	Provides further validation for EUETS
December	First debate by Council Free allocation, but 'large majority preferred that costs be borne by electricity producers	The inconsistency between the enthusiasm for both free allocation and that costs be borne by electricity producers is notable
2002		
February	Netherlands announces plans for domestic scheme	This provides a further impetus for a Europe-wide scheme
March	1. First reading in Legal Affairs Committee 2. Ministers adopt legal instrument obliging Members to ratify Kyoto using qualified majority voting	Parliament action begins, and the use of qualified majority voting is re-emphasised
April	1. Environment Committee of EP meets 2. EEA publishes report showing more progress needed 3. UK domestic trading begins	The evidence on emissions indicates that further action is needed to meet the Kyoto target, and EU ETS is perceived as a key response. The UK move creates an incentive for UK to support opt out and voluntary participation in pilot phase of EU scheme, and is another pressure to get the European scheme implemented before inconsistent national schemes become the norm
May	Burden sharing becomes law EU ratifies Kyoto	These further intensify the logic for EUETS
July	Denmark takes on Presidency	It provides skilful leadership in overcoming pressure from Germany, UK and Finland for voluntary participation in the pilot phase
August	Disastrous flooding in Germany—Elbe and Danube	This both convinced the German public that climate change was 'real' and potentially catastrophic, and generated support for the Greens in the general election
September	1. German government re-elected with stronger Green representation 2. Parliament adopts its Plenary position—80 amendments	New German government more sympathetic to trading. European Parliament supportive but wants more auctioning, and more centralisation of allocation
October	German government agrees ET, but with free allocation and pooling	This is the key to progress and finalisation of the Council position

Table 1 Continued

2003		
March	Council Common position adopted Communication from Commission to Parliament	Final effort by Commission to convince Parliament that it had secured some of its key priorities
June	Second Reading by Parliament Environment committee adopts main position Compromise proposals tabled and agreed	This clears the stage for enactment
July	1. Formal adoption by Council of EU ETS Directive 2. Linking Directive proposed Environment Working Group meets	Linking Directive had been 'parked' pending agreement on EU ETS. Now it moves centre stage
October	EU ETS Directive published in Official Journal	EU ETS Directive becomes law
December	Rapporteur Alexander de Roo MEP wants agreement on linkage directive before 2004 elections	The sands of time running out for MEPs adds urgency to the task of agreeing the Linking Directive
2004		
April	Parliament dissolved	
October	1. Russian Duma approves Kyoto Protocol 2. Irish Presidency, Rapporteur and Commission informal agreement on linking directive 3. Linking Directive formally adopted by EP and Council	The *quid pro quo* for Russian support was EU support for its membership of the World Trade Organisation. Rapid Progress on Linking Directive a product of the Parliament not being too ambitious in pressing its amendments; from proposal to final agreement takes only 12 months
2005	Kyoto Protocol enters into force	

Note of the author: Not EEA is the European Environment Agency. Its primary task is to provide timely and reliable information on environmental performance at country and EU-wide levels.

The European Council is the 6 monthly meeting of European Heads of State, where strategies and sometimes targets are agreed.

The European Parliament is directly elected, and has the power to amend legislation proposed by the Commission. For environmental legislative proposals, the Committee on Environment, Health etc is the key forum for analysis, and its work and its views are orchestrated by a rapporteur appointed by the Committee.

The Council of Ministers comprises the representatives of the Member States. The Council must approve legislation before it can become law.

The Presidency operates on a 6 monthly cycle whereby a Member State on a rotating basis takes on the role of helping set priorities for Council, and achieving agreement both within Council and sometimes with Parliament.

a See: http://ec.europa.eu/environment/climat/eccpl.htm. Comprised 6 working groups focused respectively on: flexible mechanisms (including trading), energy supply, energy consumption, transport, industry, and research. Most of the work relative to EU ETS took place in WG1 e of the author:-

ESSAY 3:

Public and private investments for environmental protection:
The case of livestock

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Tables, Figures and Boxes

Tables

Figures

Boxes

Abbreviations used unless otherwise stated:

Symbol	Meaning
M	Million(s)
B	Billion(s)
k	Thousand(s)
,	Thousands separator
.	Decimal separator
CAGR	Compound Annual Growth Rate

1. Introduction and Methodology

1.1. Research Design

This paper has the specific target of mapping livestock investments and livestock development strategies of the last decade and connecting them to sustainable outcomes. This target derives from the need to have a clear vision of the current status-quo of the livestock sector by means of assessing the main public and private players operating in it, the most important market trends, the geographical localization of investments and the financial flows connected.

As a matter of fact, all these topics are rarely addressed by the literature in a holistic way, mainly due to the use of inconsistent/incomplete data-sources and the general lack of data.

Accordingly, the paper defines the following Research elements, that would be analysed by means of using the last available information of public data sources for the public sector and by a process of database creation for private sector.

1. Collect quantitative information and data on both private and public livestock investments of the last decade;
2. Analyse how livestock trends have evolved over the past 10 years per each livestock sub-sector;
3. Perform a database creation for private investments in the livestock sector of the last decade;
4. Identify other investment flows in the livestock sector;
5. Define and classify both private and public livestock investments strategies of the past 10 years;
6. Assess how past and current sector investments contribute to sustainable food and agriculture outcomes (equity and growth; climate and resources; global health and food security – including animal welfare);

These elements of research will permit to have a comprehensive and holistic approach to quantitatively evaluate livestock sector trends and to perform an in depth-analysis of applicable policies.

1.2. Methodology

Livestock sector specificities make that livestock is a sector which poses considerable challenges for collecting data and hence assessing effective policies and investments (World Bank, FAO, ILRI, AU-IBAR, 2014); consequently, the quantitative analyses realized within this paper are based on robust assumptions and elaborations that will be presented in addressing the research elements presented above.

Moreover, having this paper the intention to present global phenomena concerning sector investments and trends, the analyses and elaborations have been framed within a coherent perimeter, able to clearly describe the sector, which is set as following:

- The analyses do not provide technical data concerning animal health/diseases or regarding production systems and methods and only marginally deal with animal nutrition and feeding procedures and innovations;
- Even recognizing the importance of implementing better livestock modules within national agricultural census, innovating collection strategies that may be applied to livestock sector are not part of this paper;
- Details concerning livestock genetics are not explored.

According to data availability, the reference period for this paper are the years 2001 – 2011, which permit to cover a coherent set of uniform information. Some analyses, however, cover a shorter period of time.

The value added of this analysis is also due to the fact that it is presented, when possible, in terms of ah-hoc geographical areas, which are not originally presented within primary databases explored and for which specific aggregations have been performed. The area investigated are:

Ah-hoc geographical areas investigated
Africa
Asia without China and India
Australia & New Zealand
Brazil
China
Europe
India
Northern America
South America without Brazil

Table 1 – Ad-hoc geographical area investigated

The following subparagraphs present a deeper analysis of the methodological approach used, mainly presenting the quantitative features of the data related to the livestock sector and its risks.

1.2.1. The features of livestock sector

The livestock sector is characterized by a certain number of specificities which make quantitative and qualitative analyses of sector investments more complex than similar analyses for other agricultural sectors.

First, livestock analysis must necessarily deal with a spatial complexity due to the fact that the presence of animals across space depends on a variety of factors, such as agro-ecological conditions and animal movements, which implies that the spatial distribution of livestock changes throughout the year and is somewhat uncorrelated to that of rural households and farm holdings, which are the typical sampling units (World Bank, FAO, ILRI, AU-IBAR, 2014).

Secondly, the annual variation of stocks depends on the animal biology and production systems that change according to sectorial yearly policies and public/private case-by-case decisions.

Thirdly, the livestock sector is one of the agricultural sector which is more suffering for the negative externalities of high urbanization rates, urban pollution, climate change and volatile climate, which collectively make more and more difficult for livestock operators to continue using their traditional supply chain systems and to manage seasonality, making production estimations very difficult if not pondered on specific case observations.

Fourthly, the sector is relentlessly moving from traditional agricultural production systems to industrialized concepts and methods, bringing intensification of farming, rapid vertical integration of production, indiscriminate use of antibiotics and chemicals and a consistent reduction in supply chain elaboration time (e.g. the KFC "instant chicken" scandal in China), altering the traditional livestock supply chains per sub-sectors.

Finally, the livestock sector is rapidly changing in response to globalization and growing demand for animal-source foods, driven by population growth and increasing wealth in much of the developing world (FAO, ILRI, 2011) and it is showing a dramatic change in the composition of production methods and market approaches. All these rapid/instant changes are bringing several concerns to international community regarding the consequences of the so-called "livestock revolution" (Delgado C. et al. 1999;

Pica-Ciamarra U., Otte J. 2010) and its impact on agri-pastoral systems, traditional farmers, animal health, food quality, food security, equity and growth.

As a matter of fact, indeed, the shift of livestock-production centre from agri-pastoral systems to corporate industrialized plants is altering the entire landscape of agricultural systems and economics and creating a new multiple dimensions of livestock-poverty interface (FAO, 2012 b), provoking the sharp reduction of the importance of livestock sector in helping the achievement of the socially desirable outcomes such as rural poverty alleviation, equity, growth, gender parity and social glue.

The megatrends of the livestock sector

According to FAOSTAT data 2014, the livestock sector contributes about 40 per cent of agricultural GDP[1], and provides, at least in part, a livelihood for about one billion people (World Bank, 2012). According to the World Bank (World Bank, 2012), the last decades have been characterised by a highly dynamic sector context and by a certain number of "megatrends", as described by the following table, which are expected to continue over the next decades.

Megatrends	Short description
Increasing demand	• The population growth, the urbanisation and higher incomes in developing countries have resulted in the increased consumption of the livestock products, meat, milk and eggs[2]. • The rate of this increase is three times higher than in developed countries (Delgado et al, 1999) and this trend is projected to continue for decades to come in the developing world, particularly in Asia (Pica-Ciamarra and Otte, 2009).
Higher food quality and safety standards.	• The increasing role of international regulation within the livestock sector, especially concerning trade disputes (and bans)[3], and the wealthier and more discerning consumers are leading to more exacting food quality and safety standards.
Faster growth in the pig and poultry sector	• The growth in the pig and poultry (non-ruminant) sector is more massive than the growth of cattle, sheep and goat (ruminant) sectors because of its suitability to economies of scale and technologies easy transferrable to developing countries. • On the contrary ruminant production is much more dependent on local conditions and local specific technologies, and can therefore less easily be transferred from the North to the South, and is less susceptible to economies of scale.
Greater competition for feed resources	• Competition for feed resources is particularly important within the grain sector, where alternative uses (bio-fuel) and increasing grain shortages for human consumption cause major price volatility (Steinfeld et al., 2010; Herrero et al., 2009b; Dixon et al., 2010). • This affects in particular the non-ruminant sector, which relies for a much greater part of their nutrition on grains. It might, over time, cause a reverse of the current increased demand of feed grains by non-ruminant pigs and poultry with a shift in favour of production systems which rely on grass, rangeland and crop residues (and hence ruminant cattle, sheep and goat production).
Increasing shortage of land and water resources	• In particular in South and East Asia, the shortage of land and water will imply that the future increased demand for animal source foods will have to be met by increase in productivity, intensification of production and more efficient resource use.
Structural changes in the sector	• As the manufacturing and service industry expand, and employment opportunities outside the sector increase, it can be expected that the number of smallholders will gradually decline, as happened (and is still happening) in OECD and middle income countries. • On the other hand, new entrepreneurs are entering into the sector. Some of them engage directly in raising livestock, including new breeds, and some providing feeds,

[2] For additional analysis of the close relationship between the livestock sector and population growth please refer to chapter 2.1.

[3] A practical example of international trade ban is the US ban on China's poultry, cited by Pi C., Rou Z., Horowitz S., 2014.

Megatrends	Short description
	forages, or veterinary services.
Environmental and ethical aspects	• Increasing concerns regarding the environmental and ethical aspects of livestock production, in particular of the so-called "bio-industry".

Table 2 - Megatrends of the livestock sector of the last decades.
Source: adapted from World Bank, 2012.

As shown in the table, the livestock sector is going through several structural changes (World Bank, 2012) which are significantly modifying the multiple role plaid by the livestock (Meltzer M. I, 1995) within agricultural systems, industrial paths and social organizations.

Additionally, the increasing industrialization rate for the sector and its demand-driven path are making livestock production more and more closely related with food security, natural resource shortages and safety issues (both for animals and humans).

For example, regarding the issue of food security, in 2009, the FAO forecasted the need to increase global food production by 70 per cent in order to feed 9 billion people by 2050 (Sharma S., 2014 a) and some countries, like China or India, are experimenting even higher demands for industrialized livestock finished and semi-finished products.

Data collection difficulties and risks

In order to evaluate the global investments within the livestock sector, the quantitative and qualitative analyses undertaken have been based on a coherent set of datasets and sources which are extrapolated from international, regional and national data sources.

As amply recognized by the literature (Hurley R., 1957; World Bank, FAO, ILRI, AU-IBAR, 2014; World Bank, FAO, ILRI, AU-IBAR, Issue 23; FAO, The World Bank, 2011) the process of data collection for livestock sector is very complex and presents several intrinsic difficulties due to the specificities of livestock sub-sectors and the average inadequate information concerning livestock indicators within national agricultural census. Difficulties regarding the livestock sector are also partially shared with the entire agricultural sector, which often lacks of adequate data.

For example, in order to improve this deficiency, the Global Strategy to Improve Agricultural Statistics (FAO, The World Bank, 2011) suggests the implementation of the following pillars:

1. The establishment of a minimum set of core data that country Governments should collect on a regular basis;
2. The integration of agriculture into the national statistical system;
3. Governance and statistical capacity building.

Specifically regarding livestock data collection problems within agricultural census, the main problem consists in the fact that "livestock sector has long been treated as an appendage to agriculture, with both policy-makers and development practitioners giving higher priority to staple crops than to high-value agricultural products such as ASFs or fruits and vegetables." (FAO, 2012 b)

Insufficiency of national agricultural surveys

The scare quantity and quality of livestock data and statistics available to the public and private sector depends on many factors which differ from case to case. However, a general insufficiency of national

agricultural survey exists, as recognized by the literature (Hurley R., 1957; World Bank, FAO, ILRI, AU-IBAR, 2014; World Bank, FAO, ILRI, AU-IBAR, Issue 23; FAO, The World Bank, 2011).

For example, concerning the collection of livestock are in Africa, the main issues for the collection of livestock are (World Bank, FAO, ILRI, AU-IBAR, 2014):

1. The existence of a variety of livestock - related indicators at country level which are often questioned by livestock stakeholders;
2. National agricultural and/or farm surveys tend to marginally appreciate livestock;
3. Specialized livestock surveys are rarely undertaken by national Governments;
4. The quality of data on animal disease is not sufficient;
5. No information concerning pastoral production systems are stated.

Within this uncertain quantitative framework, the definition of livestock policies, support measures and investments is very difficult and dangerous and this constraint significantly hamper the potential contribution of the livestock sector to economic growth, food security, equity, animal health and poverty alleviation.

Example of statistical trick

One of the reason why statistics concerning livestock data are very risky is the estimation of livestock value added in the national accounts by means of the use of technical conversion factors. These coefficients, which are used in order to convert primary livestock data into elaborated data having different unit of measure may risk to be applied in an inappropriate way (e.g. using the same technical coefficient for very different countries) or not to be updated for years.

Box 1 - Example of statistical trick in livestock data collection.
Source: World Bank, FAO, ILRI, AU-IBAR, 2014.

As a matter of fact, indeed, as stated by the literature (World Bank, FAO, ILRI, AU-IBAR, Issue 11. 2010-2013), "many countries, especially in the developing world, lack the capacity to produce and report even the minimum set of agricultural data necessary to monitor national trends, or inform the international development debate".

All this difficulties, merged with the fact that livestock data "change every day of the year" (Hurley R., 1957), make the quantification and the statistical analysis of livestock indicators and data very complex and uncertain.

Consequently, within this analysis, the illustration of livestock data and statistics (obtained by mean of using coherent databases and applying coherent elaborations) will be accompanied by a robust methodological description, in order to allow the reader to fully understand main hypotheses used and the principal assumptions which were necessary in case of derived data.

Livestock core indicators

For tackling the persistent problem of missing data within livestock statistics, the Global strategy to improve agricultural and rural statistics identifies a consistent set of primary and elaborated data required for the analysis of the livestock sector such as:

Primary data:

1) Inventory and annual births;
2) Production of products such as meat, milk, eggs, and wool, and net trade or imports and exports;
3) Producer and consumer prices.

Estimated data:

1) Livestock value added;
2) Change in components of livestock and poultry balances by species.

A data collection considering the above information may be able to produce more consistent aggregated data and to monitor sector trends and evolutions on more precisely basis.

However, these indicators are not able to totally describe the complexity of livestock sector and the analysis of the related underlying policy strategies and frameworks existing at regional/national or international level is necessary for better define the complete framework surrounding livestock investments[4].

Consequently, this paper specifically focuses on livestock supporting policy analysis and livestock investment strategies, which are explored in order to show the comprehensive framework of livestock investments.

1.2.2. Definition of investment in Livestock sector

Private investments

According to the literature (FAO, 2012 a; Narrod C. A., Fuglie K. O., 2000; Steinfeld H., Mack S., 2012), a private investment is generally defined as change in capital stock. Capital, in turn, refers to physical items such as machinery, buildings, storage facilities, fertilizers, pesticides and high-yielding varieties that are not used up in the production of a product.

This set of physical items with these characteristics is known as fixed (or physical capital). Therefore, private investment can be understood as expenditure on fixed assets (physical capital) in order to produce goods for future consumption (FAO, 2012 a).

Accordingly, within the livestock sector, fixed asset private investments can be considered all these investments which are used in the supply chain phases (i.e. machinery, equipment, farm buildings, tracks, slaughtering tools, etc.).

A broader definition of private investment also comprehends the variation of live animal stock, its growth and evolution, both from a quantitative and a qualitative point of view, and all the ameliorations implemented within animal grazing, feeding, slaughtering and processing methods alongside the supply chain.

Public investments

The institutional framework for private investments, historically defined by the State, significantly influences the nature and the extent of private investments within the livestock sector and can be considered as important as private behaviours and strategies.

Consequently, public investments in the livestock sector, which directly derive from public policies and strategies generally decided on national level, are very important for the purpose of this paper.

For example, public investments for the support of livestock sector are: the reduction of import/export tariffs for livestock products (Trade policy), the introduction of compulsory quality standards (Quality

[4] For policy analysis and livestock investment strategies please refer to chapter 5.

policy), the reduction of taxes for livestock operators (Fiscal policy), the provision of a comprehensive system of rural credit financing for farmers (Agri-credit policy), the creation of national and regional institution supporting operators, farmers and cooperatives for the definition of livestock strategies and plans (Institution support) or the provision of free veterinary services for livestock operators (Animal Health policy)[5].

As a matter of fact, a holistic definition of investment within the livestock sector shall consider "new livestock" (change in fixed assets, stock variation and financial instruments for supporting farmer cooperatives and poor livestock operators), "better livestock" (ameliorations implemented within each supply chain phase and public regulations for fostering higher quality standards), "specialized livestock" (public and private research investments and training, infrastructure upgrading and transport facilities) and "cleaner livestock" (investments in manure and emission management, waste handling and resource management innovation).

1.2.3. Data sources and primary data

In order to evaluate the global investments within the livestock sector, a consistent number of data has been aggregated and elaborated from different databases and sources, as shown in the following table, which gives the details on the preliminary overview of the databases used, their main object, the primary indicators available, the elaborations undertaken and the analysis realized.

Database		Object	Primary Indicators	Elaborations	Analysis
	1) UN Comtrade	International Trade	Import/Export	Commercial Balance	Trend analysis for selected geographical zones and countries Trade share for selected industries
	2) FAOSTAT	Statistics on agri-environmental and livestock indicators	Production Food Balance Import/Export Agri-Environmental indicators	Demand/supply analysis of the livestock sub-sectors	Trend analysis for selected geographical zones and countries Quantification of livestock-related production for selected geographical zones and countries
	3) WDI	World Bank Development Indicators	Agricultural land Food production index GDP growth Population growth Livestock production index	GDP growth index and Population growth index in comparison with Livestock production index	Trend analysis for selected geographical zones and countries
FACTIVA	**4) Private Corporations**	Factiva data on international	Top - 100 International Corporations active	Comparison of last 5-7 years investment strategies for a	Balance sheet analysis Trend analysis for

[5] For an extensive analysis of livestock public and private policies according to supply chain phase please refer to chapter 5.

Database		Object	Primary Indicators	Elaborations	Analysis
		corporations	in livestock sector	sample of 27 corporations	selected corporations
AidData	**5) AidData**	Cooperation projects databases	Multilateral cooperation projects for livestock, farming and agriculture	Identification of main multilateral cooperation projects in livestock sector	GIS network analysis
	6) CDM	Clean Development Mechanism project database	Projects realized under the aegis of Kyoto protocol	Identification of livestock projects and their GHG emission reductions.	Trend analysis for selected geographical zones and countries Case studies for selected projects
Sources					
1) UN Comtrade: http://unstats.un.org/unsd/trade/ **2) FAOSTAT:** http://faostat.fao.org/ **3) WDI:** http://data.worldbank.org/data-catalog/world-development-indicators **4) Private Corporations:** http://new.dowjones.com/factiva/ **5) AidDatA:** http://AidData.org/ **6) CDM:** http://cdm.unfccc.int/					

Table 3 - Short overview of databases used.

As shown in the previous table, the analysis undertaken are able to present the multiple sides of livestock sector investments, including general commercial trends (UN Comtrade and WDI), stock variations (FAOSTAT), private investments (Factiva) and cooperation/CDM projects (AidData and CDM).

A graphical representation of livestock primary and elaborated indicators obtained, which are presented in the following chapters of this paper, is given by the following figure, that distinguishes livestock indicators according to the nature of data and the database used for the elaborations.

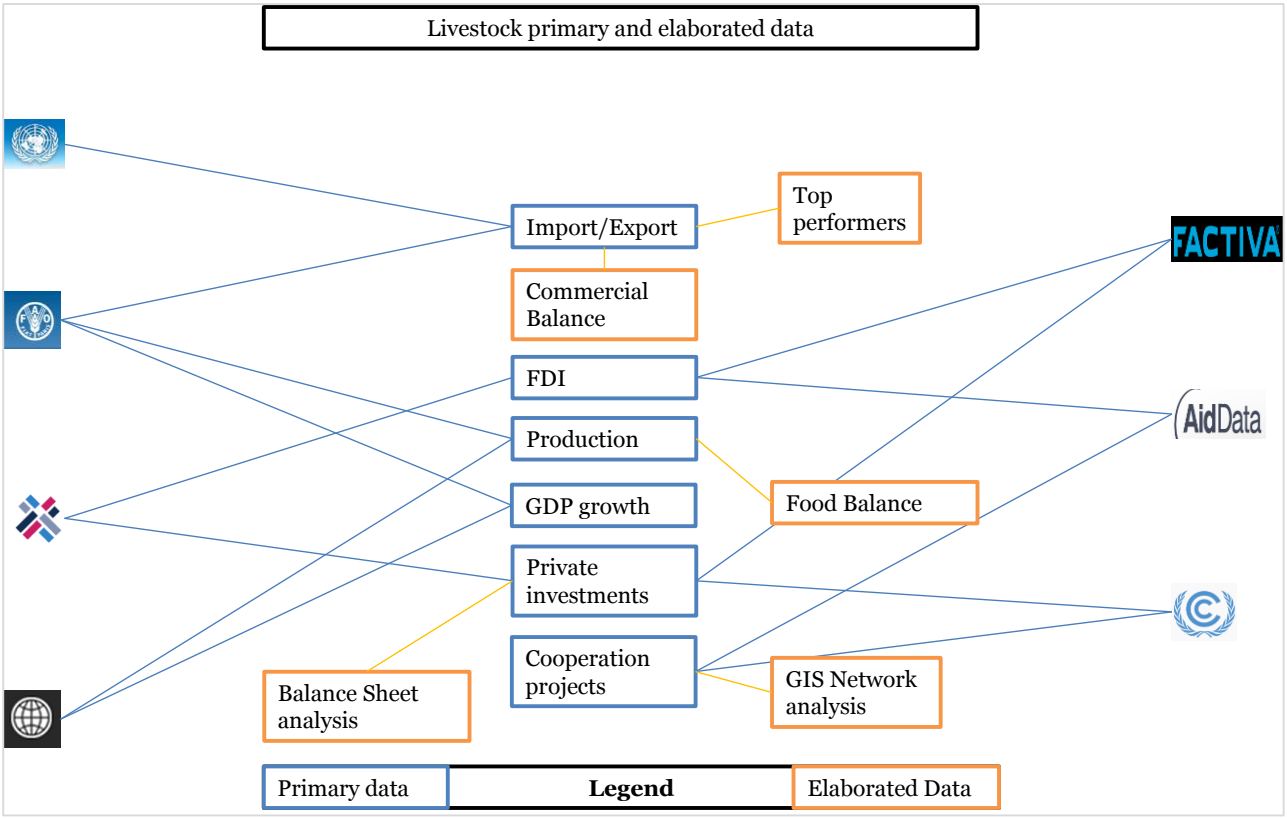

Figure 1 - Short overview of livestock primary and elaborated data according to database used.

As shown by the previous figure, the main indicators that will be presented in the following chapters regard:

- Livestock general trend with respect to other economic indicators;
- Import/Export flows and top performers;
- Private investments (Corporate balance sheet analysis);
- Country food balance;
- GIS Network analysis for cooperation projects;

These quantitative indicators, together with public and private sector investment strategies (described in chapter 5), give a coherent and comprehensive snapshot on past and current investments within the livestock sector and furnish a consistent assessment on livestock sector trends and findings.

2. Livestock investments by sub-sector

This chapter intends to give a comprehensive description of livestock investments of the past ten years (according to data availability, the reference period is 2001-2011) and to present the main findings of the quantitative analyses undertaken.

The chapter is organized in three paragraphs, giving different details on livestock investment trends according to the following perspective:

1) Livestock Market outlook (paragraph 2.1), describing livestock overall trade with respect to world trade and determining how livestock production index has changed with respect to other economic indexes (i.e. agricultural land, food production, population growth and GDP growth);

2) World trends for live animals stock by sub systems and livestock density (total livestock per hectare of agricultural area) per geographical area (paragraph 2.2);

3) Detailed investments in livestock according to geographical area (paragraph 2.3) and by the following sub-sectors:

a. Coarse grain;
b. Soybeans;
c. Bovine meat;
d. Poultry eggs;
e. Poultry meat;
f. Pig meat;
g. Dairy products (milk).

The general approach for this chapter deals with the presentation of the following information concerning livestock investments:

- Who invests;
- Investment features;
- Investment location;
- Investment type.

Private investments in the livestock sector, including private international corporation investments and the other investments in the livestock sector will be presented in chapter 3.

2.1. Livestock Market outlook

Livestock overall trade with respect to world trade

With an average trade flow of 180 billion of US $ p.a., the livestock sector represents 2% of word trade for the period 2001 - 2011 (elaboration on Comtrade 2014, average for period 2001-2011). On average, 78% of the trade flow for the livestock sector is constituted by meat and edible meat offal trade, which amounted to 222 billion of US $ in 2011 (in 2011, the total trade flows for the livestock sector was 280

billion of US $, while world trade was about 17.5 thousand of billions of US $[6]), as shown by the following table.

Trade (Billions of US $)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	CAGR
World Trade	6,032	6,311	7,351	8,944	10,118	11,763	13,477	15,614	12,070	14,663	17,494	**11%**
Live animals	17	19	19	22	26	29	5	2	2	2	1	**-24%**
Meat and edible meat offal	82	83	96	111	125	133	154	189	172	187	222	**11%**
Products of animal origin	7	7	8	9	10	10	38	46	45	49	57	**23%**

Table 4 - Trade flows for livestock sector with respect to World Trade (2001 - 2011).
Source: elaboration on Comtrade database 2014. Trade values show simple average between import and export.

The remain part of livestock trade flow (i.e. 22%, about 58 billion of US $ in 2011) is represented by the trade of live animals and other products of animal origin, respectively averagely accounting 7% and 14% of yearly trade sector flows for the period 2001-2011 (elaboration on Comtrade 2014).

Moreover, as shown by the following figure, the overall trend for meat significantly differs from products' and live animals' trends. Indeed, with a CAGR of 11% for the period, the trend for meat is in line with world trade general trend (same CAGR for the period considered), while products of animal origin recorded a higher increase (CAGR +23%, passing from 7 billion of US $ in 2001 up to 57 billion in 2011) and live animals trade dropped during the period (CAGR - 24% and -16 billion US $ of trade flow lost in 2011 with respect to 2001).

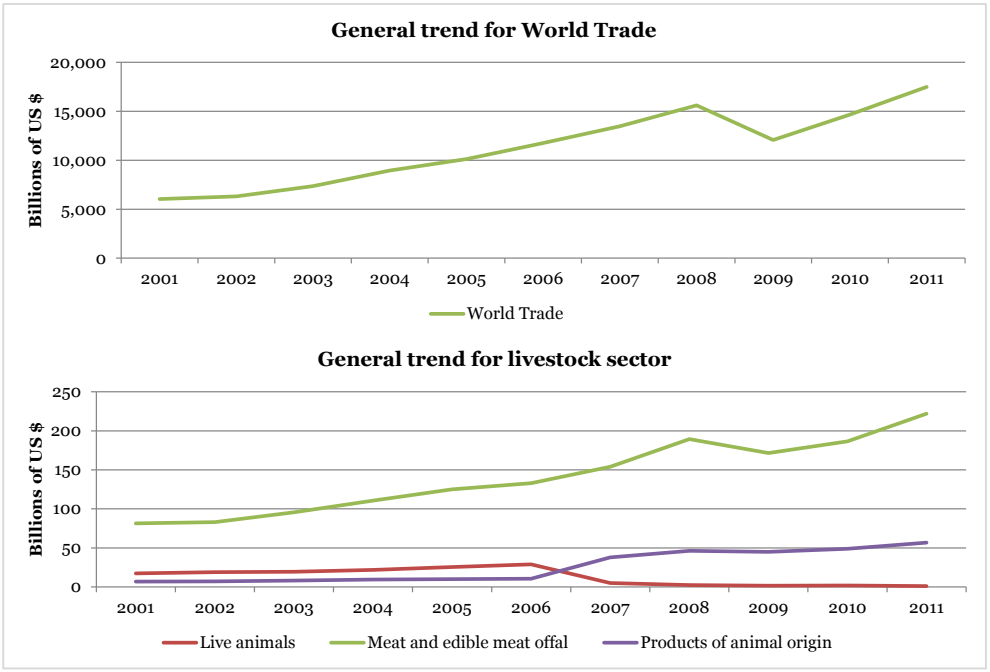

Figure 2 - General trends for the livestock sector and for the World trade.
Source: elaboration on Comtrade database 2014. Trade values show simple average between import and export.

Consequently, from the preliminary analysis of livestock sector trade trends, two main findings can be inferred:

[6] Our elaboration on Comtrade data. According to World trade report 2012 (World Trade Organization 2012), the total value of World trade is 17.7 thousand of US $.

- The overall trade for meat and products of animal origin recorded significant growth rates during the period considered and meat trend seems to be totally aligned with general world trade, representing about 2% of word flows;
- The trade of live animals, on the contrary, recorded a sharp reduction for the period 2001-2011, with decreasing growth p.a. starting from 2006-2007.

The first finding (i.e. increase of trade for meat and products), is confirmed by the literature (Delgado C. et al.1999; Pica-Ciamarra U., Otte J., 2010; FAO, 2006), which recognized as "in recent decades, there has been enormous growth in livestock production [and trade], driven by increasing demand for animal-source foods among large segments of the world's population" (Delgado C et al.1999).

Livestock production index with respect to other economic indexes

On the basis of the close relationship between agriculture and livestock, the analysis of livestock performances has been coherently compared with respect to overall agricultural trends, food production index, population growth and GDP growth rates.

As a matter of fact, indeed, livestock sector is one of the biggest player in the composition of agricultural land use and "all land use systems, including livestock production systems, can be seen as mosaics of different units of land cover and land use interconnected by spatial and functional relationships, implying that efforts to classify livestock production systems cannot be disconnected from current efforts to develop standardized classification systems for land cover, land use, and land use systems" (FAO ILRI, 2011).

The comparison of annual growth rates p.a. for agricultural land, food production, GDP growth and livestock production shows that consistent differences arise between the respective trends of the last decade (according to data availability, the reference period is 2001-2011).

As a matter of fact indeed, the dramatic drop of world GDP in 2009 (-2% with respect to the previous year) is not imitated by other sectors, which, notwithstanding a decreasing trend with respect to previous years, continue to record positive growth rates (about 1.5% from 2008 to 2009 for livestock production index and food production index) or null growth rate (as agricultural land, which has a flat trend along the entire period), as shown in the following figure.

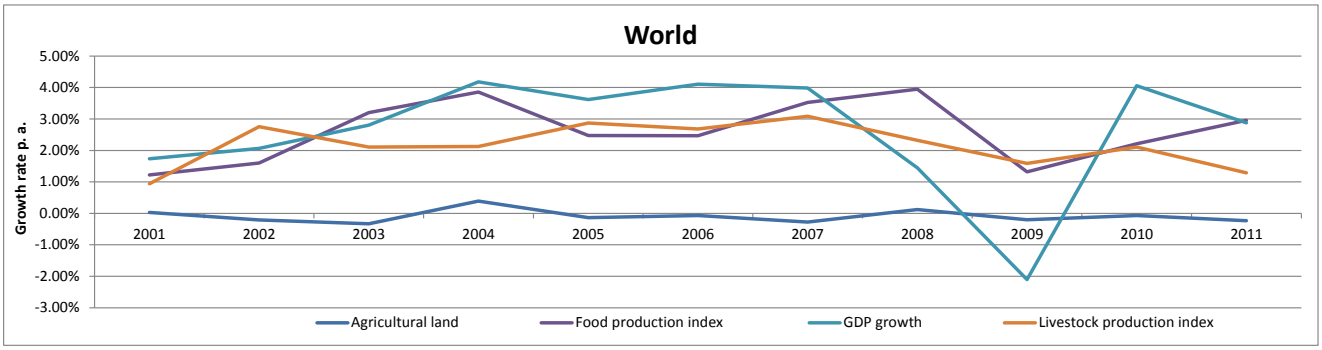

Figure 3 - World growth rates p.a. of selected livestock-related indicators.
Source: elaboration on World Bank development indicators database 2014.

Moreover, a compounded analysis of livestock production index with respect to GDP index and population index (2005 is set as 100), shows that livestock production (ranging from a minimum of 80 in 2001 up to a maximum of 130 in 2011 and describing a maximum range of 50 in the period 2001-2011) recorded much less variation than GDP index (showing a maximum range of 120, from a minimum of 55 in 2001 up to a maximum of 175 in 2011), and that, on the contrary, livestock production index is very

related with population growth, (which maximum variation range is 25, from a minimum of 90 in 2001 up to a maximum of 115 in 2011, both recorded for Sub-Saharan developing countries), as illustrated in the following figure.

As a matter of fact, indeed, from the analysis of respective growth rates, it seems that livestock trends is very linked to population growth trend in terms of sector variation (i.e. the maximum range described by the graphs).

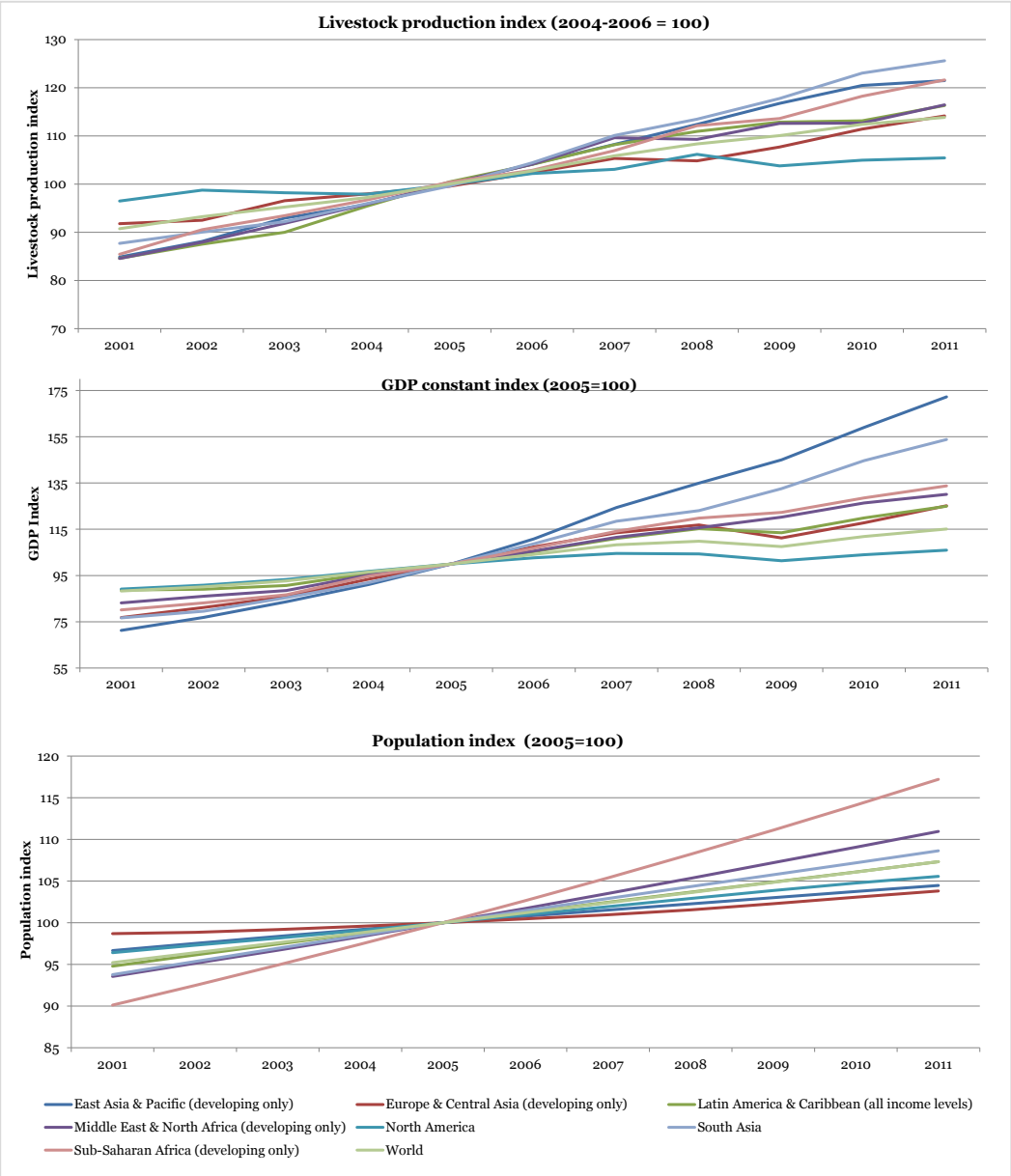

Figure 4 - Livestock production index (2004-2006 = 100), population index (2005=100) and GDP constant index (2005 = 100) for selected geographical zones.
Source: elaboration on World Bank development indicators database 2014.

The geographical areas with higher growth rates for livestock production are East Asia & Pacific, South Asia and Sub-Saharan Africa, with respective increases in livestock production from 2001 to 2011 of 37, 38 and 36 percentage points, as shown by the following table.

Country	GDP index variation 2001 to 2011	Population index variation 2001 to 2011	Livestock production index variation 2001 to 2011
East Asia & Pacific (developing only)	+ 101	+ 8	+ 37
Europe & Central Asia (developing only)	+ 48	+ 5	+ 22
Latin America & Caribbean (all income levels)	+ 36	+ 13	+ 32
Middle East & North Africa (developing only)	+ 47	+ 17	+ 32
North America	+ 17	+ 9	+ 9
South Asia	+ 77	+ 15	+ 38
Sub-Saharan Africa (developing only)	+ 54	+ 27	+ 36
World	+ 27	+ 12	+ 23

Table 5 - GDP, Population and livestock production index variations from 2001 to 2011 (2005=100) for selected geographical zones.
Source: elaboration on World Bank development indicators database 2014.

Consequently, from the preliminary analysis of livestock sector production trend, two main findings can be inferred:

1) GDP (positive or negative) growth rate p.a. only partially influences livestock production and (food production), which continued to grow even immediately after the 2009 crisis;
2) There is a close relationship between livestock production and population growth, which show similar trends and variation ranges in the period considered.

Top performers in the trade of meat and edible meat offal

An example of trade analysis pondered on the meat industry shows that USA, Brazil and the Netherlands are the top 3 exporters of meat and edible meat offal in terms of value for the period 2001-2011, with respective 189 billion, 172 billion and 138 billion of US $ of export; on the import side, Japan, Germany and the United Kingdom are the top 3 importers of meat and edible meat offal, with respectively 170 billion, 119 billion and 114 billion of US $ of import (elaboration on Comtrade 2014, refer to Table 6 and Table 7 of the following page).

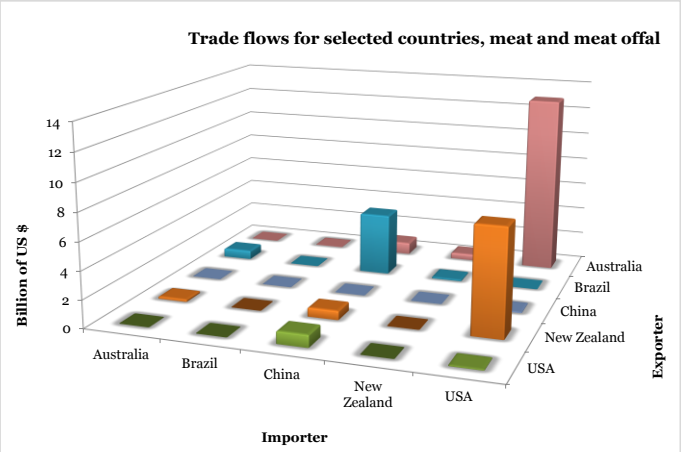

Figure 5 - Trade flows for selected countries, meat and edible meat offal for the period 2001 - 2011.
Source: elaboration on Comtrade database 2014.

Moreover, in order to select the biggest players in the world trade of meat and edible meat offal, the analysis of the commercial balance (export minus import) for this industry has been undertaken (refer to Table 8 of the following page).

This analysis shows that Brazil, Australia, USA, New Zealand, Canada, Ireland, Spain and Argentina are the top traders of meat and edible meat offal[7] for the period 2001-2011, with respective trade balances of

[7] With respect to countries listed into Table 8, The Netherlands, Denmark and Belgium are not considered as top players because of the fact that their import/export volumes and values are amplified with respect to actual internal demand (import) and internal production (export) due the presence of many international commercial ports, where goods are imported, stored and exported without any direct connection to the real market (so-called "Rotterdam Effect").

+169 billion, +103 billion, +88 billion, +65 billion, +51 billion, +38 billion, +34 billion and +26 billion of US $.

Concerning China, which is placed in the 13th position in the ranking of top importers (after Russia, France, Mexico and other countries), with average 2.72 billion of US $ of meat and edible meat offal imported p.a., its trade relationships are closely interconnected with Australia, Brazil, New Zealand and USA, as shown by the figure on the right.

Indeed, China's import of meat and edible meat offal for the entire period 2001-2011 significantly derives from imports from Australia and USA (both 3% of national import, i.e. 0.8 billion of US $ each), New Zealand (2% of national import, i.e. 0.6 billion of US $), and Brazil (15% of national import, i.e. 4.5 billion of US $).

USA is a big world importer of meat and meat offal in the period 2001-2011, as described by the figure on the right, with very significant import flows from Australia and New Zealand.

From the figure, it is also possible to infer how "the global meat industry is increasingly interlinked with emerging economies, where China and Brazil are now not only big agricultural producers and consumers" (Sharma S., 2014 a), but are also more and more active in the shaping the global meat complex, with significant bilateral trade flows.

Country	Exports (Billion US dollars)	Imports (Billion US dollars)	Ranking (Export based)	EX - IM (Billion US dollars)
USA	189.83	101.13	1	88.71
Brazil	172.82	2.83	2	169.99
Netherlands	138.56	55.98	3	82.58
Germany	128.33	119.39	4	8.94
Australia	109.50	6.21	5	103.29
Denmark	93.74	18.89	6	74.85
France	81.38	91.94	7	-10.56
Canada	79.28	28.25	8	51.03
Belgium	70.63	30.01	9	40.62
New Zealand	67.27	2.05	10	65.22

Table 6 - Top exporters of meat in terms of Export value for the period 2001 - 2011.
Source: elaboration on Comtrade database 2014.

Country	Exports (Billion US dollars)	Imports (Billion US dollars)	Ranking (Import based)	EX - IM (Billion US dollars)
Japan	0.58	170.66	1	-170.09
Germany	128.33	119.39	2	8.94
United Kingdom	28.84	114.78	3	-85.95
Italy	36.23	108.19	4	-71.96
USA	189.83	101.13	5	88.71
Russian Federation	0.24	93.21	6	-92.98
France	81.38	91.94	7	-10.56
Netherlands	138.56	55.98	8	82.58
Mexico	9.02	55.84	9	-46.82

India is not considered as a top player in the world market of meat and meat offal since its position (12th in the trade balance rank for the industry) is only to null level of import.

Country	Exports (Billion US dollars)	Imports (Billion US dollars)	Ranking (Import based)	EX - IM (Billion US dollars)
China, Hong Kong SAR	22.32	54.21	10	-31.89
Rep. of Korea	0.59	38.00	11	-37.41
Belgium	70.63	30.01	12	40.62
China	17.42	29.82	13	-12.40

Table 7 - Top importers of meat in terms of Import value for the period 2001 - 2011.
Source: elaboration on Comtrade database 2014.

Country	Exports (Billion US dollars)	Imports (Billion US dollars)	Ranking (Balance EX-IM)	EX - IM (Billion US dollars)
Brazil	172.82	2.83	1	169.99
Australia	109.50	6.21	2	103.29
USA	189.83	101.13	3	88.71
Netherlands	138.56	55.98	4	82.58
Denmark	93.74	18.89	5	74.85
New Zealand	67.27	2.05	6	65.22
Canada	79.28	28.25	7	51.03
Belgium	70.63	30.01	8	40.62
Ireland	48.23	10.16	9	38.07
Spain	61.82	26.96	10	34.86
Argentina	28.75	1.96	11	26.78
India	20.48	0.01	12	20.47

Table 8 - Top performers of meat in terms of Export minus Import and in terms of value for the period 2001 - 2011.
Source: elaboration on Comtrade database 2014.

2.2. Live Animals stocks

The first step of the quantitative and qualitative analysis regarding the identification of livestock investment trends is aimed at identifying how live animals stocks and their world composition have changed according to geographical areas during the period 2001-2011 for the macro-categories of poultry, cattle/buffaloes and sheep/goats.

As a matter of fact, indeed, as recognized by the literature (FAO, ILRI, 2011; FAO, 2011 a; Steinfeld H., Mack S., 2012), the "identification of existing and active production systems help to quantify phenomena and to integrated missing data and information" (FAO, ILRI 2011) and the analysis of live animals stock is a necessarily prerequisite for the definition of livestock trends.

Poultry birds stock

The stocks of live animals for the poultry sector has significantly increased in the period 2001-2011 with an overall CAGR of 3.3% and with high growth rates for India (CAGR 8.6%) and Asia without China & India (CAGR 4.3%); slight increases are also recorded for Australia & New Zealand, Northern America and Europe (respective CAGR 0.1%, 0.7% and 1.7%), which poultry stock trend is almost flat[8].

[8] Data for this section are based on FAOSTAT data and/or elaborations on FAOSTAT data.

As a consequences of these different trends in the sector, the world composition of poultry stock has slightly changed from 2001 to 2001 and market shares lost by Northern America (-3%) and Europe (-2%) have been allocated to India (+1%) and Asia without China & India (+3%), as shown in the Figure 6.

Cattle and buffaloes stock

The stocks of live animals for the cattle and buffalos sector has increased less than the poultry sector in the period 2001-2011 with an overall CAGR of 1.2% and very low growth rates after 2009 crisis. Negative growth rates are recorded for Europe (CAGR -1.6%) and Northern America (CAGR -0.6%) while slight increases are recorded for Africa, Brazil, China and Asia without China & India (respective CAGRs are 2.4%, 1.9%, 1.3% and 2.3%).

The world composition of cattle and buffaloes live animals stock, which sees India as the top world market player (20% of market share in 2001 and 2011), has slightly changed from 2001 to 2001 and market shares lost by Europe (-2%), Northern America (-1%) and South America without Brazil (-1%) have been allocated to Africa (+2%) and Asia without China & India (+2%), as shown in the Figure 6.

Sheep and goats stock

Similarly to cattle and buffaloes industries, the stocks of live animals for the sheep and goats sector has slightly increased in the period 2001-2011 with an overall CAGR of 1.7%, with positive growth rates for Africa, Brazil, China, India and Asia without China & India (respective CAGR 2.7%, 1.1%, 2.4%, 2.3% and 2.1%). Negative growth rates are recorded for Europe (CAGR -0.7%), Australia & New Zealand (CAGR -3.5%) and Northern America (CAGR -1.0%)

The world composition of cattle and buffaloes live animals stock, which sees Africa as the top world market player (28% of market share in 2001 and 31% in 2011), has slightly changed from 2001 to 2001 and market shares lost by Europe (-2%), Australia and New Zealand (-3%) have been allocated to Africa (+3%), China (+2%), Asia without China & India (+1%) and India (+1%) as shown in the Figure 6.

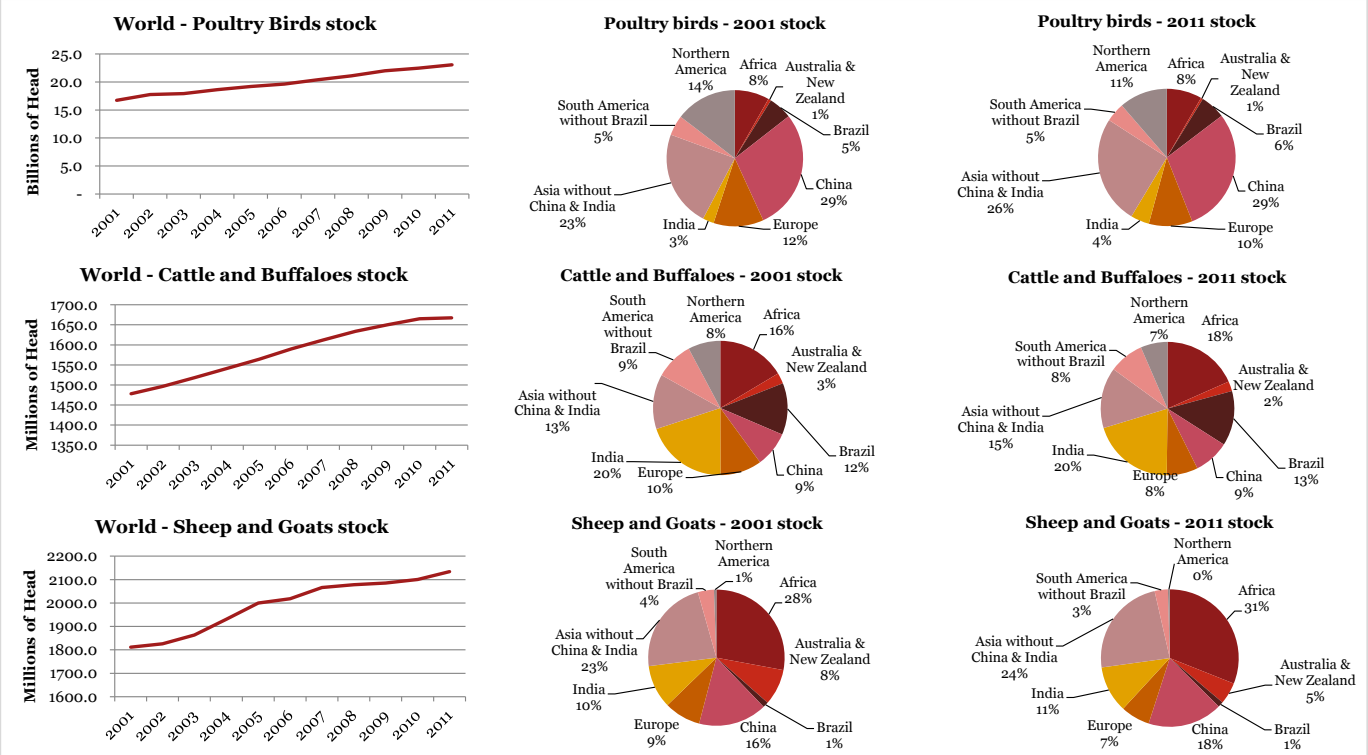

Figure 6 - Live animal stocks according to livestock category and world stock composition for 2001 and 2011. Source: elaboration on FAOSTAT 2014.

The overall composition of live animals stock shows positive trends for all the geographical areas analysed except for Australia and New Zealand (CAGR for the period 2001-2011 is -1.5%).

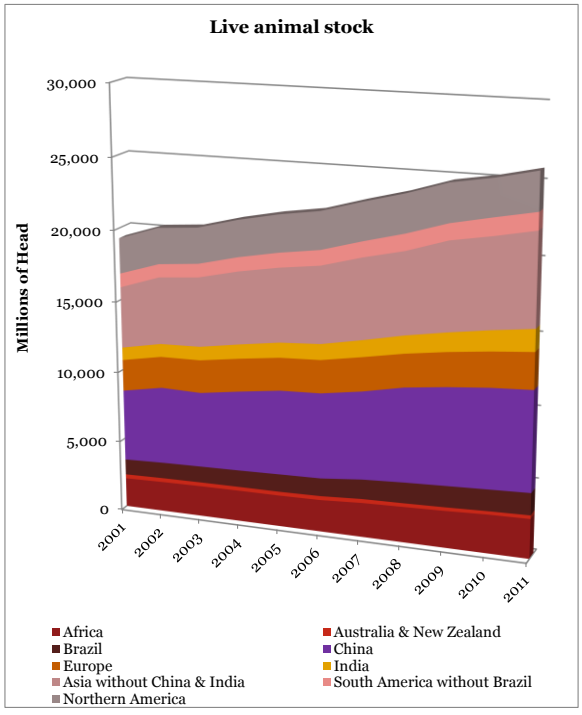

Figure 7 - Live animal stock according to Geographical area.

Africa, Brazil, China, India and Asia without India & China are significantly investing in live animals stock, with very positive CAGRs for the period 2001-2011 (respective CAGRs are 3.1%, 3.4%, 3.3%, 5.5% and 4.1%). Europe and Northern America record quite flat trends (CAGR 1.4% for Europe and 0.6% for Northern America).

The world composition of live animals stock , shown in the figure on the left, sees Europe, Northern America and South America without Brazil losing market shares (respective market share losts are -2%, -2% and -1%) while India, China and Brazil are gaining market shares and have become the top 3 countries in terms of live animal stock, collectively representing 38% of world live animal stocks in 2011 (6% for Brazil, 6% for India and 26% for China).

Value of the production

The world composition of the value of livestock production (in terms of constant 2004-2006 US $) for the period 2001-2011 is partially aligned with the world composition of the overall value of agricultural production, as shown in the following figure for years 2001 and 2011.

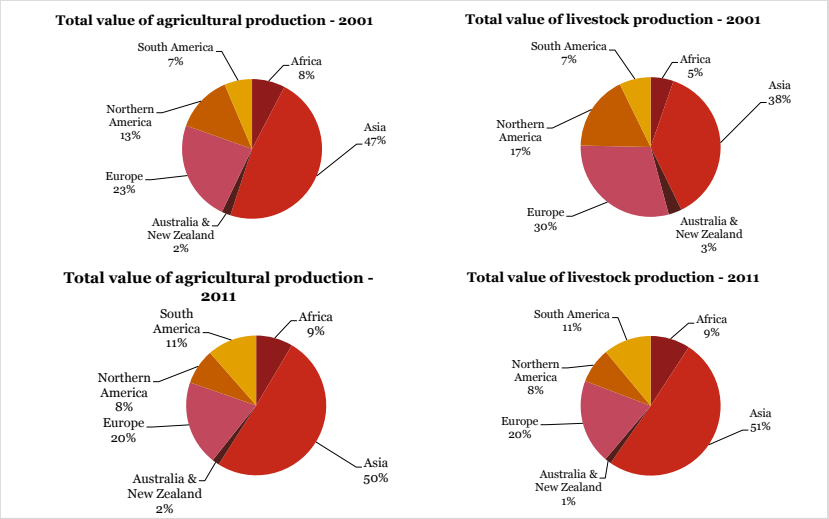

Figure 8 - Agricultural production and livestock production according to value of production and world composition for 2001 and 2011.
Source: elaboration on FAOSTAT 2014.

As shown by the previous figure, Asia has gained significant world market shares both in the world composition of livestock production value (even +13% of world market share from 2001 to 2011) and in the total value of agricultural production (+3% of world market share from 2001 to 2011), while Europe and Northern America have lost market shares in the livestock production values from 2001 to 2011 (-10% of world market shares for Europe and -9% for Northern America, please also refer to Figure 9). Europe and Northern America have also collectively lost 8% of world market share in the total agricultural production for the period 2001-2011. World market shares for Africa, South America and Australia & New Zealand are averagely more stable.

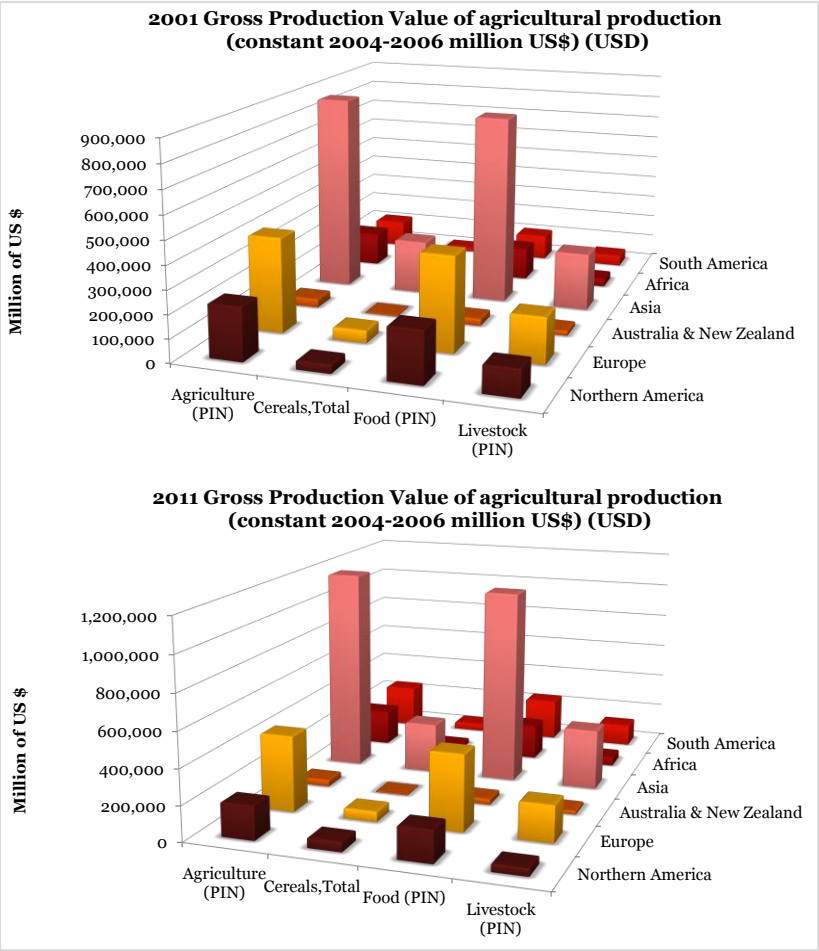

Figure 9 - World composition of Agriculture, Cereals, Food and livestock Production for 2001 and 2011. Source: elaboration on FAOSTAT 2014.

Density of live animals stocks

The analysis of live animals stock density for the period 2001-2011, presented in the following table, shows as poultry sub-industry has a very high average density in terms of total live animals stock per ha of agricultural area (No/Ha), with a world average of about 4 No/Ha and peaks of 6.51 No/Ha for Asia and 5.14 for Northern America.

Additionally, Indian density rates for cattle and buffaloes (1.67 No/Ha) and sheep and goats (1.14 No/Ha) are significantly higher with respect to other geographical areas.

Livestock total per ha of agricultural area (No/Ha)	
Cattle and Buffaloes	
Africa	0.22
Asia	0.38
Australia & New Zealand	0.09
Brazil	0.74
Europe	0.28
India	1.67
Northern America	0.23
South America	0.58
World	*0.32*
Pigs	

Livestock total per ha of agricultural area (No/Ha)	
Africa	0.02
Asia	0.33
Australia & New Zealand	0.01
Brazil	0.13
Europe	0.41
India	0.06
Northern America	0.16
South America	0.09
World	*0.19*
Poultry Birds	
Africa	1.30

Livestock total per ha of agricultural area (No/Ha)	
Asia	6.51
Australia & New Zealand	0.24
Brazil	4.02
Europe	4.30
India	3.54
Northern America	5.14
South America	3.22
World	*3.96*
Sheep and Goats	
Africa	0.48
Asia	0.57
Australia & New Zealand	0.29
Brazil	0.09
Europe	0.32
India	1.14
Northern America	0.02
South America	0.16
World	*0.39*

Table 9 - Total livestock per hectare of agricultural area (livestock total number / Ha) in the period 2001-2011.

Source: elaboration on FAOSTAT 2014.

Finally, from the analysis of live animals stock according to geographical areas and the analysis of livestock production value, four main findings can be inferred:

1) The world stocks of live animals have increased during the period 2001-2011 (overall CAGR 3%) and significant growth rates are recorded for poultry birds stock (CAGR 3.3%), with particular peaks for India, Africa, Brazil, China and Asia without India & China;
2) Live animals stock trends for Europe, Northern America and Australia & New Zealand are flat (Poultry) or even negative (e.g. CAGR -3.5% for sheep and goats for Australia & New Zealand);
3) Asia has gained significant world market shares both in the world composition of livestock production value (even +13% of world market share from 2001 to 2011) and in the total value of agricultural production (+3% of world market share from 2001 to 2011), while Europe and Northern America have lost market shares in the livestock production values from 2001 to 2011;
4) The analysis of live animals stock density shows that the poultry sub-sector recorded higher density rates during the period 2001-2011 with respect to other sub-sector (average world density rate for poultry sub-sector is about 4 No/Ha) and Indian density rates are consistent higher than other geographical areas for cattle and buffaloes and sheep and goats.

2.3. Detailed investments in livestock by sub-sector

2.3.1. Coarse grain

The close interdependence of crops and farms is amply recognized by the literature and "farming of crops and livestock cannot be considered independently of one another nor should they be considered in isolation since the established links between livestock numbers, cultivation levels and human populations suggest that greater attention should be paid to quantifying and mapping these associations" (FAO, ILRI, 2011).

Accordingly, the analysis of the main two crops used for livestock feeding (i.e. coarse grain and soybeans) is very important in order to assess where these two crops are produced, which are the biggest world trade players and which is the yield trend in the period 2001-2011.

Area harvested and production trends

The combined analysis of the area harvested for coarse grain and its production trend of the period 2001-2011, shown in the following picture, underlines that world production is increasing constantly (CAGR 2.4% for the period) while area harvested is increasing with some negative peaks (e.g. 2002, 2006, 2009 and 2010) and with a lower increasing rate (CAGR 0.5% for the period).

Production trend faster than area harvested trend also implies an increasing trend for average world yield (CAGR 1.9% for the world) and significant peak for Indian and Chinese yields (respective CAGRs for the period are 3.4% and 2.4%) while world trend for seeds record a consistent reduction (CAGR -1.9% during the period), with a negative trends for China (CAGR - 2.5%).

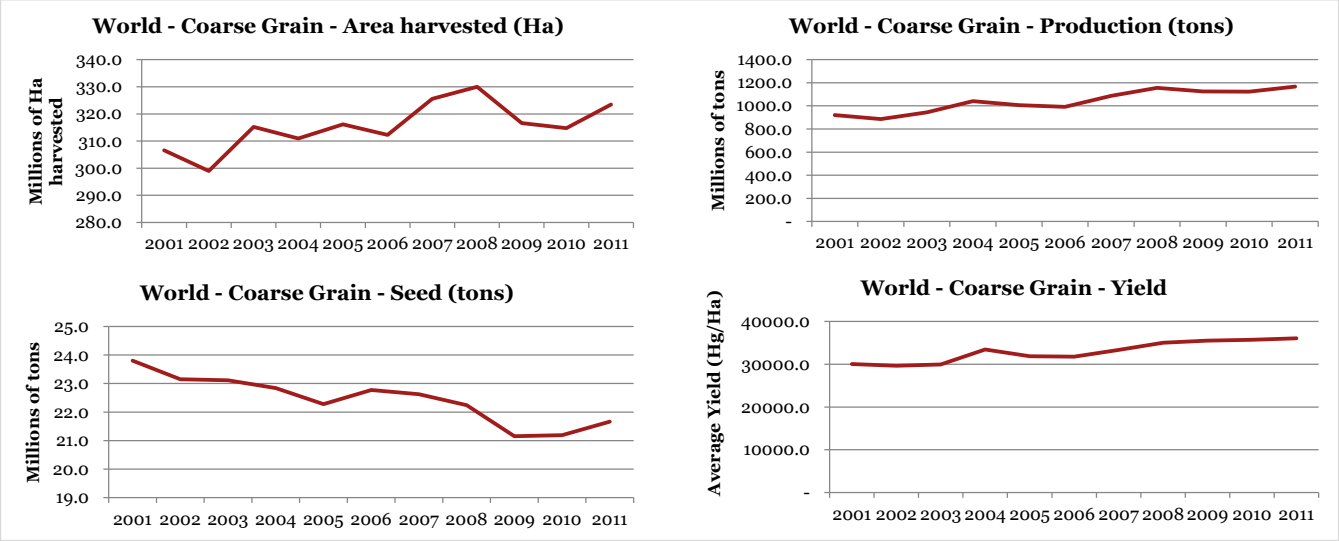

Figure 10 - Area harvested (Millions of Ha), Production (tons), Seed (tons) and Yield (Hg/Ha) for coarse grain in the world.
Source: elaboration on FAOSTAT 2014.

China, notwithstanding a very negative trend for seed, recorded a significant increase in production of coarse grain (CAGR 4.8%), second only to South America without Brazil (CAGR 5.2%); as a result, China gained world market shares in the production of coarse grain during the period (i.e. a market share increase of +4% from 2001 to 2011, refer to the following figure in the next page).

Against the null variation of world composition of area harvested, seed word composition recorded, together with the progressive reduction of Chinese market share, the increase of Africa's importance in seeding and Africa augmented its share in world composition of seed from 8% in 2001 up to 11% in 2011.

On the contrary, European position regarding coarse grain has worsened, due to very low increase in production (CAGR 0.5%), significant reduction in seeds (CAGR - 1.7%), only partially counterbalanced by increasing yield trend (CAGR 1.8%), as shown in the following figures.

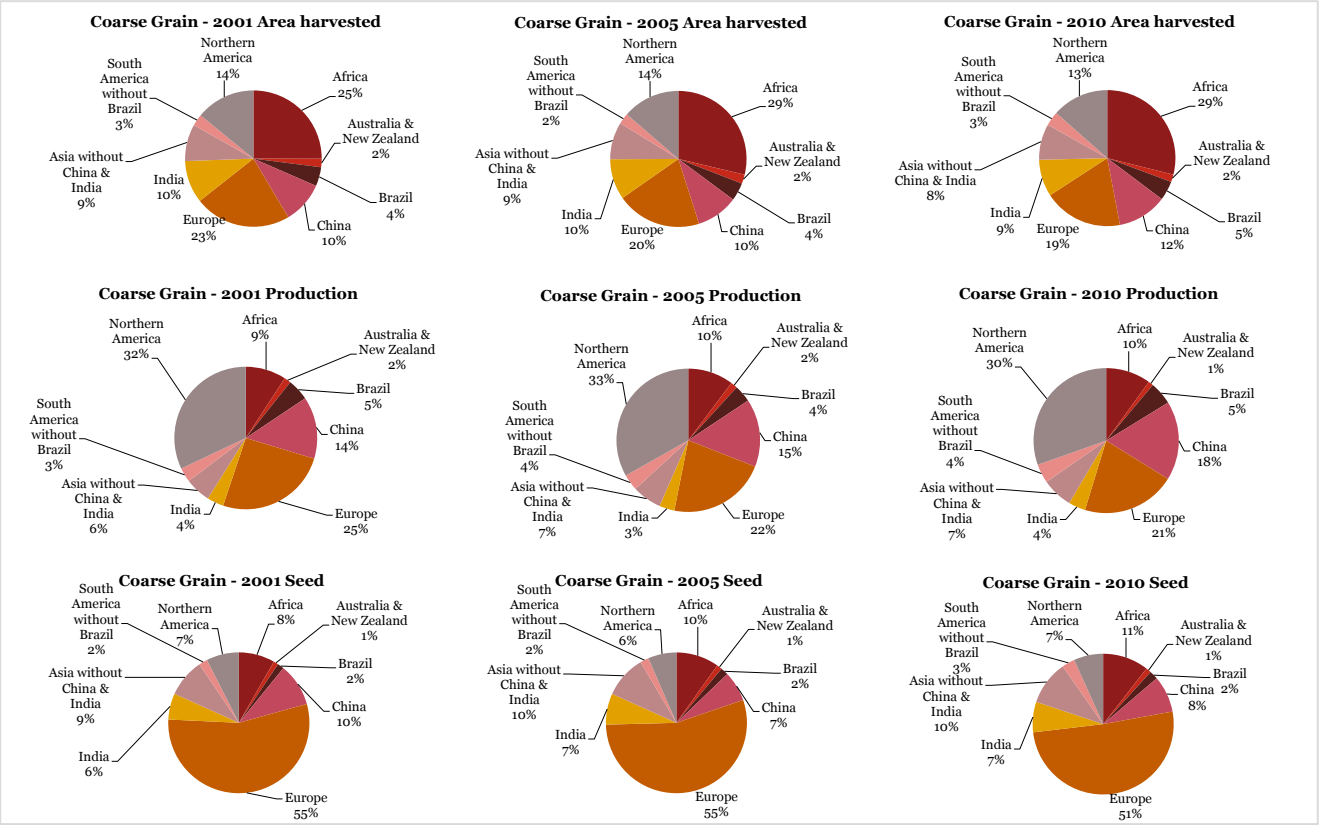

Figure 11 - Word composition of area harvested (millions of Ha), production (tons) and seed (tons) for coarse grain in 2001, 2005 and 2010.
Source: elaboration on FAOSTAT 2014.

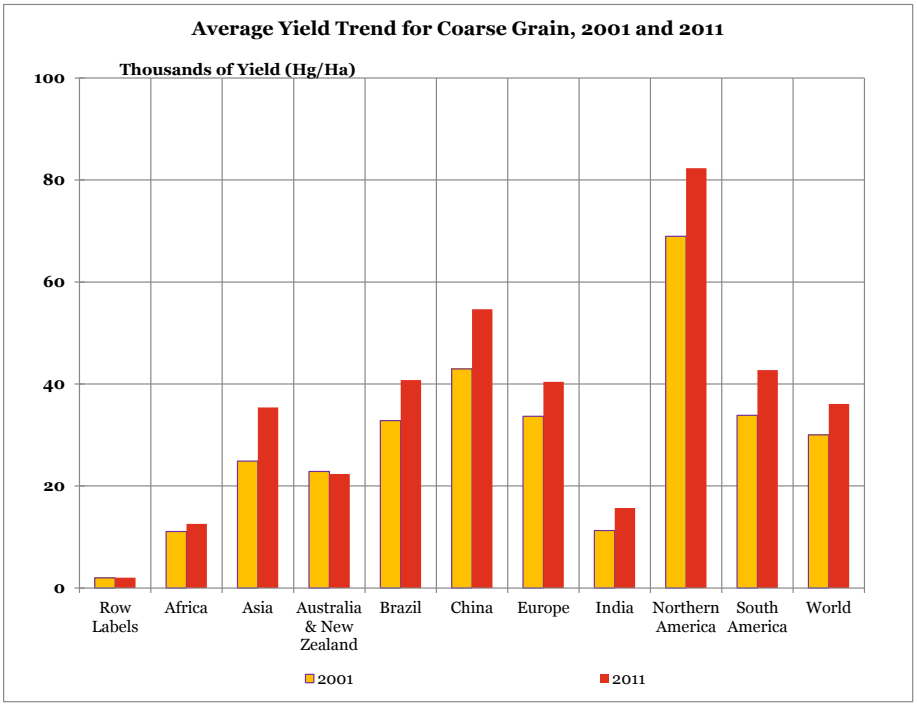

Figure 12 - Average yield trend for coarse grain in 2001 and 2011.
Source: elaboration on FAOSTAT 2014.

2.3.2. Soybeans

Soybeans are, together with coarse grain, the main crop used for livestock feeding. Consequently, the analysis of its production trends and the geographical localization of world producers, exporters and importers are very important for the purposes of this paper.

The production of soybeans in strongly concentrated in the Northern and Southern America, which recorded 85.5% of the average world production during the period 2001-2011. In particular, Brazil, USA and Argentina have very massive productions in terms of tonnage (i.e. respectively 75, 55 and 45 million of tons produced p.a.); USA, Argentina and Brazil are also in top 5 of seed producers, together with China, as shown in the following figures.

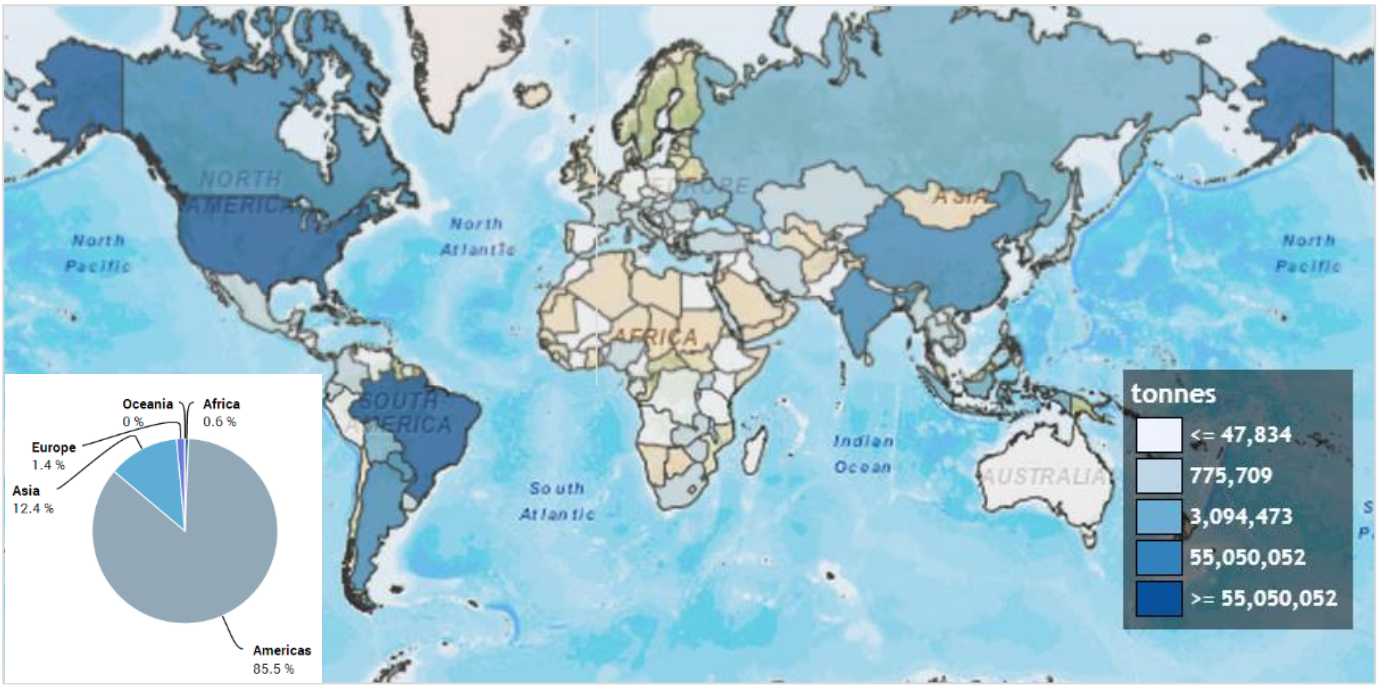

Figure 13 - Average yearly production of soybeans in the period 2001-2011.
Source: FAOSTAT 2014.

Despite being one of the biggest world producers, China's production trend recorded a small decrease during the period 2001 - 2011, with positive and negative peaks along the way. On the contrary, European production trend is remarkably increasing, bringing Europe to produce about 6 million of soybeans tons in 2011; European countries are also the countries where highest yields exist (e.g. Italian yield is averagely about 25k Hg/Ha in the period 2001-2011; i.e. second world position after Turkey and before Switzerland and USA).

Figure 14 - Statistics concerning soybeans production in the period 2001-2011.
Source: FAOSTAT 2014.

2.3.3. Bovine Meat

Food balance

Bovine meat sub-sector recorded slight positive trends in the period 2001-2011, with moderate trends for production (CAGR 1%), domestic supply (CAGR 1%), world import tonnage (CAGR 3%) and world export tonnage (CAGR 4%). Northern America and Europe are the geographical areas with higher production and domestic supply during the period (in 2011, domestic supply is 12.7 million of tons for Northern America and 11.3 million of ton for Europe, while bovine meat production is 13.1 million of tons for Northern America and 10.8 million of tons for Europe).

China and Brazil, with impressive growth rates in terms of production (CAGR 2% for China and 3% for Brazil) and domestic supply (CAGR 3% for China and 2% for Brazil), are becoming the top players of the bovine meat market, as shown in Figure 18, page 35; China's production of bovine meat is about 6.5 million of tons while Brazil's production is about 9 million of tons (they were respectively 5 million of tons and 6.8 million of tons in 2001).

Africa is playing an important role in the bovine meat sub-sector, with increasing trends for production (CAGR 3%), domestic supply (CAGR 4%) and world import (CAGR 8%); on the contrary, African export decreased (CAGR -3%).

Trade

The analysis of import and export flows and of the world trade composition for the bovine meat sub-sector underlines that China is absolutely absent from international transactions with very low values of import and export (respectively 5.9% and 2% of China's production in 2011) and almost null earning from international trade, as shown in the following figures.

Contrarily to China, Europe is the biggest player in the trade of bovine meat, with increasing market shares (from 2001 up to 2010) in the world composition of import and export in terms of US $ (Figure 16). In 2011, world import of bovine meat (9.4 million of tons) is 14% of world production (66.4 million of tons) showing a moderate trade openness degree for the sub-sector.

Moreover, as shown in Figure 17, the "exit" of Northern America from international markets (CAGR -4% for imports and null trend for export in terms of tons) was replaced by imports from Asia Without India & China (CAGR 5% in the period 2001-2011 and 2.6 million of tons imported in 2011), Brazilian exports (1.6 million of tons in 2011 and 4.3 billion of US $ in 2010) and Australia & New Zealand commercial strategies, which brought the two countries to

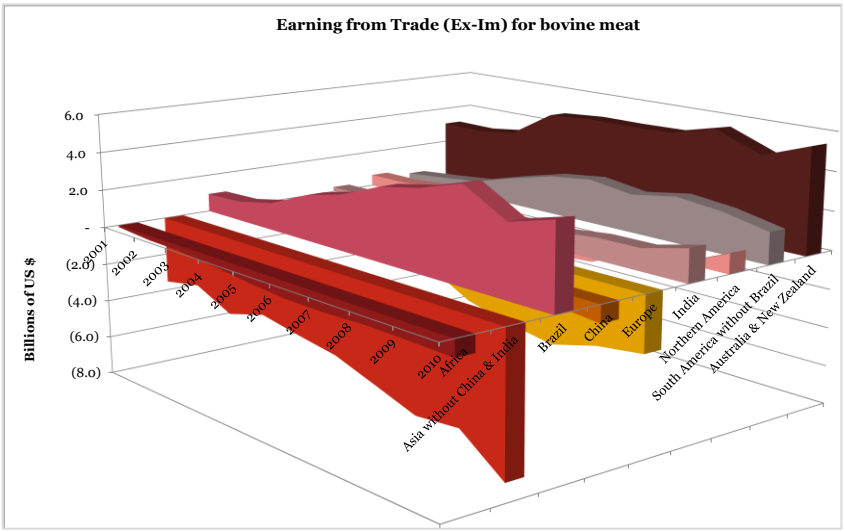

Figure 15 - Earning from Trade for bovine meat in terms of US $. Source: elaboration on FAOSTAT 2014.

be the top earners form the trade of bovine meat (they collectively recorded an earning from trade of 5.4 billion of US $ in 2010).

Brazil and South America without Brazil are also gaining from international trade of bovine meat (respective earning from trade are 4.2 and 1.6 billion of US $ in 2010) while Europe and Asia without China & India recorded negative trade balances (respective trade losses are 2.8 and 7 billion of US $ in 2010). Notwithstanding moderate world trends for the production, the consumption and the trade flows of the sub-sector, import/export flows in terms of US $ 2010 are about four times bigger than in 2001 (please refer to Figure 17) and European export and import flows, that were inferior than 5 billion of US $ in 2001, are about 15 billion of US $ in 2011.

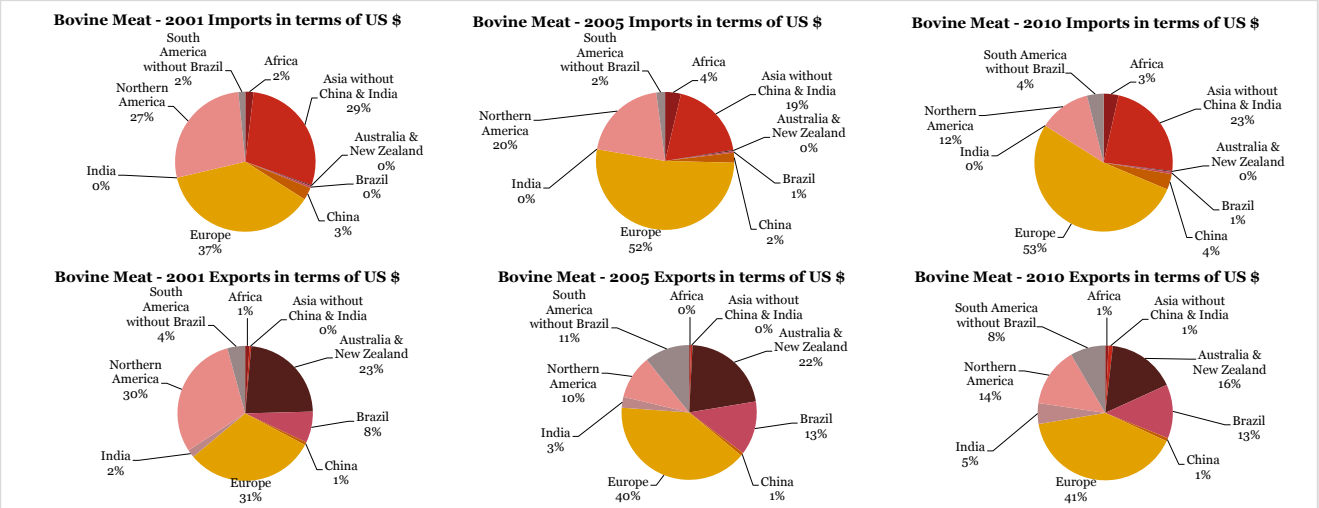

Figure 16 - Trade for bovine meat for 2001, 2005 and 2010 in terms of US $.
Source: elaboration on FAOSTAT 2014.

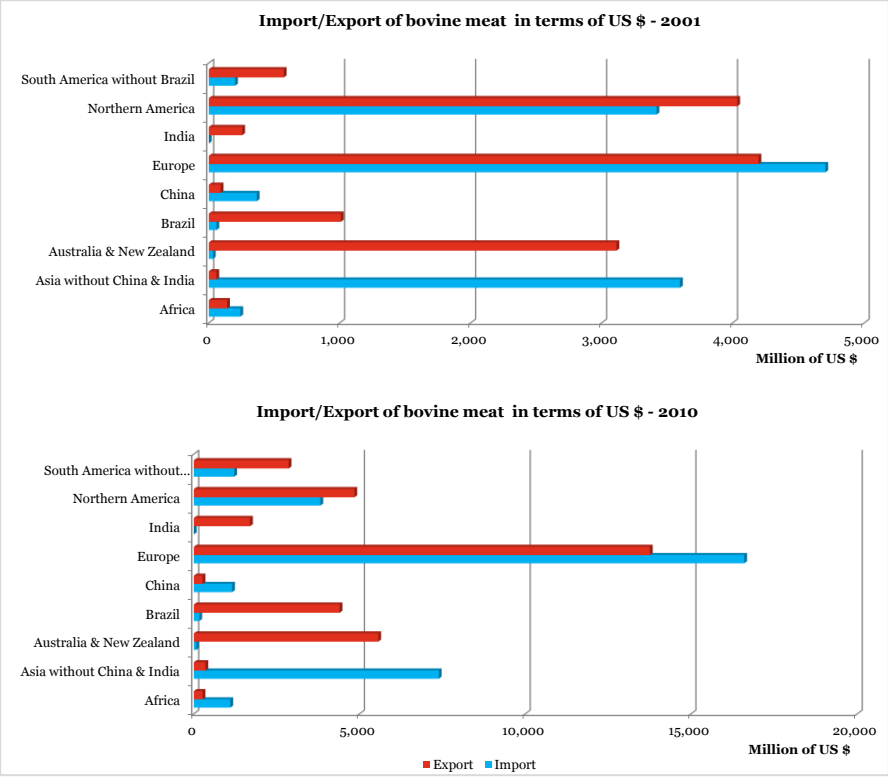

Figure 17 - Trade for bovine meat for 2001 and 2010 in terms of US $.
Source: elaboration on FAOSTAT 2014.

Conclusively, the analysis of bovine meat production, consumption and trade trends allows formulating the following findings:

- Bovine meat sub-sector recorded slight positive trends in the period 2001-2011, with moderate trends for production (CAGR 1%), domestic supply (CAGR 1%), world import (CAGR 3%) and world export (CAGR 4%);
- Northern America is leaving the international market while China do not participated in it, with very low values of import and export (respectively 5.9% and 2% of China's production in 2011), notwithstanding increasing domestic supply and production.
- Brazil, South America without Brazil and Australia & New Zealand are net earners from the bovine meat trade, while Europe and Asia without China and India recorded negative earnings from trade in the period 2001-2011.

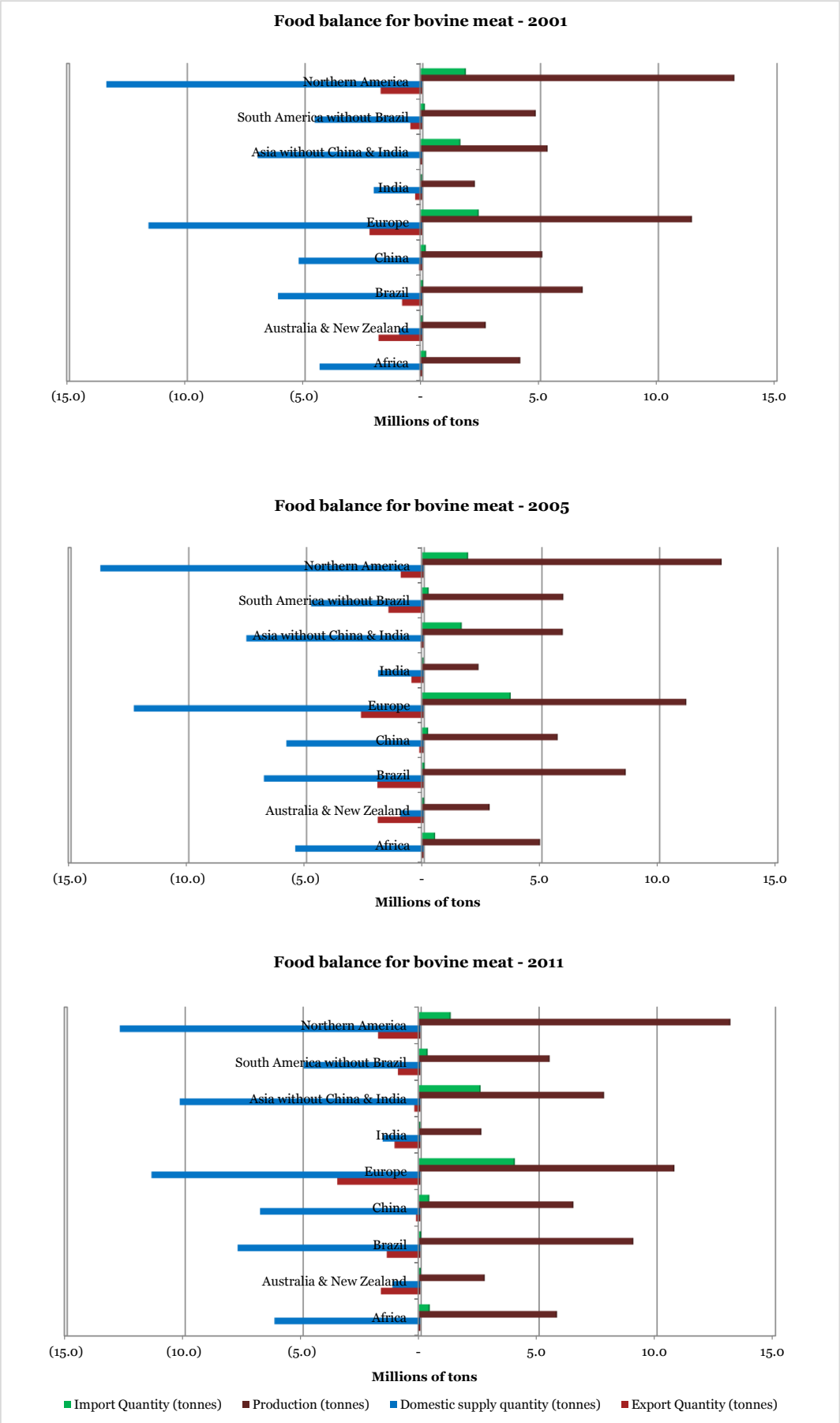

Figure 18 - Food balance for bovine meat for 2001, 2005 and 2011.
Source: elaboration on FAOSTAT 2014. Export and Domestic supply have been considered as negative values.

2.3.4. Poultry eggs

Food balance

Poultry eggs sub-sector recorded more positive trends in the period 2001-2011 than bovine meat, with significant increases for production (CAGR 2%), domestic supply (CAGR 2%), world import tonnage (CAGR 6%) and world export tonnage (CAGR 7%). China is by far the geographical area with higher production and domestic supply during the period (in 2011, Chinese domestic supply is 28.5 million of tons and eggs production recorded a similar tonnage). In 2011, Chinese production of eggs represents 40% of world production in terms of tons (amounting to 70.7 million of tons).

Europe, Asia without China & India and Northern America are important players too, with respective production amounting to 10.8, 11.3 and 5.9 million of tons in 2011. Africa and Brazil, notwithstanding positive growth rates in terms of production (CAGR 4% for Africa and 3% for Brazil) and domestic supply (same CAGRs than production), have a limited role with respect to other geographical areas.

Similarly, India and South America without Brazil recorded very positive trends in terms of production (CAGR 5% for both) and domestic supply (CAGR 5% for both) and their production in 2011 is 3.5 million of tons for India and 2.4 million of tons South America without Brazil.

Trade

Differently from bovine meat sub-sector, poultry eggs sub-sector generally shows a low trade openness degree and, in 2011, world import (2.2 million of tons) is 3.1 % of world production (70.7 million of tons).

Within this "domestic-oriented market", the analysis of import and export flows and of the world trade composition for the eggs sub-sector underlines that China is even absent from international transactions with very low values of import and export (both only 0.4% of China's production in 2011) and almost null earning from international trade, as shown in the following figures;

India and South America without Brazil, notwithstanding increasing production trends (CAGRs are 5% for both in the period 2001-2011), do not participate to international trade neither (world shares are inferior to 1% for import and for export in 2010) while Australia & New Zealand, recoding low production/supply volumes (about 0.3 million of tons each p.a.) and almost null import/export flows, are not important players in this sub-sector.

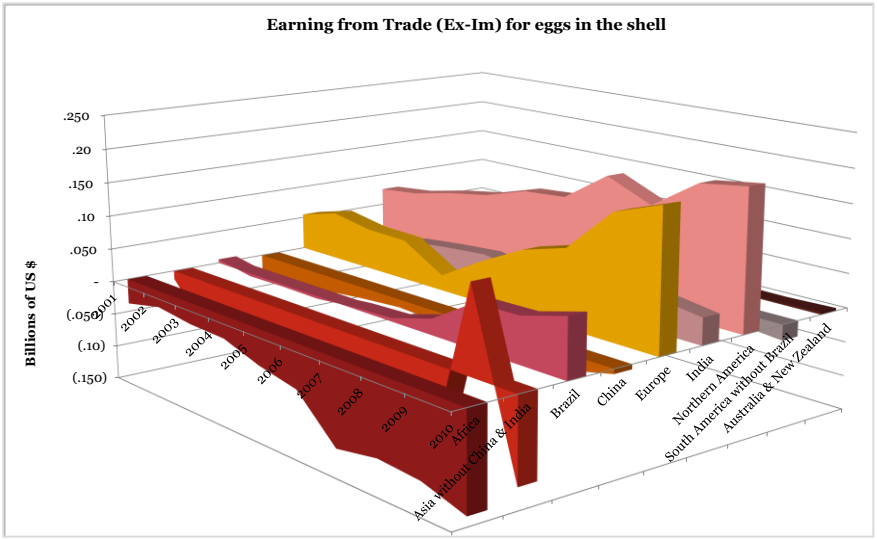

Figure 19 - Earning from Trade for poultry eggs in terms of US $. Source: elaboration on FAOSTAT 2014.

On the contrary, Europe is the biggest player in the trade of eggs, with increasing market shares

(from 2001 up to 2010) in the world composition of import and export in terms of US $ (Figure 20) and a net earning from international trade amounting to about 0.2 billion of US $ in 2010. During the period 2001-2011, Asia without China & India has increased its role both in terms of production and domestic supply (CAGR 3% for both and a production amounting to 11.3 million of tons in 2011) and in terms of presence in the trade markets; its import world share is 15% in 2001 and 21% in 2010 (i.e. 0.66 billion of US $) while export world share is 16% in 2010 (i.e. 0.53 billion of US $) generating a negative earning from trade of about 0.13 billion of US $ in 2010, as shown in Figure 19.

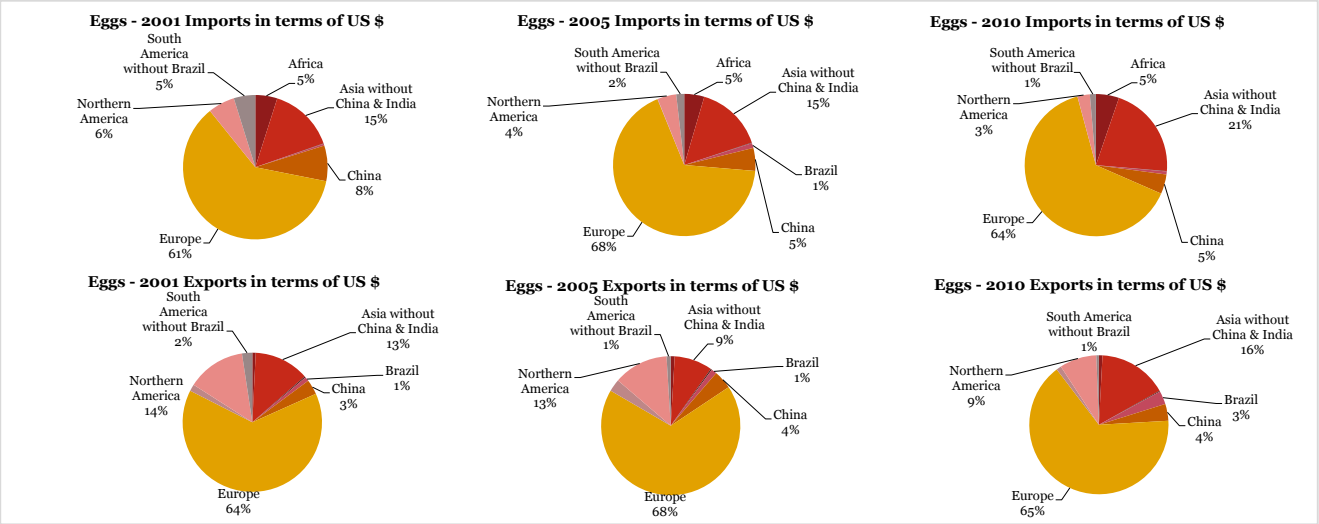

Figure 20 - Trade for poultry eggs for 2001, 2005 and 2010 in terms of US $.
Source: elaboration on FAOSTAT 2014.

Import/Export

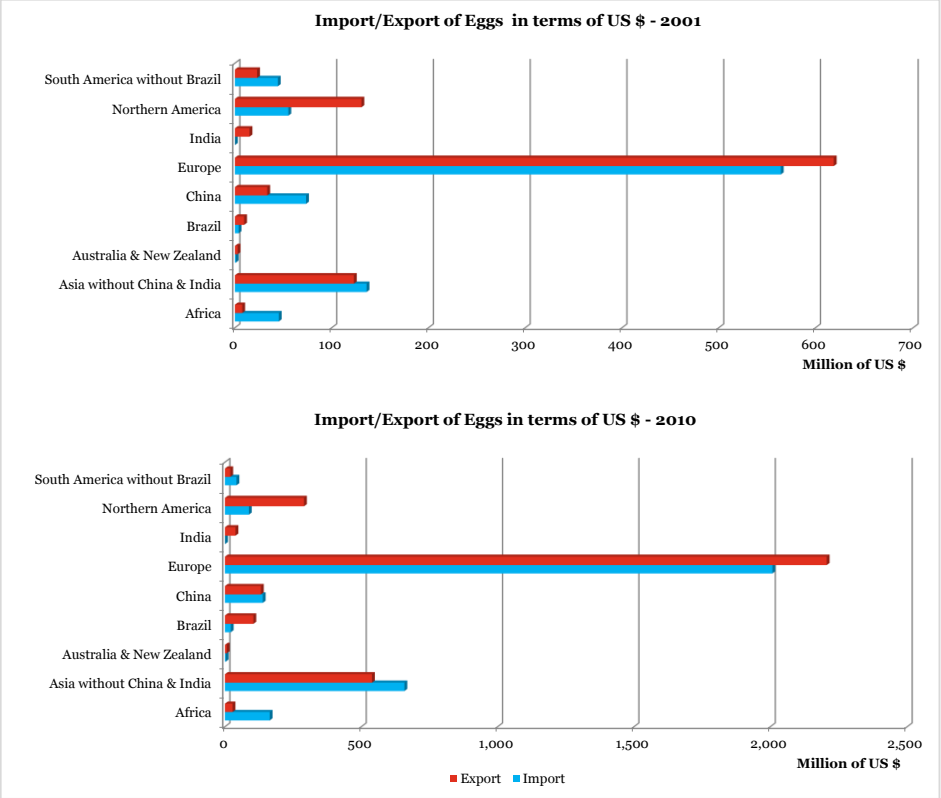

Figure 21 - Trade for poultry eggs for 2001 and 2010 in terms of US $.
Source: elaboration on FAOSTAT 2014.

Conclusively, the analysis of eggs production, consumption and trade trends allows formulating the following findings:

- China recorded the higher production and domestic supply during the period (in 2011, Chinese domestic supply is 28.5 million of tons and eggs production recorded a similar tonnage); in 2011, Chinese production of eggs represents 40% of world production in terms of tons (amounting to 70.7 million of tons);
- Poultry eggs sub-sector generally shows a low trade openness degree and, in 2011, world import (2.2 million of tons) is 3.1 % of world production (70.7 million of tons); China is even absent from international transactions with very low values of import and export (both only 0.4% of China's production in 2011).
- Europe and Asia without China & India are important players with the first recording a very positive earning of 0.2 billion of US $ in 2011 and the latter meanwhile having a trade loss of about 0.13 billion of US $.

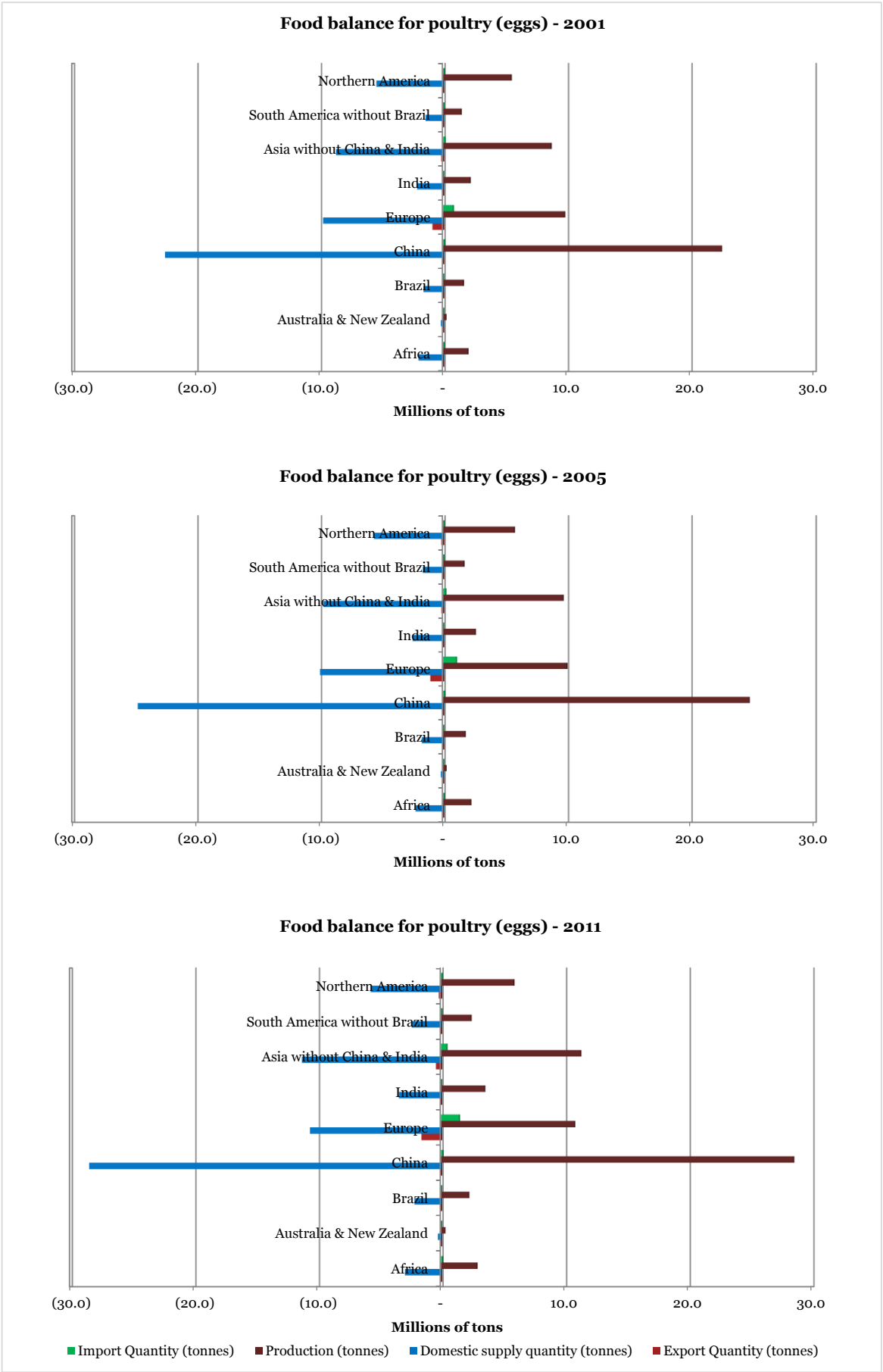

Figure 22 - Food balance for poultry (eggs) for 2001, 2005 and 2011.
Source: elaboration on FAOSTAT 2014. Export and Domestic supply have been considered as negative values.

2.3.5. Poultry meat

Food balance

Poultry meat sub-sector recorded consistent increases in the period 2001-2011, with positive trends for production (CAGR 2%), domestic supply (CAGR 2%), world import tonnage (CAGR 6%) and world export tonnage (CAGR 7%). Northern America, Asia without India & China, Europe, China and Brazil are the geographical areas with higher production during the period (in 2011, production is 21 million of tons for Northern America, 16.2 million of tons for Asia without India & China, 17.4 million of tons for China, 11.9 million of tons for Brazil and 16.8 million of tons for Europe) as shown in Figure 26, page 43.

India and Brazil, with impressive growth rates in terms of production (CAGR 9% for India and 6% for Brazil) and domestic supply (similar CAGRs than production), are becoming very important players in the poultry meat market, together with South America without Brazil (which production is 6.5 million of tons in 2011).

The analysis of the domestic supplied quantities shows that Asia without India & China, India, China and Africa have recorded consistent variation during the period with significant increases in 2011 with respect to 2001 (+82% for Asia without India & China, + 132% for India, +38 % for China and +82 % for Africa).

Asia without India & China surpassed the Northern America for the domestic supplied tonnage of poultry meat in 2010, and recorded 19.2 million of tons domestically supplied in 2011, becoming the top domestic supplier before Northern America and China (both with about 17.5 million of tons), providing about 20% of the world supply of poultry meat.

Trade

Differently from eggs sub-sector, poultry meat sub-sector generally shows an average trade openness degree and, in 2011, world import (14.5 million of tons) is 14.2 % of world production (102.5 million of tons).

Within this framework, China is an important player within the market with import amounting to 11.4% of its production in 2011 (i.e. import of 2 million of tons on a total production of 17.4 million of tons).

As a result of domestic supply increase faster than production, Asia without India & China is a net importer on international market, as shown by the following figure, and its share in world import composition is 30% in terms of US $ in 2010 (i.e. 7.7 billion of US $), as shown in Figure 24.

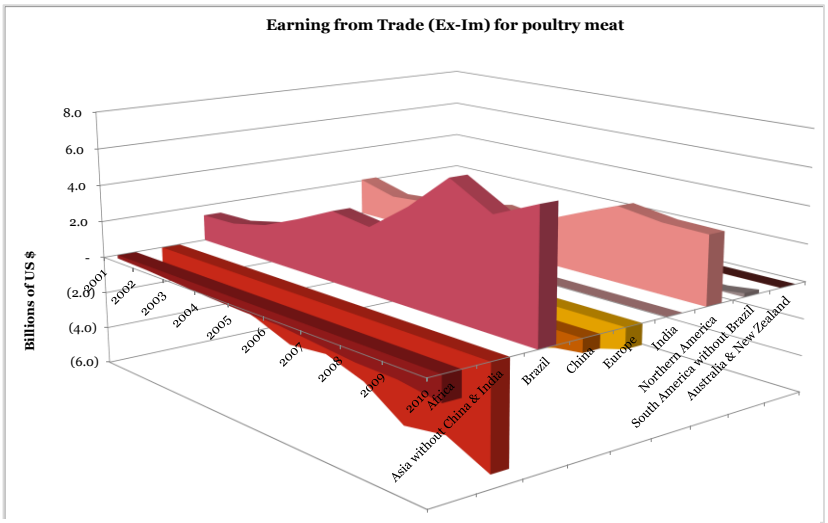

Figure 23 - Earning from Trade for poultry meat in terms of US $. Source: elaboration on FAOSTAT 2014.

On the contrary, Brazil is the biggest export in the trade of poultry meat, with enormous increase in world export market shares (+ 11% from 2001 up to 2010) (Figure 24) and a net earning from international trade amounting to about 6.6 billion of US $ in 2010.

Northern America, with a 3.6 billion of US $ earning form trade in 2010, is the second larger player within poultry meat market while China, Europe, Australia & New Zealand, Africa and India compensate import financial losses with export flows.

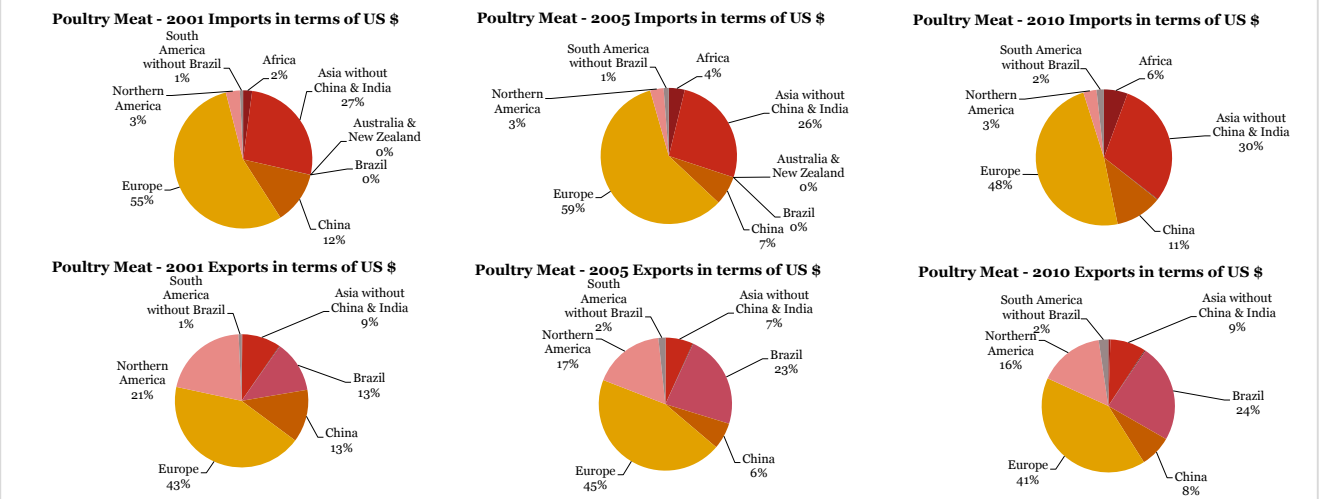

Figure 24 - Trade for poultry meat for 2001, 2005 and 2010 in terms of US $.
Source: elaboration on FAOSTAT 2014.

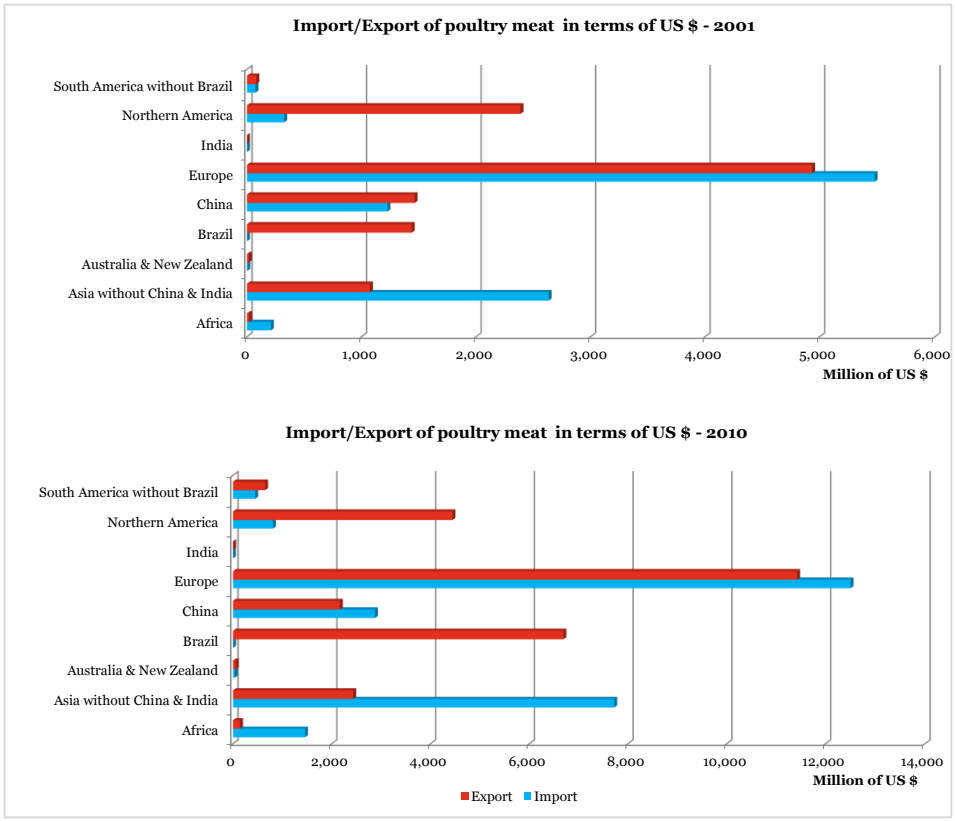

Figure 25 - Trade for poultry meat for 2001 and 2010 in terms of US $.
Source: elaboration on FAOSTAT 2014.

Conclusively, the analysis of poultry meat production, consumption and trade trends allows formulating the following findings:

- Northern America, Asia without India & China, Europe, China and Brazil are the geographical areas with higher production during the period (in 2011, production is 21 million of tons for Northern America, 16.2 million of tons for Asia without India & China, and less than 18 million of tons for China, Brazil and Europe);
- Asia without India & China surpassed the Northern America for the domestic supplied tonnage of poultry meat in 2010, and recorded 19.2 million of tons domestically supplied in 2011, becoming the top domestic supplier before Northern America and China;
- Asia without India & China is a net importer of poultry meat (share in world import composition of 30% in terms of US $ in 2010; i.e. about 7.7 billion of US $), while Brazil is a net exporter and its net earning from trade is 6.6 billion of US $ in 2010.

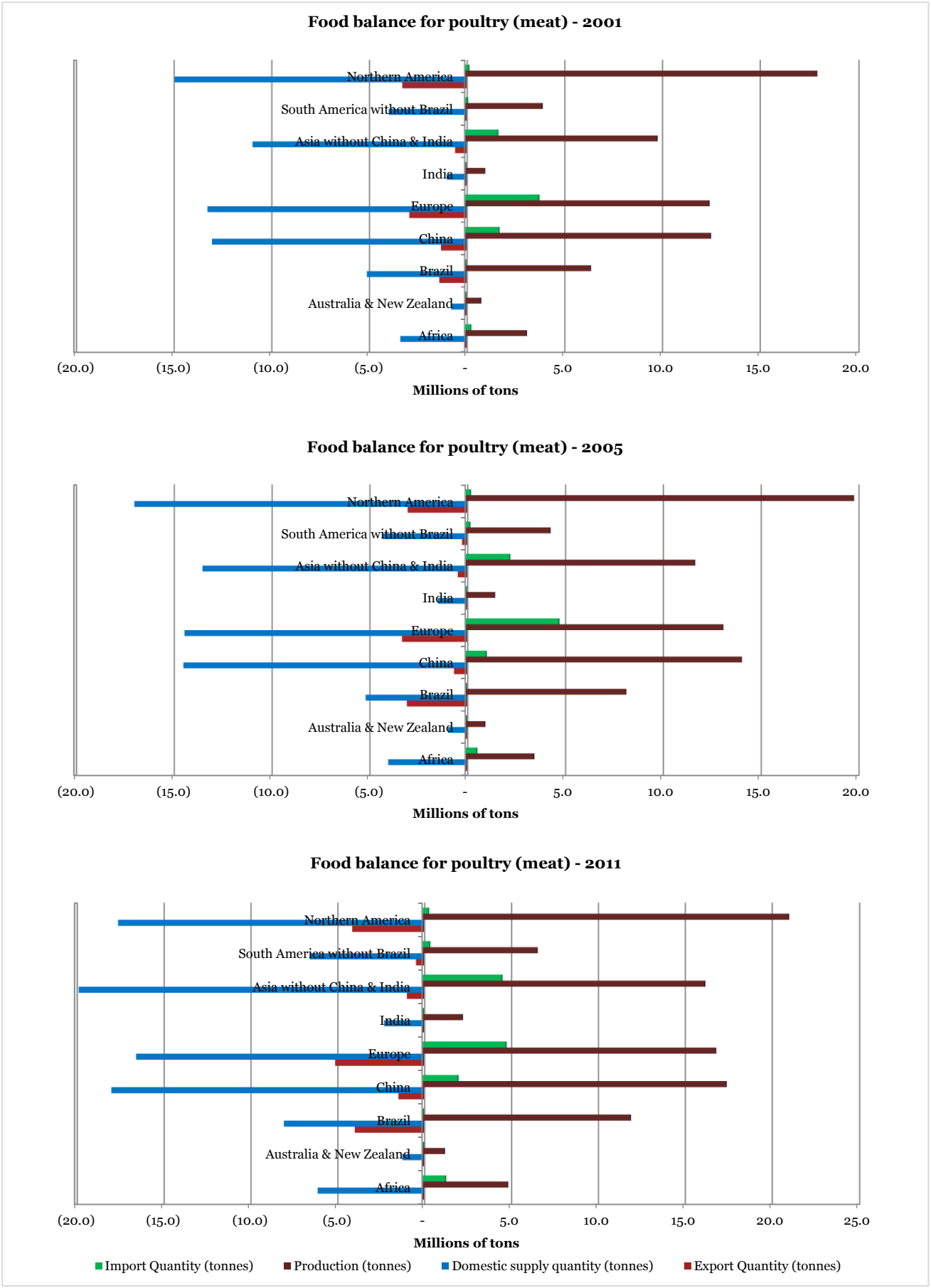

Figure 26 - Food balance for poultry (meat) for 2001, 2005 and 2011.
Source: elaboration on FAOSTAT 2014. Export and Domestic supply have been considered as negative values.

2.3.6. Pig meat

Food balance

Pig meat sub-sector recorded positive trends in the period 2001-2011 for production (CAGR 2%), domestic supply (CAGR 2%), world import tonnage (CAGR 7%) and world export tonnage (CAGR 7%). As for poultry eggs sub-sector, China is by far the geographical areas with higher production and domestic supply during the period (in 2011, Chinese domestic supply is 50.3 million of tons and pig meat production recorded a similar tonnage). In 2011, Chinese production of pig meat represents 50% of world production in terms of tons (amounting to 107.9 million of tons).

Europe, Asia without China & India and Northern America are important players too, with respective production amounting to 27.6, 10 and 12.3 million of tons in 2011. Africa and Brazil, notwithstanding positive growth rates in terms of production (CAGR 4% for Africa and 2% for Brazil) and domestic supply (CAGR 5% for Africa and 1% for Brazil), have a limited role with respect to other geographical area; India and Australia & New Zealand have lower importance in the world market composition (e.g. India production even decreased along the period, CAGR -3%).

Trade

Differently from eggs sub-sector, pig meat sub-sector generally shows an average trade openness degree and, in 2011, world import (14.8 million of tons) is 13.7 % of world production (107.9 million of tons).

Within this framework, the analysis of import/export flows and world trade composition for the pig meat sub-sector underlines that China is absent from international transactions with very low values of import and export (import is 2.8% of Chinese production and export is 1%) and almost null earning from international trade (negative earning of about 0.2 billion of US $ in 2010, as shown in the following figures).

On the contrary, Asia without India & China, which recorded positive trends for production and domestic supply (both CAGRs are 4%), is a net importer on international market (its import in 2011 is about 2 million of tons, i.e. the difference between production and domestic supply), as shown by the following figures, and its share in world import composition is 20% in terms of US $ in 2010 (i.e. 6.4 billion of US $), as shown in Figure 29.

Europe is the biggest player in the trade of pig meat, with constant market shares in the world composition of export in terms of US $ (i.e. 73% in 2001 and 71% in 2010, refer to Figure 28) and a predominant role in world imports (its world market share for import passed from 58% in 2001 up to 66% in 2010) a net earning from

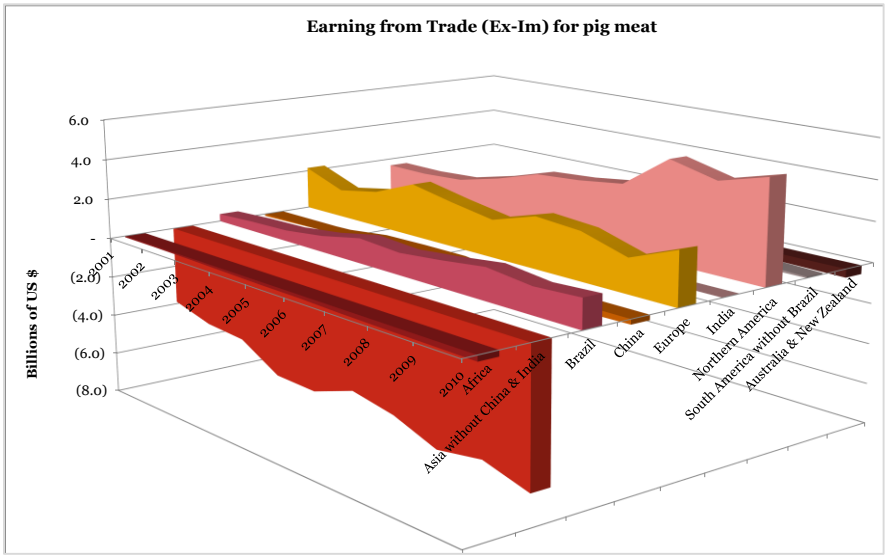

Figure 27 - Earning from Trade for Pig meat in terms of US $. Source: elaboration on FAOSTAT 2014.

international trade amounting to about 2.5 billion of US $ in 2010. Northern America in another big player in the international market of pig meat, recording increasing production (CAGRs are 2%), very low import (inferior to 0.2 million of tons in 2011), very consistent export (i.e. 3.2 million of tons in 2011) and very high (and increasing) earning from international trade (net earning from trade for Northern America amounted to 4.4 billion of US $ in 2010).

Brazil is a net exporter of pig meat (very low import tonnage in 2011), with about 0.8 million of tons exported in 2011 (and a CAGR of 8% during the period) and a net earning from trade amounting to 1.4 billion of US $ in 2010.

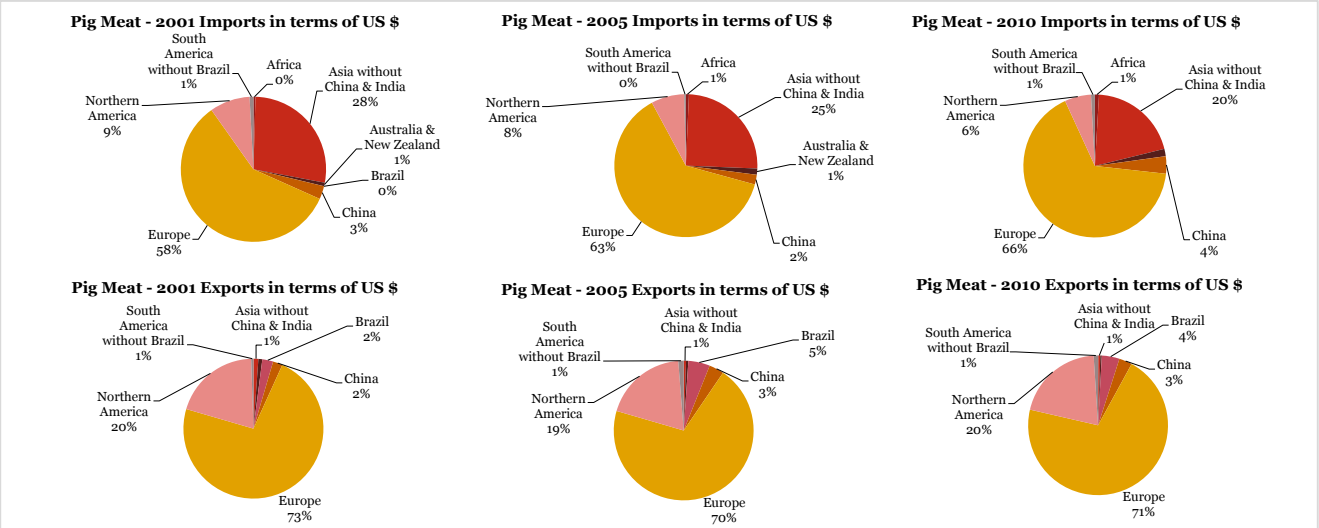

Figure 28 - Trade for pig meat for 2001, 2005 and 2010 in terms of US $.
Source: elaboration on FAOSTAT 2014.

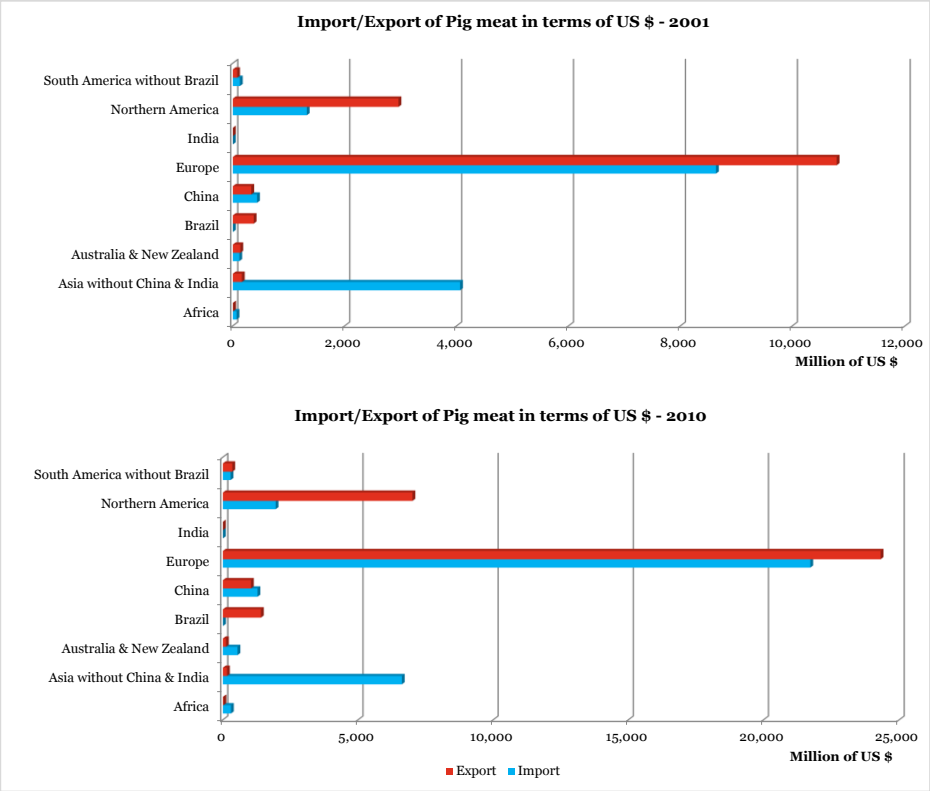

Figure 29 - Trade for Pig meat for 2001 and 2010 in terms of US $.
Source: elaboration on FAOSTAT 2014.

Conclusively, the analysis of pig meat production, consumption and trade trends allows defining the following findings:

- China recorded the higher production and domestic supply during the period (in 2011, Chinese domestic supply is 50.3 million of tons and production recorded a similar tonnage); in 2011, Chinese production of pig meat represents 50% of world production in terms of tons (amounting to 107.9 million of tons);
- Despite pig meat sub-sector generally shows an average trade openness degree and, in 2011, world import (14.4 million of tons) is 13.7 % of world production (107.9 million of tons), China is even absent from international transactions with very low values of import and export (import is only 2.8% of China's production in 2011).
- Europe, Northern America and Asia without China & India are important players with the first two recording positive earning from trade and the last being a net importer of pig meat (about 2 million of tons imported in 2011).

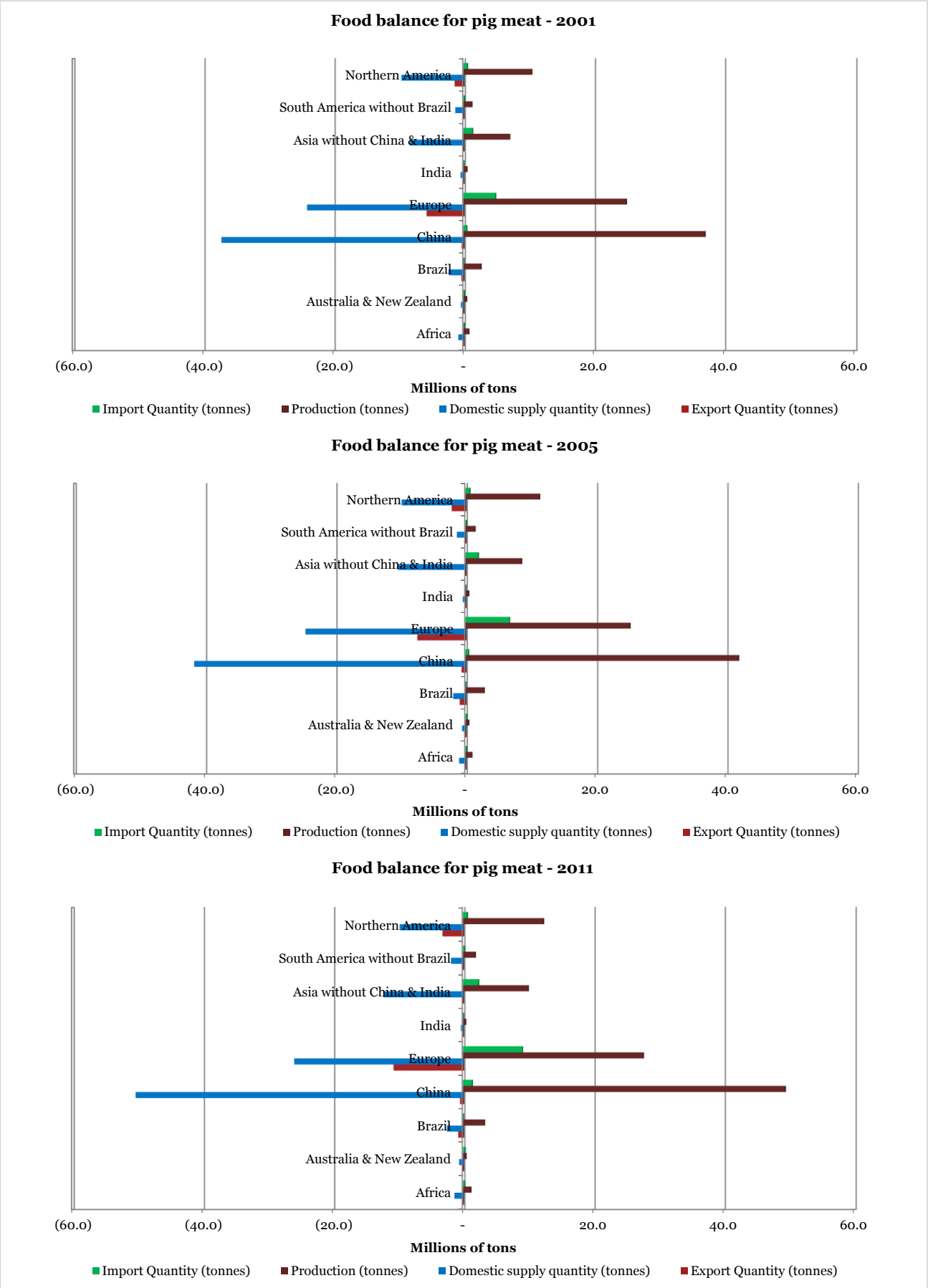

Figure 30 - Food Balance for pig meat for 2001, 2005 and 2010.
Source: elaboration on FAOSTAT 2014. Export and Domestic supply have been considered as negative values.

2.3.7. Dairy products (milk)

Food balance

The dairy sub-sector (here approximated with the proxy of milk) recorded positive increases in the period 2001-2011, with moderate trends for production (CAGR 2%), domestic supply (CAGR 2%), world import tonnage (CAGR 4%) and world export tonnage (CAGR 2%). If Northern America and Europe are the geographical areas with higher production and domestic supply during the period (in 2011, domestic supply is about 100 million of tons for Northern America and 205 million of ton for Europe, while milk production is 97.3 million of tons for Northern America and 210 million of tons for Europe), India is by far the larger country player within the sub-sector, with a production of 123 million of tons in 2011 and a similar domestic supply; Indian trends for production and domestic supply are also increasing more than world average (CAGRs are 4% both for production domestic supply).

Despite very increasing trends in the period 2001-2011 (production and domestic increase recorded respective variations of +195% and +188% from 2001 to 2011), China is not a very important producer within milk sub-sector (2011 production is 41.8 million of tons), and Brazil, Africa, South America without Brazil and Asia without China & India recorded similar or higher productions in 2011 (production in 2011 in terms of millions of tons is 32.2 for Brazil, 44.2 for Africa, 34.2 for South America without Brazil and 108.2 Asia without China & India), as shown in Figure 31.

Trade

Differently from pig meat sub-sector, dairy sub-sector generally shows a low trade openness degree and, in 2011, world import (29.6 million of tons) is only 4 % of world production (739.1 million of tons). Within this framework, China's behaviour is different than other sub-sectors and Chinese import are in line with average world import with respect to national production (import is 8.1% of Chinese production). Moreover, Chinese import trend recorded consistent increases during the period 2001-2011 (CAGR 13%) and Chinese import of dairy products in 2011 is 3.5 times bigger than in 2001.

Europe is the main player within international milk market, with 16.9 million of tons exported in 2011 (and 12.2 million of tons imported) amounting to 50% of world export; on the contrary, Africa and Asia without China & India are net importers of dairy products (in 2011, export in terms of millions of tons is 0.2 for Africa and 1.6 for Asia without China & India while import in terms of millions of tons is 4.4 for Africa and 5.3 for Asia without China & India), as shown in Figure 31. Conclusively, the analysis of dairy product production, consumption and trade trends (approximated with the proxy of milk) allows defining the following findings:

- Northern America and Europe are the geographical areas with higher production and domestic supply during the period (in 2011, domestic supply is about 100 million of tons for Northern America and about 205 million of tons for Europe);
- India is by far the larger country player within the sub-sector, with a production of 123 million of tons in 2011 and a similar domestic supply; Indian trends for production and domestic supply are also increasing more than world average (CAGRs are 4% both for production domestic supply).
- China is not a very important producer within milk sub-sector (2011 production is 41.8 million of tons), and Brazil, Africa, South America without Brazil and Asia without China & India recorded similar or higher productions in 2011;
- Europe is the main player within international milk market, with 16.9 million of tons exported in 2011 (and 12.2 million of tons imported) amounting to 50% of world export.

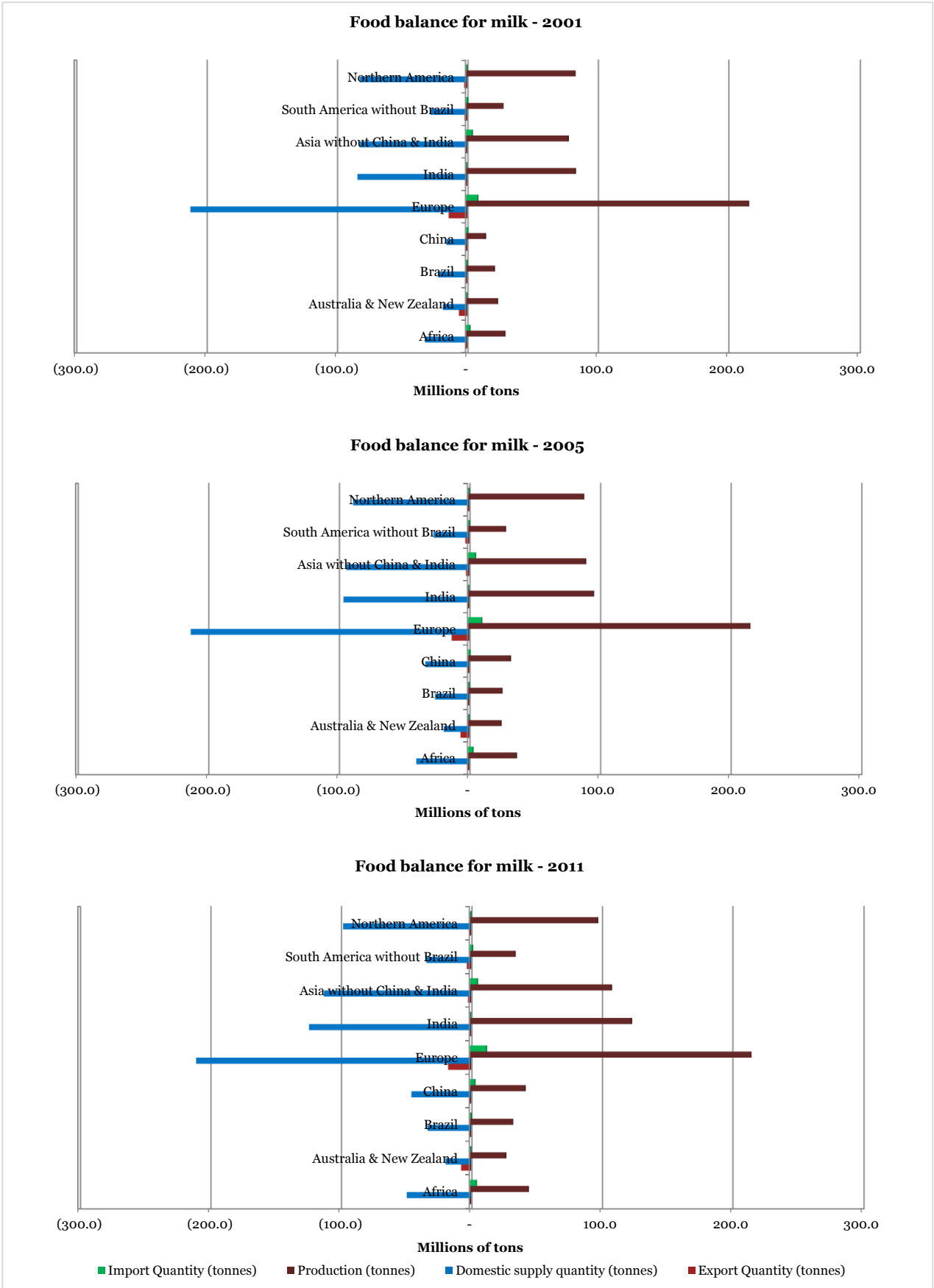

Figure 31 - Food Balance for milk for 2001, 2005 and 2010.
Source: elaboration on FAOSTAT 2014. Export and Domestic supply have been considered as negative values.

3. Private investments in the livestock sector

3.1. International Corporations

The analysis of private investments in the livestock sector surely constitutes an important part of this paper, providing specific information on headquarters and subsidiaries location of main international corporations, their financial performances and 2013 sales, and assessing corporate strategies of the top world companies active in the livestock sector.

As a matter of fact, indeed, a coherent and comprehensive analysis of livestock investments cannot rescind from a robust assessment of private corporations behaviour during the last decade.

> *Like most agricultural commodities, the meat industry is not local, regional or national—it is global.*
> *And the multinational companies that dominate this industry, from production to feed to processing and distribution, are set on exporting this industrial model of production around the globe.*
> *The industry is aided by trade agreements that threaten to lower worker safety, health and environmental standards while further empowering the legal standing of corporations to challenge national regulations.*
>
> *The Need for Feed:*
> *China's Demand for Industrialized Meat and Its Impacts*
> *Sharma S., 2014*

According to this considerations, and with the final aim of mapping private investments in the livestock sector around the world, a balance sheets analysis of international corporations active in the livestock sector has been undertaken (the analysis is composed of an universe of 100 corporations and a sample of 27 companies).

Top 100 private corporations active in livestock sector

The following table identifies the top 100 private corporations which are active in the livestock sector according to 2013 sales ranking and Headquarter location (elaboration on Factiva database)[9].

Rank	Company Name	Sales USD M 2013	HQ Location	Rank	Company Name	Sales USD M 2013	HQ Location
1	Fonterra Co-operative Group Ltd.	15,364	New Zealand	**51**	Nongshim Holdings Co. Ltd.	299	Korea, Republic Of
2	Charoen Pokphand Foods Public Co. Ltd.	11,898	Thailand	**52**	Australian Agricultural Co. Ltd.	294	Australia
3	Inner Mongolia Yili Industrial Group Co., Ltd.	7,890	China	**53**	Henan Huaying Agriculture Development Co., Ltd.	290	China
4	MEGMILK SNOW BRAND Co., Ltd.	5,278	Japan	**54**	United Plantations Bhd.	289	Malaysia
5	LDC SA	3,767	France	**55**	Huat Lai Resources Bhd.	285	Malaysia
6	Marine Harvest ASA	3,167	Norway	**56**	Multiexport Foods SA	283	Chile
7	Industrias Bachoco SAB de CV	3,045	Mexico	**57**	Heritage Foods Ltd.	282	India
8	Bright Dairy & Food Co., Ltd.	2,690	China	**58**	Venkys India Ltd.	281	India

[9] Data for this section are based on Factiva data, elaborations on Factiva data and case-by-case balance sheet analysis for the selected sample of 27 corporations.

Rank	Company Name	Sales USD M 2013	HQ Location	Rank	Company Name	Sales USD M 2013	HQ Location
9	Dairy Crest Group Plc	2,318	United Kingdom	**59**	Luoniushan Co. Ltd.	278	China
10	Origin Enterprises Plc	1,828	Ireland	**60**	DUC SA	277	France
11	Lerøy Seafood Group ASA	1,768	Norway	**61**	Nireus SA	273	Greece
12	MHP SA	1,496	Ukraine	**62**	Tassal Group Ltd.	263	Australia
13	Maeil Dairy Industry Co., Ltd.	1,292	Korea, Republic Of	**63**	Shenzhen Kondarl (Group) Co. Ltd.	258	China
14	Cal-Maine Foods, Inc.	1,288	United States	**64**	Dongwoo Co., Ltd.	238	Korea, Republic Of
15	Pacific Andes Resources Development Ltd.	1,120	Hong Kong	**65**	Baiyang Aquatic Group, Inc.	223	China
16	SalMar ASA	1,029	Norway	**66**	DABACO Group	223	Viet Nam
17	Sultan Center Food Products Co.	910	Kuwait	**67**	Zemaitijos Pienas AB	211	Lithuania
18	Société Centrale Laitière SA	856	Morocco	**68**	Xinjiang Hops Co., Ltd.	201	China
19	Cermaq ASA	849	Norway	**69**	CAB Cakaran Corp. Bhd.	187	Malaysia
20	Kwality Ltd.	832	India	**70**	Hunan New Wellful Co. Ltd.	187	China
21	Harim Holdings Co., Ltd.	785	Korea, Republic Of	**71**	Avanti Feeds Ltd.	185	India
22	Fujian Sunner Development Co., Ltd.	777	China	**72**	Selonda Aquaculture SA	178	Greece
23	Banvit Bandirma Vitaminli Yem Sanayii ve Ticaret AS	770	Turkey	**73**	Lay Hong Bhd.	177	Malaysia
24	Malayan Flour Mills Bhd.	702	Malaysia	**74**	Sumpo Food Holdings Ltd.	170	China
25	Empresas AquaChile SA	695	Chile	**75**	Fortune Ng Fung Food (Hebei) Co., Ltd.	166	China
26	AvangardCo Investments Public Ltd.	661	Ukraine	**76**	Hunan Dakang Pasture Farming Co. Ltd.	165	China
27	Sichuan Gaojin Food Co. Ltd.	580	China	**77**	Shandong Minhe Animal Husbandry Co. Ltd.	165	China
28	Genus Plc	526	United Kingdom	**78**	Guangxi Royal Dairy Co., Ltd.	164	China
29	National Agricultural Development Co.	514	Saudi Arabia	**79**	Shandong Homey Aquatic Development Co. Ltd.	160	China
30	Inner Mongolia Pingzhuang Energy Co., Ltd.	493	China	**80**	Livestock Improvement Corp. Ltd.	160	New Zealand
31	Bombril SA	491	Brazil	**81**	AP Co., Ltd.	153	Japan
32	Milkiland NV	473	Netherlands	**82**	Invermar SA	151	Chile
33	Zhangzidao Group	433	China	**83**	Minupar	148	Brazil

Rank	Company Name	Sales USD M 2013	HQ Location	Rank	Company Name	Sales USD M 2013	HQ Location
	Co. Ltd.				Participaçoes SA		
34	Bakkafrost P/F	430	Faroe Islands	**84**	Vilkyskiu Pienine AB	145	Lithuania
35	Norway Royal Salmon ASA	429	Norway	**85**	YuanShengTai Dairy Farm Ltd.	143	Hong Kong
36	Saudia Dairy & Foodstuff Co.	414	Saudi Arabia	**86**	Valsoia SpA	138	Italy
37	Hatsun Agro Product Ltd.	413	India	**87**	Daqing Dairy Holdings Ltd.	136	Hong Kong
38	China Huishan Dairy Holdings Co. Ltd.	406	China	**88**	Australis Seafoods SA	134	Chile
39	Grieg Seafood ASA	396	Norway	**89**	Innodis Ltd.	133	Mauritius
40	Taiyo Kagaku Co., Ltd.	352	Japan	**90**	K.S.E. Ltd.	133	India
41	Country Bird Holdings Ltd.	350	South Africa	**91**	Dias Aquaculture SA	128	Greece
42	Synlait Milk Ltd.	346	New Zealand	**92**	The Scottish Salmon Co. Plc	125	United Kingdom
43	Grupo Pochteca SAB de CV	343	Mexico	**93**	Ifuji Sangyo Co., Ltd.	123	Japan
44	AB Rokiškio suris	343	Lithuania	**94**	Industrial Milk Co. SA	120	Ukraine
45	Muyuan Foodstuff Co., Ltd.	338	China	**95**	Donegal Investment Group Plc	119	Ireland
46	Cairo Poultry Co.	333	Egypt	**96**	R.E.A. Holdings Plc	117	United Kingdom
47	Maniker Co., Ltd.	333	Korea, Republic Of	**97**	Zhytomyr Dairy	114	Ukraine
48	PT Sierad Produce Tbk	317	Indonesia	**98**	Sociedad Agricola e Industrial San Carlos SA	113	Ecuador
49	Chuying Agro-Pastoral Co. Ltd.	308	China	**99**	Dongwon Fisheries Co., Ltd.	111	Korea, Republic Of
50	Anhui Golden Seed Winery Co., Ltd.	301	China	**100**	Huasi Agricultural Development Co., Ltd.	105	China

Table 10 - Top 100 international corporations active in the livestock sector (Ranking in order of 2013 Sales). Source: elaboration on FACTIVA 2014 data.

As shown in the previous table, the New Zealander company Fonterra (dairy sector), the Thai company Pokphand (poultry sector) and the Chinese company Inner Mongolia Group (all products) are the biggest world corporations active in the livestock sector, with respective 2013 sales amounting to 15.3 billion, 11.8 billion and 7.8 billion of US $. After these three "giants", other international corporations follow, with lower sales for 2013, amounting to less than 6 billion of US $ each and headquarters scattered around the world.

China is simultaneously the country hosting the bigger number of corporations (23, refer to Table 11) and recording the higher collective sales for 2013 (about 16 billion of US $, please refer to Figure 32). New Zealand, Thailand, Norway and Japan follows China in terms of private sales for 2013, with sales values superior than 5 billion of US $. After China, Norway, the Republic of Korea and India are the countries hosting the larger number of international corporations belonging to the top 100 (6 firms for each country).

Notwithstanding the "U.S.-based corporations, and their model of industrial animal production, have certainly been a major catalyst in the growth of industrial meat production around the world over the last 50 years" (Sharma S., 2014), there is only one corporation from US in the top 100 firms active in the livestock sector, the Cal-Maine Foods Inc, which sold about 1.2 billion of US $ of livestock products in 2013.

Even if China's firms represent about 25% of livestock companies around the world (in terms of number of top 100 corporations), their dimension in terms of average sale p. firm is quite small and China is only positioned 13th in the ranking of average country 2013 sales p. firm; in this firm-based ranking, Thailand, New Zealand, France, Mexico and Japan occupy the first 5 positions (with respective average sale p. firm of 11.8 billion, 5.2 billion, 2.0 billion, 1.6 billion and 1.4 billion of US $), as shown in the following table.

Country where HQ is located	Sum of Sales USD m 2013	N of firms	Average Sales p. firm 2013	Ranking Average Sales p. firm	Ranking Country Sales
China	16,745	23	728	13	1
New Zealand	15,869	3	5,290	2	2
Thailand	11,898	1	11,898	1	3
Norway	7,638	6	1,273	7	4
Japan	5,906	4	1,476	5	5
France	4,044	2	2,022	3	6
Mexico	3,388	2	1,694	4	7
United Kingdom	3,086	4	771	11	8
Korea, Republic Of	3,059	6	510	15	9
Ukraine	2,391	4	598	14	10
India	2,126	6	354	20	11
Ireland	1,947	2	973	8	12
Malaysia	1,641	5	328	23	13
Hong Kong	1,399	3	466	17	14
United States	1,288	1	1,288	6	15
Chile	1,262	4	316	26	16
Saudi Arabia	928	2	464	18	17
Kuwait	910	1	910	9	18
Morocco	856	1	856	10	19
Turkey	770	1	770	12	20
Lithuania	699	3	233	28	21
Brazil	640	2	320	24	22
Greece	579	3	193	30	23
Australia	557	2	278	27	24
Netherlands	473	1	473	16	25
Faroe Islands	430	1	430	19	26
South Africa	350	1	350	21	27
Egypt	333	1	333	22	28
Indonesia	317	1	317	25	29
Viet Nam	223	1	223	29	30
Italy	138	1	138	31	31
Mauritius	133	1	133	32	32
Ecuador	113	1	113	33	33

Table 11 - Headquarter location of top 100 private corporations according to 2013 Sales.

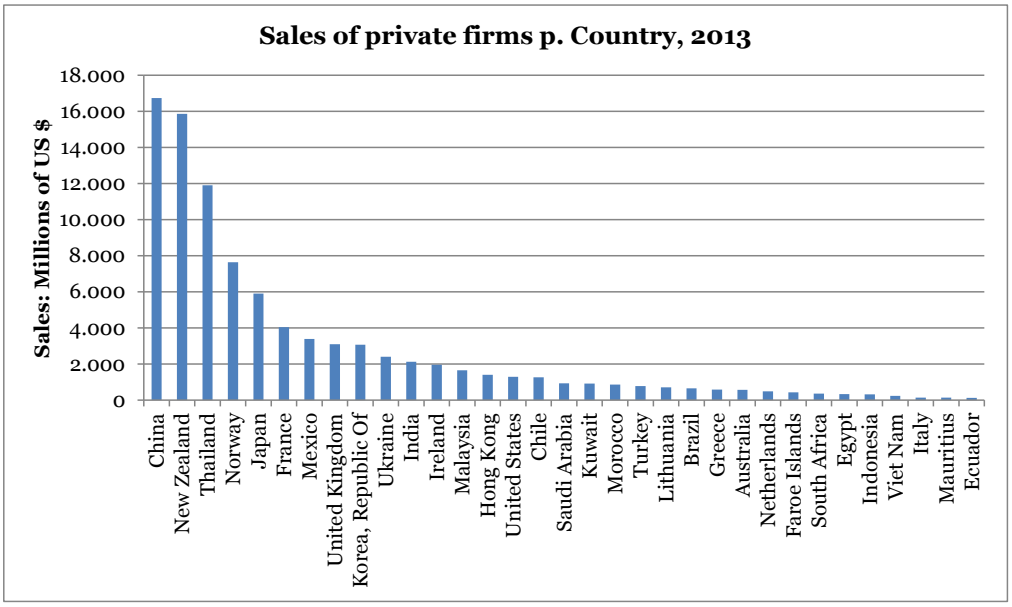

Figure 32 - Sales of private corporations according to HQ locations in 2014
Source: elaboration on FACTIVA 2014 data.

3.2. Private corporations' investment strategies

The analysis of private corporations' investment strategies is realized by means of assessing how corporate structures of a selected sample of 27 private corporations has changed within a certain amount of time (generally 5-6 years) with respect to the following items:

1) Live animal stocks, finished and semi-finished livestock products and food products commercialized;
2) Location of subsidiaries controlled all over the word.

Both information were extrapolated by analyzing the balance sheets (or the annual reports) published by the corporations on their official websites.

Regarding product commercialized (point 1 above), this analysis shows that international corporations have been mainly focusing their production on the following products:

- Seafood
- Poultry
- Raw materials for food
- Dairy products
- Feeds
- Fertilizer
- Genetics
- Food products
- Shell eggs
- Grain Growing
- Meat
- Animal Feed
- Cheese
- Flour
- Fodder

- Biochemical - feed additives

No particular new products have been discovered by international corporations in the past 5-10 years and it seems that production is significantly converging towards a world homologation, in the sense that large private corporations tend to focus on 3-4 livestock products and to acquire complementary products from other producers.

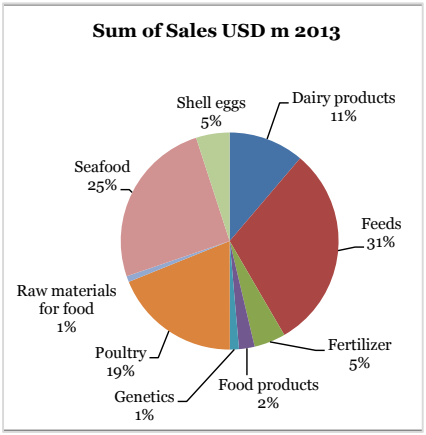

Figure 33 - Composition of sales for private corporations according to primary product commercialized.

The indicative[10] share of 2013 sales according to livestock product type for international corporations, described by the figure on the right, shows that seafood and feeds sales are the most important products in terms of values (respectively constituting 25% and 31% of 2013 sales for the sample of 27 companies analysed); Poultry and dairy products follow with respective 19% and 11% of 2013 sales for the sample.

The analysis of the locations of the main international corporations according to primary product commercialized in 2013, described in the following figure, shows that China hosts corporations producing every kind of livestock products while other countries are more specialized according to their geographical location (i.e. Norway and Chile for seafood), market needs (e.g. Turkey and Egypt for poultry) or religious vocation (e.g. India for dairy products).

United Kingdom, hosting the Headquarter of one of the biggest international corporation for Genetics (i.e. Genus Plc, 0.5 billion of US $ 2013 sales) and France, hosting one of the biggest poultry company of the world (i.e. LDC Sa, 3.7 billion of US $ 2013 sales), are classified accordingly.

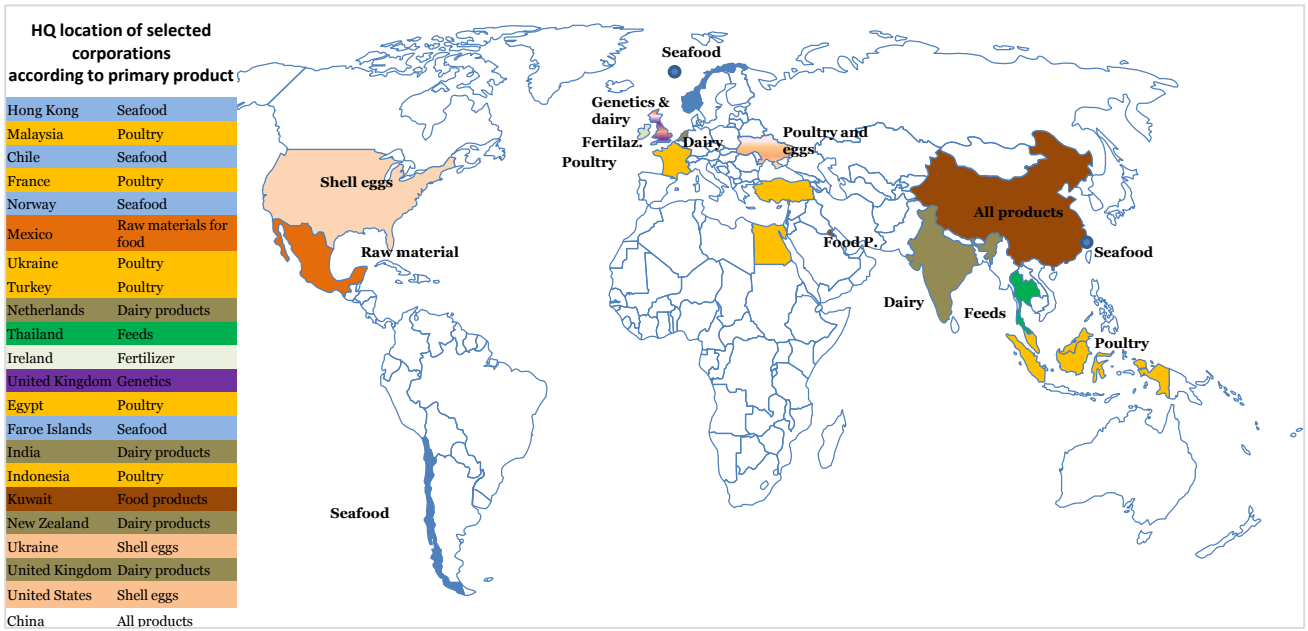

Figure 34 - Location of international corporations according to livestock primary product. Source: elaboration on FACTIVA 2014 data. Data for China, even not available within the sample of selected countries (mainly because of translation issues), were extrapolated by other sources for the purpose of this representation.

[10] Since the analysis is based on the overall values of 2013 sales, only one product (i.e. the main product) p. firm is considered.

Additionally, differently from products commercialized, the analysis of subsidiaries shows that international corporations are discovering new markets and leaving others. Indeed, particularly attracting new markets have been attacked by international corporations such as: Denmark, El Salvador, Japan, Korea, Namibia, Nigeria, Norway, Peru, Russia, UAE and Vietnam. Within these countries, international corporations are significantly investing in the field of livestock products as a counterbalance for the abandon of other countries.

The following table gives a short snapshot of the international corporations that are investing in these new markets and their main activities in terms of livestock products commercialized.

Company Name	**Base country**	**Products**	**New markets**
Pacific Andes Resources Development Ltd.	Hong Kong	Seafood	Peru, Namibia, Singapore, Nigeria
Grupo Pochteca SAB de CV	Mexico	Raw materials for food	Guatemala, Brasil, El Salvator, Costa Rica
MHP SA	Ukraine	Poultry, Grain Growing, Meat, Fodder	Cyprus, Russia
Banvit Bandirma Vitaminli Yem Sanayii ve Ticaret AS	Turkey	Poultry	Netherlands, UAE
Milkiland NV	Netherlands	Dairy products	Cyprus, Ukraine, Russia, Poland
SalMar ASA	Norway	Seafood	Scotland, Japan, Korea
Cermaq ASA	Norway	Seafood	Scotland, Canada, Chile, Vietnam
Charoen Pokphand Foods Public Co. Ltd.	Thailand	Feeds, Meat, Poultry, Feeds	China, Vietnam
PT Sierad Produce Tbk	Indonesia	Poultry	Myanmar
Bakkafrost P/F	Denmark	Seafood	United Kingdom, Norway

Table 12 - New markets for selected international corporations.
Source: elaboration on FACTIVA 2014 data.

Consequently, from the analysis of private investments in the livestock sector, realized by means of the identification of top 100 firms active in the livestock sector in terms of 2013 sales and by undertaking a detailed balance sheets analysis for a selected sample of 27 companies, three main findings can be inferred:

- China is simultaneously the country hosting the bigger number of corporations (23, refer to Table 11) and recording the higher overall sales for 2013 (about 16 billion of US $, please refer to Figure 32) while other countries, such as New Zealand, Mexico, Thailand, France and Japan record lower sales; USA is represented with only one firm in the top 100 ranking in terms of 2013 corporate sales;
- No particular new products have been discovered by international corporations in the past 5-10 years and the composition of 2013 sales according to livestock product type sees feed, seafood, poultry and dairy products as the top contributor to 2013 sales (with respective market shares of 31%, 25%, 19% and 11%);
- Differently from products commercialized, the analysis of subsidiaries shows that international corporations are discovering new markets and leaving others; countries such as Denmark, El Salvador, Japan, Korea, Namibia, Nigeria, Norway, Peru, Russia, UAE and Vietnam have been "attacked" by international corporations, that constituted (or bought) new subsidiaries within these countries.

4. Other investments in the livestock sector

Livestock sector is also targeted by other "atypical" financial flows and investments which have not fully explored by the literature. Among these, international cooperation projects dealing with livestock matters and issues and the more recent emission reduction projects under the aegis of the Clean Development Mechanism (CDM) defined by the UNFCCC are surely the most important typologies of "atypical" financial flows.

The following paragraphs intends to give a short snapshot of current and past investments concerning international multilateral cooperation projects (for a bunch of selected multilateral donors) and to present main official registered CDM projects in the livestock sector.

4.1. International cooperation projects

International cooperation, among other things, is a way to help poor and developing countries in reaching the targets of poverty reduction, economic growth and environmental sustainability. Cooperation world is generally twofold and projects are divided according to the nature of the financing donor. Multilateral cooperation projects are financing by international institutions (such as the World Bank, the African Development Bank, the EBRD, etc.) while bilateral cooperation projects are financed by single States.

For the proposes of this paper, the analysis of international multilateral cooperation projects financed by a bunch of selected multilateral donors has been undertaken, in order to understand where environmental projects are financed and, among them, which projects foresee a livestock component or programme within their structure.

The multilateral donors analysed are (AidData 2014):

- Asian Development Bank (ASDB)
- European Communities (EC)
- Global Environment Facility (GEF)
- Islamic Development Bank (ISDB)
- United Nations Development Programme (UNDP)
- United Nations Economic Commission for Europe (UNECE)
- World Bank - Carbon Finance Unit
- World Bank - International Bank for Reconstruction and Development (IBRD)
- World Bank - International Development Association (IDA)
- World Bank - International Finance Corporation (IFC)
- World Bank - Managed Trust Funds

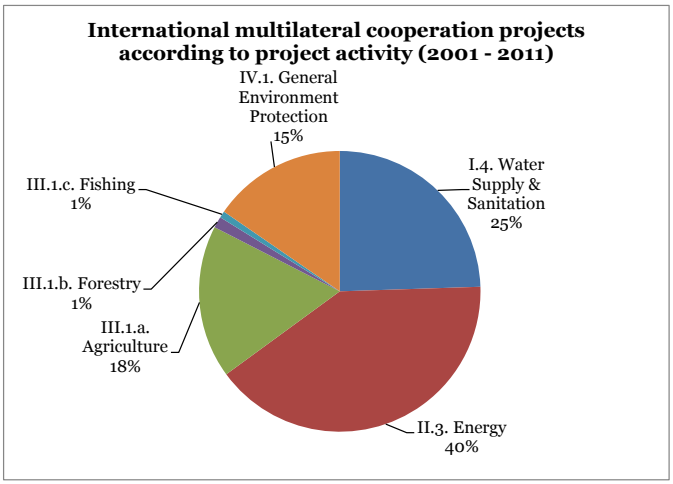

Figure 35 - Multilateral cooperation projects according to project activity.
Source: elaboration on AidData 2014.

As shown by the figure on the right, in the period 2001-2011, these donors distributed their financing for environmental projects in the fields of energy, water supply and sanitation, agriculture, general environmental protection and fishing & forestry.

The geographical distribution of multilateral cooperation projects, described in the following figures by means of a Network GIS analysis, shows that green projects were concentrated in Africa, Central Asia a partially in South America (the lines indicate the relationship donor-receiver, according to the year of project's start).

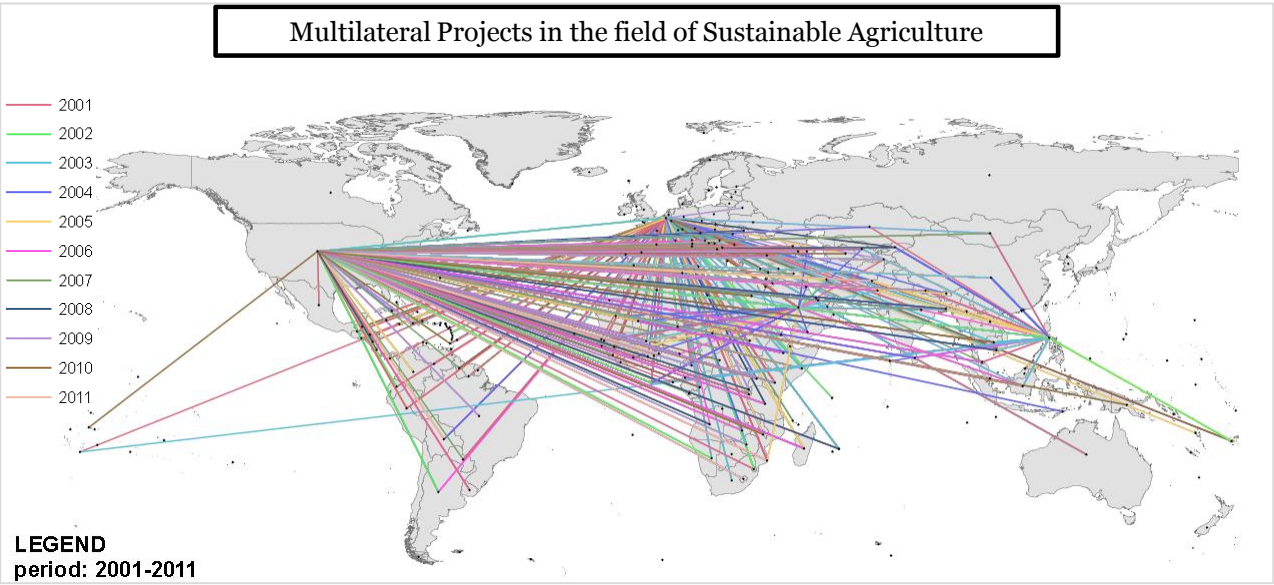

Figure 36 - Multilateral Projects in the field of sustainable Agriculture. Network GIS Analysis for Multilateral Donors.
Source: elaboration on AidData 2014.

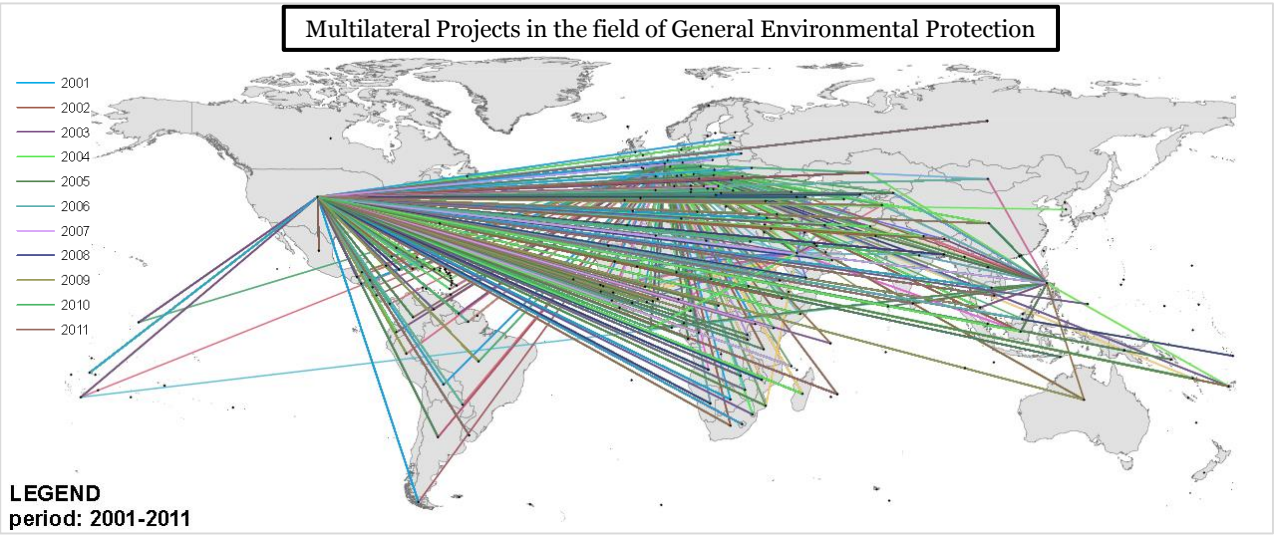

Figure 37 - Multilateral Projects in the field of General Environmental Protection. Network GIS Analysis for Multilateral Donors.
Source: elaboration on AidData 2014.

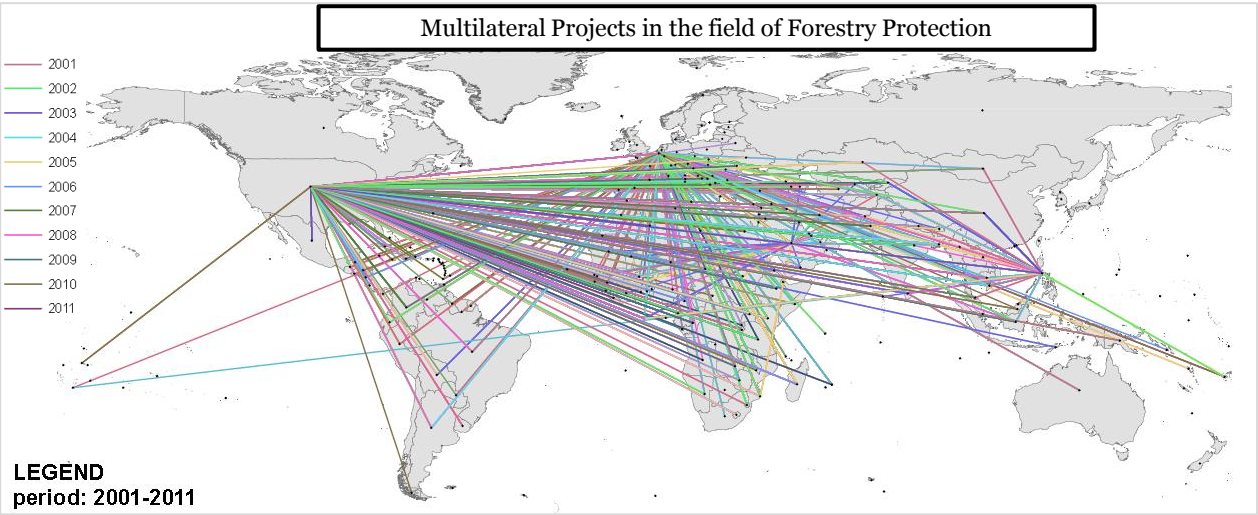

Figure 38 - Multilateral Projects in the field of Forestry Protection. Network GIS Analysis for Multilateral Donors.
Source: elaboration on AidData 2014

4.2. Cooperation projects in the livestock sector

Livestock is a transversal category within green cooperation projects (except fishing) and, frequently, a technical module within projects that specifically target other domains. As a matter of fact, indeed, specific components or programmes for livestock protection or improvement can be found within energy, general environmental protection, agricultural and sanitation projects.

The analysis of multilateral donors' activities in the livestock sector (AidData 2014) shows that livestock financing by multilateral donors has not been constant during the period 2001-2011, with peaks in 2001, 2003, 2006 and 2009 (e.g. multilateral financing amounted to 0.2 billion of US $ in 2006) and drops in 2002, 2004 and 2007 (i.e. overall multilateral financing inferior that 0.05 billion of US $), as shown by the following figure. The total amount of financing donated by selected multilateral donors for the realization of livestock programmes (and livestock components within more extensive projects) was about 767 million of US $ at 2005 constant prices.

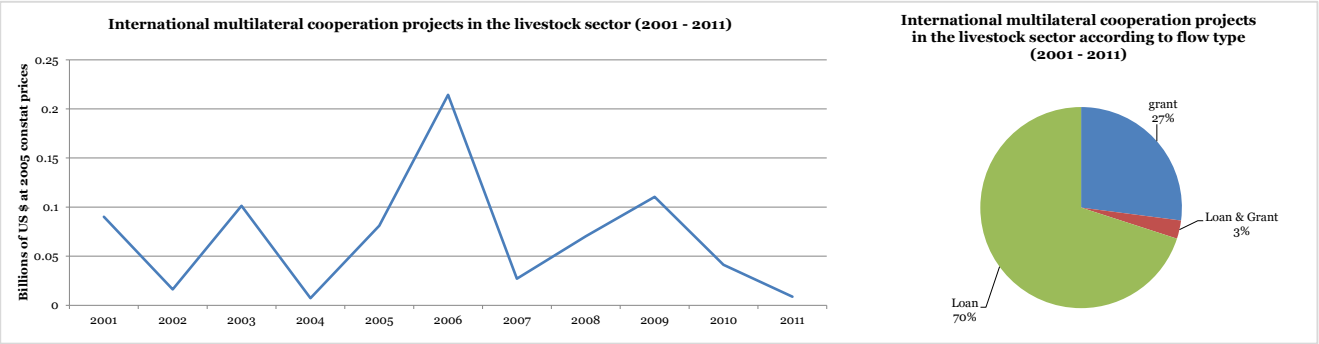

Figure 39 - International multilateral cooperation projects in the livestock sector (2001 - 2011).
Source: elaboration on AidData 2014.
Data for 2010 and 2011 are not available for all Donors.

Moreover, 70% of multilateral financing in the period 2001-2011 was due to loans and only 27% to grants (elaboration on AidData 2014)[11]. The following figure, showing the network GIS analysis for multilateral projects according to multilateral donor, underlines how the geographical distribution of livestock project is concentrated in Africa and Central Asia in the period 2001-2011.

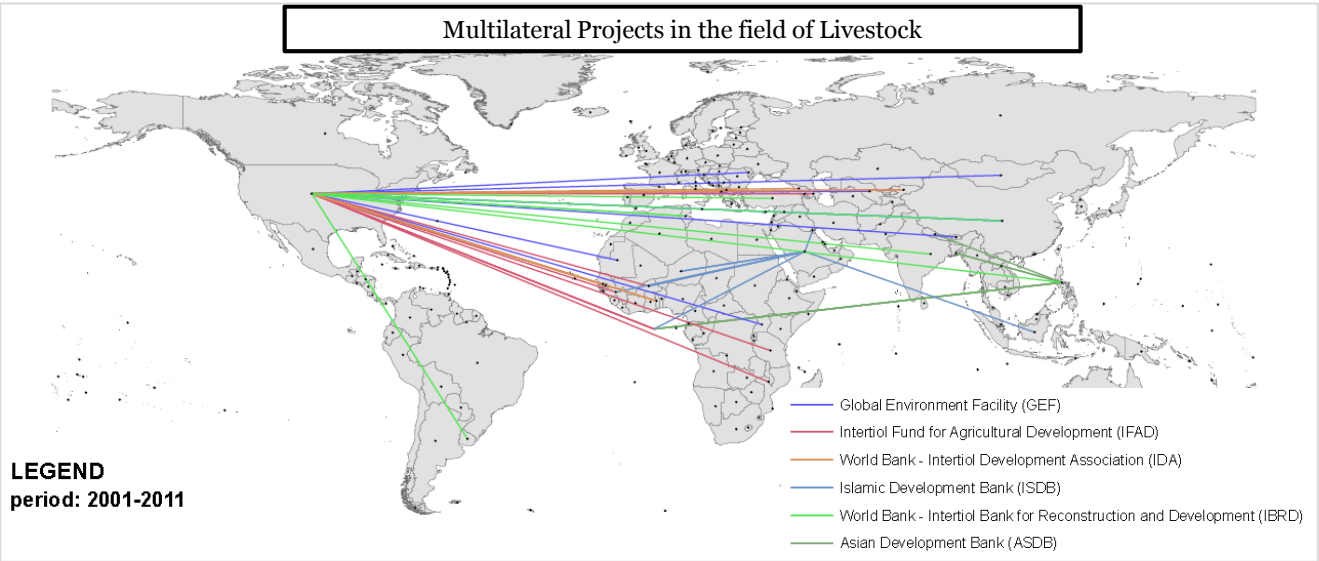

Figure 40 - Multilateral Projects in the field of Livestock. Network GIS Analysis for Multilateral Donors. Source: elaboration on AidData 2014. Data for 2010 and 2011 are not available for all Donors.

China was the top receiver of financing for the livestock sector, with a single project (i.e. Cn-Heilongjian Dairy, financed by the World Bank - IBRD[12]) that received about 110 million of US $, and an overall financing for about 120 million of US $ during the period 2001-2011.

India, Philippines, Senegal and Tunisia received more than 40 million of US $ by multilateral donors for livestock programmes or project components, as described by the following figure.

[11] This composition is probably explained by the fact that among the multilateral donors selected many multilateral banks appear.

[12] The project description is available at: http://www.worldbank.org/projects/P086629/cn-heilongjiang-dairy?lang=en&tab=overview

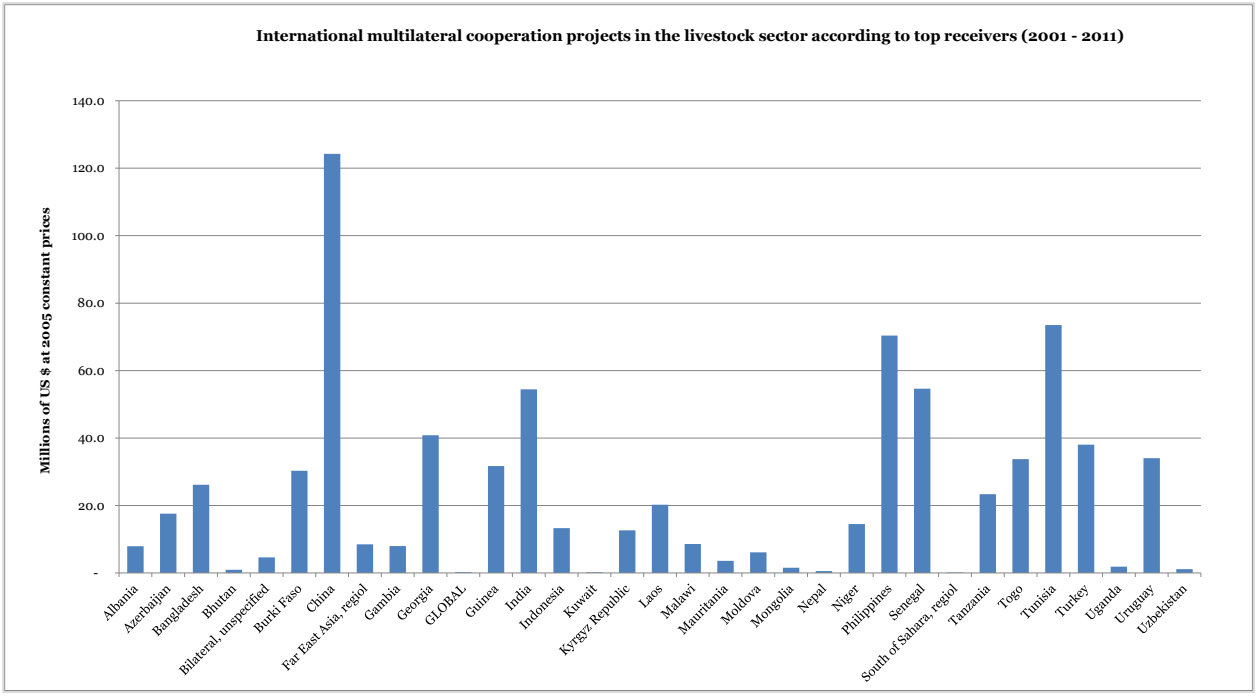

Figure 41 - International multilateral cooperation projects in the livestock sector according to top receivers (2001 - 2011).
Source: elaboration on AidData 2014.
Data for 2010 and 2011 are not available for all Donors.

The World Bank - IBRD was the top financer for the realization of livestock projects or livestock components within cooperation projects in the period 2010-2011, with about 380 million of US $, constituting the 50% of total financing for the period 2001-2011 (refer to the figure on the left).

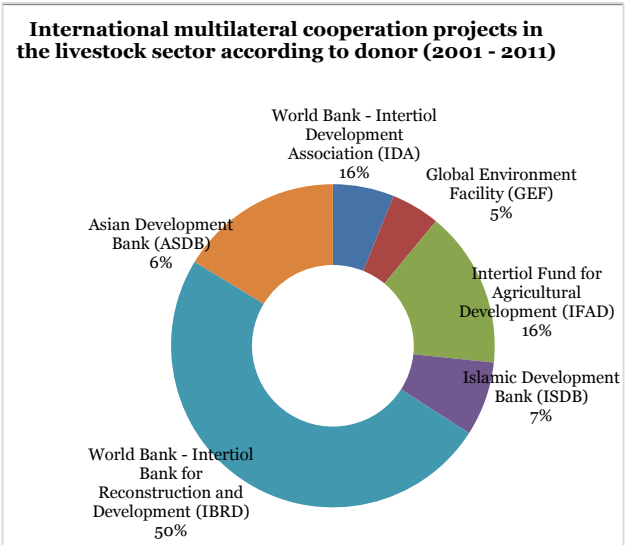

Figure 42 - International multilateral cooperation projects in the livestock sector according to donor (2001 - 2011).
Source: elaboration on AidData 2014.
Data for 2010 and 2011 are not available for all Donors.

Finally, from the analysis of livestock cooperation projects for a selection of multilateral donors, three main findings can be inferred:

1) Livestock financing trend by multilateral donors has not been constant during the period 2001-2011, with peaks and drops in different years.
2) China is the top receivers of financing for the livestock sector for the period, with huge projects financed by the World Bank - IBRD;
3) The rest of developing countries financed by multilateral donors are located in Africa and Central Asia.

4.3. Clean Development Mechanism

Livestock projects under the "cap" of Kyoto Clean Development Mechanism (CDM) defined by the UNFCCC are surely worthy to be counted as very important typologies of "atypical" financial flows for livestock financing. However, differently from cooperation projects, CDM projects foresee a twofold financial flow, where:

- The first fold is given by the investment financed by a company (generally based in a developed country, referred as "partner" country) for another company (generally based in a developing/poor country, referred as "host" country);
- The second fold consists in the flow of certified emission reductions (CER) or equivalent credits that follow the reverse path.

> *Carbon markets currently provide very limited mitigation incentives for the [livestock] sector.*
> *They either do not include livestock sector emissions or provide only a limited coverage.*
> *However, with continued research and development to improve measurement methodologies and the ongoing evolution of market-based instruments, the role of carbon markets should increase over the long term.*
>
> *Tackling Climate Change through livestock*
> *FAO, 2013*

Despite existing limitations and difficulties in accurately and cost effectively measuring emission reductions (FAO, 2013), the low suitability of "cap-and-trade schemes" to livestock sector and other considerations regarding the falling prices of primary CERs after 2012, CDM projects in the livestock sector are very important for the complete mapping of international sector investments and financial movements[13].

Host countries

During the period 2007-2013, Brazil, China and Mexico are the top 3 hosting countries in terms of emission reduction projects in the livestock sector, with respective reductions of about 0.94 million (i.e. 31% of total reductions), 0.61 million (i.e. 20% of total reductions) and 0.51 million (i.e. 17% of total reductions) of metric tonnes of CO2 equivalent p.a. over an overall reduction recorded for the livestock sector of about 3.5 million of metric tonnes of CO2 equivalent p.a., as shown in the following figure.

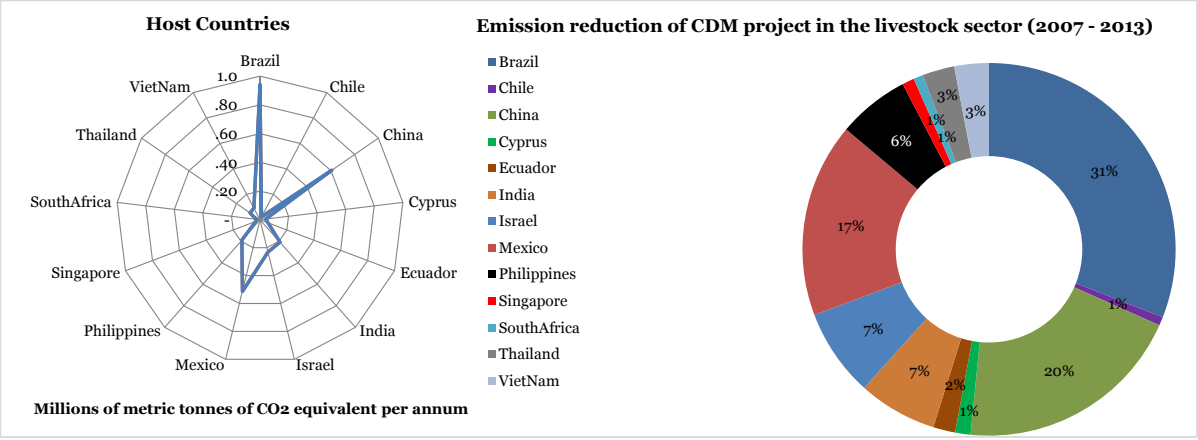

Figure 43 - Reductions in metric tons of CO2 equivalent per annum in host countries for 2007 - 2013. Source: elaboration on CDM database 2014.

[13] CDM projects in the livestock sector have been identified by selecting livestock-related methodologies for registered CDM projects.

The geographical distribution of livestock CDM projects, presented in the following figure, shows how countries where emission trading schemes (ETS) exist or are planned (such as European Union, Canada, Japan, Norway, Switzerland, etc.) have established partnerships[14] with countries where livestock CDM projects are implemented.

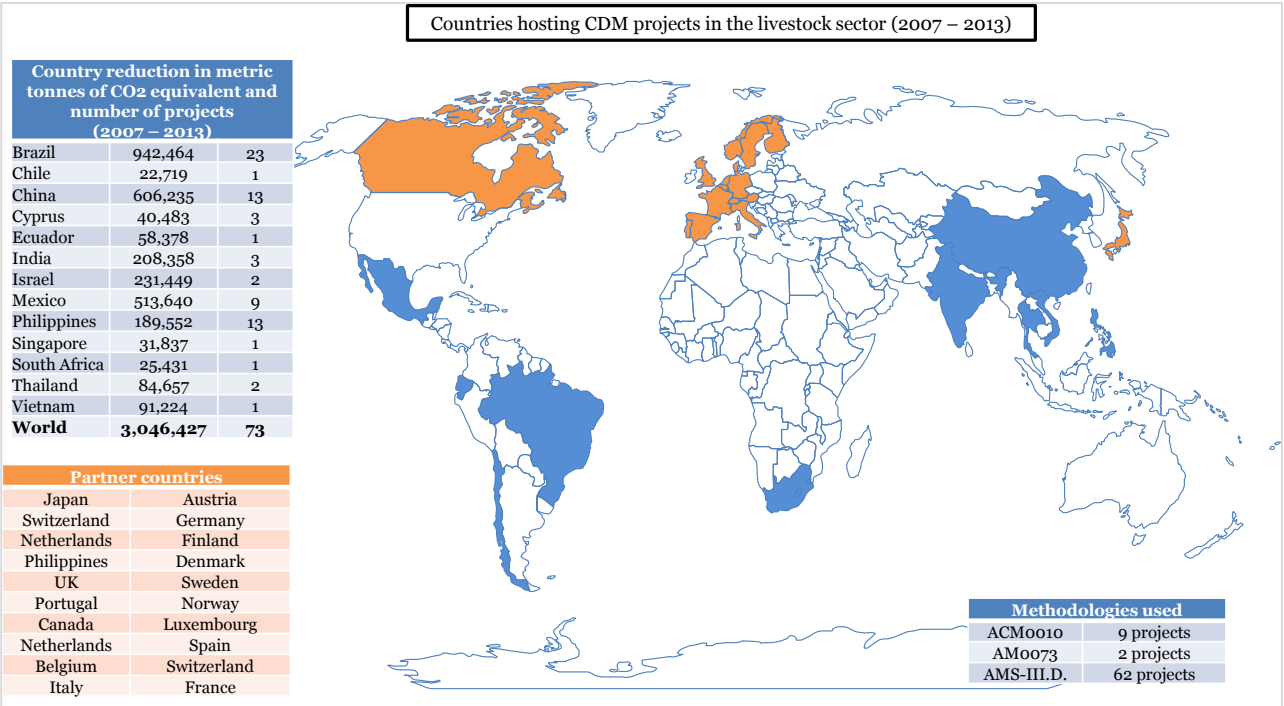

Figure 44 - Countries hosting CDM projects in the livestock sector (blue) and main partner countries (orange) for 2007-2013.
Source: elaboration on CDM database 2014.

Partner countries

Concerning partner countries, Portugal (mainly in partnership with Brazil), Switzerland and UK are the top 3 partner countries in terms of emission reductions in the livestock sector, with respective reductions of about 0.7 million, 0.38 million and 0.35 million of metric tonnes of CO2 equivalent, as shown in the following figure[15]. Portugal, Switzerland and UK collectively count for 68% of emission reduction of metric tonnes of CO2 equivalent in the livestock sector.

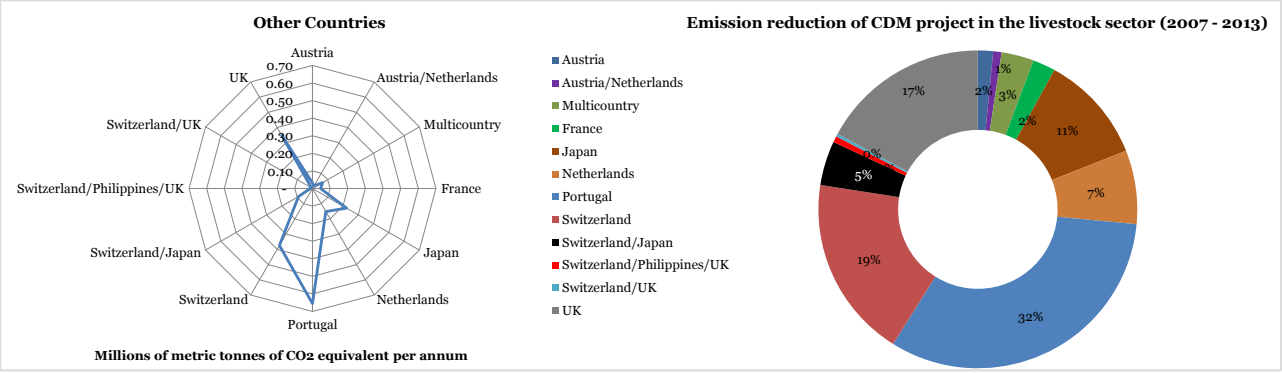

Figure 45 - Reductions in metric tons of CO2 equivalent per annum in partner countries for 2007 - 2013
Source: elaboration on CDM database 2014.

[14] Within this context, partnerships are intended to be company-to-company agreements.
[15] Obviously, the reductions took place in the host countries where livestock projects are based.

Finally, from the analysis of CDM projects in the field of livestock emission reduction, two main findings can be inferred:

- Brazil, China and Mexico are the top 3 hosting countries in terms of emission reductions in the livestock sector, with reductions collectively amounting to 68% of all livestock reduction in the period 2007-2013 (i.e. about 2 million of metric tonnes of CO2 equivalent p.a.);
- Portugal, Switzerland and UK are the top 3 partner countries in terms of emission reductions. Portugal, in particular, has several CDM projects in partnership with Brazil.

5. Livestock investment strategies

5.1. Strategies and drivers of the past 10 years

The quantitative analysis of current and past decade investments in the livestock sector (please refer to chapter 2) shows that world production, consumption and trade trends have significantly increased during the period 2001-2011 and that new players have entered into the markets with impressive growth rates for production (e.g. China, India), import demand (e.g. South Asia without India & China and Africa) while other players have partially left international markets (e.g. Northern America for bovine meat import).

Despite being mainly demand-driven, with a close relationship with demographic trends (as already shown paragraph 2.1), the livestock sector is strongly influenced by private strategies and national public policies, which define the legal and economic frameworks for the activities of livestock operators *lato sensu*.

> *Livestock data are not widely collected by national Governments and rarely on a regular basis; and the quality of available data is mixed in its timeliness, completeness, comparability and accuracy.*
> *This makes it difficult the design and implementation of effective investments and policies in the sector.*
>
> *Investing In The livestock Sector: Why Good Numbers Matter*
> *World Bank, FAO, ILRI, AU-IBAR, 2014*

In order to better explore how national legal and economic frameworks can influence and condition national production and trade trends, the first part of this chapter presents a description of the main strategies and drivers applied by public institutions and private operators in the livestock sector during past 10 years.

Accordingly, the first part of this chapter describes public and private strategies in the livestock sector of the last decade (paragraph 5.2) and explores the potential strategies for supporting the livestock sector according to supply chain phase (paragraph 5.3)

5.2. Recent investment strategies in the sector

5.2.1. Public strategies

A correct policy approach

According to a recent FAO/World Bank publication (World Bank, FAO, ILRI, AU-IBAR, 2014. Investing In The livestock Sector: Why Good Numbers Matter), a correct policy approach for determining the effectiveness of livestock public policies and investment strategies shall be based on the following guidelines:

General Questions	Elements
Why invest in livestock?	Trends and projections in total and per-capita consumption of animal-source foods; Trends in livestock value added over the years; Number and proportion of rural households keeping selected livestock species; Rates of under-nutrition, daily per capita intake of meat and milk, and the proportion and section of the population not consuming animal-source foods; Number and type of persons employed along selected livestock value chains.
Whom to target?	Mixed subsistence-oriented livestock producers; Specialized market-oriented livestock producers; Commercial farms.

General Questions	Elements
Which constraints?	Identification of critical and binding constraints that prevent the different livestock producers from making better use of their farm animals.
What to target?	Availability of feed concentrates in rural markets; Number of feed producers and their productive capacity; Availability of pasture; Relative prices of feed concentrates to the products to be produced, including their seasonal fluctuations; Quality of available feed concentrates; Access to information on feed concentrates by livestock producers.
How to invest?	Realisation of a coherent Implementation Plan.
How to ensure effective implementation?	**Input indicators**, which show whether appropriate financial, human and physical resources are allocated to policy and investment implementation. An example is the number and recruitment of public veterinarians. **Output indicators**, which measure the immediate effects as determined by access to inputs, e.g. whether more animals are vaccinated against certain diseases as a consequence of increased numbers of veterinarians. **Outcome indicators**, which quantify the effects generated by the outputs, e.g. reduced incidence of certain animal diseases. **Impact indicators**, which measure the effects of the outcome beyond its direct and immediate results, e.g. increased animal productivity and improved households' livelihood.

Table 13 - Guidelines for livestock policy strategies.
Source: adapted from World Bank, FAO, ILRI, AU-IBAR, 2014.

As shown by the table, a correct policy approach for the definition of livestock policies and public strategies shall be based on the preliminary availability of sector data, specific sub-sector trends, clear definition of targets, identification of constraints and quantitative/qualitative indicators (input/output and impact/outcome) in order to monitor the entire policy implementation process.

Unfortunately, for a number of reasons presented in the paragraph 0 of this paper, the preliminary quantitative analysis assessed by the guidelines is not always entirely possible and, as a matter of fact, national policies and strategies are sometimes designed on the basis of incomplete information.

An example of incomplete information underlined by the literature (Ayre-Smith R.A., 1971) concerns the definition of livestock policies imposed from on high (Top-down approach), with no preventive identification of social requirements and traditional schemes for rural and urban population.

Moreover, according to the literature (Agriterra, 2012; Ayre-Smith R.A., 1971; Dries L. at al., 2014; Rich K. M., Narrod C. A., 2010; Waheed S., 2013), during the process of policy design, a paramount distinction shall be made between small farmers, cooperatives and corporations active in the livestock sector.

This distinction, corresponding to the item "Whom to target?" of the guidelines, is very important because of the differences existing between these three livestock operator categories in terms of farm size, production size and methods, primary markets, machinery and equipment availability, financial resources, etc.

An example of a compounded policy for financial support for livestock operators which reflects this distinction is the one given by Uganda where possible source of financing for the livestock sector are designed according to value chain level and to livestock operator size, as shown in the following table.

Investment Opportunity	Small Farmers	Cooperatives	Processors
Relatives	x		
SACCO's*	x	x	
Micro finance institutes	x	x	
Commercial Banks		x	x

Table 14 - Finance Matrix in Uganda.
*** Sacco's stands for community based savings and credit cooperatives.**
Source: reproduced from Agriterra, 2012, page 91.

National goals and policy agenda

The fundamental role of the institutions for the support of livestock sector is amply recognized by the literature (FAO, 2012 b; Ly C. et al, 2010; Rich K. M., Narrod C. A., 2010; Ashley S. Nanyeenya W., 2002; FAO, 2012 a), which actually underlines how the broader objective of economic development is closely related to good-functioning institutions.

Moreover, within the process of defining the right strategies for supporting the livestock sector, "it is fundamental to address those institutional, governance and politico-economic factors that tend to exclude individuals and population groups from progress." (FAO, 2012 b).

As a matter of fact, indeed, a positive correlation between Government effectiveness and labor productivity in the livestock sector has been demonstrated, and countries where institutions do not function correctly are the ones where livestock sector productivity reaches negative peaks, as shown in the following figure.

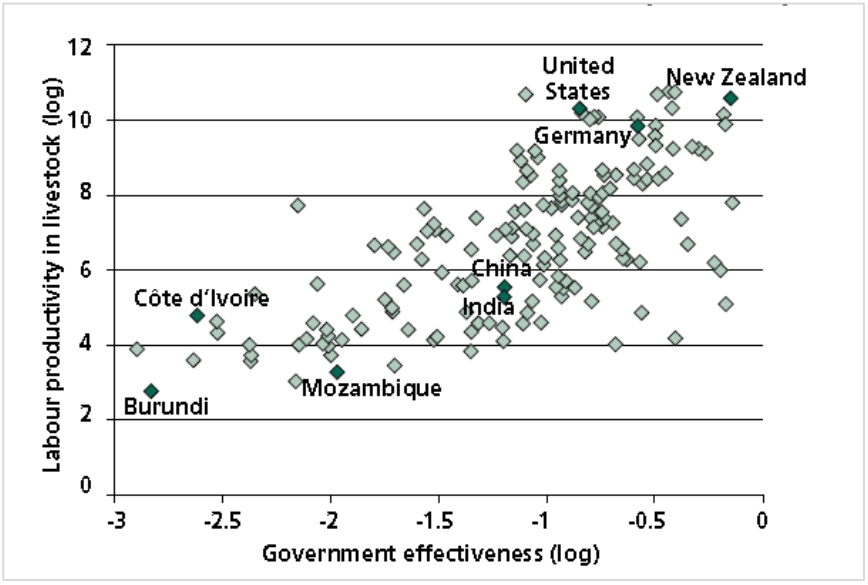

Figure 46 - Government effectiveness and livestock labor productivity.
Source: reproduced from FAO, 2012 (b).

Concerning the goals that national policies shall target, corresponding to the item "What to target?" of the guidelines, livestock sector's objective is multifold and several purposes can be targeted such as, for example (targets in part identified by Ayre-Smith R.A. 1971):

- More or better quality food:

  This may be for urban or rural populations within a country. Most animal products are of high nutritional value, but they must satisfy consumer preferences and be within their purchasing power.

- More clothing:

  The use of wool as an apparel fiber has increased in certain countries concomitantly with a rise in the standard of living. Where there is an unexplored potential for wool-bearing sheep, the development of wool-producing and processing industries can lead to a more favorable balance of payments.

- The saving of imports:

  Increasing livestock production to obtain this end can be made to appear a most desirable goal in countries first experiencing nationalism.

- More exports:

  This aim may also have an immediate appeal in a newly-independent country. Its slavish and continued pursuit may deny local populations the benefits derived from consuming adequate quantities of the products themselves.

- More employment;

  Many countries have experienced a drift of the rural population to towns and cities where employment opportunities are frequently inadequate. Re-settlement in rural areas may need to be associated with schemes for increased livestock production.

- More rural income:

  Changes in international trade can precipitate dramatic changes in areas of a country highly dependent upon a single agricultural crop for income. Livestock production may be an appropriate form of alternative land use.

- More draught animals:

  The use of tractors to enable increased crop production has caused severe problems in many countries; moreover, the increasing demand for arable agriculture cannot always be met by the use of such power. Although not as manifestly progressive as the tractor, draught animals still have an important role in many parts of the world.

- Utilization of grass leys and crop residues:

  The hazards of continued crop production can be minimized by the use of chemicals to help restore soil fertility and to reduce the incidence of plant pests and diseases, but they are often costly and dangerous to employ. Grass leys have long been recognized as a valuable alternative, and their costs can be substantially offset by the value of the animal products obtained from grazing them.

- Better use of resources and waste management:

  Regarding water and feed management, livestock sector shall tend to minimize inefficiencies and excessive consumption by means of adopting specific measures for farm management and processing.

According to the target fixed, specific policies shall be designed and applied by respecting the social and economic vocation of communities involved. Furthermore, the pursue of this policies can significantly influence livestock sector potentialities to contribute to the achievement of desirable outcome such as equity and growth, better resource management and food security and health (please refer to next chapter).

Additionally, the identification of precise targets and measure for the sector surely helps the institutions in the definition of a clear policy agenda (FAO, 2012 b), that shall be formed by specific drivers and components, for the institutional support of livestock operators, as shown in the following table.

Drivers	Components
Livestock policy	• Creating a conducive macro-environment
Managing the basics for livestock production	• Securing access to land, feed and water • Providing insurance and risk coping mechanisms
Enhancing livestock productivity and competitiveness	• Securing access to livestock/animal health services • Securing access to credit and other inputs
Sustaining livestock productivity and competitiveness	• Promoting access to national/international markets

Drivers	Components
	• Promoting the provision of public goods: research • Promoting the provision of public goods: food safety, quality, environment protection

Table 15 - A policy framework for inclusive growth of the livestock sector.
Source: reproduced from FAO, 2012 (b), page 136.

5.2.2. Private strategies

The increasing trends in world production, consumption and trade of livestock primary and finished products are also due to the intensified role of private sector operators (such as large private corporations, State controlled firms, livestock companies, food products supplier, genetics corporations and State national cooperatives), which are more and more important within the livestock sector.

The impact of modern production methods applied by private operators mainly consists in an increased process of intensification and industrialization where the arrival of large multinational firms, predominating in industrialized systems, entails the vertical control of all levels of production, processing and distribution of outputs (FAO, ILRI, 2011).

Indeed, the history of production methods applied within the livestock sector during last decade mainly deals with intensification of the production, mechanization, economic return rate as a driver for production and higher productivities, while traditional "grazing and pasture are becoming archaic necessities which have been largely replaced by hormones, grains, and concrete" (Gunderson R., 2011).

The mechanization of the production, its industrialization and concentration and the increasing productivity rate have been extremely intense for particular livestock sub-sectors, such as poultry sub-sector, provoking that "around two thirds of the world's broiler and half of the world's egg production is now industrialized" (Gura S., 2007).

Moreover, the increased concentration of production, market relationships (as described in paragraphs 2.1) and corporate specialization (as described in paragraph 3.1) significantly supported the creation of "oligopolies in global grain trade, meat processing and retail, that have enabled a globalized industry to deliver cheap meat products" (Gura S., 2007).

Intensification, industrialization and mechanization of the production

Industrialized meat production, processing and consumption have truly become a global phenomenon with global implications (Gura S., 2007) and the intensification of production methods along livestock supply chains has become a driver unconditionally followed by large private operators.

As described by a recent FAO, ILRI publication (FAO, ILRI 2011), the positive process of "traditional intensification" of production for small livestock producers, such as farmers or cooperative, totally differs to "industrial intensification" which shall be intended as a massive concentration of the industrial production in limited spaces and shorter times, obtained with extreme mechanization, increased antibiotic concentration p. head and by means of using genetic measures (Gura S., 2007).

Concerning the mechanization, in order to maximize profits and minimize costs and time, large corporations tend to mechanization processes able to embrace all the activities related to livestock supply chain and this is largely possible for monogastric species (pig and poultry), which show short regeneration intervals and are well suited for mechanized production.

This extreme mechanization of production, that Gunderson calls the "monopoly capital's transformation of livestock production" (Gunderson R., 2011), is in part responsible for the impressive quantitative results in terms of production of many developing countries (as analysed within paragraph 2.3) and will probably meet the expected demand of primary and finished livestock products projected within those countries.

Higher productivity and economic return rate (ERR)

The increasing of animal productivity and the importance given to the economic return rate of investments are very key drivers for the strategies of large corporations, which are conceiving specific programmes in order to maximize the profitability of the production according to these two drivers.

Regarding the first driver (i.e. higher productivity), the need to increase productivity per animal and to ensure a better feed utilisation is perceived by international corporations as a critical factor in enhancing the profitability (World Bank, 2012) and some companies active in genetically modified seed (such as the US company Monsanto, known for its leadership in seed genetics) are planning to enter into the market of livestock feeds (Gura S., 2007).

On the revenue side (second driver), the importance of the economic return rate of investment of a given agricultural project, shared by every livestock private operators, from farmer level (FAO, 2012 a) to micro-enterprises level (Waheed S., 2013), become, within large corporations, the final step in the analytical framework (Gura S., 2007) of investment evaluation, conditioning the entire productive process to the detriment of food quality, safety measures and health.

5.3. Livestock policies according to supply chain phase

As stated by relevant authors, "improved supply chain relationships are critical precondition for the recapitalization of the agri-food sector" (Dries L., Gorton M., Urutyan V, White J., 2014) and a supply chain smooth functioning is vital for the livestock sector. As a matter of fact, indeed, the importance of supply chain is twofold:

- From a public point of view, a smooth functioning of livestock supply chains basically implies the absence of market failures, which the public sector is historically responsible for (in terms of responsibility for the correction of failures);
- From a private point of view, non-problematic supply chains allow the rationalization of the production, the increase of revenues (for small operators), the stock augmentation of live animals' products (for cooperative) and a progressive increase in the mechanization rate (for livestock corporations, as described in paragraph 5.2.2).

Accordingly, specific policies can be defined and implemented for the support of the livestock sector, according to supply chain phase (i.e. live animals, processing and production, and markets), sub-systems, and desired outcomes, as described in the Figure 47, page 74).

Trade policies

Trade policies are very important to enhance the competitiveness of primary and finished livestock products commercialized by national producers, cooperatives and companies within international

markets. Examples of such policies are import/export tariff reductions or subsidies for live animals and semi-finished products produced by national corporations or inside the national territory.

Specific trade policies (in terms of duty free on imports or similar conditions) can also be conceived for the import of machinery, feeding products and fertilizers. This kind of policies, indeed, is very important for small livestock operators and local cooperatives that may risk not having enough capital allowances for paying tariffs on imported equipment and machinery.

The coordination of food producers and/or the definition of import and export special provisions (e.g. import limitation and quotas) for supporting national industries are also very important trade (and regulation) policies, enabling national operator to have access to a fixed quota of national demand.

Quality policies

The pursue of quality policies within livestock sector, which is generally perceived as "regulation burden" by livestock operators in the short term, is a consistent tool to increase national quality production standards, that, on the contrary, generally have positive externalities for livestock operators in the medium terms by means of increasing their export of premium high quality products to richer markets.

Quality measures for sub-systems are the respect of SPS measures imposed by international regulation (i.e. WTO's SPS), better pasture, better breeding and grazing, increased quality in feed supply and herding, the use of appropriate technologies, the scientific monitoring of animal health (and the correct use of vaccines, anthelmintic, medicines, etc.).

Taxes and fiscal policies

Fiscal policies and tax schemes are very powerful instruments that public institutions can use for the support of every phase of livestock supply chain. As a matter of fact, indeed, tax reduction for livestock operators and ad-hoc fiscal policies can significantly reduce the costs linked with production of primary and finished livestock products.

Example of tax schemes and fiscal policies for the support of livestock sector are:

- VAT deduction for sub systems, new equipment and livestock herd acquisition;
- Income tax exception for farmers and producers and for persons engaged in agro processing;
- Incentives for employees and firms in the livestock sector (e.g. corporate tax reduction);
- Direct and indirect de taxation of finished products (such as milk);
- Export credit for local cooperatives;
- VAT deduction for sustainable transport;
- Market insurance policies paid by the Government.

Furthermore, State intervention is very important in case of animal disease (which must be considered as a case of market failure within the livestock sector) and "public interventions that have nurtured growth in the livestock sector by directly or indirectly leveraging farmers' incentives include the eradication of rinderpest (or "cattle plague") in almost 130 countries worldwide" (FAO, 2012 b).

Agricredit and financial products

Together with fiscal policies and tax schemes, agricredit policies, designed to increase financial viability and access to credit for poor livestock operators, are vital for the surviving of smaller livestock operators and rural cooperatives.

Agricredit policies, which complexity has been assessed by the literature (Dries L. et al, 2014; Rich K. M., Narrod C. A., 2010; Waheed S., 2013) must be studied on case-by-case basis and conceived in a way not to alter existing social, rural and land equilibriums.

> *Repayment of loans is a painful procedure in all communities and it is hardly facilitated if credit has been imposed.*
> *Indeed, taxation of the financial returns obtained by farmers for the purpose of credit repayment, and for the support of other activities which are claimed to be in their interests, may lead to them failing to obtain any monetary reward in the end.*
>
> *Enhancing innovation in livestock value chains thought networks*
> *Ayre-Smith, 1971*

Selected examples of agricredit policies and financial products addressed to small livestock operators are:

- Capital allowances on specialized trucks and machinery;
- Capital allowances and conditional loans for farmers and producers and for persons engaged in agro processing;
- Insurance policy on livestock partially paid by the Government;
- Agricultural credit facility provided by rural banks for small farmer and cooperatives;

Furthermore, it is very important to underline that this policies are not "standing-alone policies" in the sense that financing institutions are requested to assist from a technical financial point of view the policy addressees, with the provision of market and financial free consultancies and services, in order to avoid that producers that have not formerly practiced a cash economy, risk not be able to manage financial incentives received (Ayre-Smith, 1971).

For this reason, financial incentives and "credit schemes for animal production are best [if] kept simple, and should also be equitable with the value of livestock products" (Ayre-Smith, 1971), also because credits provided is vulnerable due to the potential loss of asset or investment through death or theft of the animals involved. On the other hand, producers usually welcome financial incentives, particularly if they are not associated with obligations to restrict farm production.

Institutions, national plans and regulation

The role that institutions can play within the livestock sector, already described within this paper (please refer to paragraph 5.2.1), also consists in the definition of a precise legal framework for the sector and of a specific livestock plan/program, able to establish certain rules for national operators.

Additionally, national plans shall be able to avoid the adverse social and economic repercussions of livestock sector development (Ayre-Smith R. A., 1971) such as the possible negative consequences of a production system alteration, the potential negative spillovers of increased livestock management (e.g. manure, emissions, etc.) and the possible changes in social roles in agricultural communities.

Regarding institution building in the livestock sector, some measures can be listed such as:

- Creation of National/ Regional supporting institutions and preparation of a National livestock Plan;
- Establishment of rural regional Banks in charge of providing agricredit (including microcredit);
- Definition of agribusiness initiatives and programs;

- Use of national Foreign funds or Equity funds to sustain agricultural development;
- Marketing information and communication systems.

Institutions also have a very important role for avoiding market distortion and failures within markets; some example with this respect are the African Government intervention in agricultural markets (presented by Meltzer M. I., 1995) and the Brazilian State intervention for tackling Foot-and-Mouth Disease (FMD) by means of PPP schemes, which was partially successful (presented by Rich K. M., Narrod C. A., 2010).

Animal health and education

Policies related to animal health and education significantly influence the increase of standards and controls for animal health and nutrition and help the provision of better specialized veterinary care. Specific examples of these policies are:

- Farm management lessons paid by national and regional institutions;
- Access to external service providers, and tighter control of the production environment through factors such as light, temperature and humidity;
- Appropriate research financing (p. area);
- Supply of discounted (or free) veterinary services and processing specialized consultancy;
- Monitoring and supporting formal and informal education regarding livestock sector (e.g. scholarships and university).

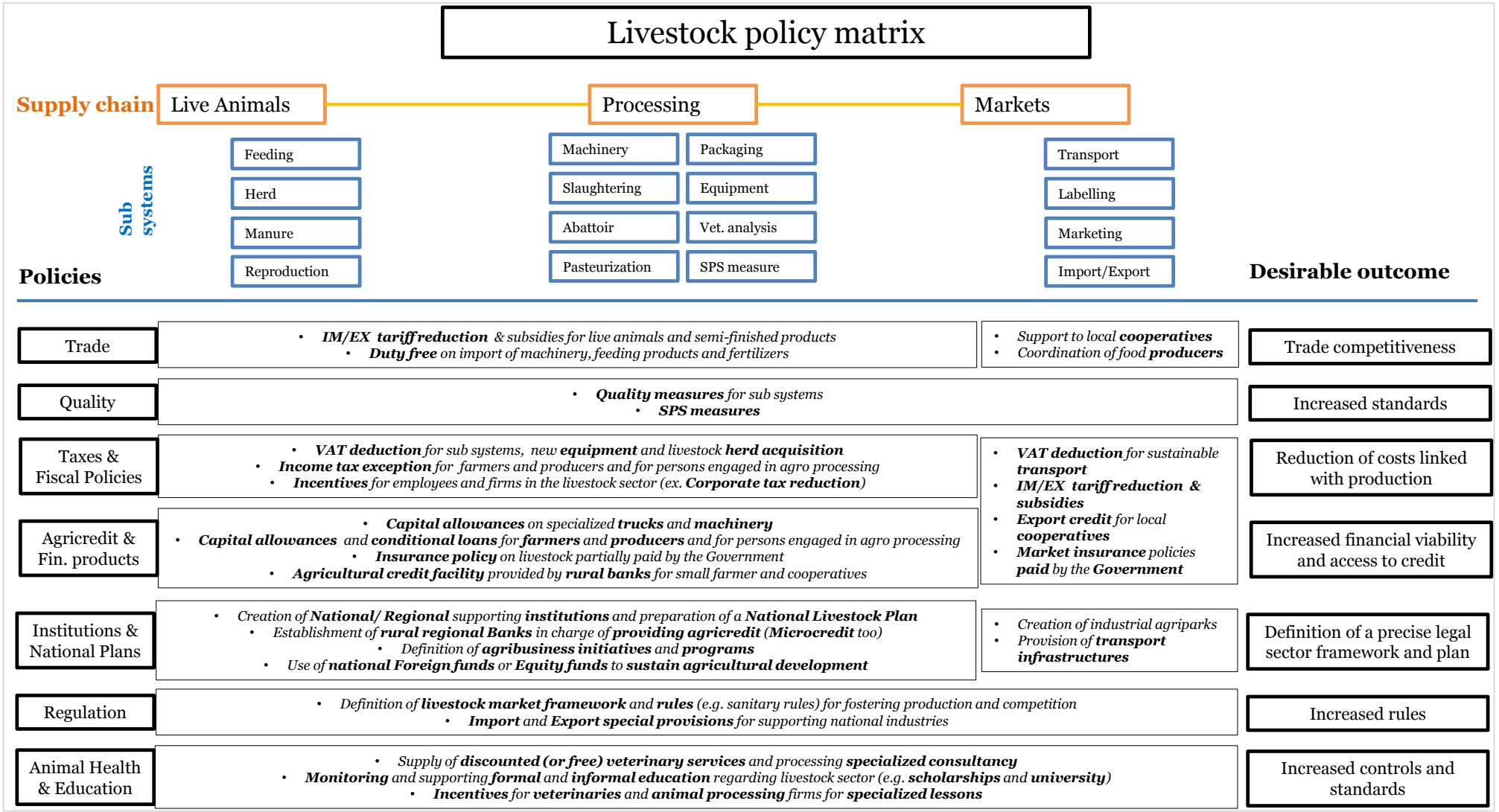

Figure 47 - Livestock policy matrix according to supply chain phase.

Private-Public-Partnerships (PPP)

In addition to the above mentioned public and private strategies for fostering livestock production during each phase of the supply chain, Private-Public-Partnerships (PPP) can play a very important role, as deeply explored by Rich and Narrod (Rich K. M. and Narrod C. A., 2010). Indeed, as assessed by the authors, PPP can play a "key role in strengthening links within the supply chain, particularly where market failures impede access by the poor [or] small scale producers, often left out of the process, due to their low productive capacity, remote location, and limited competitiveness with larger growers".

As a matter of fact, PPP instruments are enough adequate and malleable to guarantee positive outcome if applied correctly within high-value agriculture supply chains (HVA), which are often interrupted by market failures, which can be identified in the following macro-categories (Rich K. M. and Narrod C. A., 2010):

- Information asymmetries;
- Anonymous transactions (no traceability);
- Insufficient standards;
- Coordination failure;
- Transaction cost barriers;
- Regulatory barriers (overregulation);
- Tariffs or taxes.

The role of public sector, that has historically been to cope with market failures and to conceive solutions for a better management of supply chains, is even more effective if PPP structures are applied. Indeed, a typical PPP scheme foresees the public sector to provide infrastructures and equipment while leaving to private sector the control of production, marketing and distribution of commodities (Rich K. M. and Narrod C. A., 2010).

Within this framework, PPP instruments constitute an additional tool to coordinate public and private actors in chain-level interventions and the right entry-point for supporting the production chains, as assessed within the following table.

Supply chain activity	Role of public sector	Role of private sector	Market Failures	Possible entry point for PPPs and NGOs
Production	Input and output price policies; regulation of competition	Generic commodity and final product production	Producer scale, limited technical skills in new techniques, low farmer income, poor price incentives	Link farmers with public support agencies and private sector buyers using NGOs as a facilitator/partner
Input procurement	Input and output price policies; regulation of competition	Purchases of inputs for production	High taxes/subsidies, lack of credit access for inputs	Creation of producer organizations to procure high-quality inputs in bulk to reduce costs
Logistics	Public distribution of commodities	Specialized logistics functions to manage distribution activities	Poor infrastructure, crowding out by public sector, low market access for remote areas	Development of partnerships to link distribution activities in remote communities
Marketing	Public certification; promotion of orphan crops	Development of brands and labels; commodity promotion and retail activities	Limited smallholders' capacity in formal marketing and branding strategies; limited smallholder capacity to meet specifications of brands	Use of producer organizations or NGOs to establish marketing partnerships with processors and retailers to promote innovative or socially beneficial

Supply chain activity	Role of public sector	Role of private sector	Market Failures	Possible entry point for PPPs and NGOs
				products and create brands
Credit	Public-sector banks, credit subsidies	Private-sector banks, microfinance activities, informal credit (moneylenders)	Smallholders' access to credit limited by high transaction costs and rationing in credit provision	Provision of microcredit by NGOs and village leaders, in conjunction with underwriting by public and private
Research and development	Public R&D and production for seeds, inputs, varieties; input price policies	Private R&D and production for seeds, inputs, varieties	Private profitability of varieties with social benefits may be low or negative	Research partnerships to develop socially beneficial inputs to production

Table 16 - Market failures within agricultural supply chains and possible entry points for PPP schemes. Source: reproduced from Rich K. M., Narrod C. A., 2010, page 9.

Another advantage of PPP with respect to classical instruments is that PPP allows assembling resources and sharing risks between several parties with diversified business orientations and targets (i.e. private profit operators and public no-profit operators).

The following figure (Rich K. M. and Narrod C. A., 2010) gives an example of how PPP can help to eradicate market failures (dot arrows) within a simple supply chain[16].

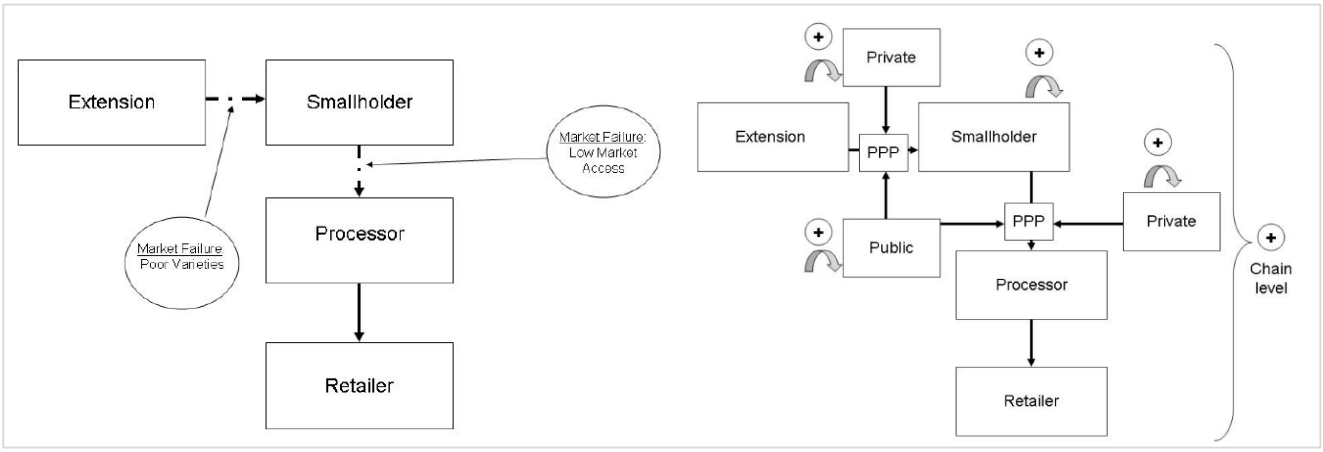

Figure 48 - PPP contribution in correcting market failures in supply chains. Source: reproduced from Rich K. M., Narrod C. A., 2010, page 14.

As described by the previous figure, PPP can overcome the two main market failures existing within supply chains (i.e. poor varieties of supply and market access) by strengthening the supply chains by means of private and public supports.

[16] The authors identify five requirements for PPP correct functioning:
1. The benefits to the targeted beneficiary (the smallholder) from the PPP must be greater than the costs associated with participation costs.
2. The benefits to public partners in the PPP must be greater than the public costs of partnering.
3. The overall net benefits to private partners in the PPP must be greater than the overall net private benefits of partnering without the PPP.
4. The benefits to the entire supply chain resulting from the PPP must be greater than the associated costs to the chain.
5. The benefits to any supply chain participant at any period of time from a PPP-led intervention will depend both on the investments made by that participant in the supply chain that are induced by the PPP and on those taken by other actors in the supply chain that are directly linked with that participant.

The use of PPP instruments, indeed, allows to join together private operators and national (or regional) institutions and to significantly increase the available capital expenditures for any "missing link" along the supply chain.

For example, the low variety for a particular product (e.g. milk) can be attacked with focused PPP policy were State institutions provide infrastructures and equipment for pasteurization while private operators are responsible for better marketing and commercialization (as it happened in India during past decade).

6. Desirable outcomes

6.1. General considerations

The desirable outcomes connected to the livestock sector have not changed within the livestock-related literature of past 20 years.

For instance, in 1995, Meltzer addressed the following questions (Meltzer M.I, 1995) regarding the possible desirable outcomes of the sector:

1) Can livestock continue to improve the nutritional status of the growing human population?

2) Can production of livestock continue to contribute to economic growth (i.e., can it generate employment opportunities)?

3) Can livestock production systems continue to be developed so that they will be sustainable?

The relative importance of different livestock species varies by country and production system.
Alongside other types of information, a better understanding of the value of production (and therefore importance) of livestock products would help target investments, both in terms of species and regions.

Targeting strategic investment in livestock development as a vehicle for rural livelihoods
ILRI, 2009.

These three questions, respectively addressing the relationships between livestock and food production, livestock and economic growth and livestock and sustainability, continue to constitute the core of discussions related to desirable outcomes of livestock sector development.

Accordingly, this chapter explores the role of livestock sector in contributing to the achievement of desirable outcomes for the society such as:

- Equity and growth;
- Resources and climate change;
- Food security and health.

6.2. Equity and growth

Livestock sector has many characteristics that make it very important for a sustainable rural development (FAO, 2012 b) including the following:

- livestock can increase crop production, on condition that manure is used correctly;
- livestock can produce high quality food and products less subject to climate shocks;
- livestock convert organic material not suited for human nutrition into high-value food;
- livestock asset management constitute an important acquisition for woman by conferring them independent income and an increased social status.

Unfortunately, "the livestock sector's potentiality for contributing to economic development and poverty reduction has so far remained largely untapped, and it is difficult to identify a single developing country where growth of the sector has been unambiguously pro-poor" (FAO, 2012 b) and possible indicators for this contribution are often based on case-by-case studies and analysis.

As a matter of fact, indeed, as well as poverty alleviation efforts must target relatively small groups of people (FAO, ILRI, 2011), poverty alleviation results are significant if analysed for specific cases, while broader analysis risk to underestimate this positive results.

Poverty reduction

According to Khan A. A., Bidabadi F. S., (2004) livestock sector is central to the livelihood of the rural poor in developing countries in at least six ways.

1. they are an important source of cash income;
2. they are one of the few assets available to the poor, especially poor women;
3. livestock manure and draft power are vital to the preservation of soil fertility and sustainable intensification of farming systems in many developing areas facing population density;
4. livestock sector allows the poor to exploit common property resources, such as open grazing areas, in order to earn an income. Fifth, livestock products enable farmers to diversify incomes, helping to reduce income variability;
5. livestock sector provides a vital and often the only source of income for the poorest and most marginal of the rural poor, such as pastoralists, sharecroppers and widows.

Feeding a growing global population in the next century will require a multi-faceted response that takes into account distribution and equity, ecological limits, climate change, nutrition, corporate power, rural livelihoods and social justice.
This means that Governments everywhere [..] must begin to address the globalized socio-economic and ecological impacts of industrial agriculture production and meat production in particular.

The Need for Feed:
China's Demand for Industrialized Meat and Its Impacts
Shefali S., 2014

The contribution of livestock to household incomes has been deeply explored by an ILRI study (ILRI, 2009) which assessed in which ways livestock can contribute to livelihood strategies for poverty alleviation and food insecure reduction.

However, according to this study "there is a dearth of knowledge about the relative contribution of livestock to total household incomes across regions, species and production systems" (ILRI, 2009) and a case-by-case approach must be selected.

Respecting this micro-approach, specific cases in sub-Saharan Africa and South Asia have been targeted and analysed by the INLRI study by means of addressing to the interviewees the following questions:

- What is the total household income for livestock keepers (US$/year)?
- What is the share of income from livestock production in total household income?
- What variations exist according to type of production system and species kept?

concerning the following system categories (formed by mixed crop/livestock, pastoral and other):

- dairy cattle;
- small ruminants species;
- mixed species;
- poultry.

The result of the study (based on 92 specific cases) assessed that livestock sector significantly contributes to rural incomes, and that livestock production averagely account for close to 40% of total household income across all livestock production systems, species and regions (ILRI, 2009), as described in the following figures.

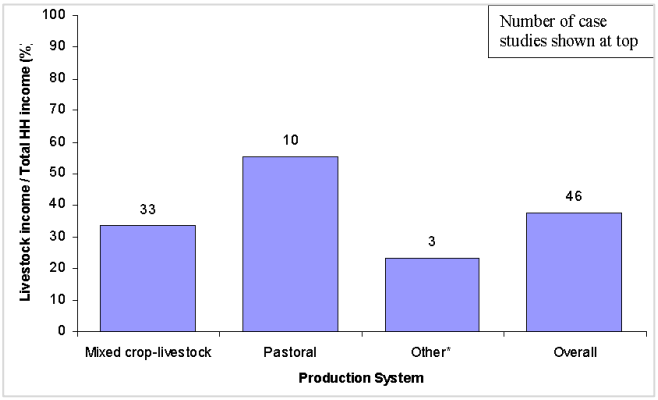

Figure 49 - Share of livestock income in total household income, by production system.
*** "Other" comprises one exotic poultry study from Bangladesh and two local goat/sheep studies from India.**

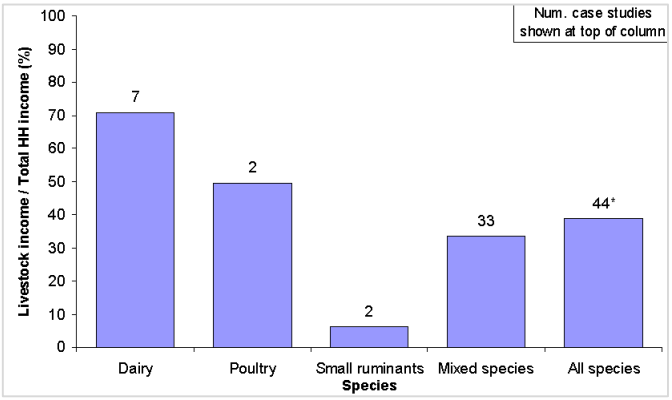

Figure 50 - Percentage of livestock income in total household income, by species.
*** Two case studies not included as species description missing.**

Source: reproduced from ILRI, October 2009, page 10-11.

As shown in the above figures, livestock sector constitutes a very important income source for pastoral production systems (where livestock contribute to 55% in total household income) and for dairy and poultry sub-sectors (respective contribution to total household income is 70% and 48%).

Economic growth

If the relationships between livestock sector income and the total household income has been amply recognized by the literature (ILRI, 2009; Leroy J. L. et al, 2007; Meltzer M. I., 1995), which likewise recognizes the difficulties to assess relative contribution of livestock to total household incomes across regions without a specific case-by-case analysis (ILRI, 2009), the relationship between livestock sector and economic growth mainly rely on the work realized by Pica-Ciamarra and Otte in 2008.

> *There is considerable spatial heterogeneity in the determinants of rural poverty, and development interventions increasingly need to be targeted at relatively small groups of people, calling for a finer grain in the definition of intervention domains than has been available in the past.*
>
> *Global livestock production systems*
> *FAO, ILRI, 2011*

The authors, using a panel dataset assembled from the World Bank's indicators database and FAO's internal statistical database covering the period from 1961 to 2003, "found a statistically significant causal relationship between livestock sector development and economic growth in 36 of the 66 countries analysed" (example reproduced from FAO, 2012 c).

Indian example of poverty reduction

India constitutes a successful case study of PPP partnership in livestock markets in developing countries (Rich K. M. and Narrod C. A, 2010) that brought to a consistent reduction of poverty for small livestock operators and increased revenues for bigger operators and companies. India, which is now the biggest milk produced of the word (as already showed in Figure 31) presented a traditional unorganized supply

chain for milk production and distribution (where "traditional operators" lived below the poverty line and often sold unpasteurized milk), mainly because of the following reasons (Rich K. M. and Narrod C. A, 2010):

- consumers not willing to pay more for pasteurized and packed milk;
- consumers often regarding raw milk and traditional products obtained from reliable vendors as of better quality (than formally processed dairy products).

The Government modified this situation by defining a specific program for milk supply chain (i.e. "Operation Flood") which foresaw the creation of market infrastructures, paid by the Government but controlled by farmers and cooperatives. These infrastructures, providing all the ancillary services for milk trade (i.e. chemical control, pasteurization facilities, veterinary services, etc.), significantly helped milk supply chain to evolve from a traditional organisation to a modern (and more efficient) one and to increase the revenues of traditional operators which could sell better products.

Finally, India represent an example of PPP within livestock supply chain that helped the increase in quantity and quality of animal products processed (and sold) which favoured both public and private sector in terms of revenues and poverty reduction targets, as showed in the following figure.

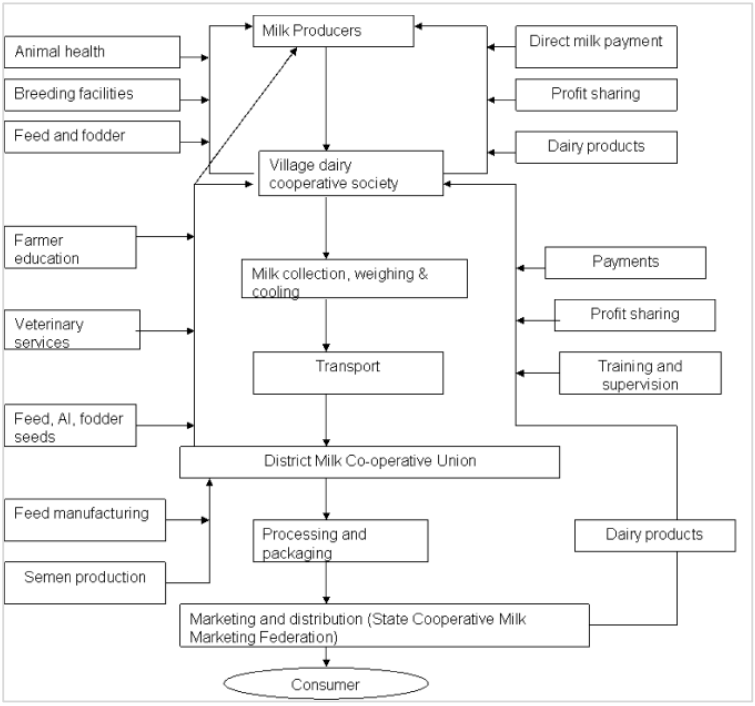

Figure 51 - Organization of the Indian milk supply chain.
Source: reproduced form Rich K. M., Narrod C. A., 2010, page 17.

6.3. Resources and Climate change[17]

Livestock sector emissions

The livestock sector plays and important role in climate change, whit estimated sector emission amounting to 7.1 gigatonnes CO_2-eq p.a. (FAO, 2013). The analysis of sector emissions underlines how

[17] Items for this chapter are mainly based on FAO, 2013. Tackling climate change through livestock - A global assessment of emissions and mitigation opportunities; Rome.

beef and cattle milk production are respectively responsible for 41% and 20% of emissions while pigs and poultry sub-sectors provoke minor emission quantities, as shown in the following table.

Regarding the supply chain for production, feeding and processing phases cause the large majority of emissions (i.e. 45% of supply chain emissions), together with the enteric fermentation for ruminants (i.e. 39% of supply chain emissions), as shown in the following table.

Sub-sectors	% on CO2-eq emissions
Beef	41%
Cattle milk production	20%
Pig meat	9%
Poultry	8%
Other sub-sectors	22%
Feed production and processing (including pasture and feed crops)	45%
Enteric fermentation from ruminants	39%
Manure storage	10%
Other phases (including transport)	6%

Table 17 - Livestock sector emissions according to sub-sector and supply chain phase. Source: FAO, 2013.

On the contrary, the mitigation potential for sector emissions is mainly linked with the implementation of efficient practices and technologies, able to improve the efficiency of the production at animal and herd levels, including better quality feed and feed balancing for lower enteric and manure emissions (FAO, 2013)[18].

Main emission reduction strategies

Emission intensity can be primary tackled with the efficient use of resources within sub-sectors and supply chain phases, tailoring the intervention to local objectives and conditions. For example, for reducing the emissions deriving by monogastric and ruminant species, the following strategies may apply (FAO, 2013):

Intervention level	monogastrics	ruminants
Animal level	improve feed balancing, animal health and genetics.	optimize feed digestibility and feed balancing; achieve better animal health; improve performance through breeding.
Herd level		reduce the proportion of the animals in the herd dedicated to reproduction and not to production.
Production unit level	produce or source low emission intensity feed; adopt energy efficient practices and equipment; enhance manure management.	in grazing systems: improve grazing and grassland management to increase feed quality and carbon sequestration; in mixed systems: improve the quality and utilization of crop residues and fodder; enhance manure management.
Supply chain level	foster energy efficiency and use of low emission intensity energy; reduce waste generation along supply chains; increase recycling.	increase the relative beef production supplied by herds producing both meat and milk; adopt energy efficient practices and equipment; encourage waste minimization along supply chains.

Table 18 - Example of possible interventions for monograstic and ruminants species for emission reduction. Source: adapted from FAO, 2013.

[18] Practical examples of mitigation potentialities are given in chapter 6 of FAO, 2013.

Existing policy framework

The current national and sub-nationals policies and programmes for fostering the reduction of emission in the livestock sector are quite weak (FAO, 2013) and even the Kyoto Protocol seems to foresee poor space for livestock mitigation potentialities (the analysis of officially registered CDM projects in the livestock sector has been presented in chapter 4.3. of this paper).

The possible policies for the mitigation of livestock emissions, that are commonly shared with other environmental management and development projects, could be the extension of agricultural support services, the increase of research financing, the improvement of financial incentives and the better definition of sector regulation (FAO, 2013).

6.4. Food Security and health

The general prefaces of the last three articles published by Sharma in 2014 concerning China's demand for industrialized livestock food products (i.e. Sharma S., 2014 a; Sharma S., 2014 b; Sharma S., Rou Z., 2014), shared the following consideration:

"When the Chinese company Shuanghui International Holdings announced its intention to purchase Smithfield Foods, it got the attention of the U.S. Congress and the media. The idea of a foreign firm owning a giant U.S. pork producer, and an influential player in the U.S. food system, raised a Government debate about the links between food security and national security" (Sharma S., 2014 a).

As a matter of fact, indeed, "livestock keeping is critical for many of the poor in the developing world, often contributing to multiple livelihood objectives, including improved household food security" (ILRI 2009).

Moreover, livestock plays a very important role in food security in dryland areas, where agriculture is not available and where about 180 million people world live (FAO, 2012 c).

Additionally, according to FAO (FAO 2012 c) livestock sector helps the achievement of national food security object in many ways:

- contributing indirectly to food security by increasing crop output through providing manure, which is a valuable source of organic plant nutrients and reduces the need for chemical fertilizers;
- enhancing the flexibility and thus the stability of food production;
- serving as a buffer to mitigate the impact of fluctuations in crop production on the availability of food for human consumption;
- providing more proteins with respect to agricultural products and ensuring the presence of important minerals (calcium, phosphorous, iron, zinc, magnesium and manganese) and vitamins - thiamine (B1), riboflavin (B2), niacin, pyridoxine (B6) and B12;
- reducing the burden of disease attributable to protein and micronutrient deficiencies with respect to agricultural products.

Animal welfare

Investments in the livestock sector aimed at augmenting the quantity and quality of medical control, and introducing better farm management practices, are a pre-requisite for a global better management of the

livestock supply chain. Such investments shall be aimed at increasing the access to veterinary services and better feeds and shall permit ensuring tighter control of the production environment through factors such as light, temperature and humidity, which obviously have positive repercussion on animal health and welfare (FAO, ILRI 2011).

On the contrary, investments destined to increase the use of antibiotics and excessive chemical components within livestock feeds will result in a consistent detriment of animal (and human) health. This scenario, which is already taking place in private supply chains in many countries where State regulation is too weak, risk to be very dangerous for those species particularly suited for industrialization and mechanization (e.g. poultry and pigs).

Accordingly, "excessive concentration of animals in large scale industrial production units should be avoided and adequate investments should be made in heightened biosecurity and improved disease monitoring to safeguard public health" (Pi C., Rou Z., Horowitz S., 2014) in order to avoid the replication of weak public policies, permitting the excessive use of antibiotics[19].

Example of Food security: Brazil

In Brazil, the availability of agri-credit facilities for livestock operators and the Governmental support to livestock sector helped the achievement of poor population reduction and prices reduction for food primary products, significantly contributing to household food security and to reduce human nutrition issues, as showed in the following figures.

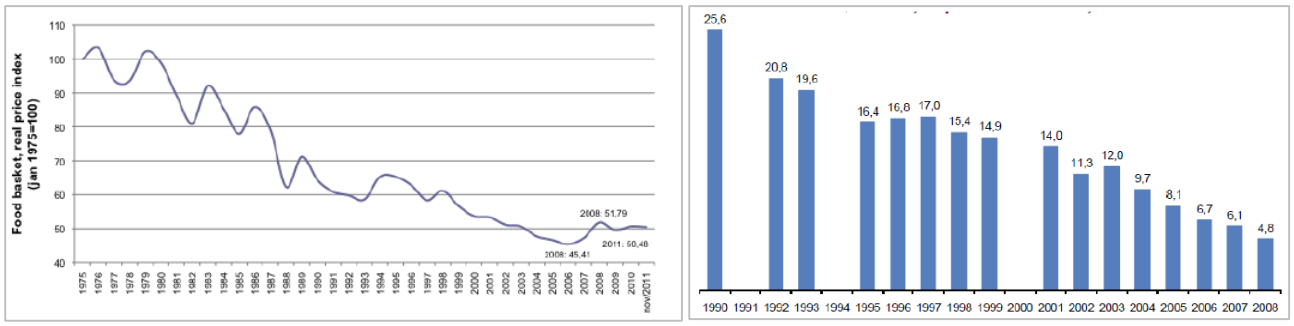

Figure 52 - Real monthly price index for a food basket in the city of Sao Paulo and Share of Brazilian population living with less than USD 1.25 per day.

As shown by the figure, Brazil recorded consistent decreasing trends for food product prices (in San Paolo) and for the number of poor (identified as population living with less than US $ 1.25) in parallel with the implementation of national and regional policies aimed at supporting the livestock sector and its middle-size operators, such as farmers and cooperative.

[19] According to a study by a Beijing-based consulting firm, cited by Pi C., Rou Z., Horowitz S., 2014, "more than half of China's antibiotics go to livestock, which is a trend that coincides with the industrialization and scaling up of those farms".

7. Main findings and Policy recommendations

7.1. Main findings and Answers to the Research elements

The analyses carried out within this paper permitted to address the target of mapping livestock investments and livestock development strategies of the last decade, and connecting them to sustainable outcomes.

Indeed, notwithstanding the intrinsic difficulties linked with the data reliability for the livestock sector and its risks (please refer to chapter 1), this paper gives an answer to each Research element presented within chapter 1.1.

In particular, the following **main general findings** can be drawn for the last decade:

1) Regarding livestock sector **trade** trends, two main findings can be inferred:

   - The overall trade for meat and products of animal origin recorded significant growth rates during the period considered and meat trend seems to be totally aligned with general world trade, representing about 2% of word flows;
   - The trade of live animals, on the contrary, recorded a sharp reduction for the period 2001-2011, with decreasing growth p.a. starting from 2006-2007.

2) In relation to livestock sector **production** trend, two main findings can be inferred:

   - GDP (positive or negative) growth rate p.a. only partially influences livestock production and food production, which continued to grow even immediately after the 2009 crisis;
   - There is a close relationship between world livestock production and population growth, which show similar trends and variation ranges in the period considered.

3) Regarding the analysis of **live animals stock** according to geographical areas and the analysis of **livestock production value**, four main findings can be inferred:

   - The world stocks of live animals have increased during the period 2001-2011 (overall CAGR 3%) and significant growth rates are recorded for poultry birds stock (CAGR 3.3%), with particular peaks for India, Africa, Brazil, China and Asia without India & China;
   - Live animals stock trends for Europe, Northern America and Australia & New Zealand are flat (Poultry) or even negative (e.g. CAGR -3.5% for sheep and goats for Australia & New Zealand);
   - Asia has gained significant world market shares both in the world composition of livestock production value (even +13% of world market share from 2001 to 2011) and in the total value of agricultural production (+3% of world market share from 2001 to 2011), while Europe and Northern America have lost market shares in the livestock production values from 2001 to 2011;
   - The analysis of live animals stock density shows that the poultry sub-sector recorded higher density rates during the period 2001-2011 with respect to other sub-sector (average world density rate for poultry sub-sector is about 4 No/Ha) and Indian density rates are consistent higher than other geographical areas for cattle and buffaloes and sheep and goats.

The analysis of **livestock specific sub-sector** for the last decade (chapter 2.3) also defined very interesting finding:

1) Regarding **Coarse grain and soybeans**, two main findings can be inferred:

   - China, notwithstanding a very negative trend for seed, recorded a significant increase in production of coarse grain (CAGR 4.8%), second only to South America without Brazil (CAGR 5.2%);
   - On the contrary, European position regarding coarse grain has worsened, due to very low increase in production (CAGR 0.5%), significant reduction in seeds (CAGR - 1.7%), only partially counterbalanced by increasing yield trend (CAGR 1.8%);
   - China's soybeans production trend recorded a small decrease during the period 2001 - 2011, with positive and negative peaks along the way. On the contrary, European production trend is remarkably increasing, bringing Europe to produce about 6 million of soybeans tons in 2011.

2) In relation to **Bovine Meat sub-sector**, the analysis of bovine meat production, consumption and trade trends allows formulating the following findings:

   - Bovine meat sub-sector recorded slight positive trends in the period 2001-2011, with moderate trends for production (CAGR 1%), domestic supply (CAGR 1%), world import (CAGR 3%) and world export (CAGR 4%);
   - Northern America is leaving the international market while China do not participated in it, with very low values of import and export (respectively 5.9% and 2% of China's production in 2011), notwithstanding increasing domestic supply and production.
   - Brazil, South America without Brazil and Australia & New Zealand are net earners from the bovine meat trade, while Europe and Asia without China and India recorded negative earnings from trade in the period 2001-2011.

3) In relation to **Poultry Eggs sub-sector**, analysis of eggs production, consumption and trade trends allows formulating the following findings:

   - China recorded the higher production and domestic supply during the period (in 2011, Chinese domestic supply is 28.5 million of tons and eggs production recorded a similar tonnage); in 2011, Chinese production of eggs represents 40% of world production in terms of tons (amounting to 70.7 million of tons);
   - Poultry eggs sub-sector generally shows a low trade openness degree and, in 2011, world import (2.2 million of tons) is 3.1 % of world production (70.7 million of tons); China is even absent from international transactions with very low values of import and export (both only 0.4% of China's production in 2011).
   - Europe and Asia without China & India are important players with the first recording a very positive earning of 0.2 billion of US $ in 2011 and the latter meanwhile having a trade loss of about 0.13 billion of US $.

4) In relation to **Poultry Meat sub-sector** the analysis of poultry meat production, consumption and trade trends allows formulating the following findings:

   - Northern America, Asia without India & China, Europe, China and Brazil are the geographical areas with higher production during the period (in 2011, production is 21 million of tons for Northern America, 16.2 million of tons for Asia without India & China, and less than 18 million of tons for China, Brazil and Europe);
   - Asia without India & China surpassed the Northern America for the domestic supplied tonnage of poultry meat in 2010, and recorded 19.2 million of tons domestically supplied in 2011, becoming the top domestic supplier before Northern America and China;

- Asia without India & China is a net importer of poultry meat (share in world import composition of 30% in terms of US $ in 2010; i.e. about 7.7 billion of US $), while Brazil is a net exporter and its net earning from trade is 6.6 billion of US $ in 2010.

5) Regarding **Pig Meat**, the analysis of pig meat production, consumption and trade trends allows defining the following findings:

- China recorded the higher production and domestic supply during the period (in 2011, Chinese domestic supply is 50.3 million of tons and production recorded a similar tonnage); in 2011, Chinese production of pig meat represents 50% of world production in terms of tons (amounting to 107.9 million of tons);
- Despite pig meat sub-sector generally shows an average trade openness degree and, in 2011, world import (14.4 million of tons) is 13.7 % of world production (107.9 million of tons), China is even absent from international transactions with very low values of import and export (import is only 2.8% of China's production in 2011).
- Europe, Northern America and Asia without China & India are important players with the first two recording positive earning from trade and the last being a net importer of pig meat (about 2 million of tons imported in 2011).

6) Regarding **Dairy products**, investigated with the proxy of milk products, the analysis of dairy product production, consumption and trade trends (approximated with the proxy of milk) allows defining the following findings:

- Northern America and Europe are the geographical areas with higher production and domestic supply during the period (in 2011, domestic supply is about 100 million of tons for Northern America and about 205 million of tons for Europe);
- India is by far the larger country player within the sub-sector, with a production of 123 million of tons in 2011 and a similar domestic supply; Indian trends for production and domestic supply are also increasing more than world average (CAGRs are 4% both for production domestic supply).
- China is not a very important producer within milk sub-sector (2011 production is 41.8 million of tons), and Brazil, Africa, South America without Brazil and Asia without China & India recorded similar or higher productions in 2011;
- Europe is the main player within international milk market, with 16.9 million of tons exported in 2011 (and 12.2 million of tons imported) amounting to 50% of world export.

Regarding the **definition of private investments in the last decade**, from the analysis of private investments in the livestock sector, realized by means of the identification of top 100 firms active in the livestock sector in terms of 2013 sales and by undertaking a detailed balance sheets analysis for a selected sample of 27 companies, three main findings can be inferred:

- China is simultaneously the country hosting the bigger number of corporations (23, refer to Table 11) and recording the higher overall sales for 2013 (about 16 billion of US $, please refer to Figure 32) while other countries, such as New Zealand, Mexico, Thailand, France and Japan record lower sales; USA is represented with only one firm in the top 100 ranking in terms of 2013 corporate sales;
- No particular new products have been discovered by international corporations in the past 5-10 years and the composition of 2013 sales according to livestock product type sees feed, seafood, poultry and dairy products as the top contributor to 2013 sales (with respective market shares of 31%, 25%, 19% and 11%);
- Differently from products commercialized, the analysis of subsidiaries shows that international corporations are discovering new markets and leaving others; countries such as

Denmark, El Salvador, Japan, Korea, Namibia, Nigeria, Norway, Peru, Russia, UAE and Vietnam have been "attacked" by international corporations, that constituted (or bought) new subsidiaries within these countries.

The analysis of **other investments** in the livestock sector for the last decade mainly permits to formulate the following findings:

1) In relation to the analysis of **livestock cooperation projects** for a selection of multilateral donors, three main findings can be inferred:

   - Livestock financing trend by multilateral donors has not been constant during the period 2001-2011, with peaks and drops in different years.
   - China is the top receivers of financing for the livestock sector for the period, with huge projects financed by the World Bank - IBRD;
   - The rest of developing countries financed by multilateral donors are located in Africa and Central Asia.

2) From the analysis of **CDM projects** in the field of livestock emission reduction, two main findings can be inferred:

   - Brazil, China and Mexico are the top 3 hosting countries in terms of emission reductions in the livestock sector, with reductions collectively amounting to 68% of all livestock reduction in the period 2007-2013 (i.e. about 2 million of metric tonnes of CO2 equivalent p.a.);
   - Portugal, Switzerland and UK are the top 3 partner countries in terms of emission reductions. Portugal, in particular, has several CDM projects in partnership with Brazil.

Regarding **livestock investment strategies** and drivers of the past 10 years, chapter 5 gives a detailed holistic approach recent investment strategies in the sector (both public and private strategies), setting the main National goals and policy agenda for public sector and the main driver of the private sector (i.e. intensification, industrialization and mechanization of the production). In addition, livestock policies according to supply chain phase have been presented (Figure 47) as well as specific examples of investment in livestock sector.

chapter 6 amply deal with the **Desirable outcomes** connected with the livestock sector good management and policy, showing the casual effects to be determined for the evaluation of livestock outcomes, and identifying a list of main desirable outcomes (i.e. Equity and growth, Resources and Climate change, Food Security and health).

The following paragraphs intend to show the policy recommendations deriving from this intensive data and policy analyses, presenting the lessons learnt and Entry points to support decision making, together with the better chievement of desirable outcomes.

7.2. Policy recommendations

Lessons learnt

The livestock sector is characterized by a certain number of specificities, that make quantitative and qualitative analysis of sector investments more complex that a similar analysis for other agricultural sector, and by the existence of particular "megatrends" (World Bank, 2012), which are mainly based on

increasing demand (deriving by a similar increase in population growth), faster growth in the pig and poultry sector (especially in Asia) and interconnection with safety and food security issues.

This megatrends are bringing significant structural changes in the livestock sector and "traditional" supply chains and production methods are slightly moving towards an increased importance of private operators, mainly oriented to industrialization, mechanization and scaling-up.

Within this framework, public (national and international) policies have the very important role to foster production and to limit it according to the exigencies of every country. For example, Chinese Government, which is a very important player in each livestock sub-sector analysed (i.e. bovine meat, poultry meat, poultry eggs, pig meat and dairy products) decided to have a quasi-autarchic approach for some markets (e.g. bovine meat) and to strongly focus on internal production for poultry meat and pig meat sub-sectors, making China to produce 50% of world pig meat production in 2011.

> *In the global industrial meat complex, long supply chains, including feed production, genetics and breeding, span the globe and blur national identity.*
>
> *The Need for Feed:*
> *China's Demand for Industrialized Meat and Its Impacts*
> *Sharma S., 2014*

Additionally, the analysis of global investments in the livestock sector in terms of production/consumption trends (FAOSTAT), commercial trends (UN Comtrade and WDI), private corporations and other projects (multilateral project and CDM projects), shows that China is an impressive player for all kind of investments involving the flow of financial transactions, the trade of semi-finished and finished products and/or live animal stock variations.

Together with China, other areas such as India, Brazil, South America without Brazil, Asia without China & India and Africa are emerging both in terms of domestic supply and production, while Europe, Northern America and Australia & New Zealand, which are very important players in some markets, have recorded lower growth rates during the period 2001-2011.

Additionally, emerging economies are more and more trading with each other, and, for example, Brazil and China show impressive complementarities in trade (e.g. China is often the final destination for a certain type of Brazilian product and vice versa).

Within this framework of increasing world population (demand of animal products) and structural changes in the livestock sector, the role of public policies is very important in order to create a coherent and sustainable legal and regulatory framework for the support (or the limitation) of private operators.

Entry points to support decision making

The analysis of public policies for the livestock sector according to supply chain phase shows that fiscal policies and trade supports are very important both for small operators & cooperatives and large corporations, allowing them to cut costs and capital expenditures, and significantly increasing their access to the market (Brazil is a good example of these measures).

Consequently, fiscal measures and tax reduction are very important tools that public institutions can use for the support of every phase of the livestock supply chain, and, from a fiscal point of view, fiscal measures constitute strategic entry points for supporting decision making along the entire supply chain.

For example, a fiscal measure reducing VAT for new slathering machinery acquisition is a strategic entry point for the processing phase (please refer to Figure 48) while another policy reducing taxes to veterinary operators is a tactical entry point for supporting the chain phase regarding live animals.

Together with fiscal support and tax reduction, the creation of agricredit financing schemes and financial products, controlled by the Government and targeting livestock small scale producers and cooperatives, is a very important entry point for ensuring that the entire population of livestock operators, including small size micro enterprises of even one-animal operators (Waheed S., 2013), have access to financial support.

Agricredit policies, which must be studied on case-by-case basis in a way not to alter social, rural and land equilibriums, can substantially help small livestock operators to reduce initial capital allowances for start their business or to modernize it. Entry points for agricredit policies shall be collocated at the beginning of each livestock supply chain phase (please refer to Figure 54) in order to be more effective.

Moreover, public policies aimed at attracting foreign investments in the livestock sector are very important entry points in order to enlarge the market dimension of national production and to increase financial liquidity in the country. However, in order to make sure that foreign capitals effectively contribute to national development, the national Government has to create an institutional framework able to co-ordinate this financial flow, for example imposing the use of local workers as prerequisite for tax reduction or in order to limit foreign control of local firms.

Furthermore, public policies targeting animal health and veterinary standards are very powerful entry points (covering the first part of the livestock supply chain) able to influence the increase of standards and controls for animal health and nutrition and to help the provision of better veterinary care.

For example, the establishment of free public veterinary centres in rural areas could help to increase the frequency of animal monitoring and to prevent the risk of diseases (for example in Kenya the Government evaluated the creation of a system for examination and certification of livestock for export, ReSAKSS 2008).

In addition to tactical entry points to support decision making according to supply chain phase, strategic entry points can be also defined in terms of actors involved in the investment. In this respect, Private-Public-Partnerships (PPP) can play a "key role in strengthening links within the supply chain, particularly where market failures impede access by the poor [or] small scale producers, often left out of the process, due to their low productive capacity, remote location, and limited competitiveness with larger growers" (Rich. K.M., Narrod C.A., 2010) and PPP schemes are adequate entry points to support decision making within every phase of the supply chains.

For example, as described in paragraph 6.2, India tested a PPP structure in the milk supply chain that was able to increase milk quality and augment the revenues of "traditional" milk supplier, bringing them out of the poverty circle.

> *Because of unsecured or unrecognized property rights over land, houses and other fixed and movable goods, the poor cannot use their assets as collateral to obtain credit and invest in growth-enhancing technologies and enterprises.*
>
> *Livestock Sector Development for Poverty Reduction*
> *FAO, 2012*

As amply described in the paragraph 5.2.1, the effectiveness of national Government and the creation of a coherent institutional framework are very important pre-requisite for the establishment of effective measures in the livestock sector. A consistent communication strategy

and a general support to practical implementation of national policies are very important entry points too. As a matter of fact, indeed, it is essential that national policies, tools and decisions are able to reach (in terms of communication and capacity building) their respective addressees in rural community and within traditional agripastoral systems.

> *Will countries such as China, Brazil and India continue down the same path of the U.S. on industrializing their meat production? Or, is a different path possible?*
>
> *The Need for Feed:*
> *China's Demand for Industrialized Meat and Its Impacts*
> *Sharma S., 2014*

All this entry points and strategies, directly derived from livestock public policies already described in paragraph 5.3, if correctly implemented and monitored, are aimed at ensuring the alignment of the livestock sector to sustainability outcomes, as described in the following item.

Achievement of desirable outcomes

According H. Steinfeld and S. Mack (2012), in order to be sustainable, livestock development strategies shall have the target to:

- conserve the natural resource base;
- raise productivity through better utilization of available resources: capital (animals), land and labour;
- expand production where there is a sufficient demand and resources can be utilized at reasonable cost to the environment;
- optimize the allocation of development resources through rational administration and management.

Accordingly, the public policies identified within this paper (paragraph 5.2.1) and the related entry points underlined according to livestock supply chain phase contribute to the objects of natural resource conservation, better utilization and allocation of resources and cost optimization.

Moreover, as describe in this paper (please refer to paragraphs 6.1 - 6.4), the livestock sector can significantly contribute to many outcomes that are desirable from a social point of view such as equity, development, growth, woman empowerment, poverty reduction, emission mitigation, food security, animal welfare and health.

Furthermore, the importance of creating a regulatory framework for private strategies and operators, that has been stated several times within this paper (please refer to paragraphs 3 and 5.2.2), is essential for the achievement of the desirable outcomes described above on a country level.

Consequently, the national Government shall give the support (or even to impose) firm-based virtuous policies and strategies, in order to avoid negative phenomena such as massive low quality production, animal diseases, food scandals and excessive productivity rates, which are unfortunately characterizing the livestock industrial sector of some countries.

8. Bibliography

Books, essays and articles

1. Ayele S., Duncan A., Larbi A., Tan Khanh T., 2012. Enhancing innovation in livestock value chains through networks: Lessons from fodder innovation case studies in developing countries; Oxford University Press.
2. Ayre-Smith R. A., 1971. Principles for increasing the efficiency of livestock production in a developing country; Trop. Animal Health.
3. Delgado C., Rosengrant M., Steinfeld H., Ehui S., C. Courbois, 1999. Livestock to 2020. The Next Food Revolution; Food, Agriculture and the Environment Discussion Paper 28, IFPRI, Washington D.C. .
4. Dries L., Gorton M., Urutyan V, White J., 2014. Supply chain relationships, supplier support programs and stimulating on farm investment: evidence from the Armenian dairy sector; International Journal 19 (2014) 1. - ISSN 1359-8546 - p. 98 - 107.
5. Gunderson R., 2011. The Metabolic Rifts of Livestock Agribusiness; SAGE Publishing, Organization & Environment 24(4) 404- 422.
6. Gura S., 2007. Livestock Genetics Companies, Concentration and proprietary strategies of an emerging power in the global food economy; League for Pastoral Peoples and Endogenous Livestock Development, Ober-Ramstadt, Germany.
7. Hurley R., 1957. Livestock data problems in the Census of Agriculture; Journal of Farm Economics, 39: 1420-1426.
8. Leroy J. L., Nicholson C. F., Demment M. W., Schelling E., Randolph T. F., Pomeroy A. M., Frongillo E. A., 2007. Can livestock production ameliorate undernutrition? Draft report; International Livestock Research Institute (ILRI), Nairobi.
9. Ly C., U. Pica-Ciamarra, J. Otte, 2010. A Dual-track Approach to Livestock Development. Economic Rationales and Institutional Bottlenecks in West Africa; Paper presented at the 'Réseau de Prévention des Crises Alimentaires', 26th Meeting on Livestock Breeding and Food Security, Accra, Ghana, December.
10. Meltzer M. I., 1995. Livestock in Africa: The economics of ownership and production, and the potential for improvement; Agriculture and Human Values Volume 12, Issue 2, page 4-18.
11. Narrod C. A., Fuglie K. O., 2000. Private Investment in Livestock Breeding with Implications for Public Research Policy; Agribusiness, Vol. 16, No. 4, 457-470.
12. Nouala S., Pica-Ciamarra U., Otte J., N'guetta A., 2011. Investing in Livestock to Drive Economic Growth in Africa: Rationales and Priorities. A Live Policy Note; Nairobi.
13. Otte J., Roland-Holst D., Pfeiffer D., Soares-Magalhaes R., Rushton J., Graham J., Silbergeld E., 2007. Industrial Livestock Production and Global Health Risks; Pro-Poor Livestock Policy Initiative.
14. Pica-Ciamarra U., Otte J., 2010. The Livestock Revolution: Rhetoric and Reality; Outlook on Agriculture, 40(1): 7-19.
15. Rich K. M., Narrod C. A., 2010. The Role of Public-Private Partnerships in Promoting Smallholder Access to Livestock Markets in Developing Countries; IFPRI Discussion Paper.
16. Steinfeld H., Mack S., 2012. Livestock development strategies; FAO, Rome.
17. Waheed S., 2013. Return on investment from livestock micro-enterprise in rural areas of Punjab (Pakistan); Herald Journal of Agriculture and Food Science Research Vol. 2 (6), pp. 185 - 193 December, 2013.

Paper of national (or regional) authorities and organisations

18. African Development Fund, 2005. Agriculture and Rural Sector Review, Republic of Uganda; Abidjan.
19. Agriterra, August 2012. Identification of livestock investment opportunities in Uganda. A study undertaken with financial support of the Embassy of the Kingdom of the Netherlands in Uganda.
20. Ashley S., Nanyeenya W., 2002. More than income: Pro-poor livestock development policy in Uganda; LADDER paper. London, Department for International Development.
21. ReSAKSS (The Regional Strategic Analysis and Knowledge Support System) Paper No. 12, 2008. Investment Opportunities for Livestock in the North Eastern Province of Kenya: A Synthesis of Existing Knowledge.
22. Tanzanian Government, Ministry of livestock and fisheries development, 2011. Investment opportunities in livestock industry; Dodoma.
23. Tanzanian Government, Support To NEPAD-CAADP Implementation, 2005. Volume IV of VII: Bankable Investment Profile, Crop and Livestock Private Sector Development (Mainland), Dodoma.

Paper of international authorities and organisations

24. FAO, 2005. Livestock Sector Brief, Peru; Livestock Information, Sector Analysis and Policy Branch, FAO, Rome.
25. FAO, 2006. The State of food insecurity in the world; FAO, Rome.

26. FAO, 2011 (a). Paper: Mapping Supply and Demand for Animal-Source Foods to 2030; FAO, Rome.
27. FAO, 2011 (b). Paper: Wealth Index Mapping in The Horn of Africa; FAO, Rome.
28. FAO, 2012 (b). Livestock Sector Development for Poverty Reduction: An Economic and Policy Perspective. Livestock's Many Virtues; FAO, Rome.
29. FAO, 2012 (c). Pro-Poor Livestock Policy Initiative, Livestock sector development for poverty reduction: an economic and policy perspective Livestock's many virtues; by J. Otte, A. Costales, J. Dijkman, U. Pica-Ciamarra, T. Robinson, V. Ahuja, C. Ly and D. Roland-Holst; FAO, Rome.
30. FAO, 2013. Tackling Climate Change through Livestock. A Global assessment of emissions and mitigations opportunities; FAO, Rome.
31. FAO, ILRI, 2011. Global livestock production systems; FAO, Rome.
32. FAO, The World Bank, 2011. Global Strategy to Improve Agricultural and Rural Statistics; World Bank, Washington.
33. Global Agenda of Action in support of sustainable livestock sector development. Retrievable at www.livestockdialogue.org.
34. IFAD, 2010. Investment Opportunities in the Dairy sub-sector of Rwanda; by Innocent Rutamu.
35. ILRI, 2009. Targeting strategic investment in livestock development as a vehicle for rural livelihoods; Nairobi.
36. UNFCCC, 2013. CDM Methodology Booklet, fifth edition; Bonn, Germany.
37. World Bank, 2012. Identifying investment opportunities for ruminant livestock feeding in developing countries; by Agriculture and Environmental Services, Washington.
38. World Bank, FAO, ILRI, AU-IBAR, 2013. Investing in African Livestock: business opportunities in 2030-2050; Washington.
39. World Bank, FAO, ILRI, AU-IBAR, 2014. Investing In The Livestock Sector: Why Good Numbers Matter. A Sourcebook for decision makers on how to improve livestock data, by Ugo Pica-Ciamarra, Derek Baker, Nancy Morgan, Alberto Zezza, Carlo Azzarri, Cheikh Ly, Longin Nsiima, Simplice Nouala, Patrick Okello, Joseph Sserugga.
40. World Bank, FAO, ILRI, AU-IBAR, Issue 11. 2010-2013. Livestock Indicators for Effective Investments in Developing Countries; by Nancy Morgan, FAO-World Bank, Derek Baker, ILRI, Ugo Pica-Ciamarra, FAO.
41. World Bank, FAO, ILRI, AU-IBAR, Issue 20. 2010-2013. Brief of Livestock Data Innovation in Africa: Uganda: Identifying and Producing Core Livestock Indicators; by Joseph Sserugga, MAAIF, Patrick Okello, UBOS, Ugo Pica-Ciamarra, FAO.
42. World Bank, FAO, ILRI, AU-IBAR, Issue 21. 2010-2013. Brief of Livestock Data Innovation in Africa: Livestock and Livelihoods in Tanzania: Can the Sector Deliver on Growth and Poverty Reduction?; by Nancy Morgan, World Bank, Ugo Pica-Ciamarra, FAO.
43. World Bank, FAO, ILRI, AU-IBAR, Issue 23. 2010-2013. Brief of Livestock Data Innovation in Africa: A Critical Indicator: Livestock's Contribution to Gross Domestic Product; by Alberto Zezza, World Bank, Longin Nsiima, Tanzania Ministry of Livestock and Fishery.

Internet resources and databases

44. UN Comtrade: http://unstats.un.org/unsd/trade/
45. FAOSTAT: http://faostat.fao.org/
46. WDI: http://data.worldbank.org/data-catalog/world-development-indicators
47. Private Corporations: http://new.dowjones.com/factiva/
48. AidData: http://AidData.org/
49. CDM: http://cdm.unfccc.int/

GENERAL CONCLUSION TO THE THREE ESSAYS

Interesting results emerge from the exercise of quantifying and determining the actual amount of financing flows for environmental projects across the world and across the years.

With regard to the first essay, the review of Literature retrieved shows that previous Scholars systematically failed in correctly estimating the actual amount of green financing, mainly due to the use of incomplete/partial data, and that a general lack of quantitative indicators exists. Similarly, the Literature concerning ODA Flows does not deal with green sectors alone, but it generally considers all sectors as a whole, defining no causal relations specifically using green Aid as dependent (or independent) variable.

Regarding renewable energy projects (essay 2), the findings retrieved permit to assess that the introduction of CDM projects (and Kyoto's Protocol) brought positive effects in the field of renewable projects for the period 2005-2012. Indeed, CDM projects were much less volatile, had much lower average cost ratio and definitely appeared more energy efficient with respect to similar ODA projects.

From an econometric perspective, the regression results confirm the fact that the introduction of the Kyoto protocol has a very positive impact on the energy efficiency of renewable energy projects. Indeed, the dummy for CDM projects (β_3) shows a negative and statistically significant coefficient, contributing in reducing the dependent energy cost ratio (r_i).

The results of the DD Model applied show that the impact of Phase II is positive in terms of cost ratio reduction, but the DD coefficient is not statistically significant, implying that additional research is needed in this field.

Concerning the green financing for the livestock sector (essay 3), the main quantitative findings of the essay reveal that the overall trade for meat and products of animal origin recorded significant growth rates during the period considered (2001 – 2010) and that meat trend seems to be totally aligned with general world trade. Yet, new players (with new strategies) are emerging for each livestock sub-sectors (such as China, Asia without India & China) while others are leaving world market shares.

Regarding private investments, China is simultaneously the country hosting the bigger number of corporations and recording the higher overall livestock-product sales for 2013. The analysis of other investments shows that Livestock financing trend by multilateral Donors has not been constant during the period 2001-2011, while CDM livestock projects are mainly hosted by Brazil, China and Mexico.

The specific policy recommendations deriving from a global interpretation of the three essays permit to conclude that:

- In the global context of financing environmental protection, Kyoto system has an important role to play, especially for the future generations and "Ecological debt" shall find a place within future world negotiations on climate change and debt relief. More important, these two paramount themes shall be treated simultaneously by the International Community in order to put on the same

balance past, current and future credits and liabilities own both by developing countries and by developed ones.

- The reform of International Institutions towards a greater importance given to the protection of the environment (the so-called "Greening of Institutions") is another very important theme for any future policy structure aimed at increasing environmental protection worldwide.
- The interaction between ODA, CDM and EU ETS systems is very complex and the need to increase the Literature on this regard definitely arise.
- It is evident that EU ETS is going much faster in terms of market attitude than other similar Carbon markets and maybe even faster than Kyoto Protocol itself. Accordingly, a better coordination shall be enhanced between ODA, CDM and EU ETS systems, in order to avoid misalignment in terms of market attitude.
- Furthermore, the importance of no-market Carbon Funds for poor countries is vital for both ODA and Kyoto institutional systems and there is an urgent need to find consensus on the International Community with respect to the market orientation of post-Kyoto carbon markets and their accessibility for Developing and Poor countries.