

**Food and Agriculture Organization of the United Nations
Policy Assistance Support Service (TCSP)**

Public Policies and Agricultural Investment in Brazil.

(Final Report)

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Abbreviations and acronyms

ABC	Low Carbon Agriculture Program
ABCAR	Brazilian Association of Credit and Rural Assistance
ACAR	Credit and Rural Assistance Associations
AGF	Acquisition by the Federal Government
ANFAVEA	National Association of Automobile Manufacturers
APEX	Brazilian Agency for Export and Investment Promotion
BCB	Brazilian Central Bank
BFS	Brazilian Forest Service
BNDES	Brazilian Development Bank
CCR	Rural Credit Note
CDA	Agricultural Certificate of Deposit
CDCA	Certificate of Agribusiness Credit Rights
CIBRAZEM	Brazilian Storage Company
CNT	National Transportation Confederation
CONAB	National Supply Company
COV	Sales Option Contract
CRA	Certificate of Agribusiness Receivable
ECLAC	UN Economic Commission for Latin America
EGF	Federal Government Loan
EMATER	Technical Assistance and Agricultural Extension Enterprises
EMBRAPA	Brazilian Agricultural Research Corporation
EMBRATER	Brazilian Enterprise of Technical Assistance and Rural Extension
ERR	Expected rate of return
EU	European Union
FAO	United Nations Food and Agriculture Organization
FDI	Foreign Direct Investment
FIAS	Foreign Investment Advisory Service
FINAME	Special Agency for Industrial Financing, a branch of BNDES
FVL	Forest Vocation Land
GCF	Gross Capital Formation
GDP	Gross Domestic Product
Geoeconomica	Brasilia Geo-economic Region Development Special Program
GoB	Government of Brazil
IBGE	Brazilian Institute for Geography and Statistics
IBRD	International Bank for Reconstruction and Development
IDB	Inter-American Development Bank
IFAD	International Fund for Agriculture Development
IFC	International Finance Corporation
IGP	General Price Index
IICA	Inter-American Institute for Cooperation on Agriculture
ILO	International Labor Organization
IMF	International Monetary Fund
IPEA	Institute for Applied Economic Research
ISI	Import Substitution Industrialization
LAC	Latin America and the Caribbean
LCA	Agribusiness Credit Note
LICUS	Low Income Country Under Stress
MAPA	Ministry of Agriculture, Livestock and Food Supply
MDA	Ministry of Agrarian Development
MDG	Millennium Development Goals
MERCOSUL	South Common Market
MIGA	Multilateral Investment Guarantee Agency
MMA	Ministry of Environment of Brazil

MODERAGRO	Program for the Modernization of Agriculture and Conservation of Natural Resources
MODERFROTA	Modernization Program of the National Fleet of Tractors, Combines and Farm Machinery
MODERINFRA	Incentive Program for Irrigation and Storage
nFVL	Non forest Vocation Land
NPR	Rural Promissory Note
OECD	Organization for Economic Co-operation and Development
PAA	Food Acquisition Program
PAC	Growth Acceleration Program
PEPRO	Equalizing Premium Paid to Producer
PGPM	Guaranteed Minimum Price Policy
PNDA	National Household Survey
PNRA	National Agrarian Reform Plan
POLOAMAZONIA	Agriculture and Mineral Poles Program for Amazonia
POLOCENTRO	Cerrados' Development Program
POLONOROESTE	Brazil's Northwest Integrated Development Program
PROAGRO	Guarantee Program of Agricultural Activities
PROALCOOL	National Alcohol Program
PRODECER	Cooperation Program Japan-Brazil for the Development of the Savannahs
PRODEGRAN	Grande Dourados Development Special Program
PRODEPAN	Pantanal Development Special Program
PRODUSA	Program for Fostering Sustainable Farming
PROGER	Income Generation Program
PROMECIF	Forestry Investment Business Climate Improvement Process
PRONAF	National Program for the Strengthening of Family Agriculture
PRONATER	National Technical Assistance and Rural Extension Program for Family Farming and Land Reform
PROP	Private Sale Option Contracts
R&D	Research and Development
SEAF	Family Farming Insurance
SNCR	National Rural Credit System
SOE	State Owned Enterprise
TCS	FAO's Policy and Programme Support Division
TFP	Total Factor Productivity
TNC	Transnational Corporations
UFV	Federal University of Viçosa
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Program
USD	Dollars of the United States of America
USDA	United States Department of Agriculture
VEP	Premium for Transporting Agricultural Products
WB	The World Bank

Units.....

BRL*	Brazilian Real
CR\$*	<i>Cruzeiro</i>
CZ\$*	<i>Cruzado</i>
NCR\$*	New <i>Cruzeiro</i>
NCZ\$*	New <i>Cruzado</i>
URV	Unit of Real Value
USD	United States Dollars

*The different currencies and notes of Brazil and period of existence can be found at <http://www.bcb.gov.br/?CEDBRLISTA>

Executive Summary

- i. Ensuring food security has always been a top priority for governments, international organizations and societies in general. Recent developments have further increased the political, professional and public concern for this issue worldwide. In this regard, the literature has shown that several countries have made significant progress in terms of achieving food security and reducing poverty by rapidly expanding agricultural production and productivity through increased investment in this sector. Therefore, in-depth analyses of these experiences offer some opportunities to learn about what constitute successful practices from the past to guide current and future agricultural policy.
- ii. Brazil is one of the world's most dynamic rising agricultural producers, boasting astonishing growth in the 1970-2000 period. Once a food importing country, Brazil rapidly became a world agricultural power. It is globally important for both food security and environmental sustainability. It is the largest exporter of coffee, beef, broiler, orange juice, sugar, ethanol and soybeans in the world and it is among the three main foreign sellers of corn, cotton, bananas and pork. Moreover, it provides vital environmental services to the world and has a large number of farmers with strong entrepreneurship capacity. The country is also notable for having a strong agricultural research capacity, using top level technologies and showing a rich agricultural development experience, which could be of value for other countries.
- iii. Given the above elements, the overall purposes of this study are twofold: first, to review Brazil's experience in terms of how its policy framework contributed to a favorable environment for agriculture investment by farmers in the 1960-2010 period; and second, to identify the lessons learned from this process. More specifically, it addresses the following questions: how different public policies can influence farmers' investment in agriculture? Which were the main elements of the policy framework adopted by Brazil during the 1960-2010 period to promote agricultural investment and increased production? How was agricultural investment financed? What types of financial instruments were used to finance farmers' investments in agriculture? Which were the main results and limitations of the adopted policy frameworks? What lessons can be learned from this experience?
- iv. In order to pursue the above-mentioned objectives the study is organized in six chapters in addition to the introduction. Chapter two presents the framework of analysis used to examine the links between public policies and agricultural investment by farmers. Given this framework of analysis, chapter three reviews the set of policies adopted by Brazil during different periods (i.e. import-substitution industrialization, 1960-1980; transition decades 1980s and 1990s; and economic stability and growth, 2000-2010) and shows how it influenced agricultural investment.

- v. Taking as a reference the elements presented in Chapter three, the next chapter examines the impact of the policy sets followed by the government on the trend of agricultural investments made by farmers. Chapter five further illustrates the relationship between public policies and agricultural investment in Brazil by highlighting the influence of these policies on farmer's decision to investment in agricultural activities in the savannah region of the country. Following the analysis carried out in these chapters, the implications of the adopted policy frameworks to agricultural performance, food security and poverty alleviation are addressed in chapter six. Finally, chapter seven summarizes the main lessons learned from public policies and increased agricultural investment by farmers in Brazil.
- vi. According to the literature, investment is generally defined as changes in capital stock. Capital, in turn, refers to physical items such as machinery, buildings, storage facilities, livestock, fertilizers, pesticides and high-yielding varieties that are not used up in the production of a product. This set of physical items with this characteristic is known as fixed or physical capital. Therefore, investment can be understood as expenditure on fixed assets (physical capital) in order to produce goods for future consumption.
- vii. In addition to the above, there are other types of capital such as human, social, knowledge, and institutional capital. They are all important to economic growth and development. However, considering these different types of capital would involve an analytical effort which goes beyond the scope of this study. Thus, the focus of the discussions is on farmers' investment in physical capital. Notwithstanding this aspect, attention is given also to policy measures like investment in agricultural research and provision of extension services, which contribute to enhance farmers' skills, induce technological innovations, and improve labor productivity.
- viii. The main lessons which emerge from Brazil's experience in terms implementing a policy framework which has contributed to creating a favorable environment for farmers' investment in agriculture are neither a panacea nor best practices to follow blindly. However, their positive and negative aspects provide some elements which could be useful to policy makers in some countries. These lessons are as follows.
- ix. The modernization of Brazilian agriculture was a relatively fast and successful process. Within approximately 35 years (1965-2000), the country changed its condition of food importer to a major world producer and exporter of agricultural and agro-energy products. The development of the sector contributed significantly to enhance the national food security and to reduce poverty. The process is also notable for placing Brazil in a global leading position in terms of technology generation for tropical agriculture. However, besides the positive aspects there were also some negative ones. For instance, the approach followed resulted in

- major concentrations of agricultural production in the group of large producers as well as in the South, Southeast, and Center-West regions of the country. In addition, until the mid-1990s little attention was given to integrate small farm holders into the economy.
- x. Several factors contributed to the above results, for instance, the entrepreneurship capacity of farmers, investments in agricultural research and the implementation of public policies, which established a favorable environment for farmers' investment in agriculture.
 - xi. Given the low development level of agriculture in the early 1960s, the path followed by Brazil to modernize the sector consisted of a two stage policy approach. First, to kick start the process by focusing the policy measures on three major elements: establishment of an agricultural credit system, which provided large amounts of subsidized credit to domestic producers, particularly to those with higher capacity to respond to policy incentives, i.e. medium and large farmers; increased investment in agricultural research; and provision of agricultural extension and technical assistance service. The first and the third of these measures contributed to moving the sector from the interior of the production possibility frontier to its border. The investment in agricultural research takes some years to generate results; therefore, its function was to shift the production possibility frontier outwards. Those three policy measures were complemented with several others including public investments in road construction, electrification and education.
 - xii. The second stage of the policy approach consisted in taking the opportunity created by the macroeconomic crisis of the 1980s and 1990s and the strong pressure placed by the IMF and the World Bank to carry out a major policy reform which emphasized the role of market forces as the main mechanism for resource allocation. Therefore, starting in the 1980s, the intervention of the government in the sector followed a sharp downward trend including reducing substantially the previous role of major agricultural credit provider. In this context, the risk of public intervention crowd out private sector development was eliminated.
 - xiii. Only the first phase of the above-mentioned policy approach was planned by the Government. The second resulted from circumstances which emerged along the way such as the foreign debt crisis, oil price shock, low economic growth and high inflation rates that required the adoption of strong economic measures to bring back the economy to its path and foster economic growth. Notwithstanding the unplanned nature of the second stage of the approach, the experience lived by Brazil suggests that, the two stage policy process summarized above with some adjustments, could be a reasonable alternative to consider for modernizing agriculture.

- xiv. Another element which comes out from Brazil's experience is that, the policies followed to modernize agriculture between 1960 and mid-1990s did not benefit small farmers as much as larger ones. The lesson learned from the above result is that, the intervention strategy for enhancing investment should include not only general policies which establish a favorable investment climate for medium and large farmers (i.e. for those which in general have a better comparative advantage to respond to the incentive structure) but also, specific measures aimed at promoting the development of low income farmers' groups with a potential to grow economically within the agricultural sector. The specific policies for this group of farmers could include financing mechanisms, insurance schemes, extension services, agricultural product acquisition programs specially designed for them.
- xv. A third lesson from Brazil's experience is the relevance of including special attention to investment in agricultural research early on in the enabling policy framework for increased farmers' investment in agriculture, and maintaining it as a priority measure throughout the years. The expansion of agricultural production and productivity requires, among other elements, the use of modern technologies and innovations which demands several years to be generated.
- xvi. In the case of Brazil, it was noticed that it was no longer possible to continue expanding agricultural production in the traditional areas of cultivation with the existing stock of technologies. It was necessary to incorporate new land into production. The alternative chosen was to explore the large areas of the "unproductive" savannah. This required a major boost in technology development. The Government faced the challenge of creating EMBRAPA and maintaining its strong support to the R&D activities of this institution until today.
- xvii. Another lesson from Brazil's experience is that the sophistication of the policy instruments used to build a positive environment for farmers' investment in agriculture should be incremental. Examining the policies followed by Brazil during the 1960-2010 period, it is observed that the Government relied initially on relatively simpler instruments like investing directly in the provision of key services such as credit, technical assistance and extension as well as in agricultural research. After some years, with the gradual development of the sector, it introduced more sophisticated policy instruments like Agricultural Certificate of Deposit, Agribusiness Credit Note, Rural Promissory Note, Certificate of Agribusiness Receivable, Certificate of Agribusiness Credit Rights and rural insurance scheme run by the private sector. The implementation of these types of financing and risk minimizing instruments require among other elements, the development of private rural insurance companies, the creation of a futures market, the establishment of an institutional arrangement to regulate the functioning of securities market and the existence of specific purpose societies that undertake securitization business.

- xviii. An additional lesson regarding the content of a policy framework aimed at creating an environment conducive for farmers' investment in agriculture is that it should involve a set of complementary policies which address key areas that influence the expected rate of return of investment. Thus, despite the importance of a single policy like public investment in agricultural research or the provision of agricultural credit, they should not be adopted in isolation.
- xix. The policy framework should be comprehensive and systemic in the sense of including policies which enables the establishment of attractive product prices by the market; contribute to reducing costs; facilitates the marketing, transport and storage of products by the private sector; and assist in the development of technical and managerial abilities of farmers and workers. The challenge is defining the extent of government intervention in the sector. In this regard several experiences have shown (including Brazil's) that, unless the circumstances require a specific and temporary policy support, the framework should not involve a strong government intervention in the sector. The policies should give priority to promoting private sector participation and the role of market forces as the main mechanism for resource allocation.
- xx. Further to the above elements, the Brazilian experience corroborates several lessons provided by various other countries; for instance, the relevance of a macroeconomic stability for a conducive policy environment to increased investment and economic growth. As highlighted earlier, in the late 1980s the Government adopted a wide range of reforms including macroeconomic stabilization, structural reforms and trade liberalization. Macroeconomic stability was achieved in the mid-1990s. It benefited agriculture as well as the other sectors of the economy by providing a more stable investment climate and stimulating economic growth.
- xxi. Another lesson corroborated by Brazil's experience concerns the importance of farmers' human capital to maximize their resource endowment, the opportunities created by the national policy framework and hence, to modernize agriculture and to expand its production and productivity. In the case of Brazil, the relevance of this human capital factor to increased investment in agriculture was demonstrated by the abilities and performance of a relatively large group of farmers from the State of Rio Grande do Sul known as *gauchos*.
- xxii. In sum, these are the main lessons which emerge from Brazil's experience in terms of implementing a policy framework that has contributed to creating a favorable environment for farmers' investment in agriculture. Recognizing that there are no blueprints neither "one size fits all", perhaps some of them could be useful for other countries.

I. Introduction

1. Ensuring food security has always been a top priority for governments, international organizations and the society in general. Recent developments have further increased the political, professional and public concern for this issue worldwide. After remaining at historic low levels during decades, food prices became substantially higher and more volatile since the 2007-2008 food crisis. Between January 2007 and June 2008 they increased significantly ranging from 38% in the case of sugar to 224% for rice (HLPE 2011). The price of other major food crops such as maize and wheat also registered sharp spikes in the same period.
2. Following this period of steep rise, the prices of these and other crops registered a major downturn in the second half of 2008. Since the second semester of 2010, food prices reversed its trend again, increasing significantly. Depending on how the world production evolves in the next years, food prices could remain at or above the 1997-2006 level (OECD/FAO 2009) (USDA 2010).
3. The consequences of higher prices and excessive volatility in food markets are well documented in the literature. They include economic and political instability as well as cycles of positive and negative effects on consumers and producers. At high prices, increased poverty and malnutrition among the poor can be expected, but this trend for higher prices may also enhance investments in agricultural activities. With increased supply, food prices decrease, benefiting consumers. However, excessive volatility may discourage long-term investment in agriculture and hence jeopardize an expansion in agricultural supply.
4. The degree of future volatility in the food system is uncertain. Therefore, efforts are needed to minimize high levels of volatility in global food markets and hence, ensure food security for all. The nature of this challenge requires country actions on several fronts, including increasing investment in agriculture to enhance agricultural growth and food production. However, as highlighted by FAO's Policy and Programme Support Division (TCS), it is not clear how to achieve sustained long-term increase in agriculture investment in developing countries. According to this Division of FAO, efforts are needed to develop a thorough understanding of the factors that uniquely or jointly drive investment by the different economic agents. This set of factors involves several elements including the need to understand what constitutes a sound policy environment to propel investment in agriculture.
5. The historical record of agricultural transformation shows that some countries have made significant progress in terms of rapidly expanding agricultural production and productivity through increased investment by domestic farmers. Therefore, in-depth analyses of these experiences offer some opportunities to learn about what constitute successful practices from the past to guide current and future agricultural policy.
6. Brazil is one of the world's most dynamic rising agricultural producers, boasting astonishing growth in the 1970-2000 period. Once a food importing country, Brazil rapidly became a world agricultural power. It is globally important for both food security and environmental sustainability. It is the largest exporter of coffee, beef, broiler, orange juice, sugar, ethanol and soybeans in the world and it is among the

three main foreign sellers of corn, cotton, bananas and pork. Moreover, it provides vital environmental services to the world and has a large number of farmers with strong entrepreneurship capacity. The country is also notable for having a strong agricultural research capacity, using top level technologies and showing a rich agricultural development experience, which could be of value for other countries.

7. Given the above elements, the overall purpose of the paper are twofold: first, to review Brazil's experience in terms of how its policy framework contributed to a favorable environment for agriculture investment by farmers in the 1960-2010 period; and second, to identify the lessons learned from this process. More specifically, it addresses the following questions: how different public policies can influence farmers' investment in agriculture? Which were the main elements of the policy framework adopted by Brazil during the 1960-2010 period to promote agricultural investment and increased production? How was agricultural investment financed? What types of financial instruments were used to finance farmers' investments in agriculture? Which were the main results and limitations of the adopted policy frameworks? What lessons can be learned from this experience?
8. In order to pursue the above-mentioned objectives the paper is organized in six chapters in addition to this introduction. Chapter two presents the framework of analysis used to examine the links between public policies and agricultural investment by farmers. Given this framework of analysis, chapter three reviews the set of policies adopted by Brazil during different periods (i.e. import-substitution industrialization, 1960-1980; transition decades 1980s and 1990s; and economic stability and growth, 2000-2010) and show, to the extent possible, how it influenced agricultural investment. Taking as a reference the elements presented in this chapter and the data available, chapter four examines the impact to the set of policies followed on the trend of agricultural investments made by farmers. Chapter five further illustrates the relationship between public policies and agricultural investment in Brazil by highlighting the influence of these policies on farmer's decision to investment in agricultural activities in the savannah region of the country. Following the analysis carried out in these chapters, the implications of the adopted policy frameworks to agricultural performance, food security and poverty alleviation are addressed in chapter six. Finally, chapter seven summarizes the main lessons learned from public policies and increased agricultural investment by farmers in Brazil.


II. Farmers' investments in agriculture: framework for analysis


9. According to the literature, investment is generally defined as changes in capital stock. Capital, in turn, refers to physical items such as machinery, buildings, storage facilities, livestock, fertilizers, pesticides and high-yielding varieties that are not used up in the production of a product. This set of physical items with this characteristic is known as fixed or physical capital. Therefore, investment can be understood as expenditure on fixed assets (physical capital) in order to produce goods for future consumption.
10. In addition to the above, there are other types of capital such as human, social, knowledge, and institutional capital. They are all important to economic growth and development. However, considering these different types of capital would involve an analytical effort which goes beyond the scope of this study. Thus, the focus of the discussions will be on farmers' investment in physical capital. Notwithstanding this aspect, attention will be given also to policy measures like investment in agricultural research and provision of extension services, which contribute to enhance farmers' skills, induce technological innovations, and improve labor productivity.

2.1 - What influences investments in agriculture

11. Investments in agriculture depend on investors' perception of how factors influencing the climate for agribusinesses affect the expected rate of return (ERR) of their future investment. Figure 1¹ shows a causal model that summarizes the main variables, factors and policy interventions that influence investments in agriculture. The greater the expected rate of return of an agriculture-based business project as compared with alternative investment opportunities, the greater the investment level in agriculture. This is the basic hypothesis used in this study to explain the agricultural development in Brazil in the last 50 years.
12. The investment in agriculture is important because it increases the stock of capital used to produce food and fiber. As agricultural production increases, more food and fiber become available for consumption at relatively lower prices; populations have greater food security; and nutrition improves. Greater agricultural production will reduce food-related expenditure, releasing funds to finance other economic activities and/or consumption, increasing income and jobs, and thereby decreasing poverty, particularly in rural areas. A population with better nutrition and less poverty will see its levels of welfare increased.

¹ In this figure, causal relationships between variables were represented in two forms:

1- Variable A  + Variable B – This relationship should be read: if A increases (decreases), then B increases (decreases) more than it would without the change in A. The variables generally move in the same direction.

2- Variable J  - Variable K – This relationship should be read: if J increases (decreases), then K decreases (increases) more than it would without the change in J. The variables generally move in opposite directions. The rounded shape at the beginning of the Inward flow and the end Outward flow means that the model does explain where these flows come from or go to.

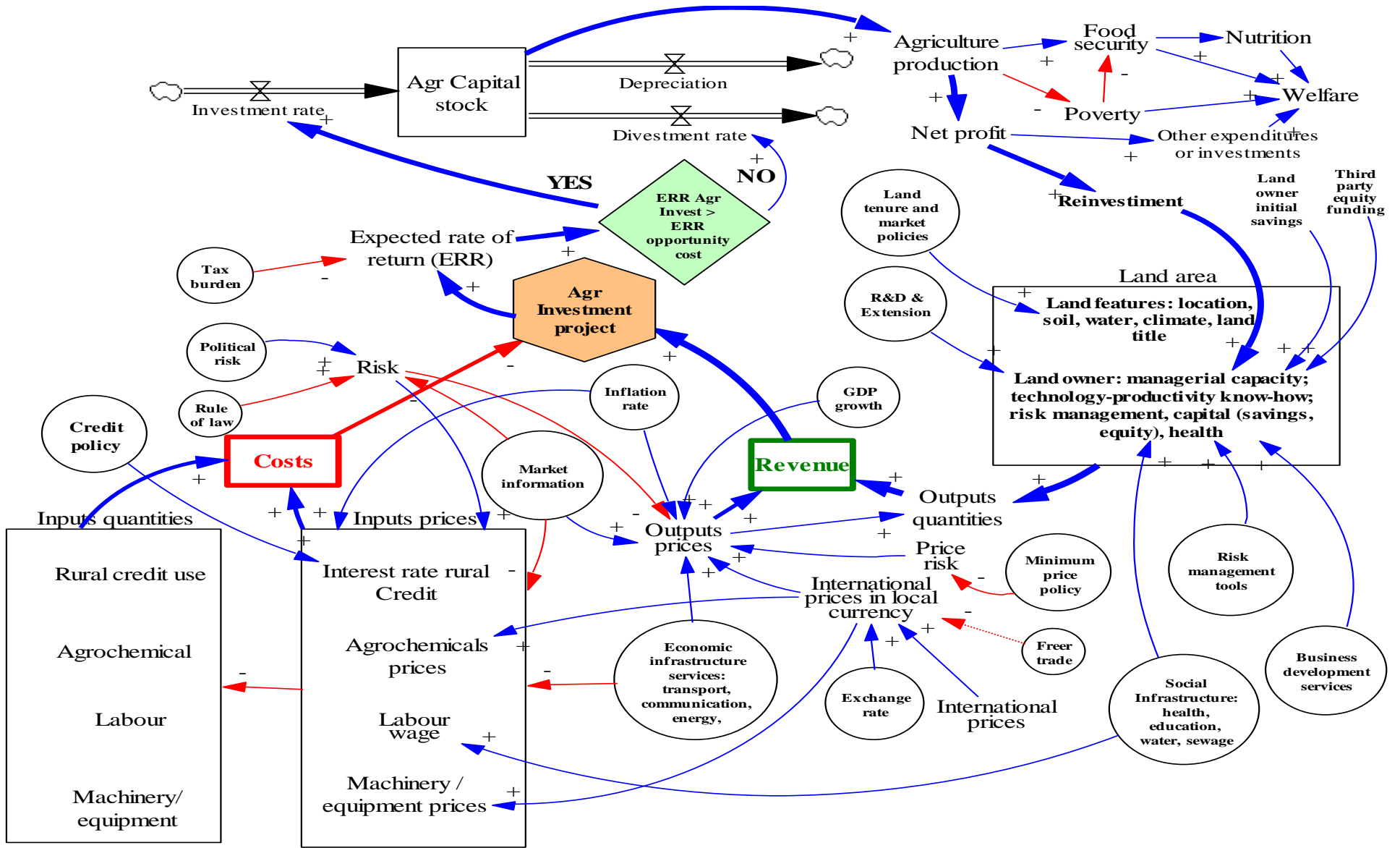


Figure 1 - Factors affecting investment in agriculture

13. The financial profit an investor or a farmer may obtain from a project to produce food or fiber can be estimated by calculating its expected rate of return (ERR). It depends on the stream of costs and revenues that such agricultural project is expected to generate under the contingencies of the land area where the project will be undertaken. It depends also on the business climate the investor faces and expects to face during the execution period of the agricultural investment project and their impacts on costs and revenues.
14. The contingencies of the land area where the project will be undertaken can be divided in land features and landowner characteristics. Both of them influence the choice of project type and its dimensions. In the short run, these elements limit the alternative projects that investors or farmers can pursue in a given farm. Land features are those attributes of the property area, such as its location, its tenure situation, and the quality of the natural resources that it has and that can be used for production. The closer the land area is located to input suppliers and to agricultural markets the less transportation costs the investors will have and the greater the profitability of the investment will be.
15. The natural resources endowment of the farm include mainly soil quality and slope, the size of the land area, water availability and the climate regimen. These features of the land are usually intrinsic to it and changing them will often require the use of substantial capital. All these factors influence the selection of the food or fiber to produce and the technological package to be adopted, which in turn define the need for inputs and the expected productivity. The more appropriate these factors are for the investment intended, the more likely the investment will be profitable and the more attractive the investment will be for landowners.
16. Land tenure and protection is also an important factor for the profitability of a food or fiber investment. The more secure the land tenure under the control of the landowner or investor is the less uncertainty and risks of losing the revenues of the production or of having additional costs to protect the property and other associated assets he/she will face. More secure land tenure also allows investors to explore alternative projects such as forest plantations, which have longer maturity, since they are more certain of harvesting the trees.
17. The second type of contingencies of the land area where the project will be undertaken is landowner characteristics. Any investment or business venture depends on the capabilities of its owner to undertake the production, managerial and related activities required for efficient operation and profitability. The owner has to know about agricultural production of potential crops, as well as to be able to understand and to manage business activities (labor, legal, fiscal, financial, accounting, risk). Landowners also have their own educational and health conditions that allow them to undertake tasks, acquire and use skills, and adopt new technologies. Another landowner trait that influences the choice of investment is the amount of financial savings which they can use to produce crops, invest in alternative projects or use for consumption.
18. For a given land area with its particular land features and landowner capabilities, the ERR which can be obtained from an agricultural project depends on other out-of-farm factors that directly affect the stream of cost and revenues of the project. On

the cost side, the farmer or investor will consider different technological packages he knows and take into consideration the quantities of inputs that will be needed for a given input price level. Within certain limits of the flexibility of the technological production package selected, the farmer will tend to use more of a given input as it becomes cheaper.

19. The opposite is true when the input price increases. Some of the main inputs used for agricultural production and whose prices will be determinant of the choice of technology, and quantities to use, are: rural credit available; agrochemicals such as fertilizers, pesticides, etc.; labor; machinery and equipment. The prices of such inputs at the farm gate like the interest rate of rural credit, agriculture labor wages, and the prices of agrochemicals, machinery, and equipment will determine the quantities used and the cost stream associated with their use. Obviously, the greater the costs of production, the smaller the ERR and the less attractive the investment.
20. On the revenue side, the ERR of a given agricultural project will be greater the larger the revenue the farmer can obtain from it at harvest time. The revenue will depend on the farm gate prices of the output and the quantities produced and delivered to wholesalers or consumers. Output prices depend on domestic market conditions, and on how international prices are transmitted into the domestic market. International prices' influence on domestic prices depends on the foreign exchange rate and on how the domestic economy is open to international trade. International prices themselves are determined by the world demand and supply of the crop. It is beyond the scope of this paper to discuss how international food and fiber prices are affected by different factors.
21. Actual farm gate prices received by investors may vary from location to location as farmers have to discount the transaction costs associated with selling the production such as transportation, communication, port services, marketing, etc.
22. Output prices are critical not only at the time of harvest. They are also an essential factor that farmers must consider when deciding which crop to produce. For that purpose, farmers have to form an expectation about the prices of alternative crops at future harvest time. Independently of how well the farmer forms this expectation about the price at the selling time, it is often an element of risk. This can have a positive impact on the project's rate of return when prices turn out to be better than expected, but it can also have a negative impact (not rarely, a catastrophic one) on the rate of return when prices are worse than expected.
23. Revenue will also depend on the quantities produced. Naturally, the greater the quantities harvested and delivered, the greater the revenue. Crop output quantities depend on several factors: some are under the farmer's control, like the choice of technologies, and monitoring the protection of plants and produce; while others, like the weather, are not. The exact quantities of output produced may then vary, which makes this another source of risk for the farmer to manage in order to reduce negative impacts and increase the chances of positive effects.

2.2 - Impacts of public policies and actions on agricultural investment

24. Public policies, investments, and other government actions impact the expected rate of return of an agricultural project. Therefore, they influence investment in agricultural production. Public policies and investments are represented in Figure 1 as circles. The way they affect costs and revenues of agricultural projects are shown by the causal relationship arrows.
25. The tax burden imposed on agricultural investments reduces the ERR and makes these investments less attractive. The tax burden increases the cost of doing business not only directly by the tax rate imposed, but also because of the additional expenditure and time consumed to comply with tax code and bureaucratic requirements. Depending on the tax system of a country, the complexity and the diversity of taxes generate innumerable distortions and create incentives for evasion and corruption. Because the tax burden in an economy can affect many points of the production chain, it is represented in Figure 1 as having an adverse impact directly on the ERR as the taxes increase. On the other hand, the reduction of the tax burden or a negative tax burden, also known as a tax incentive, will increase the ERR of agricultural investments and make them more attractive to investors.
26. The word “expected” in ERR indicates that such estimate of the profitability of an agricultural investment project depends on the probability of the occurrence of events which considers different assumptions in their calculations. These events may be more or less predictable or uncertain. When the occurrence of these events is less known, they introduce an element of risk that makes the ERR calculation results less reliable. Although risks may have impacts that turn out to be favorable, investors are particularly worried by the negative impacts that they may have on profitability. The riskier an investment is, the less attractive it is and a relatively higher ERR is demanded by investors to compensate for the possibility of failure. When the nature of such risky events, the size of their impacts, and the probability of their occurrence allow and require so, investors will try to manage them by taking actions to eliminate, mitigate, or share the risks and their impacts.
27. Figure 1 shows that production-related risks associated with land property features and landowner capabilities can be managed by the adoption of preventive measures, and the selection of appropriate crops and technological packages so as to increase the chances that their productivity will be acceptable. There are other risks over which investors have less control like the fluctuations of input and output prices. For output prices, governments may adopt policies that try to assure investors of a minimum compensation by fixing a minimum guarantee price that it is willing to pay for the production.
28. In some countries, agricultural investors can hedge their price risks by selling their future production at a pre-established price, either in contractual arrangements with the industry or wholesalers, or in the commodity futures markets. Policies and actions that promote timely and accurate market information availability can also help to reduce risks and uncertainty, as well as allow better prices for input buying and output selling by investors, which helps to maximize profits.

29. However, there are risks that investors have less means to manage, such as political risks or the uncertainties linked with the sudden and adverse change of the rule of law, or its failure to protect investors in their transactions, or in ensuring their rights to the outputs of their properties. Although there are insurance instruments for these risks, they usually are out of reach for the average investor. Indeed, they intrinsically depend on government actions, so investments in agriculture could be increased when political risks are reduced and favorable rule of law is clearer and fully enforced.
30. A critical source of uncertainty in many countries is related to the rights of land owners to capture the benefits of the land in which they are producing and pay for the consequences of its poor management. Land tenure clarity, property protection, and the existence of well-functioning land markets are critical for investors to have access to land resources and to make their agricultural production investment decisions considering socially desirable incentives that lead to long term planning and resource conservation. These conditions are needed to ensure that land resources are sustainably managed. Government policies that address these issues lead to greater profitability and investments in agricultural production and a more sustainable land use.
31. The stability of the economy also contributes to better investment decision making. A higher inflation rate will generate uncertainties about future expected prices, lead investors to anticipate input purchases and reduce consumers' income. Credit becomes nominally more expensive and riskier for investors since they tend to increase output prices to compensate for higher production costs. Inflation-controlling policies help investors to better plan their agricultural businesses, preserve their and consumer's purchasing power and reduce risks.
32. As the economy grows in real terms, agricultural investors can expect consumers' income to grow. This in turn leads to greater demand for agricultural products and better prices. The growth in income can indeed have substantial impact on some product prices and consumption, since it may lead to a change of consumer preference for previously unaffordable goods. This short-term increase in prices provides incentives for greater agricultural investment and production when it is feasible, either through increase in land area and/or adoption of more productive technological packages. Policies that favor GDP growth, therefore, will tend to favor greater agricultural investments. Conversely, an economy that grows less tends to have more unemployed citizens, less income available for food and fiber consumption, which may lead to reduced agricultural investor revenues.
33. When food or fiber prices at a country's border are high, policies and actions that let these prices be transmitted to the domestic market will increase revenues of agricultural businesses, making them more attractive and leading to higher investments in agricultural production. On the other hand, if these border prices are lower than domestic ones, countries would benefit consumers by importing such products. Domestic producers which cannot compete with such lower prices will redirect their resources to producing other products that they can produce competitively. As international prices for food and fiber are currently high and are expected to continue in the near future, countries that can increase their production will do so when they adopt policies and actions that allow domestic prices to

fluctuate with border prices. These prices will be closer to each other when there is a freer trade regimen with minimum or no tariffs, quantity controls, or other restrictions. A policy of maintaining an equilibrium exchange rate will also allow food and fiber exporters to obtain compensating revenues from exports without substantially increasing their costs to import needed foreign inputs.

34. Economic infrastructure also has substantial impacts on the ERR since it influences both, the final input prices investors have to pay and the prices they get for their production. Economic infrastructure such as transportation from the farm to consumption markets (Batista 2008) is in general a major portion of the final product price. This is critical to the competitiveness of specific production sites and the geographic distribution of production.
35. Energy and communication services may also be important contributors for final prices, especially for some products. Irrigation services may also be critical in areas where rain-fed agriculture is not feasible or can be made more competitive. Therefore, the availability of transportation (roads, railroads, fluvial ways and ports, airports, and ocean ports), communication, energy and irrigation at competitive prices may determine the financial feasibility and size of agricultural investments in a country and in specific locations. Government policies and actions that result in such competitive prices will make investments in agriculture more attractive.
36. Social infrastructure and services also affect the ERR of agricultural investment projects. Services such as health care, potable water and sewage have a major impact on the health and productivity of labor. Educational services can also substantially increase the productivity of labor. The short supply of such services in quality and quantity in rural areas in most Least Developed Countries is well-known. Effective government policies and actions that seek the provision of such social services at competitive prices can contribute to the feasibility of agricultural investments (Dethier and Effenberger 2011) (The World Bank 2005) (Josling 2011).

III. Evolution of policies affecting agricultural investments

37. Given the objectives of this case study, the purpose of this chapter is to provide a summary of the policy frameworks adopted by Brazil during the 1960-2010 period. According to the terms of reference of this document, the objective here is not to undertake an analysis of the policies followed (i.e. strengths, limitations, distortions, etc.). Rather, the purpose is to present an overview of the main policies followed during specific periods of time. In particular, attention is focused on the major policies which were more influential on investment in agriculture by domestic farmers.

3.1 - Import-substitution Industrialization (ISI): 1960-1980

38. During the 1960-1980 period Brazil was governed by 8 Presidents. The country was also run by two interim Presidents and by a provisional governing junta during two months (31 August to 30 October, 1969). Each of these Governments implemented a set of specific policies to pursue their objectives. Notwithstanding the difference between some of the adopted policies, they all followed the same overall orientation, i.e. import-substitution industrialization (ISI). The sections below summarize the main elements of this general policy orientation.

3.1.1. - Economic development strategy, policies and programs

39. According to the Economic Commission for Latin America (ECLAC), after World War II the terms of trade between agricultural and industrial products moved against raw material exporting countries. Therefore, the economic development model proposed to be followed by these countries should be one which favored the development of the domestic market and the diversification of exports, i.e. the adoption of an import substitution industrialization strategy (Prebisch 1964). This overall economic policy orientation was followed by Brazil during the 1950-1980 period. It relied significantly on foreign capital as a complement to public investment.

40. In general, the strategy followed consisted of a multiple exchange rate system to facilitate the imports of capital goods and to constrain the foreign purchase of other products. This promotion of the domestic industry was further complemented with the provision of subsidized loans, the establishment of new import tariffs and/or increasing previous ones. Special attention was given to industries considered essential for growth such as automotive, steel, cement, aluminum, heavy machinery, cellulose and chemical industries. Priority was provided also to wage protection and investments in housing and health. In this context, food prices were kept low in order to avoid inflationary pressure via higher wages of urban workers.

41. Since 1964, the military Government adopted a series of reforms aimed at removing some of the distortions of the import-substitution industrialization, modernizing the capital markets and reducing inflation. In this regard it gradually introduced

incentives for direct investment, adopted measures to promote exports², and introduced a mechanism of periodic devaluation of the national currency (mini devaluation system) taking into account the difference between the domestic and external inflation rates. In addition, it took actions to further expand public investment in infrastructure and to develop state-owned basic industries.

42. A major investment effort was carried out by the Government since 1968 based specially on foreign savings. Benefiting from the low interest rates charged in the international markets, the Government promoted a major change in the country's industrial park over the 1970s. The most successful stage of this process was achieved during the implementation of the II National Development Plan in 1974-1979.
43. The long cycle of Brazil's industrialization was marked by a strong intervention of the state in the economy. In addition, it was also influenced by a growth strategy, capital accumulation and investment decisions of large international enterprises particularly in the automobile and electric-electronic industries. However, it was the Government who created the favorable financing conditions, provided large amounts of credit, granted tariff and exchange rate protection and contributed to relatively low wages.
44. During the import-substitution industrialization period, Brazil was hit by the oil shocks of 1973 and 1979 as well as by a unilateral increase of interest rates adopted by the United States in this last year. In this context, the financing of the external liabilities demanded growing reductions of the public budget and of domestic investments. Therefore, the accumulation pattern based on variable proportions of public investment, foreign capital and national private capital went in crisis.
45. As will be seen latter, in the case of agriculture, the 1960-1980 period was characterized by the objective of meeting the national requirements of a growing urban population and in the second place, to generate foreign exchange earnings to finance imports. It was also marked by major government interventions in the domestic market of agricultural products. In general, the main policies followed in those decades included the provision of substantial volumes of agricultural credit at subsidized interest rate, technical assistance to farmers through extension services, and the implementation of price support mechanisms including the purchase and storage of various products.

3.1.2 - Agricultural development strategy, policies and programs

46. The focus on ISI activities in the 1950s resulted in a neglect of agricultural planning and policy development by politicians and academics alike (Baer 2008). Notwithstanding this aspect and a discrimination of the industrialization policies against agriculture, the sector registered a sustained positive performance expanding at average yearly growth rates between 4.2% and 5.8% in 1951-1962 compared with a population growth rate of 3% and 2.7% in the 1950s and 1960s, respectively. This

² Among others it included the establishment of financing system to exports at subsidized interest rates and a fiscal incentive system to exports which consisted in a reduction of the import tax on industrial products.

result was achieved based on growth style centered on land expansion and the use of traditional, labor intensive methods of cultivation and harvest.

47. Following these years of strong emphasis on industrialization via import substitution, the role of agriculture in the economy began to change since the mid-1960s due to the following aspects: increased rural-urban migration, the need to compensate the decline of industrialization as an engine of growth with agriculture-based exports, and the creation of an urban middle-working class which demanded ever-increasing quantities of food.
48. Specifically, starting in the middle 1960s, the country began to experience major changes in the methods of agricultural production. The traditional methods of production together with land expansion were no longer sufficient to sustain agricultural growth at the pace required by the growth in the industrial sector. Therefore a process of “conservative modernization” was initiated by agricultural policies which channeled part of the urban-industrial capital to the sector and started to promote the use of technologies generated internationally by the green revolution.
49. Under this process of “conservative modernization”, the agricultural sector was expected to generate larger agricultural surplus, with the objectives of supplying resources for the growth of the domestic market and to produce raw material for the national agroindustry, which was starting to develop. In addition, it should produce food for the urban population, to generate foreign exchange earnings to finance imports and to provide labor for industrial employment. Given these objectives the 1960-1980 period was marked by major government interventions in the agricultural sector. As will be discussed below, the main policies behind the development of Brazilian agriculture in this period were agricultural credit, extension service and agricultural research.

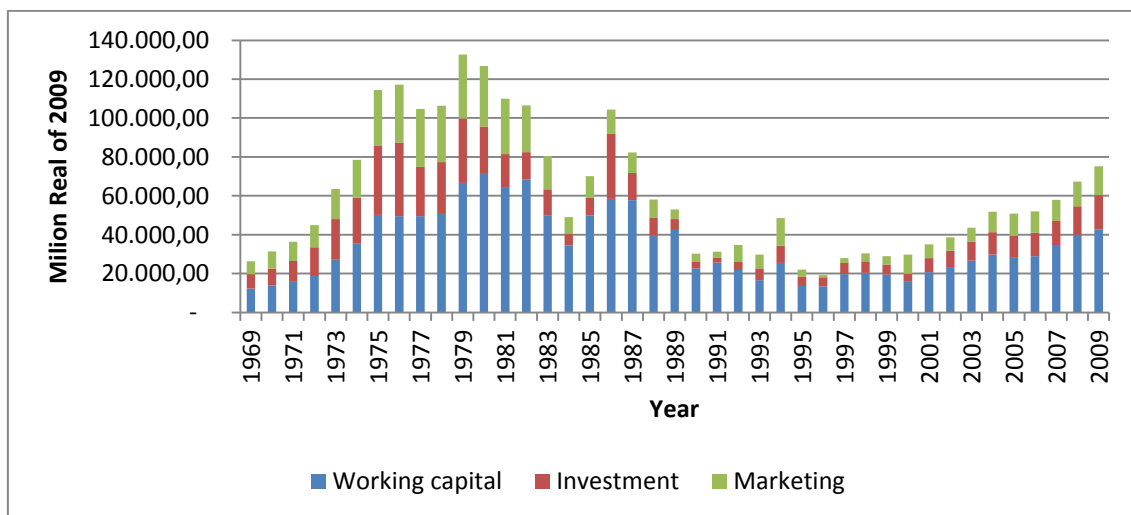
a.1. - Rural credit

50. The approach followed by Brazil to expand agriculture output and productivity during the 1960-1980 period involved promoting the utilization of modern factors of production, e.g. agricultural inputs and machinery. Given the relatively high cost of these factors, one of the main policies implemented by the government to pursue this objective was the provision of rural credit at low interest rates through the National Rural Credit System (SNCR) established in 1965. The purposes of this policy were also to finance a substantial part of the operating costs of production and marketing of agricultural products; to stimulate the process of capital formation in agriculture; and to strengthen the economic situation of farmers especially small and medium ones (Law No. 4829 of 1965).

In addition to the above, it seems that an implicit objective of this policy was to partially compensate the discrimination of the domestic policies against agriculture especially the negative effects of the price and exchange rate policies, which sought to promote the industrialization of the country and to control the domestic inflation by using food as a wage good. The rural credit policy contributed also to the industrialization process by expanding the domestic demand for tractors and agricultural machineries produced by the national industry.

51. Besides the above objectives, the rural credit policy of the 1960s and 1970s had three main characteristics: nominal interest rates lower than the inflation rate; legal requirement for banks to provide loans to farmers based on growing shares of the total amount of checking deposits made in those institutions; and relatively lower interest rates charged on small loans, supposedly those made to small farmers. The underlying motivations behind these aspects were the need to break up the traditional resistance of banks to lend money to the rural sector, and the assumption that small farmers required special incentives to engage in credit operations.
52. As shown by Figure 2, the total volume of credit provided to farmers and cooperatives increased in real terms from about BRL 20 billion in 1969 to approximately BRL 123 billion in 1980. The largest share of the total amount of credit granted during that period was for working capital, i.e. between 40% and 57%. However, investment and marketing³ credit experienced also a major expansion. The first, increased from BRL 7.4 billion in 1965 to BRL 24.8 billion in 1980 and the second expanded from BRL 6.6 billion to BRL 31.2 billion.

Figure 2 – Brazil: total credit provided to farmers and cooperatives by purpose of expenditure, 1969-2009 (in constant value of 2009)



Source: Central Bank of Brazil (BCB)

53. The purpose of the credit for working capital was to finance several crop and/or livestock operations (e.g. land preparation, seedling, weeding and harvesting) as well as the purchase of modern inputs such as fertilizers, seeds, herbicides, animal feed and vaccines. The provision of this type of credit contributed to expanding significantly the use of these inputs, some of which belong to the category of fixed capital, for instance fertilizers, high yield varieties and pesticides.
54. Between 1966 and 1976 the total use of chemical fertilizer increased 550% (Araújo and Meyer 1983). According to the literature however, there were allegations that in some regions the quantity of the inputs financed by this type of credit did not correspond to the volume effectively sold. Moreover, as highlighted by (Baer 2008), on a regional level, there was an enormous difference in fertilizer use between the northeast, the southeast, the south and the State of São Paulo. The greater use of

³ The credit provided for agricultural marketing included storage cost.

modern inputs in the State of São Paulo is related to a longer tradition of the state government in promoting agricultural research and encouraging greater use of fertilizer, chemicals and improved seeds.

55. In addition to stimulating the use of modern inputs and promoting the investment on some types of fixed capital, the credit for working capital contributed to creating a favorable environment for farmers' investment in crop and livestock production. The large supply of this credit, together with the negative real interest rate charged on these loans improved the expected rate of return on agricultural investment making it more attractive to farmers. However, as will be discussed later, this did not benefit equally all types of producers, regions and agricultural products.
56. Similarly to the credit for working capital, the large volumes of marketing credit contributed also to stimulating farmers' investment in agriculture. The provision of this type of credit at controlled interest rate has been implemented through two instruments, the Federal Government Loan (EGF) and the Acquisition by the Federal Government (AGF). The first involves the provision of credit to farmers based on the value of the crop on storage, and the second consists on the acquisition of the production the farmers wishes to sell to the government. In both cases the loan received by the farmer is calculated according to the minimum guarantee price established by the government.
57. The share of EGF in the total volume of production of the main agricultural products covered by Brazil's marketing credit policy was substantially larger than that of AGF throughout the 1970s (Leite 2001). Moreover, until the end of the 1970s the EGF had a large participation in the production of cotton (61%), soybeans (35%) and rice (16%). Regarding the AGF, it was more utilized in the acquisition of products of the basic food basket, i.e. rice, edible beans and corn.
58. In line with the objectives of the credit policy of the 1960s and 1970s, the provision of investment credit by the SNCR facilitated an expansion of capital stock at farm level. According to (Araújo and Meyer 1983), the Brazilian production of tractors increased from 6,300 units in 1967 to more than 62,000 in 1975, most of which was sold to domestic farmers. Moreover, in 1970 the total investment in agriculture by farmers amounted to Cr\$ 4.4 billion (IBGE 1974) 57% of which was financed by loans of the SNCR. Almost half of this investment was concentrated on the purchase of tractors and machinery.
59. An important element of an agricultural credit system is the comprehensiveness of its coverage (i.e. the number of farmers covered by the system). In the case of Brazil, there is no data available on this issue for the 1960-1980 period. However, according to an approximated estimate made by (Pinto 1980), the coverage of the SNCR at the end of the 1970s comprised only 20% of the total number of farms.
60. Another important aspect of a credit system is the distribution of the credit among the different types of farmers. During the 1960-1980 period, the provision of credit was done according to specific credit limits. Small producers could receive loans equivalent to a maximum of 50 minimum wages; mid-size producers were granted loans corresponding to between 50 and 500 minimum wages; and the loans to large producers could amount to more than 500 minimum wages. This because of the

relationship between the size of the loan and the guarantee which farmers could offer in return.

61. As shown in Table 1 the share of the crop loans provided to small and medium size producers followed a downward trend between 1966 and 1976 falling from 34% and 46%, respectively to 11% and 35%. In contrast to this, the participation of the loans granted to large farmers increased from 20% to 53% during the same period. A similar picture was observed in the case of the loans for livestock activities. Therefore, the implementation of the rural credit policy in the 1960s and 1970s favored significantly the investment in agriculture by large farmers *vis-à-vis* small and medium ones.
62. Another evidence of the credit concentration in the hands of the large producers is obtained by comparing the value of the credit provided by the banks with the cultivated area and the value of production of different farm sizes. As Table 2 shows, in 1975 the credit granted to farms with an area smaller than 10 hectares was Cr\$ 200 per hectare. In contrast to this, farms with an area larger than 10,000 hectares received Cr\$ 3,143 per hectare. Similarly, while the credit provided to farms with less than 10 hectares corresponded to 6% of the value of production, the loans granted to large farms (i.e. those with more than 10,000 hectares) were equivalent to 75% of the production value.
63. One of the consequences of concentrating the provision of credit on large farmers was that they used part of their own resources to purchase more land. Therefore, in addition to creating a circle large farm size – credit – more land – more credit – etc., the concentration of credit resulted also in a significant increase of land price.
64. A similar picture to the one above was also observed with respect to the distribution of credit between regions and among crops. Specifically, the implementation of the rural credit policy during the 1960-1980 period concentrated the provision of loans on the center south region of the country and on commercial crops such as soybeans, coffee, sugar cane, cotton and wheat. Products which are more associated with the domestic market like edible beans, rice and corn received in general relatively less resources from the rural credit policy during the 1960s and 1970s.
65. Figure 2 also shows that after the end of the 1970s, the volume of credit provided to farmers followed a downward trend until the mid-1990s. The reason behind this change was the deterioration of the macroeconomic conditions of the country (high external debt, rising inflation and low economic growth), which led the government to adopt a series of orthodox measures, including a restrictive monetary policy. Until 1985, the agricultural credit policy was financed mainly (about 80%) with resources from the government monetary budget. This budget included resources from *conta movimento* (floating debt account) at Bank of Brazil, which enabled the Central Bank to “print” the money needed to cover any negative balance of this account at the end of the year. With the creation of the “credit budget” as part of the government budget this account was extinguished in 1986.

Table 1 - Distribution of the agricultural credit provided to group of producers and purpose of the loan (producers + cooperatives)

YEARS	AGRICULTURE PRODUCTION ¹						LIVESTOCK PRODUCTION ¹					
	SMALL FARMERS ²		MEDIUM SIZE PRODUCERS ²		LARGE SIZE PRODUCERS ²		SMALL FARMERS ²		MEDIUM SIZE PRODUCERS ²		LARGE SIZE PRODUCERS ²	
	NUMBER OF CONTRACTS (%)	VALUE OF CONTRACTS (%)	NUMBER OF CONTRACTS (%)	VALUE OF CONTRACTS (%)	NUMBER OF CONTRACTS (%)	VALUE OF CONTRACTS (%)	NUMBER OF CONTRACTS (%)	VALUE OF CONTRACTS (%)	NUMBER OF CONTRACTS (%)	VALUE OF CONTRACTS (%)	NUMBER OF CONTRACTS (%)	VALUE OF CONTRACTS (%)
1966	90,05	34,13	9,51	45,60	0,44	20,27	81,43	33,27	18,34	54,34	0,23	12,39
1967	88,48	32,29	10,93	47,20	0,59	20,51	82,73	39,23	17,04	55,30	0,23	5,47
1968	87,27	31,07	12,22	49,72	0,51	19,21	84,47	39,53	15,30	45,93	0,23	14,54
1969	88,16	30,95	11,17	45,81	0,67	23,24	86,79	42,54	12,91	42,11	0,30	15,35
1970	85,91	27,57	13,25	47,16	0,84	25,27	84,51	39,45	15,23	45,91	0,26	14,64
1971	85,71	24,61	13,25	43,99	1,04	31,40	80,32	30,32	19,05	51,26	0,63	18,42
1972	83,56	20,69	14,92	42,17	1,52	37,14	79,83	28,92	19,42	50,09	0,75	20,99
1973	79,46	17,22	18,59	38,75	1,95	44,03	70,98	17,43	27,35	47,62	1,67	34,95
1974	76,61	15,12	20,88	37,43	2,51	47,45	70,38	17,24	27,47	48,41	2,15	34,35
1975	74,18	11,77	22,48	34,18	3,34	54,05	67,06	15,06	30,02	49,48	2,92	35,42
1976	73,73	11,38	22,93	35,09	3,34	53,53	68,69	12,12	27,47	40,97	3,84	46,91

^{1/} - percentage with respect to the total number of contracts and to the total credit provided by class of producers

^{2/} small producers = credit contracts up to 50 minimum wages; medium size producers = credit contracts up to 500 minimum wages; large size producers = credit contracts greater than 500 min. wages

Source: Comissão Coordenadora da Política Nacional de Crédito Rural - COMCRED- Bank of Brazil

Table 2 - Comparison between the value of credit provided for agricultural production and cultivated area by farm size, 1970 & 1975

Farm Size (Ha)	Share Of Credit Provided		Credit Provided	
	In Total Value Of Production (%)		By Unit Of Area (Ha)	
	1970	1975	1970	1975
Less Than 10	5	6	38	200
Between 10 And < 100	13	19	87	631
Between 100 And < 1,000	23	35	182	1,256
Between 1,000 And < 10,000	24	42	255	1,654
Greater Than 10,000	36	75	840	3,143

Source: *Fundação IBGE, Censos Agropecuários de 1970 & 1975*

66. The other main source of financing consisted of a compulsory requirement which obliged the commercial banks to devote a fixed percentage (15%) of the checking deposits to agricultural credit. During the 1966-1985 period this source of rural credit financing contributed with approximately 12% of the total credit provided. Therefore, about 92% of the total credit provided to agriculture during the 1966-85 period was funded with this source of credit and with resources from the monetary budget.
67. According to (Leite 2001), the total subsidies provided by the Brazilian government through credit policies, despite not referring exclusively to agriculture, increased from 3% of the country's GDP in 1973 to 7.6% in 1980. It should be noted that the abundance of financial resources did not result necessarily on an efficient use by farmers in general. Part of the agricultural credit was used for other purposes outside of the sector. Moreover, as highlighted above, the agricultural credit policy of the 1960s and 1970s resulted also in a major concentration on large farmers, commercial crops and on farms located in the center south of the country. In addition, it created other distortions such as encouraging some farmers to substitute their financial resources by those provided by the credit system, and a much greater expansion of the total agricultural credit provided vis-à-vis the net internal product of agriculture. With the exception of soybeans, which experienced a substantial expansion of cultivated area and production during the 1960-1980 period, most of the other products registered a modest performance in terms of production and productivity. Among other reasons, this result reflected the fact that the rural credit was not properly accompanied by the necessary technical assistance service.
68. The policy of abundant subsidized credit continued until 1979 when the second oil shock impacted negatively the inflation level raising it significantly and further increasing the disequilibrium of the trade balance. As a result, as discussed latter in this chapter, the government changed the credit policy.

a.2. - Agricultural extension and technical assistance service

69. Inspired by the north-American model "Farm Security Administration", the agricultural extension service established in Brazil in 1948 promoted from the beginning, the use of rural credit as an integral component of its operating activities. Therefore, given this view, the policy framework to promote the modernization of agriculture during the 1960-1980 period included the expansion of both, the rural credit and the agricultural extension and technical assistance services. The activities

of these services worked hand in hand with the rural credit policy assisting farmers to develop the technical projects needed to obtain the loans provided by the banks. In addition, they aimed at inducing farmers to adopt technological packages and lead them to make greater investment in agriculture.

70. The technological packages were established for the production of specific crops and livestock activities by agricultural research institutions with the participation of extension agents. In general, the packages included technical recommendations on several aspects including the following: planting schedule, use of high yield varieties, quantity of fertilizer and limestone to be utilized, cultural practices (soil preparation, plant density per unit of area, spacing between plants, etc.), and insect and disease control through the utilization of agrochemical (herbicide, insecticides and fungicides). In addition they provided orientation on the utilization of tractors, machineries and equipment to prepare the soil, plant and harvest the crop. Therefore, the promotion of the technological packages by the extension agents contributed to promote farmers' investment in several capital goods.
71. Until the early 1960's, the agricultural extension and technical assistance services were provided by a small number of Credit and Rural Assistance Associations (ACAR), which were coordinated by the Brazilian Association of Credit and Rural Assistance (ABCAR). Therefore, only 10% of the municipalities received the services of the ACAR offices. Nevertheless, given the objective of the government to promote the modernization of the sector, the number of municipalities covered by the national system of agricultural extension and technical assistance services increased significantly reaching about 78% of the total in 1980 (Table 3). As a result of this expansion and the need to strengthen the coordination among the different offices, the government created the Brazilian Technical Assistance and Agricultural Extension Corporation (EMBRATER) in 1974. With the creation of EMBRATER, the ACAR offices were little by little transformed in Technical Assistance and Agricultural Extension Enterprises (EMATER). They continued to be funded by local government funds but received also additional resources from the Federal Government.

Table 3 - Brazil: number of agricultural extension and technical assistance offices of municipalities covered and of extension officers with specialization in agriculture, 1954-1981

Years	Brazil		
	No. of Extension offices	No. of municipalities covered	No. of extension officers
1954	35	76	-
1955	69	111	-
1956	101	150	127
1957	126	182	169
1958	164	207	232
1959	182	215	236
1960	199	277	270
1961	232	295	303
1962	257	319	324
1963	338	449	412
1964	424	634	512
1965	562	760	634
1966	755	1.040	896
1967	949	1.271	1.110
1968	1.004	1.349	1.184
1969	1.025	1.451	1.340
1970	1.049	1.589	1.438
1971	1.132	1.877	1.788
1972	1.249	2.096	2.343
1973	1.401	2.371	2.832
1974	1.444	2.396	2.706
1975	1.571	2.539	3.653
1976	1.787	2.848	5.059
1977	1.817	2.997	5.532
1978	2.013	3.086	6.327
1979	2.134	3.128	6.832
1980	2.231	3.034	6.757
1981	2.371	3.103	7.526

Sources: Brazilian Association of Credit and Rural Assistance; Brazilian Enterprise of Technical Assistance and Rural Extension.

72. After promoting the expansion of the agricultural extension and technical assistance service in the 1960s and early 1970s, the government observed that the existing agricultural research system and the set of technologies and technical knowledge to be transferred to farmers was relatively limited. Thus, in 1974 it strengthened the country's institutional research framework creating the Brazilian Agricultural Research Corporation (EMBRAPA). As will be discussed later, this policy measure contributed to producing a major transformation of Brazilian agriculture in the 1980-2011 period.

73. Another aspect of the agricultural extension and technical assistance service provided in the 1960-1980 period is that, given its strong link with the implementation of the rural credit policy, its activities were concentrated on medium and large size producers. Moreover, the products with which the extension agents worked and transferred technologies to farmers presented the same distortion as those of resulting from the implementation of the rural credit policy, i.e. concentration on commercial crops.

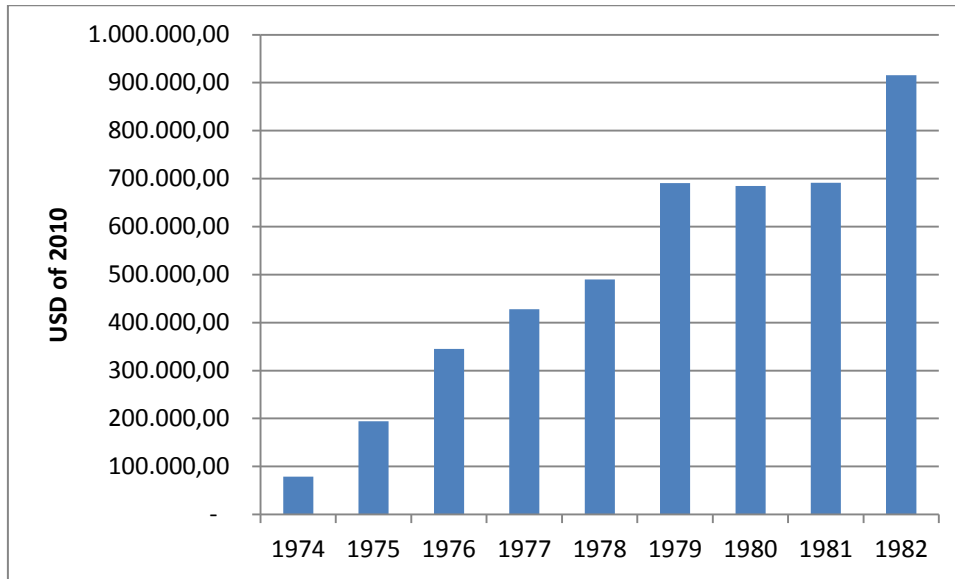
74. As highlighted above, since the creation of the agricultural extension service in Brazil, the link between this service and the rural credit was strongly desired due to

the understanding that the credit was the main instrument to facilitate the adoption of technologies by farmers. Therefore, it is not a surprise that one of the consequences of this association was that the activities of the agricultural extension service were focused mainly on medium and large size producers. Notwithstanding the above mentioned distortions, the agricultural extension and technical assistance service contributed significantly to promote farmers adoption of better technologies and to invest in physical capital goods.

a.3. – Investment in Agricultural Research

75. In the early 1970's, Brazil like many other countries faced a food crisis which affected the domestic consumers through relatively higher prices. This fact, together with the limited possibility to continue expanding agricultural production in the traditional areas of cultivation with a small stock of agricultural technologies, led the Government to realize that actions should be taken to overcome this challenge. The decision taken was to incorporate the “unproductive” savannah areas of the mid-west of the country into production and to improve land and labor productivity through better technologies and innovations.
76. The implementation of the above policy option required among other measures, major investments in agricultural research. Therefore, EMBRAPA was created in 1973. It was founded in two pillars: (i) a *focused research model*, concentrated on products and areas of fundamental importance for the development of the country, and which constitutes an objective way of identifying research priorities; and (ii) *human resource capacity building*, based on strong training programs in centers of excellence around the world.
77. The decision to organize EMBRAPA as a public corporation was crucial for its success (E. R. Alves 2010). It exempted EMBRAPA from various bureaucratic rules applied to the public administration. This gave it the flexibility to administer its resources and personnel, to plan, assess its performance and to disseminate its results. In order to facilitate the interaction with farmers and the society, the institutional model chosen was characterized by a geographic decentralization of the research centers each of which specialized in products of economic importance (e.g. EMBRAPA rice and beans; EMBRAPA maize and sorghum, etc), eco-regional resources (e.g. EMBRAPA savannahs; EMBRAPA temperate agriculture, etc.) and thematic areas (e.g. EMBRAPA agrobiology, EMBRAPA food technology, etc).
78. During its first twelve years of existence, EMBRAPA was a promise of a research institution which would generate the technology and innovation needed to modernize the Brazilian agriculture. Betting on that promise, the Government provided increased amounts of financial resources to EMBRAPA. As shown by Figure 3, EMBRAPA's budget increased about 1,000% in real terms between 1974 and 1982 increasing from USD 78 thousand to USD 916 thousand. As will be seen later, after the 1974-1982 period, EMBRAPA's budget continued to follow an upward trend, but with some falls due in large part to the macroeconomic programs followed between 1997 and 2002.

Figure 3 - EMBRAPA's Annual Budget, 1974-82



Source: EMBRAPA

79. Aware of the risk that the lack of achievements represented for the continued support from the Federal Government, EMBRAPA's management led the research centers to implement a research program focused on short-term goals and to successfully conclude the research in progress. In addition, it gave special attention to the dissemination of the generated technologies and innovation.
80. One of the greatest achievements of EMBRAPA and the one which consolidated its image with the Government and the public opinion was the development of technologies which enabled farmers to transform the savannah from an unproductive agricultural region to one of the most important production areas of the country. The applied agricultural science unveiled the constraints imposed by the poor acid soils of the savannah.
81. The technological developments included new crop varieties adapted to low-latitudes and to soil and climatic conditions of the tropics. Among them new soybean varieties were notable. In addition to new varieties the technologies created included also the biological fixation of nitrogen, novel cultural practices, the development of livestock for meat and milk, irrigation methods and knowledge suitable for the *Cerrado* natural resources. The intensification of agricultural mechanization, particularly in grain production, was also an important part of the development of Brazilian agriculture.
82. The development of Brazilian savannah involved the generation and use of a large portfolio of technologies which transformed it in one of the top grain and beef producing regions in the world. The technologies developed focused initially on soils and plants, including pastures and then on farm animals, mainly beef and dairy cattle. Among others, the most important technologies developed by EMBRAPA and other national research institutions were related to soil fertility improvement, biological nitrogen fixation, new varieties and hybrids, no-tillage system and integrated crop-livestock systems.

83. The use of these and other technologies contributed to producing a remarkable change in Brazil's savannah. As shown by Table 4, grain production in this region increased from 8 million tons in 1970 to 13.8 in 1980 and then reached 48.2 million tons in 2006 – a six-fold increase. Today the savannah biome in Brazil, which occupies roughly 25% of the country's territory accounts for more than 50% of total grain production.

Table 4 - Grain production (million tons) in the *Cerrado* region and in Brazil

Year	<i>Cerrado</i>	Brazil	<i>Cerrado</i> share (% of Brazil)						
			Total*	Rice	Edible beans	Maize	Soybean	Cotton	Coffee
1970	8.0	22.7	35.4	53.2	25.3	32.0	6.9	50.0	40.4
1975	10.6	33.1	32.0	52.1	24.4	33.0	12.2	53.1	24.7
1980	13.8	39.5	34.9	55.2	22.3	33.6	23.0	49.0	36.4
1985	17.9	47.9	37.4	39.7	24.7	35.0	39.3	44.2	35.4
1996	26.4	58.0	45.5	25.8	29.4	46.5	62.7	57.2	38.4
2006	48.2	98.0	49.2	28.0	25.7	43.3	60.4	98.1	49.0

* Includes rice, edible beans, soybean, maize, coffee, and also cotton.

Source: (Alves 2011).

84. The most notable cases of crop expansion in the savannah region are soybeans and cotton. The technologies developed for these crops, particularly to soybeans, enabled the domestic farmers (a large number of them from the south of Brazil – known as *gauchos*) to expand the production of these products greatly. Specifically, the share of soybean production from the savannah region in the total output of this product grew from 7% in 1970 to 60% in 2006 (Table 4). In the case of cotton, the expansion was from 50% to 98% in the same period. The contribution of yield increase to cotton expansion varied considerably. Regarding soybeans, most of the production growth was explained by area increase. However, it shall be noted that the recent crop area expansion in the savannah region (1996-2006), especially soybeans in the northern portion of the biome and sugarcane in the southern *Cerrado*, is mostly occurring on previous pasture area.

85. Beef production in the savannah region totaled 32.8 million tons in 1975. Since then, it grew at an annual growth rate of 7.5% reaching 307.3 million tons in 2006. The shares of *Cerrado's* beef production in the country's output of this product varied between 38% and 53% (Table 5). In the case of milk, the production from the savannah averaged 2.2 million liters in 1970. After that year it increased steadily (3.6% per year) totaling 8.1 million liters in 2006. The participation of milk production from the savannah in Brazil's production of this product fluctuated between 37% and 45% in the 1975-2006 period.

Table 5 - Savannah's contribution to beef and milk production in Brazil

Year	<i>Cerrado</i> region share (% Brazil)	
	Beef	Milk
1975	46.43	36.89
1980	47.67	39.75
1985	38.24	41.41
1996	53.07	44.86
2006	41.96	40.10

Source: Adapted from (Alves 2011)

86. The style of growth in beef and milk production in the savannah was remarkable. Since 1985, productivity has accounted for the entire beef production expansion in the biome (Table 6). As noted by (Martha, Jr., Alves and Contini 2011) regarding the specific contribution of the components of productivity (country basis), animal performance accounted for 65%, while stocking rates were responsible for 35% of the gains.

Table 6 - Contribution of productivity gains to the growth of beef and milk production in the Savannah

Year	Yield contribution (% production)	
	Beef	Milk
1975-2006	103.28	49.03
1975-1980	84.21	60.64
1980-1985	95.69	42.87
1985-1996	104.52	97.87
1996-2006	114.96	-

Source: Adapted from (Alves 2011)

87. In the case of milk, productivity explained 49% of the production expansion in the 1975 – 2006 period. In summary, animal production in the savannah incorporated increasing levels of technology, which was translated into significant productivity gains. These productivity gains in beef and milk production provided land-saving effects that played a pivotal role in making land available for crop expansion, thus minimizing pressure over natural resources.

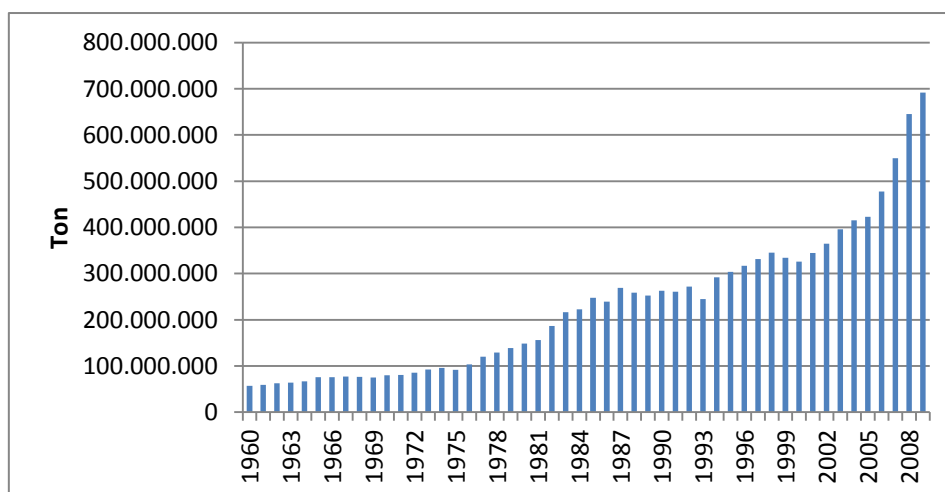
88. New-crop varieties, adapted to low-latitudes and to soil and climatic conditions of the tropics, and modern inputs were increased incorporated into novel production systems. The intensification of agricultural mechanization, particularly in grain production, was also an important part of the development of Brazilian agriculture.

a.5 Major agricultural programs

89. In addition to the above policies, the process of farmers' investments in Brazil's agriculture was also influenced by several programs. Among others they included the PROALCOOL, the road construction program and PRODECER. Their impacts on farmers' investment are discussed below.

90. **National Alcohol Program – PROALCOOL.** The 1973 oil crisis affected significantly the Brazilian economy. Among other aspects, it fuelled the inflationary process which besides resulting in very high rates of inflation contributed to further deteriorating the balance of trade. In this context, the Government gave special attention to expanding agricultural production for export and adopting policy measures such as the creation of a PROALCOOL Program in November 1975 as a means to promoting alcohol production from sugarcane as a petroleum substitute.
91. Specifically, the decree which created this program established special credit lines, and determined price parity between bioethanol and standard sugar. Moreover, it formalized the creation of the National Alcohol Commission which was responsible for managing the program. Several incentives to expand the production and use of bioethanol fuel were provided including the following (BNDES 2008): increasing progressively the addition of anhydrous bioethanol to gasoline until 25%; guarantying lower consumer prices for hydrated ethanol relative to gasoline; ensuring competitive prices to the bioethanol producers even in contexts of more attractive international prices for sugar; providing credit lines with favourable conditions for mills to expand their production capacity; reducing taxes on new vehicles run on hydrated bioethanol; and making the sale of hydrated bioethanol at gas station compulsory.
92. The implementation of the above-mentioned measures resulted in a large demand for bioethanol. This demand, together with the large volumes of agricultural credit provided to farmers stimulated large investments in sugarcane production. Therefore, between 1975 and 1980 the domestic production of this crop expanded from 92 million ton to 149 million (Figure 4). After this initial period of execution of PROALCOOL, the national output of sugarcane continued to expand substantially reaching 692 million ton in 2009. Several factors contributed to this steady expansion, including the development of new technologies and a favourable policy environment.

Figure 4 - Brazil: sugarcane production, 1960-2009



Source: IBGE

93. **Road construction program.** The expansion of agricultural production in the 1960s through the “conservative modernization” process, benefited from some policies followed in the previous decade. Specifically, the government’s investment program

on road construction implemented during the 1952-1960 period increased the federal highway system from 12.3 to 32.4 thousand kilometres. The same was observed with the state highway system in the same period, i.e. an expansion from 51 to 75.9 thousand kilometres. In addition to large investments in road construction the government, particularly the one of President Juscelino Kubitschek (1956-1961), promoted the development of the automotive industry in the country. The expansion of this industry together with the growth of the road system, contributed significantly to the incorporation of new land into production, both within the occupied parts of the center-south and in the agricultural frontier. In addition they made possible the transport of large volumes of agricultural products from distant areas to urban centers and to the ports.

94. **Cooperation Program Japan-Brazil for the Development of the Savannahs (PRODECER).** Following three years of discussions and analysis, PRODECER initiated its operations in 1978. The objectives of this program were twofold: (i) to incorporate savannah areas into production in order to increase agricultural output based on modern methods of production; and (ii) to contribute to the social-economic development of the savannah region through the establishment of new infrastructure. Initially the Program was implemented in selected areas located in the state of Minas Gerais. However, after few years it was extended to savannah areas in the states of Goiás, Bahia, Mato Grosso and Mato Grosso do Sul and more recently to the states of Tocantins and Maranhão. The activities of the Program focused in promoting the production of several crops, particularly soybeans, corn and wheat in medium size farm establishments.
95. The Program provided funds for the purchase of land, machineries and farm equipment by farmers and cooperative. It also financed crop and livestock operating costs as well as expenditures with project formulation and technical studies.

3.2 - Transition decades: 1980-2000

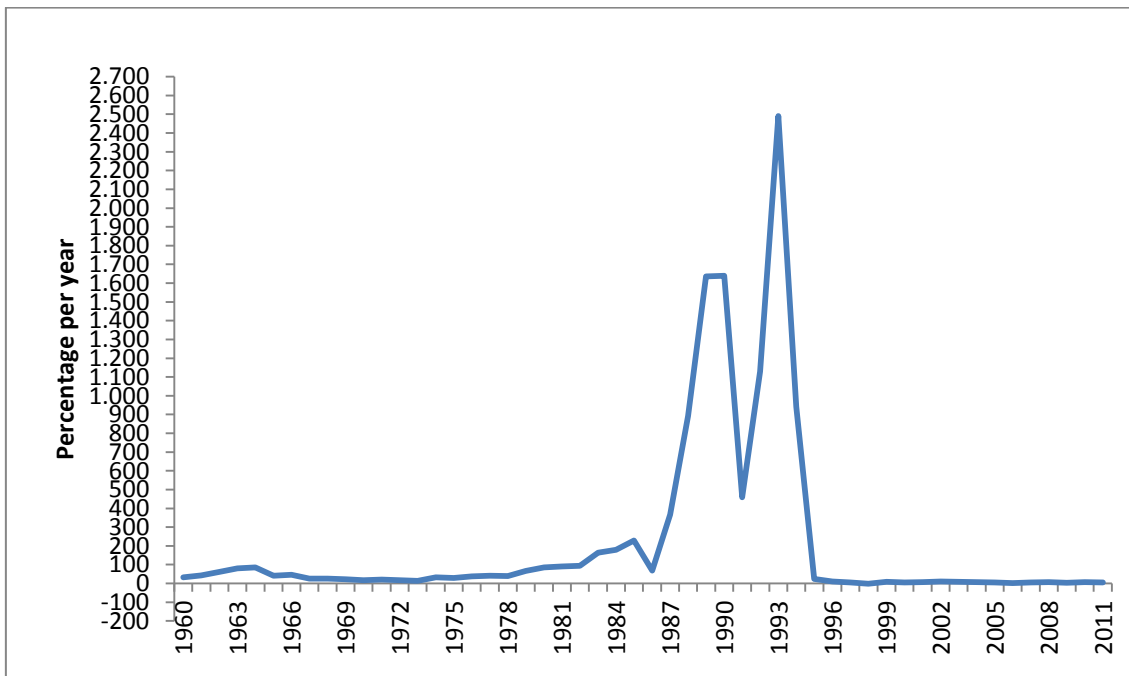
96. After experiencing high rates of economic growth in the 1960s⁴ and 1970s, Brazil faced major economic crises during the eighties and nineties, brought initially, by external shocks such as tripling the oil price, sudden increase of the international interest rate and sharp contraction of private external lending. The crises reduced the average real growth of the economy from 8.6% in 1971-1980 to 1.6% in 1981-1990 and to 2.5% in 1991-2000. In addition, the domestic inflation level increased dramatically moving from an average monthly rate of about 5% in 1980 to a record high of 31% in 1993 (Figure 5).
97. Given the above, the Government changed its policy orientation adopting several macroeconomic adjustment programs⁵ seeking to reduce the inflation rate, generate large commercial surplus to pay foreign debts and create an appropriate climate for restoring domestic investments and economic growth. Moreover, it was forced to abandon the previous strategy of relying on massive state and foreign investments in heavy industry, infrastructure and consumer durables as main engines of growth.

⁴ During the 1961-1970 period the average growth rate of the economy was 6.17%.

⁵ The macroeconomic adjustment programs were as follows: *Plano Cruzado I* ("Cruzado Plan I", February 1986), *Plano Cruzado II* (*Cruzado Plan II*, November 1986), Bresser Plan (Junho, 1987), *Plano Verão* (Summer Plan, January 1989), and Collor Plan I (March, 1990), Collor Plan II (February, 1991), and *Plano Real* (Real Plan, June 1994).

98. Regarding agriculture, the 1980-2000 period was characterized by frequent changes in the policy framework. This was caused not only by macroeconomic constraints, but also by changes in the policy objectives. On certain occasions, the main objective was to ensure a proper supply of agricultural products to avoid inflationary pressures caused by food shortages. In contrast, on other moments the focus was on the generation of foreign exchange earnings through larger exports.
99. In addition to the above, the agricultural sector became increasingly subject to complex and distorting interventions such as barriers to exports and price controls (Mueller and Mueller 2006). A third characteristic of the policy framework was that the policies followed during the 1980s became increasingly unsustainable. Therefore, a new agricultural strategy was adopted in the 1990s. The sessions below present the main elements of the policy frameworks followed during these two decades.

Figure 5 - Brazil: yearly inflation rate, 1960-2010



Source: Fundação Instituto de Pesquisas Econômicas - FIPE

3.2.1 Economic development strategy, policies and programs

100. In line with the conditions attached to the structural adjustment loans provided by the IMF and the World Bank to Brazil, the economic reform programs followed by the government in the beginning of the 1980s were of an orthodox nature. The policy measures, which emphasized the role of market forces as the main mechanism for resource allocation included: reorienting the economy towards exports so as to earn the foreign exchange required for servicing the debt; radically reducing government spending; devaluing the domestic currency against the US dollar; cutting tariffs, quotas and other restrictions on imports; privatizing state enterprises; and cutting down on wage increases. Regarding agriculture, the policy orientation focused among other elements on: eliminating the provision of subsidized credit and fertilizers; cutting extension services; reducing government involvement in agricultural marketing; and liberalizing domestic market prices.

101. The lack of effectiveness of the government efforts to stabilize the economy in the early 1980s, led it to adopt several other macroeconomic adjustment programs starting with the *Cruzado* Plan I in February 1986. This heterodox program was developed based on the hypothesis that to overcome the triple-digit inflation problem it would be necessary to break the inertial cycles of wage/price readjustments linked to the price increases of each preceding contract period (Kaufman 1990). Therefore, the policy framework followed included freezing public tariffs and key consumer prices, increasing wages and changing the domestic currency from *Cruzeiro* to *Cruzado* by dividing the face value of *Cruzeiro* by a thousand.
102. Following few months after the *Cruzado* Plan I, problems of excess demand became evident. Shortages of various goods and surcharges were observed with long queues to buy several goods. Moreover, fiscal deficits remained a problem. Thus, in November of 1986 the Government announced the *Cruzado* Plan II. Among other elements, it increased public tariffs, reintroduced mini-devaluations of the currency and softened the wage trigger provision by manipulating the inflation index. It also attempted to maintain the price freeze. However, it authorized selective increases in the price of various products. The adoption of this Plan was not capable of overcoming Brazil's macroeconomic problems. The external accounts deteriorated, protests against price freeze and manipulation of the inflation rate increased, and by early 1987 the inflation rate escalated to pre-*Cruzado* highs. In addition, in February of that year the country declared a moratorium on servicing its medium and long-term commercial debt.
103. The above led to a change of Finance Minister and to a new adjustment effort, the Bresser Plan. Like the previous plans, this one also included a wage/price freeze. Nevertheless, with the difference of establishing an explicit ninety-day duration. Moreover, it was characterized by a 9.5% devaluation of the domestic currency, and a central focus on the reduction of the fiscal deficit through spending cuts and increases in public tariffs and taxes. In line with this orientation, Minister Bresser Pereira sought to establish a capital gains tax. However, his proposal was not supported by President José Sarney. This fact, together with fierce attacks on the price freeze, strong pressures against wage deterioration and limited success of the Plan, led the Minister to resign at the end of 1987.
104. The policy followed by the new Finance Minister, Mr. Mailson da Nobrega, consisted of an orthodox economic program based mainly on minimal fiscal reform and negotiating an agreement on external debt. The implementation of this policy, known as "rice and beans policy", did not produce the expected results. The inflation rate rose gradually moving from 14% per month in December 1987 to 30% by the end of 1988. Therefore, in January 1989 the "Summer Plan" was adopted. This heterodox plan was similar in spirit to the Bresser Plan. Among other elements, it comprised the freezing of prices for an indeterminate period, de-indexation, a return to the mini-devaluation of the national currency and a new rule of adjustment⁶. A monetary reform was also established by replacing the *Cruzado* by the *Cruzado* Novo (three zeros were eliminated from the *Cruzado*). In addition, the

⁶ This new established that the total devaluation rate would be equal to current inflation rate, being achieved through six mini-devaluations during the month without pre-established dates.

disbursement of resources by the National Treasury became conditioned to the revenue actually collected plus the existing cash in hand of the government as of 31 December 1988.

105. Notwithstanding the implementation of the Summer Plan, in June 1989 the monthly inflation rate was at the same level as before the plan. According to (Barbosa and McNelis 1989), the main reason for the failure of the Summer Plan is that there was no reduction of the government deficit and the monetary policy continued on its passive path.
106. Given the persistent macroeconomic problem faced by Brazil, another set of stabilization measures, known as Collor Plan I, was adopted by the Government in early 1990. It combined trade and investment liberalization with a more radical inflation stabilization policy. The main policy measures included the following (Baer 2001): temporary freezing of prices and wages; replacement of the domestic currency, the *Cruzado Novo*, by the *Cruzeiro* (Cr\$ 1.0 = NCZ\$ 1.0); frozen during 18 months 80% of financial assets of the private sector deposited in bank accounts⁷; liberalization of the exchange rate allowing it to fluctuate; gradual opening of the economy to external competition; privatization of state enterprises⁸; extinction of several federal government agencies, including the Brazilian Enterprise for Rural Technical Assistance (EMBRATER); elimination of most fiscal incentives; and establishment of an extraordinary tax on all financial transactions.
107. Following the adoption of Plan Collor I, the inflation rate dropped during several months. However, due to the relaxation of price and wage controls, and the erratic monetization process it increased again leading the Government to adopt Plan Collor II in February of 1991. This new plan focused on a limited financial reform and an attack on inertial inflation. It consisted basically of a new freezing of prices and wage, the elimination of various forms of indexation, a tight grip on the expenditures of state enterprises, increase of public tariffs, and attempts to better manage cash flows. The implementation of these measures generated only a short run positive result. After reaching a minimum monthly inflation rate of 5% in April 1991, it returned to a two-digit level in June of that year. A month earlier of reaching this high inflation level, the Minister of Finance Zelia Cardoso, was replaced by a new minister, Mr. Marcilio Marques Moreira.
108. Like the previous ministers, Mr. Moreira established also a new macroeconomic adjustment policy known as Marcilio's Plan. Characterized by an orthodox orientation and gradualism, it included a restrictive fiscal policy, high interest rates, and liberalization of the prices which were frozen by Collor Plan II. The government obtained also a two billion loan from the IMF to complement internal currency reserves. The implementation of this plan however, did not end the hyperinflationary process faced by the country. The inflation continued at high level reaching a monthly rate of 48% in June 1994.

⁷ A real interest rate of 6% per year was paid on the frozen assets.

⁸ The National Privatization Program, expanded the scope of privatization to include a number of the enterprises formerly considered as "strategic" by earlier governments. Fifteen state-owned enterprises were privatized during the Collor Government, yielding about US\$3.5 billion in total proceeds. The most important sale was that of the Minas Gerais Iron and Steel Mills, Inc. (USIMINAS). It alone accounted for nearly twice the revenue of all previous privatizations.

109. The failure of the macroeconomic stabilization plans adopted by the various ministers of finance during the 1980-1993 period, showed that fiscal deficits and indexation were a major components of the domestic inflation. They showed also that freezing prices and salaries was innocuous against inflation. Giving these lessons, the last stabilization program adopted by the government in the 1980-2000 period, the Real Plan, consisted of: legally enforced balanced budget; privatization of State owned companies (including banks, telecommunication companies and steel plants); spending cuts on government investments, personnel, and state companies of about USD 7 billion; high interest rates practiced by the central bank; introduction of a new currency, the *real*, pegged to the US dollar; trade liberalization; changing the exchange rate regime from a crawling peg system to free floating of the exchange rate.
110. In addition to the above, the plan also included de-indexation of the Brazilian economy. This was accomplished in part by converting salaries and a number of other prices in the months preceding the implementation of the *Real* Plan into Real Value Units (URVs), which were then linked to the United States dollar. After July 1, 1994, prices in URVs were converted into *Reais*, which began officially at par with the dollar, but traded at a premium in the open market.
111. By the end of 1996, the Real Plan started to show positive signs of success towards the objective of ending decades of inflation. Late that year, the inflation rate approached an annual rate of less than 20 percent, a remarkable achievement considering that a few years earlier this was the monthly rate. Before reaching a stable macroeconomic situation, Brazil faced some turbulence as a consequence of the Asian financial crisis in 1997 and the Russian bond default in August 1998. These short-term problems led the country to establish a USD 41.5 billion international support program with the IMF in November 1998.
112. Moreover, after following a quasi-fixed exchange rate system during the 1994–1999 period, an inflation-targeting policy was adopted by the Government in January 1999, which effectively meant that the Real would no longer be pegged to the US dollar. However, the currency was never truly "free", being more accurately described as a managed or "dirty" float, with frequent central bank interventions to manipulate its dollar price. The implementation of these and other measures contributed to moderate the negative performance of economic growth that Brazil was experiencing and set the bases for an important period of macroeconomic stability.

3.2.2 Agricultural development strategy, policies and programs

113. The 1980-2000 period is characterized by drastic changes on the existing agricultural policy framework resulting in a substantial improvement of the business climate for agriculture investment. During this period, the policies were changed from heavy and commanding interventions by the state to a more market oriented paradigm. Market prices and incentives led to investments that increased productivity and expanded the domestic supply of agricultural products because prices became more attractive to producers.

114. A rapid expansion of Brazilian agriculture and agro-food restructuring resulted from the business climate improvements that started in the mid-1980s. By the early 1990s, the state's role in the economy had changed dramatically. Trade liberalization, privatization, the end of price controls, a reduction in entry and exit barriers, enactment of legislation protecting competition, a more open attitude toward foreign investment, and a sharp reduction in red tape in the life of citizens significantly transformed the business environment (Pinheiro, Gill, et al. 2005).
115. These reforms involved also the change of the domestic currency to Brazilian Real in 1994; by the late 90s the country had accumulated high levels of foreign debt and the Real was floated in 1999. The devaluation that followed enabled exports, and especially agricultural ones, to become the driver of economic growth and to finance the foreign debt burden (Directorate-General for Agriculture and Rural Development 2006). By the end of the 1990s, Brazil had managed to combine in depth structural reforms with a proper macroeconomic policy. This long overdue combination raised hopes that the elusive goal of sustainable growth was finally within grasp. (Pinheiro, Giambiagi and Moreira 2001)
116. In addition, economy-wide structural reforms introduced in the early 1990s further decreased adversities of the agricultural investment business climate in Brazil by eliminating export taxes and price controls, deregulating and liberalizing commodity markets, introducing private instruments for agricultural financing, reducing tariffs and non-tariff protection in all sectors of the economy, with emphasis on agriculture. The measures included also a gradual elimination of state-owned marketing boards and regulation of products such as coffee, sugar and wheat; clear definition of a new policy to gradually reduce government intervention in agricultural marketing; elimination of taxes on exports of agricultural products (ICMS); and the abandonment of sale of government stocks at subsidized prices, among others (Lopes, Lopes and Barcelos 2007).

a.1 - Agricultural credit

117. The fiscal difficulties of the early 1980s due to the foreign and domestic public debt crises, led the Government to reduce substantially the subsidies given to the agriculture sector via rural credit (Dias and Amaral 2001). Subsidized credit was considered as the principal policy to compensate agriculture investors for the unfavorable business climate and adversities created by the import substitution policies of the previous decades.
118. Although subsidized credit was reduced, approximately one half of the overall benefit from credit support resulted from the restructuring of large farm debt accumulated over the period of macroeconomic instability in the late 1980s to mid-1990s. Debt rescheduling was unavoidable, given the need to renew the flow of liquidity into the sector. However, successive rescheduling led to defaults on rescheduled debt (OECD 2005).
119. With the depletion of official rural credit system and the improvement of macroeconomic conditions that took place in the 1990s, new financing sources and mechanisms began to be established. For instance, supermarkets concentrate liquidity because they operate by buying with delayed payment and sell mostly for

cash on a large scale. These commercial practices allowed them to have the liquidity to finance agriculture producers. Traders / processors, especially transnational corporations (TNCs) that entered the country through foreign direct investments (FDI) (see Box 2), had access to foreign funds. Therefore, these new actors participated in the financing of agriculture, including through contract farming (Nascimento 2011).

a.2 – Minimum price policy

120. In addition to subsidized credit, Brazil also employed several mechanisms to support producer prices, such as commodity loans or intervention purchases, where the government intervened in the market to buy and store products when the market price falls below a fixed target price. However, these mechanisms did not result in broad, sector-wide price distortions. Indeed, market price support tended to be close to zero at the end of the 1990s (OECD 2005).

121. In line with the structural reforms initiated after the mid-1980s, the elimination of subsidies and the significant reduction in the rural credit volume gave way to price support (Box 1) and income security for producers as the main instrument to support agriculture.

Box 1- Guaranteed Minimum Price Policy (PGPM)

PGPM is an income policy for agriculture, whose purpose is to reduce output price risk to farmers, providing them with minimum revenue per unit of output, which induces investment and production, and thereby seeks also to ensure food security. The government acts as price regulator systematically intervening at times when the market points to unprofitable agriculture output prices. It should be noted that the effectiveness of policy depends on the value of the price fixed by the government, the availability of resources and volume of product operationalized relative to total production.

From the standpoint of the producer, the minimum price acts as insurance, guaranteeing a minimum income for its production. It can be seen also as an indicator of the market, as it becomes an important indicator for the decision making of economic agents involved in the production and marketing of agricultural products. (Ramos 2009)

This policy had the merit of reducing government intervention in the market and public spending, improving business climate by reducing price risk and assuring minimum investment profitability, while contributing to stabilize food prices and control inflation.

122. The PGPM policy experienced a series of reforms since its creation. However, the widest one took place in the 1990s. Until the mid-1980s, the PGPM focused exclusively on the formation of public food stocks purchased at the minimum price. Because of the need to reduce costs with the acquisition and management of these stocks, the traditional and more interventionist instruments of implementation were partially replaced by market oriented tools. The instruments of acquisition and financing of marketing were retained, but the formation and release of buffer stocks began to intervene less in the market. Furthermore, it was established that government stocks sales would be through auctions.

123. After the Real Plan, more selective and less costly policy instruments for the implementation of PGPM were established. Moreover, with the opening of the economy, market prices began to be less influenced by public stocks, allowing the surfacing and incorporation of private support mechanisms.

124. The government's Agriculture and Livestock Plan for 1996/1997 highlighted the changes in pricing and consolidated a less interventionist and more private agricultural marketing. The funding modality EGF / COV (further discussed below) was extinguished and was instituted in its place, the Put Option Contracts⁹ (VOC), whose main objective was to provide a guaranteed price that was not necessarily associated with the immediate expenditure of public funds and need for government stockpiling (Ramos 2009).

a.3 – Trade liberalization and realignment of price incentives

125. The liberalization of agriculture products and inputs trade is considered as one the main factors explaining agricultural growth in the 1980-2000. It allowed investors decision to be aligned more closely to the true scarcity of these goods as expressed by their prices. The elimination of the adverse and misleading trade policies generally resulted in cheaper tradable input prices and higher output prices for agriculture projects making them more attractive to investors.

126. Trade liberalization had been initially thought as a tragedy, but became a factor of great stimulus to increased competitiveness of Brazilian agribusiness leading it to the success it enjoyed later in the international market (Lopes, Lopes and Barcelos 2007).

127. The process of economic liberalization initiated in the mid-1980s benefited agricultural exports. Although trade liberalization was already consolidated in the 1990s and had brought in more competitive markets for agricultural products and processed foods, it was the opening of the input markets that had the greatest impact on agriculture. Input markets were less competitive and received more agricultural subsidies during the previous period. With greater external competition, there was a marked rearrangement of its terms of trade which, combined with productivity increases, resulted in greater purchasing power of agricultural inputs. This was the main factor explaining agricultural growth in this period (Lucena and Souza 2001) (Lopes, Lopes and Barcelos 2007) (Pinheiro et al., 1993). (Pinheiro, Gill, et al. 2005).

128. The relations of prices resulting from the opening of the economy contributed to increase commodity prices as compared to input prices. Few products (chicken, milk, cocoa, wheat and grape) had more favorable terms of trade before the liberalization. The opening of the economy allowed for import and export of products and inputs for agriculture, integrating it into international markets, which helped to improve the exchange relations for most products (Lucena and Souza 2001) (Lopes, Lopes and Barcelos 2007). More specifically, protection to domestic producers was greatly reduced as tariff on imports decreased; and non-tariff barriers, export subsidies, export tax exemptions, and export financing schemes were eliminated (Pinheiro, Giambiagi and Moreira 2001).

⁹ An option contract giving the owner the right, but not the obligation, to sell a specified amount of an underlying security (in this case an agriculture output) at a specified price within a specified time. This is the opposite of a call option, which gives the holder the right to buy shares. Read more: <http://www.investopedia.com/terms/p/putoption.asp#ixzz1tCWy4j6G>

129. Another trade change that brought a new dynamic to agriculture sector was the implementation of Mercosur in 1996. Its member states, Argentina, Uruguay, and later Paraguay, were large food producers. This common market resulted in a strong productive integration between the countries. For example, Paraguay provides corn and wheat to the West of Paraná and the West of Santa Catarina, where agro-industrial complex is a major meat exporter. The early period of the Mercosur facilitated the import of agricultural products for supply in Brazil, helping to slow down government intervention in agricultural markets (Lopes, Lopes and Barcelos 2007).
130. However, Brazil also undertook a strong reduction in its tariff structure for agricultural products for countries outside Mercosur which had negative effects on agriculture. This negative impact resulted from the lack of a legal framework that could allow Brazil to apply countervailing duties against the unfair trade practices of dumping and subsidies at the origin. So, Brazil started to import large quantities of products with subsidies granted by developed countries, notably cotton, wheat, milk powder and corn, which lasted until the late 1990s. Some segments of agriculture sector did not survive the unfair competition with the developed countries subsidized prices of certain imports. Cotton, for example, planted in Parana and Sao Paulo almost disappeared, resulting in the loss of approximately 300,000 jobs in manual harvesting. Milk producers also suffered from this type of unfair trade practices (Lopes, Lopes and Barcelos 2007).
131. Therefore, trade barriers and subsidies to domestic producers and exporters, especially in developed countries, impacted significantly Brazilian agrifood exports. (Chaddad and Jank 2006). Given that Brazil had broadly liberalized its agricultural policies, substantial benefits were expected to come to the country from reforms to unfair trade practices and agricultural policies in other countries. Brazilian agricultural exporters have faced a number of barriers to selling their produce in OECD markets (OECD 2005) (Lattimore and Kowalski 2008).

a.4 – Privatization, deregulation and foreign direct investments

132. The privatization that took place in the 1980-2000 period opened space for more investments by the private sector. This sector was also benefited by reduced operational costs resulting from the deregulation of government requirements and other regulatory burdens.
133. Privatization of public companies and functions undertaken by the government as well as reduction of bureaucratic requirements were also subject of major changes in policy orientation in 1981–93. Brazil's first attempt to control expansion of state enterprises dates to 1979, but officially privatization did not begin until 1981 when a presidential decree created the Special Privatization Commission. Over the rest of the decade, the government sold 38 companies, transferred 18 to state governments, merged 10 into other federal institutions, closed 4 and rented 1.
134. In 1990 the government launched the National Privatization Program, greatly expanding the scope to include large industrial state owned enterprises (SOEs). In 1991–93, large state holdings in steel, petrochemicals, fertilizers, and other manufacturing sectors were sold to private investors. (Pinheiro, Gill, et al. 2005)

This period also saw the extinction of the Brazilian Enterprise for Rural Technical Assistance (EMBRATER). The 1990s also saw the extinction of the Brazilian Coffee Institute, and the Sugar and Alcohol Institute and the fusion of the Production Financing Commission, the Brazilian Warehouse Company and the Brazilian Food Company into the National Supply Company (Ramos 2009).

135. The competition law and the antitrust agency were both strengthened, while a number of laws and decrees were revoked, discontinuing public monopolies, entry barriers, and restrictions on certain activities. Regulations on FDI were also eased, which helped boost FDI inflows in the late 1990s. (Pinheiro, Gill, et al. 2005)

136. Other initiatives involved, inter alia, foreign trade (e.g., the end of public monopolies in exporting coffee and sugar and in importing wheat and the elimination of import and export licenses) and foreign investment (elimination of most restrictions).

137. The Real Plan stabilized the economy, reducing inflation to around 5 percent per year and setting off a domestic demand

boom that lasted for 5 years. In early 1999, Brazil adopted a floating exchange rate. The real depreciated considerably, making Brazil an attractive low-cost supplier of food and agricultural products. That stimulus led to the rapid expansion in soybean and meat production.

Box 2- The importance and role of foreign direct investment in agriculture

Brazil is a relatively large recipient of foreign direct investments. Up to 2008, the country had accumulated a stock of over USD288 billion in FDI in all sectors of the economy. This represented 45% of all FDI in South American countries, and nearly a quarter of the total invested in Latin America and the Caribbean (LAC) region. These investments, however, represents only a relatively small portion of the country's total Gross Domestic Product. FDI inflows, nevertheless, contributed 15.1% of the fixed capital formation, which itself has been around 15-25% of GDP.

FDI inward flows and stocks into Brazil are substantial amounts which have grown especially since the early 1990s. The agriculture related sector is the third most important recipient of such investments.

FDI inflows into agriculture sector are only a small portion of the economy's Agriculture Value Added. The relative importance of inward FDI flow in agriculture related sector in Brazil from 1996 to 2009 has varied from 1% to 29.4% of the total FDI entering the country. From 1998 and 2007, FDI flows in agriculture, forestry, livestock, and fisheries were usually smaller than 20% of the total agriculture sector FDI inflows, which includes agriculture related industries. Among the agriculture related industries, food and beverage products subsector was the one that received the most of the inward FDI, for a total of USD 21.3 billion up to 2009, around 61% of the total. Within the agriculture related sector, the agriculture, livestock, and related services is the subsector with the greatest amount of the inward FDI stock, followed by the silviculture, forest exploitations, and related services.

Trans National Corporations have had an important role in Brazil economic history since the 1940s, including in the agriculture sector. TNCs such Monsanto, and Corn Products, DuPont, Dow chemical, Bunge, just to name a few, have active in the country for decades, some for a century. This important TNC presence has only grown over the year so that out of the world's 25 largest TNC suppliers of agriculture, only 4 does not have operations in Brazil. Indeed one can find the presence of TNCs in Brazil in all stages of the value chain; from suppliers of agriculture and forest inputs, to machine and equipment producers, to agriculture or forest output producer, to processors and industrial firms, to wholesalers, retailers and exporters.

Brazil's agriculture development demonstrates the importance of an appropriate business climate that allow for more profitable investments in agriculture and forest based production.

The Brazil case also illustrates the importance of liberalization policies that allow international prices be transmitted to the domestic market. Provided trade is fair without dumping or subsidies to foreign producers, liberalization allows the price signal for investors both to increase their production when prices increase or divest when prices reduce and importation of affected food or fiber products are cheaper than the local production costs which turn their investments unprofitable.

This is mainly due the macroeconomic stabilization that resulted from the successful implementation of the Real Plan, in 1994. The Plan was able to control inflation and, at the same time, contributed to reduce pressure for salary increase, and stabilizing the production costs in the economy.

(Nascimento 2011)

138. The Real Plan was accompanied by further privatization of state enterprises and elimination of remaining barriers to foreign investment, facilitating the presence of multinational companies in Brazil.
139. Multinationals stimulated investment in agricultural research and development of integrated supply chains that link inputs with commodity production and distribution. In addition, by granting credit to producers to buy inputs (fertilizers, seeds, and chemicals), the large multinational corporations have alleviated the difficulties that Brazilian producers had in seeking credit from commercial banks (Valdes 2006).

3.3 - Economic stability and growth: 2000-2010

3.3.1. - Economic development strategy, policies and programs

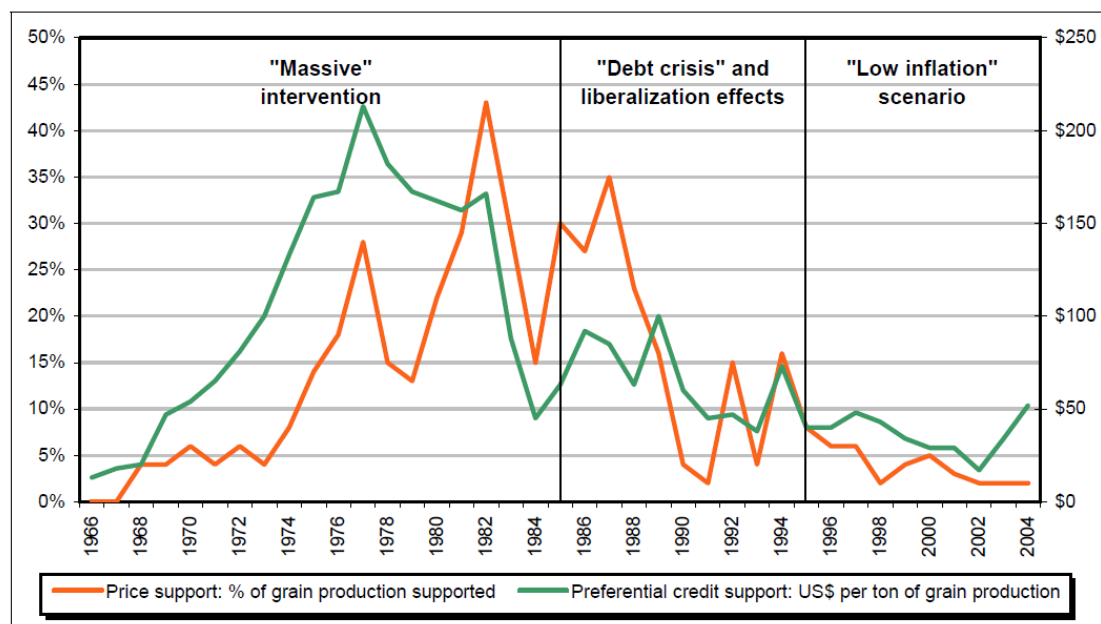
140. The economic climate at the beginning of the period 2000-2010 was characterized by a fear among domestic and foreign investors that the Government Lula, which would take power in 2003 would follow irresponsible macroeconomic policies, erode established property rights and be tempted to default on part of the national debt. In addition, there was a strong expectation that great emphasis would be given to social reforms and that fiscal responsibility established by the previous government would be sustained.
141. Lula Administration was aware of these expectations. Moreover, it recognized the importance of promoting economic growth and international competitiveness to achieve social development. Therefore, the first measures of the newly elected government included maintaining the inflation-targeting regime established after the 1999 maxi-devaluation and assuring its commitment to fiscal prudence. This last policy decision was reflected on a tight fiscal policy which involved increasing the 2003 primary surplus from 3.75% to 4.25% of GDP. This measure complemented the fiscal framework which included the Fiscal Responsibility Law established in 2000. This law specified limits on debt and certain types of public expenditures relative to revenues. It also set strict transparency requirements for all governmental operations while prohibiting intergovernmental bailouts.
142. Further to the above, the macroeconomic policy framework of the 2000-2010 period comprised a free-floating exchange rate regime. In this context, the Real has appreciated steadily since 2003, apart from the dip during the 2008 global crisis. One of the main factors behind the strengthening of the domestic currency was capital inflow. However, their effect has been compensated in part, by the favorable productivity differential between Brazil and its trading partners.
143. During the 2000-2010 period, greater attention was also given to environmental sustainability. Among other aspects, public action has focused on reducing deforestation, which accounts for almost half of Brazil's emissions. As a result, deforestation rates in the Amazon declined from 18,200 square km on average per year between 2000 and 2008 to 6,500 square km in 2010 (OECD 2011). A National Climate Change Policy was also established in 2009. It sets a national reduction target of between 36.1% and 38.9% compared to business-as-usual scenario of projected greenhouse-gas emissions by 2020.

144. Another major element of the 2000-2010 macroeconomic policy framework was a greater emphasis on public infrastructure investment, particularly since 2007 with the launching of the Growth Acceleration Program (PAC). This program, which replaced the Investment Pilot Project established in 2005, seeks to raise economic growth and enhance social inclusion through increased public and private investment in key infrastructure sectors including transport, energy and urban development. The total spending of this program during the 2007-2010 period amounted to BRL 503.9 billion (4.7% of 2007 GDP on average per year), of which around 55% was devoted to energy, 12% to investments in logistics and the remainder to urban and social development programs (OECD 2011).
145. In addition to expanding public investment in logistics, the government signed road concession agreements since the 1990s to rehabilitate the road sector. At the end of 2009 about 50 concessionaries managed 14,993 km of the road network. According to (Confederação Nacional dos Transportes 2010), approximately 87% of the highways under private concessions were in good or very good conditions in 2010, whereas the corresponding figure for those under the responsibility of the public authorities was just 32%.

3.3.2 Agricultural development strategy, policies and programs

146. Regarding agriculture, the policy framework of the 2000-2010 period was characterized by a continuation of a reduced public intervention in the sector vis-à-vis what was observed in the previous years, particularly between 1965 and 1985 when there was a strong presence of the Government in the sector (Figure 6).

Figure 6 - Commodity price and preferential credit support in Brazil



Source: (Chaddad and Jank 2006)

147. The first decade of the 2000s was marked also by a deepening of the social policies and programs which were initiated in 1995 by President Fernando Henrique Cardoso with the objective of promoting the growth of small farm agriculture. In

this respect, the PRONAF was maintained and further expanded. Other policy measures were also established to integrate small and subsistence producers into the market through targeted acquisition programs.

148. The agricultural policy framework of the last decade was notable also for the introduction of new market oriented policy instruments such as the Equalizing Premium Paid to Producer (PEPRO), the Premium for Transporting Agricultural Products (VEP) and several others which will be presented latter in this chapter. Moreover, it gave great priority to promoting the sector competitiveness, anchored on higher levels of productivity as the core mechanism to support the increase of production and income of the different groups of farmers. In addition, the Government placed important emphasis on strengthening market mechanisms, reliance on a major participation of the private sector in agricultural financing and marketing, openness to foreign trade and increased efforts to expand exports.

149. Further to the above, the framework of agricultural policies of the 2000-2010 period was characterized by the following:

- enhanced support to risk reduction through the establishment of additional rural insurance schemes which complemented the traditional PROAGRO program;
- increased concern with environmental and sustainability issues which resulted in the adoption of specific measures such as the agricultural economic zoning and the Low Carbon Agriculture Program;
- renewed attention to land reform through the launching, in November 2003, of the Second National Agrarian Reform Plan (PNRA II);
- additional emphasis on bioenergy production via the introduction of new policy measures like the creation of another biodiesel program and a Social Fuel Stamp; and
- continued support to strengthening agricultural trade.

150. The next sections summarize the main elements of the agricultural policies followed in the 2000-2010 period highlighting their relations with the investment on agricultural by farmers.

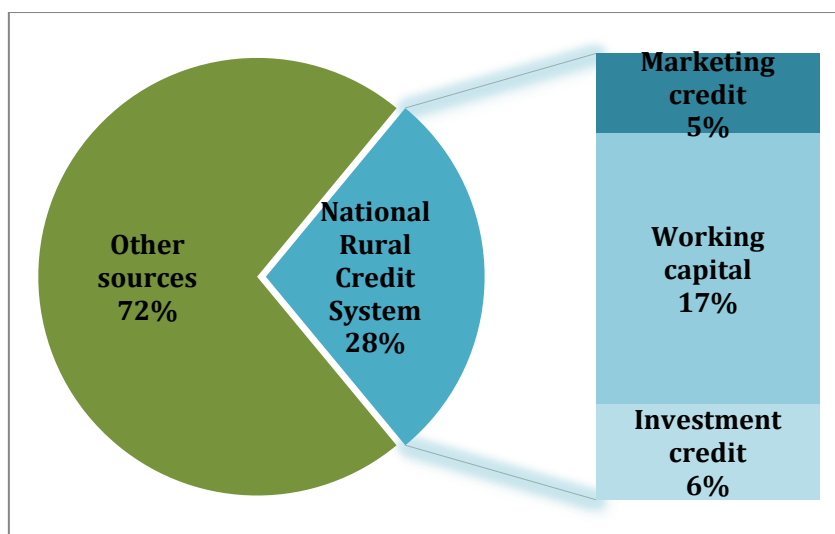
a.1. Rural credit for medium and large-scale agricultural producers¹⁰

151. The rural credit policy of the last decade followed a similar orientation as the one implemented since the end of the 1980s, i.e. a reduced participation of official credit (i.e. the one provided by the National Rural Credit System) in the financing of agricultural activities and an increased share of funds from private¹¹ sources in the total supply of credit (Figure 7). In this context, in contrast to what was observed in the 1960-1980 period, the rural credit was not the main policy instrument to support agriculture. However, as highlighted below, it played an important role contributing to expand agricultural investment, productivity and production, particularly of the commercial agriculture (i.e. of medium and large-scale producers).

¹⁰ Frequently the medium and large-scale agricultural producers are denoted to form a group of producers denominated in the literature as commercial farmers or commercial agriculture.

¹¹ These sources included credit from farmers own resources, traders, processors, input manufacturers and private banks.

Figure 7 - Brazil: share of the National Rural Credit System in the estimated aggregate borrowings of the agricultural sector in 2003

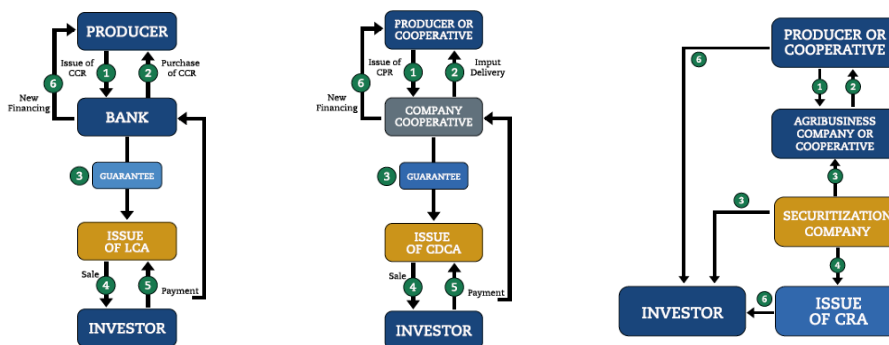


Source: Ministry of Agriculture, Livestock and Food Supply, estimated

152. In line with the above-mentioned orientation, the Government created several new credit instruments in the 2000-2010 period with the objective of attracting urban investors, whether small savers or large pension funds, to finance the rural activity, complementing the credit provided by the Government. These instruments included the Agricultural Certificate of Deposit (CDA) established in 2004 by Law number 11.076/04. It represents a promise of delivering an agricultural product which has been stored in a warehouse¹². The producer negotiates the certificate with private agents in exchange for funds to finance agricultural activities. At the end of the contract period, the producer provides the product or payback the funds received.
153. In addition to the CDA, three other credit instruments were created: the Agribusiness Credit Note (LCA), the Certificate of Agribusiness Credit Rights (CDCA) and the Certificate of Agribusiness Receivable (CRA). The first is a financial paper which the banks issue pegged to a Rural Credit Note (CCR) or to a Rural Promissory Note (NPR). These rural notes are financial instruments used to provide loans to farmers so that they can purchase inputs. The banks, instead of keeping the CCR or the NPR, they issue a LCA and trade it in the market with urban investors. At the maturity of the CCR or NPR the farmer redeems his debt with the bank which in turn, pays the LCA to its holder. The system operates in a way that urban investors feed the banks with resources which are used to finance farmers (Figure 8).

¹² The warehouse issues the certificate.

Figure 8 - Operational flow of Agribusiness Credit Note (CRA), Certificate of Agribusiness Credit Rights (CDCA) and Certificate of Agribusiness Receivable (CRA)



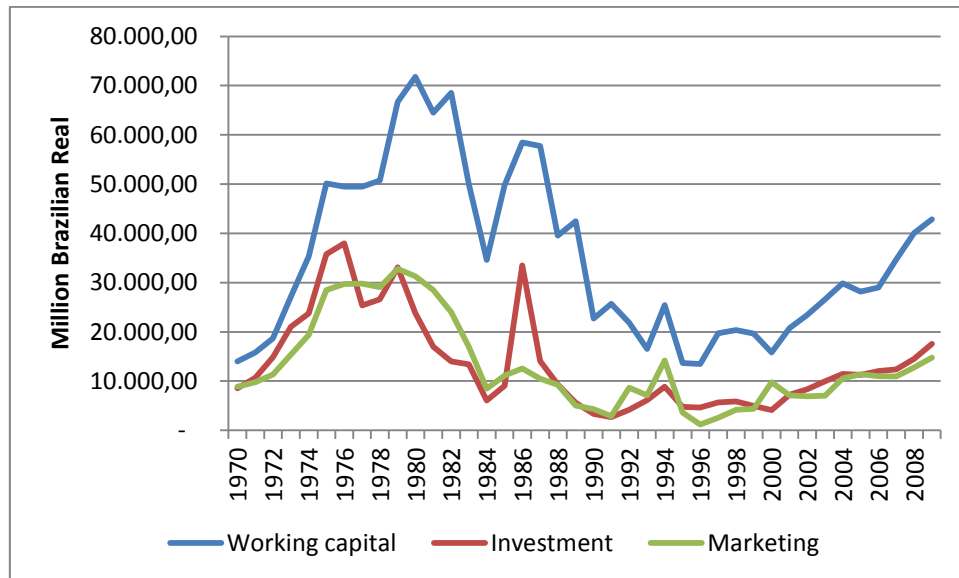
Source: Ministry of Agriculture, Livestock and Supply of Brazil

154. The CDCA is similar to the LCA, the difference is that private companies or cooperatives, which provide inputs to agricultural producers replace the banks as credit provider and issuer of the CDCA (Figure 8). In the past, the capacity of these companies and cooperatives to finance farmers' purchases of inputs was determined mainly by their budget. Thus, the creation of the CDCA opened a good opportunity for them to obtain new resources to finance agriculture and at the same time, to expand their sales.
155. In contrast to the LCA and CDCA, the CRA is quite different. As shown by Figure 8, it is carried out by specific purpose societies, which are established to undertake securitization businesses. According to the Brazilian legislation, securitization companies are not allowed to assume any risk in the market. Therefore, they identify investors willing to buy CRA and hence be exposed to rural producers' risk. Following the negotiation among the parties, the securitizing company buys the receivables from the cooperative or agribusiness company which accepted to take the risk, issues a CRA pegged to them and transfer the CRA to investors. Therefore, the default risk is assumed by the investor.
156. Besides creating new financing mechanisms to expand the volume of credit available to agriculture in the 2000-2010 period (especially that provided by private sources), the Government continued to provide large volumes of credit for working capital, marketing and storage, and to investment. As shown by Figure 9 - Brazil: credit provided by the SNCR by credit type, 1970-2009
157. , after following a downward trend during the period 1986-1996, the total volume of agricultural credit provided by the National System of Rural Credit (SNCR) increased 169% in real terms between 1997 and 2009 expanding from BRL 27.9 billion to BRL 75.1 billion¹³.
158. Among the three types of credit, the share of working capital in the total supply of agricultural credit by the SNCR followed a negative trajectory falling from 71% in 1997 to 57% in 2009. The participation of the marketing and storage credit as well as that of the investment credit followed an upward trend during the same period. In terms of geographic distribution of the total credit provided by the SNCR,

¹³ These values are expressed in Brazilian Real of 2009.

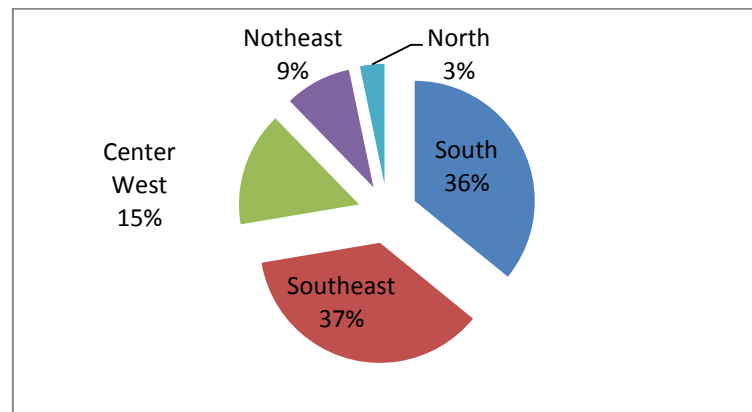
it continued concentrated in the south and southeast regions of the country (Figure 9 and Figure 10).

Figure 9 - Brazil: credit provided by the SNCR by credit type, 1970-2009



Source: Central Bank of Brazil

Figure 10 - Brazil: credit provided by the SNCR by region, 2009



Source: Central Bank of Brazil

159. The expansion of investment credit in the total amount of financial resources in 2000-2010 (i.e. 208% in real terms) reflected a new feature of the rural credit policy in this period, i.e. to enhance agricultural investment. In this regard, in addition to continue implementing investment programs created before 2000, new investment credit lines were established such as the Modernization Program of the National Fleet of Tractors, Combines and Farm Machinery (MODERFROTA)¹⁴, the Incentive Program for Irrigation and Storage (MODERINFRA), the Program for the Modernization of Agriculture and Conservation of Natural Resources (MODERAGRO) and the Program for Fostering Sustainable Farming (PRODUSA). As it can be seen from their titles, these last two programs reflect the special attention given by the public policies of the 2000-2010 period to environmental sustainability and preservation of the biodiversity.

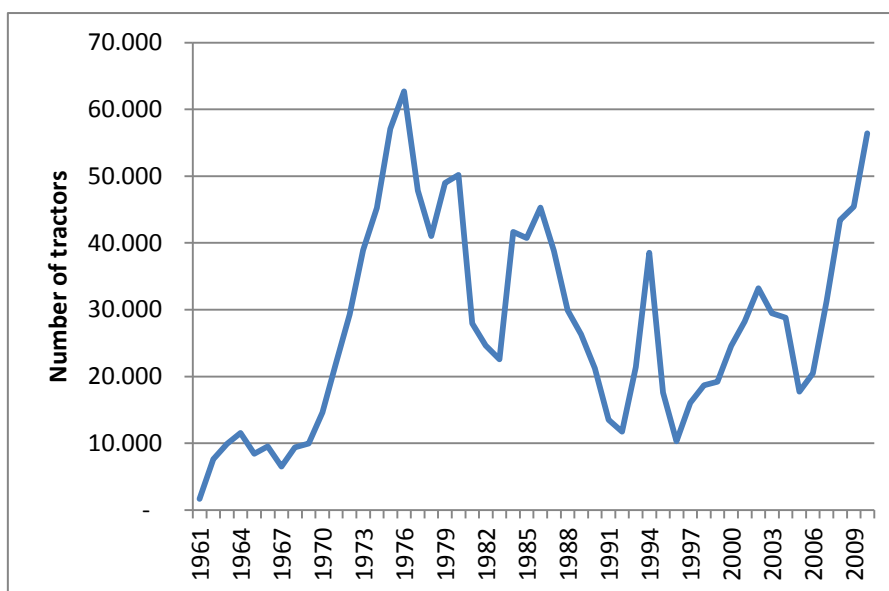
¹⁴ Modernizing Program of the Tractors, Combines and Machinery Fleet (MODERFROTA).

160. MODERFROTA, which was established in 2000, is the largest investment promotion program in terms of credit supplied. It finances the acquisition of tractors and machinery. According to (Brandão, Rezende and Marques 2005), MODERFROTA together with other factors played a major role in supporting farmers' investment in mechanization. As shown by Figure 11, after following a downward trend during the 1976-1996 period, the sale of tractors reversed this path increasing significantly. Large part of this change is associated with the implementation of MODERFROTA.

161. Since the creation of this program in 2000, the domestic sale of wheel tractors expanded 129% increasing from 24,591 units in that year to 56,420 in 2010 (Figure 11 - Brazil: sale of wheel tractors, 1961-2010

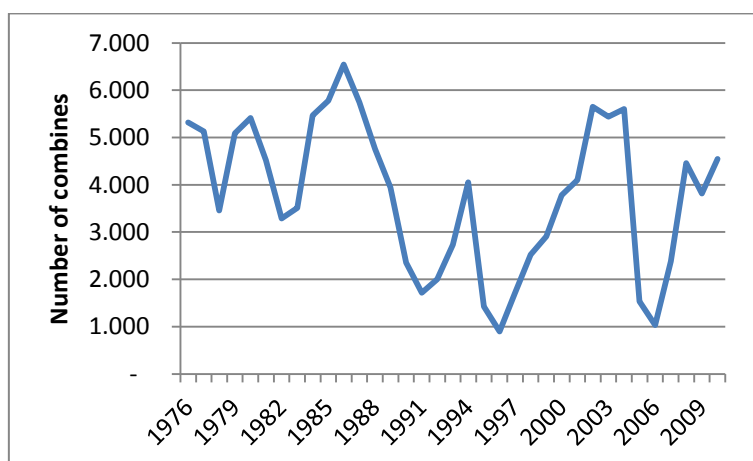
162.). The sale of combines registered a similar trend expanding from 3,780 units to 4,549 in the same period (Figure 12). The increased investment in the purchase of these machineries, especially of tractors, contributed significantly to the expansion in the planted area.

Figure 11 - Brazil: sale of wheel tractors, 1961-2010



Source: Associação Nacional de Fabricantes de Veículos Automotores - ANFAVEA

Figure 12 - Brazil: sale of combines, 1976-2010



Source: Associação Nacional de Fabricantes de Veículos Automotores

163. The main beneficiaries of MODERFROTA are in general large and medium farmers. Therefore, in order to support the investment of small farmers in tractors, combines and farm machinery, the Government created in 2008 the MODERFROTA PROGER. The resources allocated to the implementation of this program in the 2008/09 and 2009/10 cropping years totaled BRL 500 million and BRL 1 billion, respectively.
164. The MODERINFRA and the MODERAGRO were both put into operation in 2003. The objective of the first is to promote farmers investment in irrigation systems and the building of on-farm storage facilities for agricultural products. The second in turn, promotes the recovery of degraded pasture, the fertilization of soils and the implementation of projects which contribute to the sustainable production of agriculture. In addition, it supports investment activities in the production of fruits, milk, honey, flowers, poultry, pork and aquaculture. Both programs provide credit at controlled interest rate to participating farmers (mostly medium and large farmers). The implementation of these programs has been contributing to a significant expansion of farmers' investment in irrigation, as well as to a sustainable output expansion of the agricultural products covered by MODERAGRO.
165. In 2008 the Government created the PRODUSA. Like MODERAGRO, it focuses on promoting the use of technologies and cultivating systems which are consistent with national environmental and sustainability objectives. The creation of PRODUSA resulted from the merging of some previous programs as well as the incorporation of part of MODERAGRO related to the recovering and preservation of soils and pasture. The investment funds allocated to this program totaled BRL 1.0 billion in 2008/2009 and then increased to BRL 1.5 billion in 2009/2010. There is little information available on the impacts of this program. However, the increased utilization of sustainable practices of agricultural production by various farmers suggests that the program is producing positive results.
166. Further to the above-mentioned elements, the main features of the 2000-2010 rural credit policy included also the adoption of rural credit debt rescheduling arrangements in several years. The macroeconomic instability and hyper-inflation observed between the 1980s and mid 1990s resulted in major losses to agricultural producers leading many of them to accumulate substantial credit indebtedness. In

view of this situation, the Government established large-scale restructuring of rural debt measures.

167. The first debt restructuring negotiations took place in 1996 and 1999. However, since the problem persisted and became larger in some years due to climatic events, pest and disease outbreaks, increased production costs and appreciation of the real, the Government had no option but to adopt new debt resettlement packages in 2001, 2005 and 2008. The objectives of this credit support measures were to establish conditions for small, medium and large farmers to settle their financial indebtedness, to improve their long-term financial viability and to enable them to regain access to credit. Notwithstanding the efforts made, rural debt remains a concern until today as non-repayments of the restructured debt persist. Unless the rural debt problem is solved definitively, its successive rescheduling may create a “moral hazard” situation.

a.2 Credit support to small farm households

168. Besides implementing a rural credit policy to support agricultural production, marketing and investment activities of medium and large farm households, the Government continued to use a similar policy instrument, the National Family Farm Strengthening Program (PRONAF), to promote agricultural capacities of small farm agriculture in the 2000-2010 period. As highlighted earlier, this is the largest and most comprehensive policy in support of small farm households. It was established in 1995 and in view of the priority assigned by Government Lula to support the rural poor population and to integrate this group of farmers in agricultural production chains it was continued and strengthened in the last decade. Until 1999 the program was operated under the responsibility of the Ministry of Agriculture, Livestock and Food Supply (MAPA). However, after that year this responsibility was transferred to the Ministry of Agrarian Development (MDA).

169. Since the beginning, the program finances agricultural production and processing as well as investments on farm infrastructure, irrigation, storage facility, and purchase of machinery to modernize the productive structure of different groups of small producers including poor rural families settled under the National Program of Land Reform, indigenous people and other subgroups usually marginalized by State policies in the past. The interest rates charged on all loans provided by PRONAF are subsidized and vary according to specific credit bands. The support to family farm agriculture is complemented with the provision of technical assistance and rural extension services.

170. Until 2008 PRONAF was targeted to five groups of beneficiaries (Figure 13). Group A consisted of agrarian reform settlers. Group B was comprised by the smallest subsistence producers eligible for micro credit, i.e. those with a gross annual family income of BRL 2,000 or less, excluding social security benefits linked to rural activities. Groups C to E involved family farms of increasing degree of commercialization and farm size, but which did not exceed 4 fiscal modules. A credit line for “Integrated Investment” was also provided for co-operatives or other associations formed exclusively of “family farmers”¹⁵.

¹⁵ According to the Family Farming Law (Law n. 11,326 of 2006), “family farmers”, which used to be referred to as small-scale agriculture in the past are defined as those engaged in activities in rural areas who also satisfy the following requirements: (a) do not

Figure 13 - PRONAF compliance criteria, 2000-2008

	Group A	Group B	Group C	Group D	Group E
Agrarian reform settlers	Exploit part of land as owner, squatter, renter, or sharecropper				
	Possess in any capacity land areas not exceeding 4 fiscal modules				
	Live on farm or neighbouring urban or rural settlements				
	Obtain at least 30% of family income from agricultural production or other activities carried out on the farm	Obtain at least 60% of family income from agricultural production or other activities carried out on the farm	Obtain at least 70% of family income from agricultural production or other activities carried out on the farm	Obtain at least 80% of the family income from agricultural production or other activities carried out on the farm	
	Farm exploitation is based on family labour	Farm exploitation is based predominantly on family labour and only seasonal use of hired labour	Farm exploitation is based predominantly on family labour, hired seasonal labour permitted and not more than 2 hired permanent workers		
Gross annual family income BRL 2 000 or less, excluding social security benefits linked to rural activities	Gross annual family income over BRL 2 000 but not exceeding BRL 14 000, excluding social security benefits linked to rural activities	Gross annual family income over BRL 14 000 but not exceeding BRL 40 000, excluding social security benefits linked to rural activities	Gross annual family income over BRL 40 000 but not exceeding BRL 60 000, excluding social security benefits linked to rural activities		

Source: (OECD 2011)

171. However, since 2008 Groups C, D and E were merged. Therefore, the group of beneficiaries was reduced to three categories (Box 3). Groups A and B comprise the same beneficiaries as before. The new Group C includes family farmers with gross annual revenues between BRL 6,000 and BRL 110,000. Approximately 1.8 million farmers are part of Group B and 2.4 million belong to Group C. Each year farmers can receive up to BRL 130,000 (USD 73,600) of investment credit and BRL 50,000 (USD 28,000) of working capital credit for each crop, and in total they can borrow up to BRL 230,000 (USD 130,000). In 2010, the interest rate was lowered to an average of 2.5%, keeping the real interest rate constant.

have under any tenure regime an area larger than four fiscal modules; (b) predominantly rely on their own family labor in their establishment or undertaking; (c) their household income predominantly originates in the family establishment or undertaking; and (d) their establishment or undertaking is run by the family. It also explicitly defines arboriculturists, members of *Quilombo* communities, aquiculturists, extractivists and fishermen as beneficiaries.

Box 3 - Criteria for defining the beneficiary groups of PRONAF, 2009-2010

PRONAF CREDIT - Classification of Family Farmers		
Group A	Group B	Other Family Farmers
Farmers settled under the National Agrarian Reform Program (PNRA) and by the Land and Agrarian Reform Fund, provided that they have not entered into an investment loan contract at the individual limit allowed by Propera and Pronaf A.	Owners, squatters and leaseholders or partners	
	Includes members of <i>Quilombo</i> and indigenous communities	Includes concession holders under the PNRA and the Land Fund who are not beneficiaries of Group A any longer
	Live in the establishment or nearby	
	Do not have under any tenure regime an area of more than 4 fiscal modules	
	Their household income originates in agricultural/livestock and non-agricultural/livestock activities carried out in their establishment	At least 70% of their family income originates in agricultural/livestock or non-agricultural/livestock activities carried out in their establishment
	Family labor is the basic form of labor in their establishment	Family labor is predominantly used in their establishment, but they might have up to two permanent employees. Occasional help from third parties is allowed as required by the seasonal nature of the activity
	Gross family income of up to R\$ 6,000/year	Gross annual family income of more than R\$ 6,000 and up to R\$ 110,000/year

GENERAL OBSERVATIONS

The calculation of gross income excluded social security benefits for rural activities.

For Pronaf coverage, the gross income from various livestock-related activities of greater added value can be deducted by up to 90%.

Non-agricultural/livestock services, activities and income include rural tourism, handicraft, family agribusiness and provision of services in rural areas which are consistent with rural undertakings and with better use of family labor.

Source: (Silva, del Grossi and Franca 2010)

172. As shown by Figure 14, in line with the priority given by the Government to PRONAF, the total amount of credit provided by this program increased substantially in real terms in the 2000-2011 period expanding from BRL 4 billion to approximately BRL 12 billion. This expansion was observed in the provision of both working capital as well as investment credit. The first increased from BRL 3.7 billion in 2000 to BRL 5.7 billion in 2011. In contrast to this expansion, the increase in the supply of investment credit was quite notable, i.e. a growth from BRL 586 thousand to BRL 6 billion in the same period (Figure 15).

Figure 14 - PRONAF: Total credit provided by year, 1999-2011

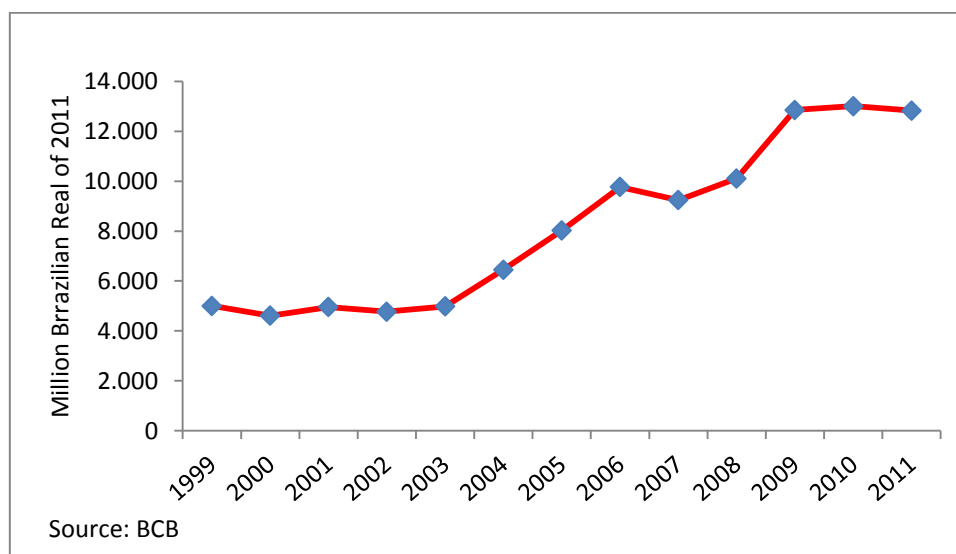
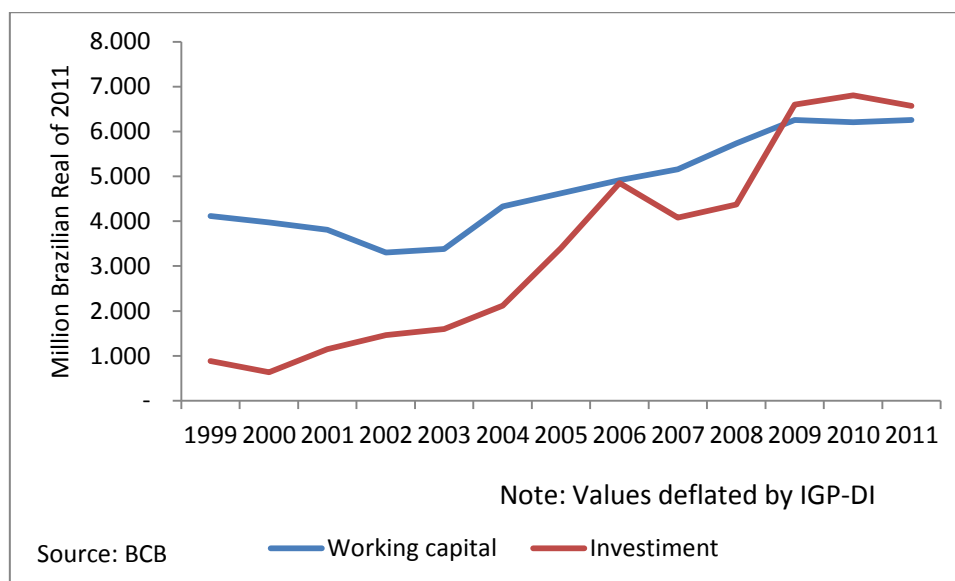


Figure 15 - PRONAF: total funds provided by credit type, 1999-2011



173. The rapid growth of PRONAF together with a more intense provision of technical assistance to its beneficiaries and the rapid growth of subsidized credit lines, has been contributing to enhance the investment of small farm households in agriculture, increase food production and expand income of rural households. Moreover, it has contributed also to boost local economies.

a.3 Marketing and income support

174. Given the price and income fluctuation nature of the agricultural production activity, the Government continued to implement marketing and income support policies in the 2000-2010 period. Like in the past, their main goal consists in reducing price instability, supporting producers' incomes, strengthening agricultural marketing, and ensuring adequate supply balance and distribution among producing regions and local consumption centers. Differently from the marketing and income policies of earlier periods, those implemented in the last decade included as part of its specific objectives, the support to small agricultural producers. Moreover, their purpose was not to build public stocks but rather to ensure the minimum price to producers through a payment of an economic subvention (premium), and to stimulate traders to direct their products to specific regions in order to balance demand and supply. Increasingly the Government has opted to use instruments through which the private sector is the main operator of the price guarantees.
175. In line with the above objectives, the Government operated the marketing and income policies of the 2000-2010 period using initially, six traditional policy instruments which were utilized in the implementation of the Minimum Guarantee Price Policy (PGPM) in the previous decades: the Federal Government Purchase (AGF), the Federal Government Loan (EGF), the minimum guaranteed prices, the Sales Option Contract (COV), the Rural Credit Note (NCR), the Premium for Commercial Buyers Program (PEP). However, since 2003 this set of instruments was expanded with the creation of additional ones. The common feature of the new instruments is their objective of increasing public resources efficiency and

expanding the direct participation of the private sector in the process of marketing agricultural products and stabilizing producers' income.

176. The main new instruments established in the 2000-2010 to implement the marketing and incomes support policy included the Equalizing Premium Paid to Producer (PEPRO), the Risk Premium for the Purchase of Agricultural Products arising from Private Sale Option Contracts (PROP) and the *Valor para Escoamento de Produto* –VEP – (Premium for transporting agricultural products). The first of these instruments was established in 2005. It operates like a deficiency payment by paying the seller (a producer or an agricultural cooperative) the difference between the guaranteed price and the price received at auction. This instrument allows the Government to provide price guarantee to producers (reference price). It exonerates the government from acquiring the product and allows the transfer of products from producing regions to complement the supply in deficit consumption centers. It is an operation in which the difference between the market price and the reference price defined by the Government, through public auctions, is paid to producers or cooperatives.
177. The PROP, which was created in 2004, works in the same way as the public Sale Options Contract to the Government, except that private agents take the role of the National Supply Company (CONAB) acting as a product buyer and the Government pays these agents a risk premium if the market price falls below the price established in the option contract. Therefore the PROP, in addition to functioning as another instrument for reducing price risks to producers, enables the Government to pass actual product purchases onto private agents.
178. The VEP in turn was launched in 2002. It is a premium offered through public auction to buyers (usually feed industry; poultry, cattle and or pig raisers) of products from Government buffer stocks stored in a given region. The buyers pay the minimum price set by the Government. In turn, as an incentive for stimulating the purchase of the product from a public stock stored at one locality and using it in a specific region with supply shortage, the Government pays a premium which corresponds approximately to the difference between the minimum and the market price. Therefore, through this instrument, the Government complements the supply in regions with deficit making use of its stocks and paying a premium which covers the transport cost to a specific location and makes the purchasing of the product attractive to the buyer.
179. In addition to the above policy instruments, the Government established the Food Procurement Program (PAA) in 2003. It was created as part of Brazil's Zero Hunger Program. Thus, its main objectives are to ensure food access to food insecure families and to promote social inclusion in rural areas through the strengthening "family" farm agriculture. Through this program the Government makes direct acquisitions of agricultural products from "family" farmers. The products are purchased at "reference prices" higher than the minimum guarantee price.
180. The purchased products are distributed to targeted groups (school children, for example) and also to vulnerable families. Part of these products is directed to forming a strategic stock, which is required by law in order to ensure the supply of

basic products to the domestic market¹⁶. In 2006 changes were made in this program including increasing the acquisition cap limit from BRL 2,500 to BRL 3,000 per farmer. Therefore, as a result, the purchase of products through this program increased from 2% of all government acquisitions in 2005/06 to 11% in 2006/07 (OECD 2009). Between 2003 and 2009 the total acquisition of agricultural products by PAA added to BRL 2.7 billion benefiting 764 thousand families of small farmers (Ministério de Desenvolvimento Agrário 2010). Moreover, about 7.5 million people per year received food which was freely provided through this program.

181. According to (Gasques, Verde and Bastos 2010), during the 2005-2009 period, the Government expenditures with the different instruments of the PGPM increased in real terms¹⁷ from BRL 2 billion in 2005 to BRL 3.5 billion in 2006 and then fell in the next two years reaching BRL 894 million in 2008. Following this downturn, the expenditures increased in 2009 totaling BRL 4.3 billion. The major increases observed in 2006 and 2009 were brought by the relatively low agricultural prices registered in those years.
182. The implementation of the PGPM in 2000-2010 has implied a gradual substitution of the direct acquisition of agricultural products by the Government through the AGF by a larger use of other market instruments like the Sales Option Contract, the Premium for Commercial Buyers Program (PEP) and the Equalizing Premium Paid to Producer. Therefore, in the last decade it has contributed to a reduced intervention of the Government in agriculture and stimulated a growing participation of the private sector in the stabilization process of producers' income and in carrying out agricultural stocks along the year. In this context, in contrast to previous periods, the public stocks of agricultural products have been reduced substantially. In contrast to previous periods, this limited the scope of the PGPM to mitigate the effect of price spikes to domestic consumers.
183. Further to the above, in 2000-2010 the PGPM has also contributed to a balanced distribution of food distribution among all regions, as well as to support small farm agriculture and enhancing food security of vulnerable groups. This policy has been particularly important to regions whose competitiveness is largely affected by transportation costs, that is, those situated far from ports and main consumption markets. In this regard, the policy instruments used by the PGPM have ensured the minimum guarantee price to producers located in those regions and facilitated the marketing of their products to urban centers.
184. In general, most of the acquisitions made by the Government through the PGPM policy in the last decade came from products sold by small farmers, especially via the PAA. The reasons for this are because the market prices were most of the time, above the minimum guarantee price. Thus, most medium and large size producers commercialized their products through the market, including using some of the PGPM instruments like the PEPRO and PROP. Some of the small farmers in turn, preferred to sell their products to the Government through the PAA since the reference price were more attractive than the market price. Given this situation, the

¹⁶ This stock should not exceed the equivalent of one month of the annual consumption except in the case of products which are traditionally imported by the country. For the latter case the stock is recommended to correspond to a maximum of two months of annual consumption of the product.

¹⁷ The figures are expressed in real terms of 2009.

PGPM has influenced small farmers' decision to invest in agriculture via the prices paid. In the case of medium and larger farmers, this influence has been mainly through the market policy instruments used which offered them good options to market their products.

a.4 Risk minimizing mechanisms

185. Brazil's approach to promoting agricultural production during the 2000-2010 period included enhancing the protection to farmers' investments against weather adversities and outbreaks of pests, weeds and diseases. In this regard, it continued implementing the Guarantee Program of Agricultural Activities (PROAGRO), which frees up the producer from the financial obligation of paying back the working capital borrowed from the banks. Producer's adhesion to the program takes place through the payment of a premium fee, which is included in the amount of agricultural credit borrowed. Due to relatively low limits of capital coverage, PROAGRO has been losing its attractiveness to commercial agriculture. Therefore, lately it has been more widely used by the beneficiaries of the PRONAF.
186. Besides the PROAGRO, the Government has continued to make use of the climatic risk zoning¹⁸ established by the Ministry of Agriculture, Livestock and Supply (MAPA) for various crops and to operate the Rural Insurance Premium Subvention Program (PSR) in order to provide increased protection to farmers' investment in agriculture. Through this program, the Government pays part of the rural insurance premium¹⁹ due by farmers. Therefore, it promotes farmers access to rural insurance, which in turn contributes to stabilizing farmers' income and consequently, inducing investment in the sector including the use of appropriate technologies.
187. In 2009, the implementation of the PSR benefited 56 million producers, ensured financial resources in the amount of approximately US\$6 billion and provided coverage to 11% of the total crop area in that year. The implementation of this program during the 2006-2009 period increased substantially the number of rural insurance contracts, the amount of capital insured, the total premium paid, and cultivated area insured.
188. In addition to the above, another risk minimizing scheme was implemented by the Government in the 2000-2010 period, the crop guarantee program entitled *Garantia Safra*. It assists PRONAF enrolled farmers in semi-arid areas. Federal benefits provided by this program expanded substantially between the 2004/05 and 2005/06 cropping years increasing from USD 7 million to USD 16.1 million.
189. The government established also a supplementary risk reducing program in 2004, the PROAGRO *Mais*, which provides insurance against the effects of drought exclusively to farmers enrolled in the PRONAF. Under this new insurance program, farmers are insured for 100% of the credit they receive and 65% of estimated future

¹⁸ The methodology used to establish the climatic risk zoning assesses the climatic risk of growing about 30 crops in more than 5,000 Brazilian municipalities. In this context, it contributes to indicating which crop to grow, where and when. The climatic risk zoning are published every year by MAPA together with an indication of the cultivars adapted to each region of the country. Given these characteristics, this zoning is used by the Government to guide the granting of working capital credits, the purchase of rural insurance and the establishment of PROAGRO operations.

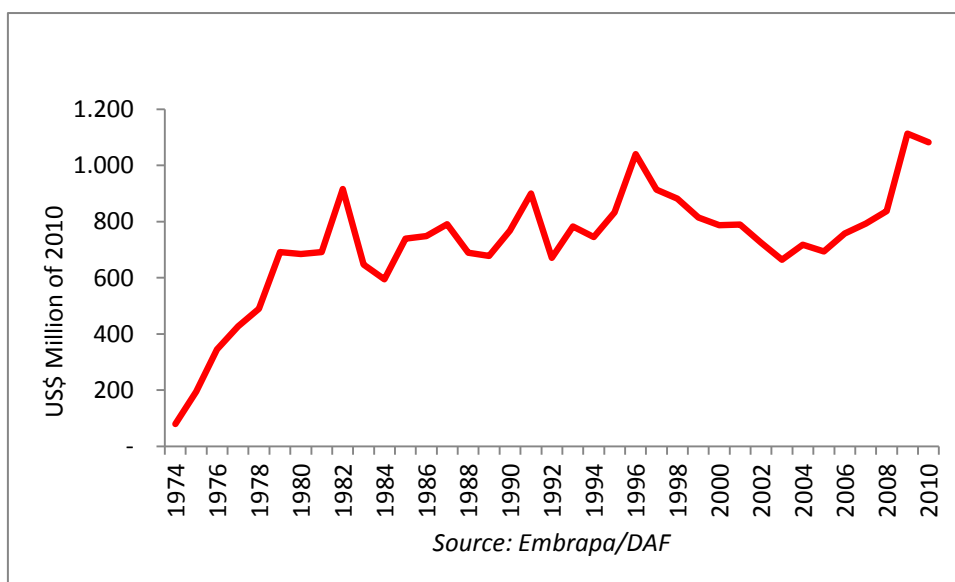
¹⁹ Between 30% and 70% of the premium depending on the crop.

revenues. There are no studies available which analyze the impact of the different risk minimizing programs on farmers' investment in the Brazilian agriculture. However, given the volume of the financial resources involved, the number and type of participating farmers and the evidences observed, it can be said that they have contributed positively to increasing household investment in this sector.

a.5 Investment in agricultural research

190. The growth of Brazilian agricultural production during the last four decades is due mainly to productivity increase rather than to area expansion. Therefore, it is not surprising that the Government continued to assign particular priority to investment on agricultural research as one of its main policies in the 2000-2010 period. In line with this orientation, EMBRAPA's budget grew about 38% in real terms between 2000 and 2010 expanding from USD 787 thousand to approximately US\$ 1 billion (Figure 16). It has been estimated that in 2006 the 27 countries of Latin America and the Caribbean spent approximately BRL 3 billion in agricultural research; Brazil alone accounted to 41% of this total (Stads and Beintema 2009).

Figure 16 - EMBRAPA's annual budget, 1974-2010



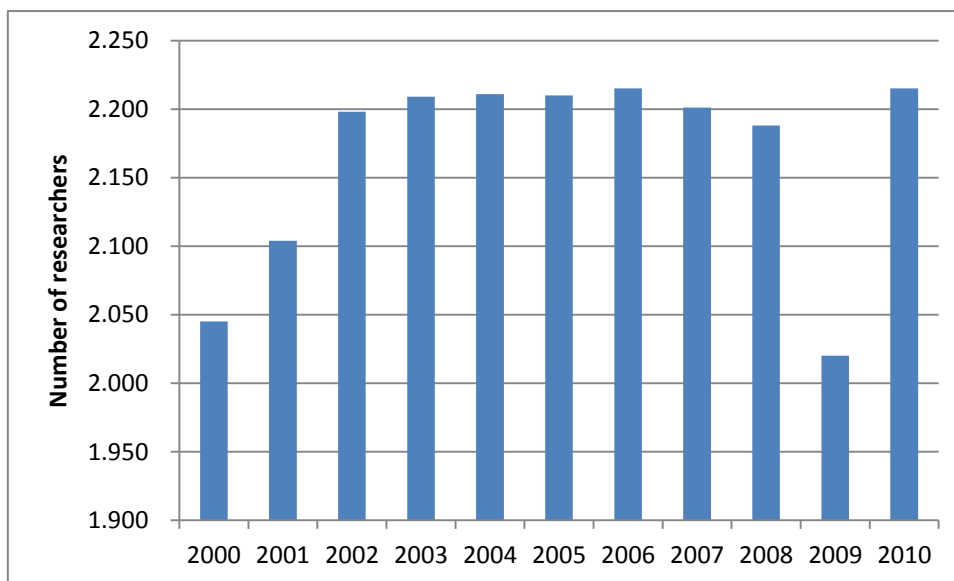
Source: EMBRAPA

191. EMBRAPA's present capacity to undertake research and technology transfer activities is also greater than in the 1990s. Between 2000 and 2010, the Government invested in the creation of six new agricultural research units²⁰. Therefore, EMBRAPA's research facilities, which are located throughout the country, were expanded totaling 46 units in 2010. Moreover, large investments were also made in human capital. Consequently, the total number of researchers expanded about 8% during the 2000-2010 period increasing from 2,045 to 2,215 (Figure 17)²¹. Similarly, the total number of projects carried out by EMBRAPA expanded substantially moving from 203 in 2002 to 1,504 in 2010 (Figure 18).

²⁰ They are: EMBRAPA Fisheries and Aquaculture, EMBRAPA Coastal Tablelands, EMBRAPA Agro-silvopastoral and EMBRAPA Studies and Training, EMBRAPA Agroenergy and EMBRAPA Coffee.

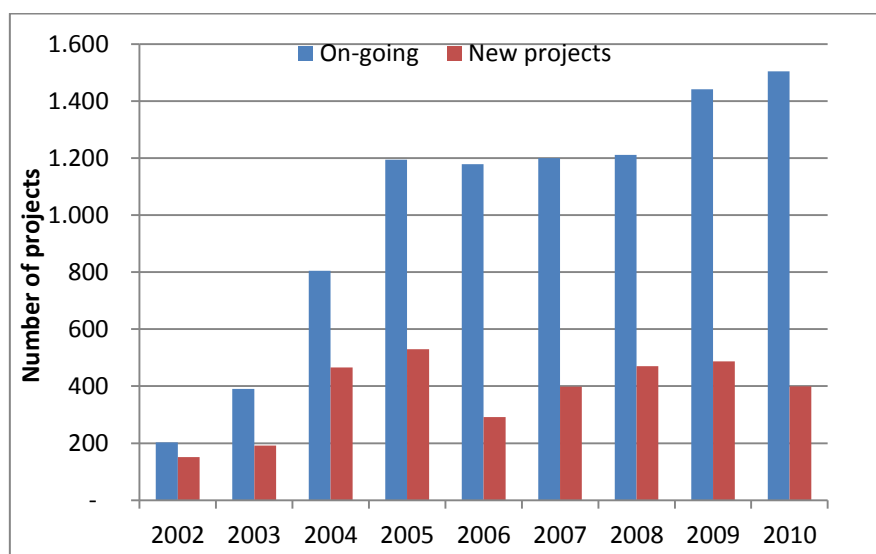
²¹ The reduction observed in 2009 was due to a substantial number of researchers going into retirement. However, as shown by Figure 17, they were quickly replaced by other professionals.

Figure 17 - EMBRAPA: total number of researchers, 2000-2010



Source: EMBRAPA

Figure 18 - EMBRAPA: number of research projects carried out during the 2002-2010 period (on-going and new projects)



Source: EMBRAPA

192. In 1998 EMBRAPA invested in the creation of its first Virtual Laboratory (also known as Labex) as a means for enabling its scientists to undertake joint research activities with top researchers in advanced research organizations around the world (E. R. Alves 2010). This unit was established in the United States. Given the success of this experience additional investment was made in the creation of four other Labex during the 2000-2010 period. These offices were located in research institutions in France, Netherlands, England and South Korea. As highlighted by (M. A. Lopes 2012), Labex is a flexible model that has been expanded with new scientists according to Brazil's and partner institutions interests. The investments on

this institutional arrangement have been producing major results for further enhancing agricultural production and productivity locally and abroad.

a.6 Support to sustained environment quality

193. One of the major characteristics of Brazil's agricultural policies of the last decade is a growing concern with environmental sustainability and preservation of the biodiversity. In line with this policy orientation, several measures were put in place during this period including the Agro-ecological Zoning (AEZ) for various crops.
194. The AEZ defines the spatial location (municipalities) recommended to grow a given crop, the type of soil suitable to cultivate it, the best period to plant the crop and the cultivars to be used. The benefits of this system are that, in addition to promoting a rational utilization of natural resources, technologies and financial capital, it contributes to protecting the environment, preserving the biodiversity and reducing climate risks.
195. In the case of sugarcane for instance, the agro-ecological zoning, which was established in September 2009, was developed in response to the strategic need of spatially determining the land potential to expand the cultivation of this crop under rainfed systems. The evaluation undertaken considered the agronomic requirements of the crop as well as studies on climate risk. In addition, it took into account the physical, chemical and mineralogical characteristics of the soil of the different regions of the country.
196. Besides the above elements, which are normally considered in setting up agro-ecological zoning, the sugarcane AEZ was defined excluding the following:
- areas with native vegetation;
 - land located in the Amazon and Pantanal biomes as well as in the Upper Paraguay River Basin;
 - environmental protected areas;
 - indigenous land;
 - dunes and mangroves;
 - forests and areas under reforestation;
 - urban and mining areas;
 - scarps and mountains;
 - areas with up to 12% slope in order to allow the use of mechanical harvesting;
 - area that was cultivated with this crop in the 2007/2008 cropping year in Central-Southern Brazilian states (M. A. Lopes 2012).
197. Given these criteria, the indicated areas for sugarcane expansion comprise those currently used for intensive and semi-intensive agricultural production, those with perennial and annual crops, and those with pasture. As shown by Table 7, this area amounts to 63.6 million hectares; fifty seven percent of which corresponds to areas with pastures and 38%, to land with crops, both figures in comparison to the respective data observed in 2002.

Table 7 - Brazil: Sugarcane agro-ecological zoning

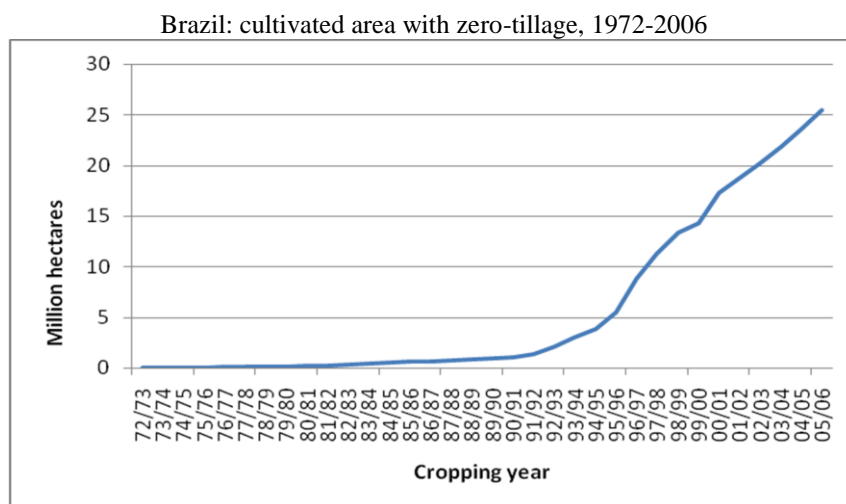
Classes of suitability	Suitable Areas by Type of Land Use (millions of ha)			
	Livestock	Agriculture and Livestock	Agriculture	TOTAL
High (H)	10.3	0.6	7.2	18.1
Medium (M)	22.8	2.0	16.3	41.2
Low (L)	3.1	0.5	0.7	4.3
TOTAL	36.2	3.1	24.2	63.6

Source: Ministry of Agriculture, Livestock and Supply

198. In order to stimulate farmers to develop their activities according to the guidance provided by the AEZ, the Government has linked the provision of agricultural credit to the orientation provided by the different zonings. More specifically, the agricultural credit is granted to grow a specific crop only at the area identified as suitable by the AEZ. Therefore, the use of these policy instruments have been contributing to guide farmers investment according to environmental sustainability criteria including the use of sustainable practices such as zero tillage (Box 4).

Box 4 - The use of zero-tillage in Brazil.

Since the early 1970's Brazilian farmers have been using zero-tillage as part of their agricultural production systems. Among other characteristics, this technology prevents soil erosion, allows greater rainfall infiltration, boosts soil's organic matter content and reduces the amount of carbon dioxide released into the air. Between 1972 and 1991, zero-tillage expanded slowly reaching 1 million hectares at the end of this period. However, after this initial phase, the area cultivated with this technology expanded exponentially totaling about 26 million hectares in 2006, i.e. 46 percent of the total cultivated area with annual crops.



Source: Zero-tillage Farmers' Association

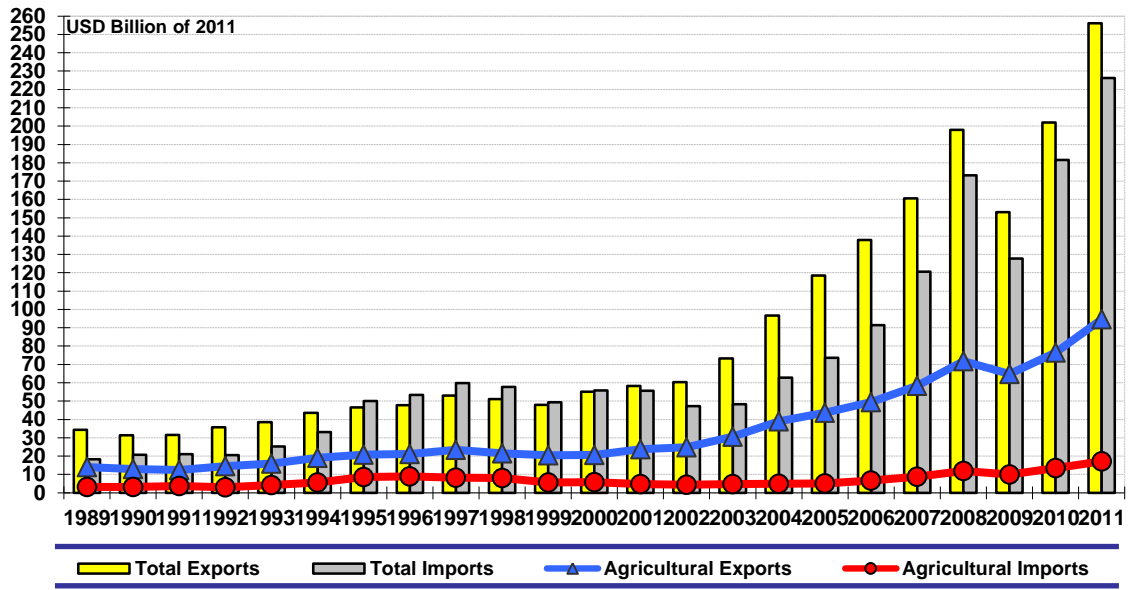
Several factors contributed to this significant change in the utilization of zero tillage in Brazil. Among them, one of the most notable facts is the development and supply of economically accessible zero-tillage farm equipment to medium and small farm establishments. During the 1985-1992 period, the national research efforts generated zero-tillage technologies which were technical and economic viable only for large farms and capitalized rural properties. The seeding machinery available in the market were all of large size and very costly. Therefore, they could be used almost exclusively by large farmers. However, since 1993 a new situation emerged with the development of zero tillage machinery adapted to the economic and soil reality of medium and small farms. The provision of adequate technology to these groups of farms together with technical assistance and training activities on the use of the new machineries and the policies carried out by the Government, particularly agricultural credit, contributed significantly to the rapid utilization of zero tillage in Brazil.

199. Besides the AEZs, the Government implemented in the 2000-2010 period the *Operação Arco Verde* (Green Arc Operation) and the Program for Commercial Planting and Recovering of Forests (PROPFLORA) as mechanisms to support farmers investment which are consistent with the objectives of environmental sustainability and preservation of the biodiversity.
200. The first of these programs offers sustainable production alternatives to municipalities with large deforestation records. EMBRAPA participates in this multi-institutional effort, providing technologies that can be used in these localities. The PROPFLORA finances the planting of forests and the recovery of Legal Reserves and Permanent Preservation areas. Both of these programs are implemented through credit provision to participating farmers.
201. Brazil's policies in the area of support to sustained environment quality include also the "Forest Code". Through this code the Government establishes legal restrictions to land utilization, for instance in the Amazon region farmers are obliged to leave 80% of the land as legal reserve. In the Savanna neighboring the Amazon region the legal reserve amounts to 35% of the land.
202. A broad discussion is being developed at the moment in relation to the Forest Code. Originally signed in 1965, when the country was radically different, it has posed a series of barriers for the expansion of Brazilian agriculture. A proposal is under discussion in the National Congress and will be voted soon. After a series of controversies confronting the interests of farmers and the ideals of environmentalists, it appears that a compromised was reached and will be approved soon by Congress. The implementation of the new forest code should contribute to improve farmers' investment in agriculture and enhance Brazil's environmental sustainability.
203. Further to the above-mentioned programs, the Government established in 2010 the Low-carbon Agriculture Program (ABC) with the following objectives: (i) promote the reduction of deforestation, particularly in the Amazon biome, through the expansion of crop, livestock and agroforestry activities in degraded areas or in process of recovery; (ii) stimulate the adoption of sustainable production systems that gives priority to recovery of degraded pastures, direct planting, adoption of integrated crop-livestock systems, planting of forests and substitution of nitrogen fertilizer use by biological fixation of this input in the process of crop production; and (iii) encourage the utilization of vegetable residues.
204. In order to implement this program, the Government provided USD 1.3 billion of credit in 2010 to enable interested producers to make investments according to the program objectives. Since the program started last year, its results have not being assessed yet. However, there are some evidences that suggest positive achievements, particularly in the use of promoted technologies and practices which contribute to environmental sustainability.

a.7 Support to strengthening agricultural trade

205. Brazil is a member of MERCOSUL. Therefore, part of the Government's policy to strengthen the national agricultural trade in the 2000-2010 period consisted in supporting the trade negotiation processes carried out by the participating countries of this common market and applying the agreed common external tariff and regulations to its trade with third countries. Brazil is a member of WTO also. In this regard, the policy followed was to play an active role on trade negotiations. The Government efforts have aimed basically on further agricultural trade liberalization and reduction of trade distorting subsidies provided by developed countries. Brazil has also been requesting consultations with certain countries under the WTO dispute settlement system in order to address illegal trade practices against domestic agricultural trade.
206. A third element of the Government's policy in the last decade to support the national agricultural trade was strengthening the capacity of its Embassies to analyze local markets and facilitate negotiations on sanitary matters. The policy instrument used in this case was the creation of agricultural attaché posts in selected Embassies.
207. In addition to the above, the Government has expanded the signature of cooperation agreements with countries. The implementation of this policy, besides strengthening the political and cultural relations between Brazil and the countries involved, is enhancing the trade flows among the cooperating nations. Important efforts have also been made by the Ministry of Agriculture, Livestock and Food Supply to strengthen the control of pests and diseases which may affect the quality of the agricultural products consumed internally and exported to other countries. Some investments are also being made by the Government to overcome the bottleneck imposed by the limited transport infrastructure and port facilities. However, there is a lot to be done to improve the existing situation.
208. The implementation of this set of trade policies together with others not mentioned here, have contributed to creating a favorable environment for farmers' investment in agriculture. This has resulted in a substantial increase in the domestic production of agricultural products as well as in a remarkable expansion of agricultural exports. As shown by Figure 19, Brazil's exports of agricultural products increased from USD 21 billion in 2000 to almost USD 95 billion in 2011. According to the Ministry of Agriculture, Livestock and Food Supply, the foreign sales of these products are estimated to reach USD 100 billion in 2012. The growth of agricultural exports generated large agricultural trade balances throughout the 2000-2010 period. This more than compensated the negative trade balances registered by the other sectors of the economy.

Figure 19 - Brazil: total international trade and agricultural exports and imports in the period 1989-2011



Source: AgroStat Brasil and SECEX/MDIC

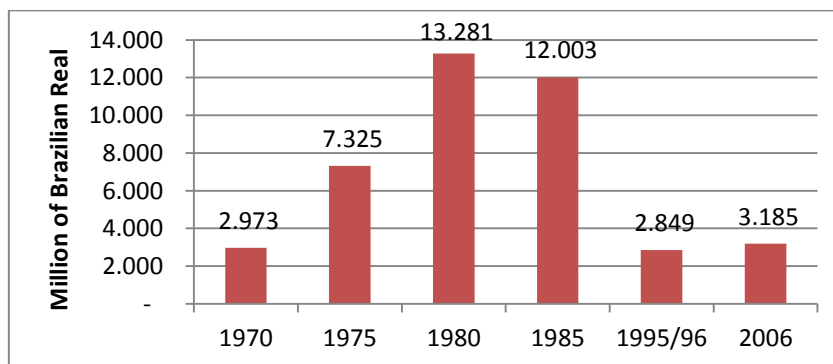
IV. Public policies and agricultural investments in Brazil

209. According to the framework of analysis presented in Chapter II, investments in agriculture depend on various factors, including the public policies followed by the government. It is complex to undertake a detailed analysis of the relationship between policy instruments and agricultural investment during a long period of time. The reasons for this difficulty are that more than one factor affects the expected rate of return of an investment. Therefore, the interactions between the forces of these factors make it difficult to attribute the observed results to a specific policy measure. In addition, in general the policy framework and the economic environment which influence farmer's investment decision are not constant. In reality in several cases they change from one year to the next creating different circumstances.
210. Given these difficulties, an alternative could be to examine the influence of the set of policies followed (or alternatively the policy framework) during specific periods of time on the trend of agricultural investment made by farmers. This is what is done in this chapter. Specifically, it considers strong correlation which has been identified in the literature between the policies summarized in the previous chapter and some variables related to investment in agriculture.
211. In order to further illustrate the relationship between public policies and agricultural investment in Brazil, an additional effort is made in Chapter V below. Specifically, an analysis on the influence of the government policies on farmers' investment in the development of the savannah region will be presented.
212. Between 1960 and 2010 the Brazilian economy faced different contexts, which led the government to adopt specific sets of policies. Given the characteristics of the observed contexts and the specificities of the attendant policy frameworks three policy analysis periods were identified: 1960-1980, 1980-2000 and 2000-2010.
213. One of the major elements which results from the analysis carried out during these periods is that, until the second half of the 1980s the policy framework was characterized as highly interventionist. However, since the early 1990s a different situation was observed, i.e. the government reduced substantially its interventions in the economy as well as in the agricultural sector. Both policy approaches created a favorable climate for farmers' investment in agriculture, particularly the one followed after the mid-1980s.
214. Several studies which analyzed the effective rate of protection resulting from the macroeconomic and agricultural policies in place have shown that, a much better result would have been achieved in the 1960-1985 period if the government policies were less distortive. Notwithstanding this aspect, the policy framework followed in the 1960-1985 period, in addition to promoting the beginning of the modernization process of agriculture, was responsible for setting up the basis for the current competitiveness of Brazil's agricultural sector. The policy framework of the 1994-2010 period in turn, relied significantly on market force mechanisms and produced a much better environment in terms of promoting farmers investment and enhancing the sector competitiveness. Moreover, it gave special attention to supporting small farm agricultural development and to enhancing environmental quality.

4.1 - Investments in agricultural land and in cultivated area with crops

215. According to Chapter III, the policies followed by Brazil between 1960 and the early 1980s included the provision of large volumes of subsidized credit to agriculture (see Figure 2), substantial investments in the construction of federal and state highways (e.g. Belém-Brasília, BR-364 and Transamazonica), and the adoption of several measures to promote the expansion of the agricultural frontier such as tax incentives²² for the establishment of new farms. The implementation of these policies together with some other elements, like a positive evolution of agricultural prices and high rates of inflation at the end of 1970s and beginning of the 1980s, contributed to creating a favorable environment for investments on agricultural land.
216. As shown by Figure 20, the total expenditure on the purchase of land for agricultural purpose experienced a major expansion in real terms in the 1970-1980 period increasing from BRL 3 billion to BRL 13 billion. The figure also shows that, towards the end of the 1980s the style of growth of the Brazilian agriculture changed from land expansion to productivity increase. Therefore, despite the attractiveness to invest in agricultural activities in the 1990-2010 period, the total amount of resources spent on the purchase of agricultural land fell vis-à-vis what was observed in the 1970s and 1980s. This situation reflects in part the impact of the significant realignment of relative input prices within the agricultural sector which resulted from the policy reforms that took place between mid-1980s and the mid-1990s. More specifically, it shows that the reforms led to a greater reliance on techniques that used tradable inputs more intensively and that economized on nontradable inputs such as land and labor.

Figure 20 - Brazil: land purchased for agricultural purposes, 1970-2006 (2006 Reais)



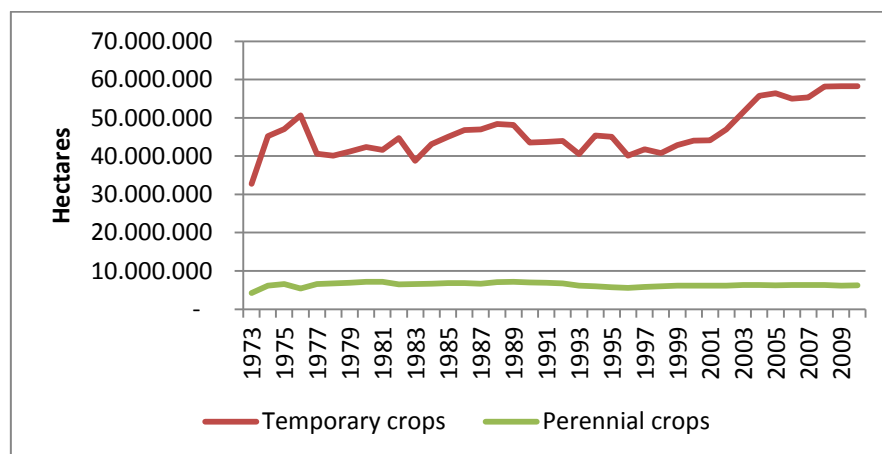
Source: IBGE, Agricultural Census, various years

217. Besides influencing farmers' decision to invest in the purchase of agricultural land, the government policies together with other factors impacted also their choice concerning the utilization of this resource. Specifically, given the different policy environments observed between 1960 and 2010, the Brazilian farmers opted to

²² Extended tax holidays and exemptions from corporate income tax encouraged southeastern Brazilian firms to buy land in the center-west and northern part of the county and begin agricultural activities including cattle ranching. Tax subsidies for Amazonian land-development initiatives, particularly in the livestock sector, facilitated the acquisition of land and contributed to the rapid increase in land value (Hecht 1985).

increase their investments in the production of temporary (annual) and perennial crops as well as to plant pasture and raise beef cattle²³. Therefore, the harvested area with the first of this group of crops expanded 78% in the 1973-2010 period increasing from 33 million hectares to 58 million (Figure 21). In terms of sub-periods, the largest increase was observed in the 2000-2010 decade, i.e. in the post macroeconomic stabilization period. The expansion in the harvested area with perennial crops was significant also (47%), i.e. an increase from 4 million hectares in 1973 to 6 million in 2010.

Figure 21 - Brazil: harvested area with annual and perennial crops, 1973-2010



Source: IBGE

218. Among the different temporary crops, the largest investments in terms of cultivated area during the 1960-2010 period were made in soybeans and sugarcane. Until the late 1960s soybeans were not important to the Brazilian economy, especially when compared to major crops such as coffee, sugarcane, corn, rice and edible beans. However, beginning in the early 1970s the domestic farmers increased substantially their investments in this crop altering substantially its relative importance on both the national and international markets.
219. In 1960 the area harvested with soybeans totaled 171 thousand hectares. Between that year and 1980 it expanded at an annual average growth rate of 24% (Table 8) reaching 8.8 million hectares, i.e. an expansion above 5,000%. Several factors influenced farmers' decision to cultivate this amount of land during this period, particularly between 1970 and 1980. First, the relative prices between soybeans and competing crops favored soybeans during the 1970s (Santana 1984). Moreover, the real price of soybeans in Brazil rose, while the real domestic prices of competing crops fell. Second, the multiplication and diffusion of high yielding varieties imported from the United States and the efforts of Brazilian scientists in creating new varieties adapted to local conditions and in improving cultural practices.

²³ The influence of public policies on farmers' decision to invest in planted pasture and beef cattle raising will be discussed latter in a specific sub-item.

Table 8 - Brazil: production, harvested area and yield of selected temporary and perennial crops; annual average growth rate, percentage, 1960-2010

Period	Coffee	Sugarcane	Edible beans	Cassava	Maize	Soybeans	Wheat	Rice
Production								
1960-1980	-3,58	4,35	0,82	1,22	3,75	27,04	10,42	2,55
1980-2000	0,21	3,49	1,41	-0,64	2,87	4,33	-1,58	0,45
2000-2010	-2,20	8,77	1,84	1,41	4,75	6,26	7,87	1,22
1960-2010	-0,18	5,03	1,02	-0,08	3,50	11,21	3,89	1,50
Harvested area								
1960-1980	-4,39	3,06	2,86	2,07	3,17	24,06	9,23	3,22
1980-2000	-1,00	2,58	-1,18	-1,27	0,13	2,19	-4,34	-3,14
2000-2010	-0,85	7,03	-0,81	1,07	1,36	5,09	3,45	-2,30
1960-2010	-0,80	3,64	0,50	-0,05	0,99	8,92	1,16	-0,72
Yield								
1960-1980	0,85	1,26	-1,98	-0,83	0,56	2,40	1,10	-0,65
1980-2000	1,22	0,89	2,62	0,64	2,74	2,09	2,88	3,71
2000-2010	-1,37	1,63	2,68	0,33	3,35	1,12	4,27	3,61
1960-2010	0,63	1,34	0,51	-0,03	2,49	2,10	2,70	2,23

Source: IBGE

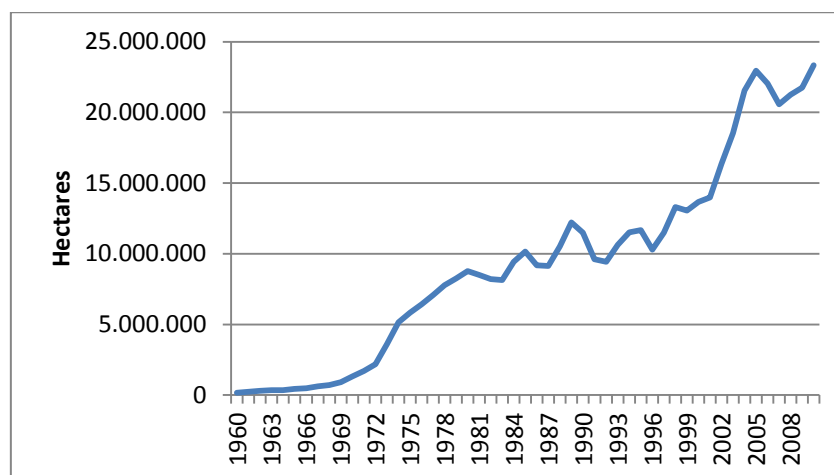
220. Third, the Brazilian government, facing an excessive large world production of coffee in the 1960s, paid domestic producers to replace old coffee trees by other crops of their choosing. As a result of that policy and of the relative profitability of soybeans, a large number of farmers invested in the production of this oil seed crop. This was especially the case in the State of Parana where 7.4% of the soybean produced during the 1970-1973 period came from areas formerly planted to coffee.
221. Fourth, the growth of soybean production was also correlated with Brazilian wheat policy. This is because until the early 1980s, a relatively large number of producers double cropped wheat with soybeans in the State of Rio Grande do Sul. Therefore, the stimulus given to wheat at that time, especially the credit subsidies for the acquisition of machinery and fertilizer spilled over into the soybean sector and thus stimulated farmers' investment in soybeans.
222. Finally, the dramatic increase in the world price of soybean oil in 1973 and 1974, the growth of the Brazilian poultry industry, the domestic agricultural credit policy, and the large and growing domestic market for soybean oil (mainly for cooking purposes) also contributed to promoting farmers' investment in soybeans during the 1960-1980 period.
223. Between 1980 and 2000, farmers' investment in the cultivated area with soybeans continued to increase, however at a relatively lower average annual growth rate (2.2%²⁴) than in the previous two decades. In this context, the cultivated

²⁴ This growth rate was calculated based on the harvested area with soybeans. Therefore, it is used here as a proxy for the area grown with this crop. The same procedure is utilized in other parts of this Chapter.

area with this crop expanded approximately 56% growing from 8.8 million hectares in 1980 to 13.7 million in 2000.

224. The major factors which contributed to establishing a favorable climate for generating this level of investment in soybean area in the 1980-2000 period included the following: government investments in agricultural research, which made soybean cropping possible in the savannah region as well as in the northern part of the country (the technologies adopted in this period included among others, zero tillage, biological fixation of nitrogen and soybean varieties adapted to the soil and climate conditions of the tropics); agricultural trade liberalization; the reduction in production costs resulting in improved margins compared to other crops; expansion of the agricultural support price program; sustained demand for protein meal to supplement feed, especially in the more developed countries with highly intensive livestock sectors; changes in production organization and the development of a dynamic processing industry. The combination of these factors boosted soybean profitability, the major factor behind the increased investment in this crop.
225. It should be noted however, that the investment climate of the 1980-2000 period was comprised not only by positive elements. In effect, it involved also several negative forces, which reduced somewhat farmers' interest to invest in soybeans as well as in other crops and agricultural activities. For instance, as highlighted by (Helfand and Rezende 2004), "the numerous stabilization plans that were adopted during that period were almost always accompanied first by euphoria and then by a deep financial crisis for the sector. The instability was expressed through price cycles in agricultural asset markets – principally land and cattle – as well as in agricultural commodity markets". Moreover, in the 1980s the government reduced significantly the volume of real credit provided to the agricultural sector and eliminated the subsidies. Therefore, as shown by Table 8, the interaction of these negative elements with the positive ones reduced somewhat the performance of agricultural production, yield and investment in cultivated area in the 1980-2000 period.
226. After registering a relatively lower level of growth in the 1980s and 1990s, farmers' investment in soybean area expanded again at a higher average annual rate of growth, i.e. about 5% per year in 2000-2010 (Table 8). Therefore, the harvested area with this crop increased by almost 10 million hectares expanding from 13.6 million hectares to 23.3 million during this ten year period (Figure 22).

Figure 22- Brazil: harvested area with soybeans, 1960-2010



Source: IBGE

227. The underlying factors behind this expansion in soybean area investment included the macroeconomic stability brought by the results of the Real Plan adopted in the mid of 1990s, the removal of nontariff trade barriers and the reduction in the State's role of setting prices, managing production, and decreased industrial protection that further contributed to agricultural modernization. In addition, they involved also a major devaluation of the national currency (in 1998), the adoption of a free floating exchange rate system, and the implementation of PRODECER, MODERFROTA and the Complementary Law N° 87 of 13 September 1996. This last policy measure, known as the Kandir Law, exempted exports of primary and semi-finished goods from the tax on the circulation of goods and services (ICMS). This gave a significant boost to external sales, especially of the soybean sector. PRODECER promoted the expansion of soybean production by providing investment credit. MODERFROTA in turn, facilitated the purchase of tractors and harvesters through medium term credit at favorable interest rates.
228. Moreover, although net soybean returns in the period 1998-2004 were similar to maize and lower than cotton, many farmers opted to grow soybean because it carried fewer technical risks and offered higher liquidity than maize. In addition, much higher investment was required for the high-tech cultivation of cotton than for soybean, not to mention the fact that growing cotton is technically more complex, requiring greater technical and management skills.
229. Besides influencing farmers' decision to invest in the cultivated area with soybeans, the different policy frameworks followed by Brazil during the 1960-2010 period impacted also on their option to invest on agricultural technologies and inputs used in the production of this crop²⁵. Taken crop production per unit of area (i.e. land productivity) as a proxy for the level of technology incorporated in the production process, it can be observed that the policy environment of the 1960-2010 period contributed significantly for farmers' investment in agricultural technologies

²⁵ As will be seen latter, the public policies influenced also farmers' investment on agricultural technologies and inputs used in the production of other crops.

and inputs used in soybean production. During this fifty years period, soybean yield increased 146% expanding from 1,200 kg/ha in 1960 to 2,947 kg/ha in 2010. The greatest positive impact of the policy and economic environment on farmers' investment in agricultural technologies and inputs used in soybean growing was in 1960-1980. During this period soybean yield expanded at an average annual growth rate of 2.4% (Table 8).

230. In addition to soybeans the other crop which presented one of the highest levels of farmers' investment in cultivated area as a consequence of the government policies and of other factors prevailing in the 1960-2010 period is sugarcane. During this period the harvested area with this crop increased from 1.3 million hectares to 9.1 million, i.e. an expansion of 577%. As suggested by Table 8, the investments in sugarcane land increased in 1960-1980 as well as in 1980-2000 and in 2000-2010. However, the largest increase took place in this last period (average annual growth rate of cultivated area of 7%).
231. The main factors which contributed to the relatively higher investments in sugarcane area in 2000-2010 were the following: the liberalization of sugarcane, sugar and ethanol prices in 1999²⁶; launching of the flex-fuel cars in 2003 and tax incentives to promote the purchase of these vehicles; and a favorable evolution of sugar prices. The enabling environment for investments in the cultivated area with this crop included also the liberalization of sugar exports by the national government, increase in the domestic and international consumption of sugar, and the adoption of a free floating exchange rate system in January 1999, which altered significantly the profitability of agricultural activities and exports²⁷. Moreover, the investments were influenced also by: the policy of maintaining the blending requirements of ethanol into the gasoline; the return to a situation characterized by large supply of agricultural credit (Figure 2); and by technology developments related to sugarcane production as well as to industrial activities, which resulted in a greater production of both sugarcane and its derivatives (sugar, ethanol, electricity).
232. In addition to these elements, the following contributed also to farmers' investments in sugarcane area in 2000-2010: the implementation of the National Incentive Program for Alternative Sources of Electric Energy (PROINFRA), which promotes the diversification of the energy matrix through the use of renewable sources of energy; government and private sector measures to establish ethanol as a commodity; and large amounts of investment credit provided by the Government for the establishment of sugar and ethanol industries.
233. The sharp increase of the international price of petroleum in the first decade of 2000 (from USD30/barrel Brent in 2000 to USD54/barrel in 2005 and reaching USD93/barrel in 2007) and its transmission to the domestic market stimulated also farmers' investment in sugarcane growing by raising the competitiveness and demand of ethanol.

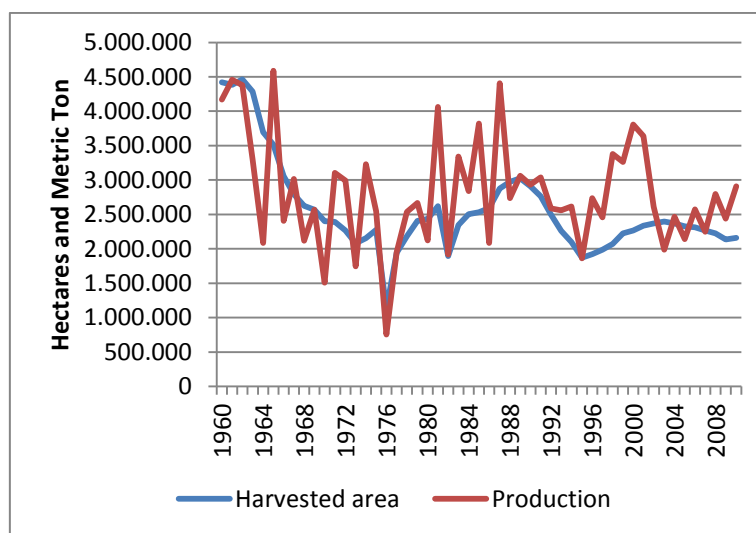
²⁶ In the 1980s the government set producer prices and provided a subsidy to sugarcane producers in the northeast region. In addition, it used production quotas to regulate sugarcane supply and was the official buyer and distributor of the final products. Moreover, the government fixed the price of alcohol, which was used as a fuel for cars.

²⁷ In January 1999 the Brazilian currency was allowed to float; in this context it registered a real depreciation of 50%.

234. As expected, the government policies influenced also farmers' investment in the use of technologies, better inputs and machinery in sugarcane production. An evidence of this is provided by the evolution of sugarcane productivity between 1960 and 2010. As shown by Table 8, the productivity of this crop increased at an average growth rate of 1.3% per year in 1960-1980. During the transition decades, i.e. 1980s and 1990s, the relatively less favorable policy and economic environment resulted in a lower average annual growth rate of productivity, 0.9%. However, in the 2000-2010 period the better investment climate created by the policy measures indicated above gave rise to a higher average productivity growth rate (1.6% per year) suggesting a greater investment by farmers in technologies, inputs and machineries used in sugarcane growing.
235. Regarding the investments in this last factor, it has been estimated that the sugarcane area harvested with combines in the Center South region of Brazil increased from 16% in 1997 to 34% in 2006 (Paes 2007).
236. In contrast to what was observed in the case of soybeans and sugarcane, the investment climate created by public policies and other factors influenced negatively the overall trend of farmers' investment in the area grown with coffee in 1960-2010. According to Table 8, the area cultivated with coffee followed a downward trajectory during this 50 years period registering negative annual average growth rates in 1960-1980, 1980-2000 and 2000-2010.
237. The main reasons which led the national farmers to invest progressively less in the area planted with this crop were public policies. Coffee was one of the most heavily regulated subsectors in Brazil. In the 1960s the government paid domestic producers to replace old coffee trees by other crops of their choosing. In the 1970s and 1980s coffee was subject to an export tax. Moreover, during this same period, the Brazilian Coffee Institute (IBC) administered a support price policy for this commodity, managed coffee stocks and controlled exports to comply with the International Coffee Agreement.
238. Following those years, the policy reforms of the late 1980s and 1990s had a significant impact on prices. Even though Brazil reduced its coffee exports, in the late 1980s the international prices of this crop dropped by 20% due to substantial foreign sales from other countries. Following this situation, the International Coffee Agreement and the IBC were abolished at the end of 1980. Given the abolishment of this domestic and international institutions that regulated supply, Brazil and other countries increased their exports of coffee significantly (about 10%). This resulted in an additional 32% fall in the international prices of this commodity.
239. In 1993 Brazil and other countries formed the Association of Coffee Producing countries which undertook coordinated actions to implement a voluntary system of export targets. This measure, together with the creation of the Deliberative Council for Coffee Policy in 1996 and several frosts, contributed to temporarily bringing the price level back to that of the 1987-1989 period. Notwithstanding these efforts, the recovery of coffee prices was short-lived. Early in 2000 the international prices were back to their 1990-1994 level. The reason for this price fall was the difficulties of cooperation among coffee exporters.

240. Given the above context of unfavorable international prices the Brazilian farmers opted to reduce their investments in coffee area in the 1960-2010 period. However, they made significant investments in better technologies, machineries and cultural practices as suggested by the average annual rate of productivity growth observed in 1960-1980 and 1980-2000 (Table 8). Despite this fact, Brazil's coffee production followed a downward trend between 1960 and 2010 (Figure 23).

Figure 23 - Brazil: annual production and harvested area with coffee, 1960-2010



Source: IBGE

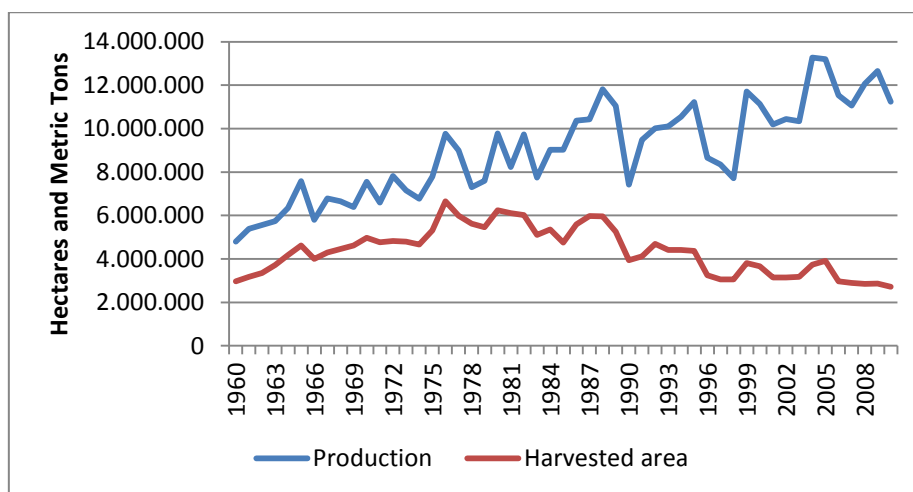
241. In addition to what was observed in the case of soybeans, sugarcane and coffee, an evidence of the influence of public policies on agricultural investment in Brazil is what happened with rice cultivation. Farmers' investment in the cultivated area with this crop followed a downward trend during the 1960-2010 period (Table 8). However, their decision to invest in this crop did not follow the same trajectory in all decades of this period. Between 1960 and 1980 the investments made in the area grown with rice expanded at an average annual rate of growth of 3.2% (Table 8). After the end of this period the situation changed, i.e. the investments in rice land fell in 1980-2000 (3.1% per year) as well as in 2000-2010 (2.3% per year).
242. The reasons for this picture are associated in a great extent, to the impact of the policy frameworks followed by Brazil in each of those periods on farmers' decision to invest in upland and irrigated rice areas. During the 1960-1980 period, Brazil's policy included a strategy to expand the agricultural frontier in the Center-West and Northern regions of the country. Therefore, in addition to implementing national policies like the provision of large amounts of subsidized credit, supporting product prices through a minimum guarantee price program²⁸ and providing extension services to farmers, the Government adopted also some regional policies.
243. These regional policies included public investment in infrastructure (highways, rural electrification, agricultural storage facilities, etc.), provision of tax incentives for the establishment of new farms, as well as several public programs like the

²⁸ This program benefited more the production of food products including rice.

Cooperation Program Japan-Brazil for the Development of the Savannahs (PRODECER), the Savannah Development Program (POLOCENTRO), the National Limestone Program for Agriculture (PROCAL), the State Plans for Rural Credit Utilization (PESAC) and a subsidy program for the use of fertilizers.

244. As indicated earlier, the implementation of these policies and programs influenced farmers' decision to purchase agricultural land between 1960 and the mid-1980s. Given the rusticity of upland rice and its tolerance to low fertility and acid soils, it was the crop chosen by most farmers to be cultivated right after deforestation. Therefore, the combination of the characteristics of this crop with the policy framework in place resulted in large investments in rice area during the 1960-1980 period.
245. During these decades of upland rice expansion, the domestic consumers started to show little satisfaction with the quality of this product. Moreover, in the 1980s agricultural researchers and farmers implemented a valorization program of the irrigated rice produced in Rio Grande do Sul. Among other aspects, this program involved a rapid dissemination of new cultivars, such as BR IRGA 409 and BR IRGA 410, with high productive potential and wide acceptance by consumers. In this context, consumers' preference turned to the type of rice produced under irrigation system in the south and south-east regions of Brazil (i.e., long and thin rice). Therefore, the prices paid to upland rice producers fell significantly between the mid-1980s until the late 1990s leading the domestic farmers to reduce their investments in the area grown with this crop.
246. In the mid-1990s EMBRAPA launched a new rice variety (*agulinha de sequeiro*) which has the same type of grain as that of irrigated rice. This new product became well accepted by consumers. However, as shown by Table 8, the introduction of this variety did not change the downward trend of farmers' investment in rice area in the 2000-2010 period. The reason for this is because the technological developments that were made with soybeans and the new policy environment (less interventionist), led this product to replace upland rice as the preferred crop to be cultivated after the opening up of new land.
247. As shown by Figure 24, the reduction in the area cultivated with rice did not imply a downward trend in the production of this grain in 1960-2010. The reason for this is because farmers' invested significantly in new technologies and inputs which in turn, resulted in positive rates of productivity growth during that period. The explanation for a greater investment in technologies and inputs is because the policy reforms carried out between the mid-1980s and mid-1990s altered favorably the product/input price ratio, especially by reducing the cost of the inputs.

Figure 24 - Brazil: production and harvested area with rice, 1960-2010



Source: IBGE

248. According to (Dias and Amaral 2001) the liberalization of agricultural exports brought by the policy reforms of the late 1980s and early 1990s, improved substantially the competitiveness of the agricultural product markets. However, it was the liberalization of the input markets that had the largest impact on agriculture by altering favorably the product/input price ratio (Table 9). In the case of rice, this ratio increased 65% in the 1987-1998 period (Dias and Amaral 2001). This provided an important incentive for farmers' investment in technologies and inputs.

Table 9 - Brazil: product/input price ratio, 1987-1998

Year	Rice	Maize	Soybeans	Coffee	Edible Beans
1987	100	100	100	100	100
1988	121.4	128.1	140.3	118.1	99.4
1989	95.1	98.2	84.8	93.4	110.8
1990	150.3	145.7	83.4	122	126
1991	173.3	143.9	102.5	120.1	111.7
1992	139.7	134.7	109.6	121.2	106.7
1993	157.3	158.7	121.3	133.2	141.9
1994	156.9	137.8	106.7	149.4	155.3
1995	132	127.2	99.6	128.8	101.9
1996	125.3	123.2	100.8	122.5	106.3
1997	146.9	112.5	122.9	139.9	108.2
1998	167.7	125	108.4	145.7	159.6

Source: (Dias and Amaral 2001)

4.2 - Investments in planted area with pasture and in beef cattle raising

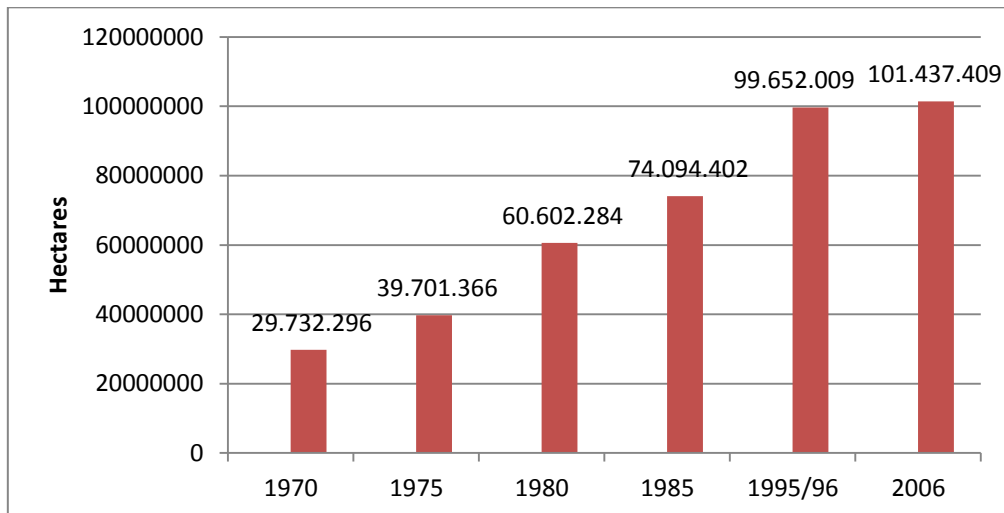
249. In addition to impacting on the investments made on the area cultivated with the above-mentioned crops, Brazil's public policies affected also farmers' decision to invest in planted pasture and beef cattle raising. Between 1960 and 1980, the

policies aimed at expanding the agricultural frontier²⁹ together with the large supply of subsidized agricultural credit influenced significantly the level of investment on these activities.

250. The investments were stimulated also by attractive beef prices, available mechanization technology and the introduction of several new cultivars of tropical grasses (e.g. *Brachiaria brizantha*, *Panicum maximum* and some others). Moreover, the enabling policy and economic environment of the 1960s and 1970s included several Government programs aimed at promoting farmers' investment in planted pasture and beef cattle raising such as the Beef Cattle Development Program (PRODEPE), the National Pasture Program (PRONAP) and the National Council for Livestock Development (CONDEPE). The first two of these programs assisted farmers through credit provision. CONDEPE in turn, provided technical assistance in the formulation of beef cattle raising projects. Some non-economic factors contributed also to influencing farmers' investment in planted pasture and beef cattle raising in 1960-1980, for instance, the need to secure land tenure of beef cattle farms (clearing, building fences, paying taxes, etc.) due to lack of formal property right.

251. Given the above-mentioned elements, the investments in the area planted with pasture increased 104% in the 1970-1980 period expanding from 30 million hectares to 61 million (Figure 25). In the case of beef cattle, the impact of the policy framework on the investment level is approximated by the number of animals purchased by farmers. As shown by Figure 26, the total number of cattle purchased between 1975 and 1980 increased from 9.2 million heads to 12.4 million, i.e. an expansion of 35%.

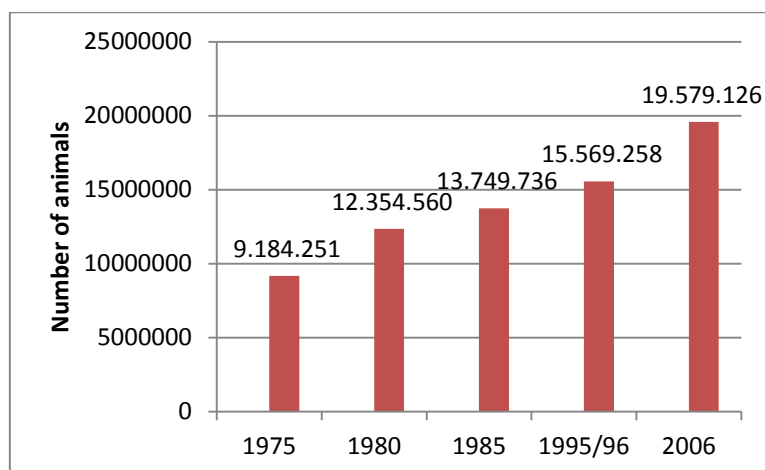
Figure 25 - Brazil: area planted with pasture, 1970-2006



Source: IBGE, Agricultural Census, various years.

²⁹ These policies have been indicated earlier; therefore they will not be specified here again.

Figure 26 - Brazil: Heads of cattle purchased by domestic farmers 1975-2006



Source: IBGE, Agricultural Census, various years.

252. Following the 1960-1980 period, when the investments in planted pasture and beef cattle raising expanded substantially, the next two decades were characterized by a continuation of this trend. However, the observed expansion was not so strong as before (Figure 25 and Figure 26). The reasons for this relatively smaller growth were the changes introduced in the policy framework due to the economic crises faced by the country during the eighties and nineties (item 3.2 of the previous Chapter refers). Among the different changes in the policies followed in that period, the elimination of tax incentives for the establishment of new farms and the drastic reduction in the provision of subsidized credit are notable for contributing most for the slowdown on the investments in those two activities.
253. Parallel to those changes in the policy framework, several other elements acted in the opposite direction to them more than offsetting their negative effects on the investments on planted pasture and on the purchase of beef cattle. These elements include the following: the availability of cheap land in the Center-West and Northern regions of the country; excellent agro-ecological conditions in the Amazon for forage production; access to technology; the efficiency of pasture establishment and management; and especially the relatively high internal rate of return of beef cattle production systems (about 10%) obtained by large and medium farmers established in the consolidated agricultural frontier (Margulis 2003). Moreover, the security of livestock income during a period of very high inflation rate and economic downturns made beef cattle raising an important form of saving and a secure destination for the investment of other incomes.
254. Given the enabling economic environment created by these elements, farmers' investment on planted pasture increased 64% in the 1980-1996 period. Regarding the investments on cattle raising, the effect was an expansion of 26% between 1980 and 1996 as suggested by the increase in the amount spent on the purchase of this livestock animals.
255. As highlighted earlier, the 2000-2010 period was characterized by a stable macroeconomic environment and a reliance on market instruments to promote economic and agricultural growth. Under this context, the agricultural credit

provided to the beef cattle sector experienced a nominal expansion of 398% (or alternatively 110% in real terms) between 1995 and 2003 increasing from BRL522 million to BRL2.6 billion. The credit provided to investment in pasture registered also an important expansion during that same period, i.e. 64% in real terms.

256. In addition to this aspect, in the beginning of the 21st Century the Government adopted several programs which stimulated the investment in planted pasture. They included the National Program for Recovering Degraded Pastures, the Incentive Program for the Use of Soil Improvement Measures (PROSOLO) and the Agricultural Modernization and Natural Resource Conservation Program (MODERAGRO). These programs involved the provision of credit at relatively lower interest rate (compared to what was charged for other economic activities).
257. Besides the above programs, which aimed at improving and recovering existing pastures, the Government adopted several measures that contributed to intensifying beef cattle-raising in the country. These measures include the following: the implementation of the Low-Carbon Agriculture Program (ABC), which promotes the adoption of integrated crop-livestock systems and the use of farming practices that contribute to the recovery of degraded pastures; and support to expanding beef cattle feedlots.
258. The implementation of this set of measures together with a limited incorporation of new land into production that took place in 2000-2010, resulted in relatively smaller investments in planted pasture (vis-à-vis previous decades) and a major expansion in the purchase of cattle in the same period (Figure 25 and Figure 26).

4.3 - Investments in fertilizer use³⁰

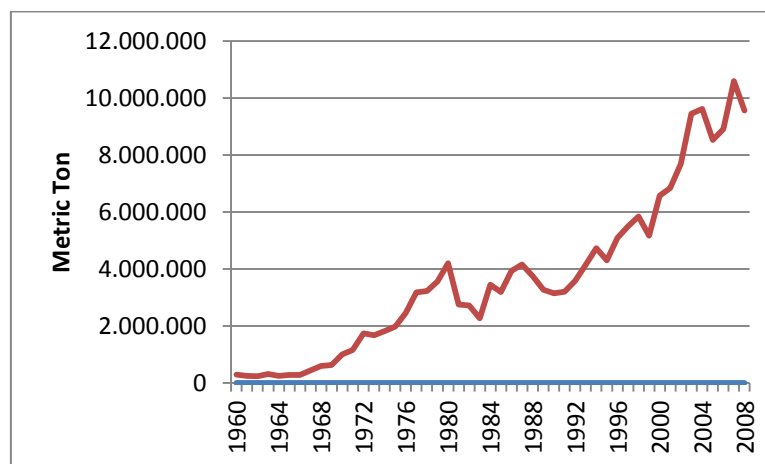
259. Recognizing the important relationship between fertilizer usage and agricultural productivity, the Brazilian government adopted in the 1960-1980 period several policies seeking to stimulate both, the growth of the national fertilizer industry as well as the expansion of the domestic consumption of this input. The adoption of these policies, especially those related to fertilizer consumption influenced substantially farmers' decision to invest in the use of this input.
260. Regarding the promotion of the national fertilizer industry, the government used several policy instruments during the 1960-1980 period such as the Incentive Fund for the Use of Fertilizers and Mineral Supplements (FUNFERTIL), the Special Fund for Agricultural Development (FUNDAG) and the National Fertilizer and Limestone Program (PNFCA). The objective of these funds and program were to stimulate the expansion and modernization of the fertilizer and limestone industries through special lines of credit. The first phase of the program covered the 1974-1980 period and the second 1987-1995. The government implemented also other policy measures in the late 1970s and early 1980s some of which supported the fertilizer industry and other taxed it. Several of them impacted the price of fertilizers for national consumers, i.e. tariffs on the imports of this input, ICM tax (wholesale marketing tax) and industrial products' tax (IPI).

³⁰ Fertilizers are part of the category of physical goods known as physical capital. Therefore, the influence of the public policies on farmers' decision to invest in this input is reviewed here.

261. In addition to these policies the government intervened in the fertilizer sector by controlling the domestic price of this input (imposing ceilings on the retail prices) and by adopting a *contingenciamento* (contingency in Portuguese) policy. This last measure consisted in determining the quantity of a given crop nutrient that an industry engaged in mixing fertilizer components could import free of tariff for each metric ton purchased from local producers³¹ (the national production was more costly). There were contingency ratios for the imports of raw material (e.g. ammonium and phosphate rock) and for the imports of fertilizer components (e.g. ammonium sulphate and chloride potash). Moreover, the contingency ratios varied among regions and fertilizer components.
262. According to (Carmo 1983), the establishment of different contingency ratios among regions resulted in a problem known as *passeio do fertilizante* (the ride of fertilizers) since the imported fertilizer (which was cheaper than the domestic product) was transported from regions where the imports were completely free to be sold in others where the policy of *contingenciamento* was in effect. The *contingenciamento* affected also the price of fertilizers paid by farmers. The fact that the cost of locally produced fertilizer was higher than the international price and that the policy of *contingenciamento* restricted imports resulted in higher fertilizer prices for domestic consumers.
263. The government implemented also an import quota policy in the 1977-1982 period. It allowed domestic firms to make occasional imports of fertilizers free of tariffs and without the obligation of buying a certain amount of the imported input from the national industry.
264. Further to the above, in an effort to reduce the negative effects of some policies, the government stimulated the domestic investment in fertilizer use by supplying a large amount of subsidized credit for farmers. The positive effect of this policy was complemented by the overvaluation of the domestic currency which prevailed during various years of the 1970s and part of the 1980s.
265. According to (Santana 1984), fertilizer was the tradable input which received the largest implicit subsidy per metric ton from the overvaluation of the *Cruzeiro* during that period. This fact, together with the impact of the agricultural credit policy overwhelmed by a large margin the impact of the other policies which taxed fertilizer use. Therefore, the net impact of the policies followed in the mid-1960s and 1970s contributed significantly to stimulating Brazilian farmers to invest in fertilizer use during that period. As shown by Figure 27, the domestic consumption of this input increased 1,300% between 1960 and 1980 expanding from 299 thousand tons to 4.2 million.

³¹ The contingency ratio was set based on estimates of domestic production and consumption for the period under consideration.

Figure 27 - Brazil: total consumption of fertilizers, 1960-2008 (Nitrogen, phosphorus and potassium)



Source: ANDA, *Anuario Fertilizantes*, various issues.

266. Between 1980 and 2000 farmers' investment in the use of fertilizer continued to follow an upward trend. However, in the 1980s it experienced a strong fluctuation and a relatively lower rate of growth. The reasons behind this situation included the economic instability created by both, the macroeconomic crisis which affected the country in that decade and the policy reform programs that were implemented to overcome them³². Following that period, the investments in fertilizer use pick up again as shown by the substantial increase (109%) in the consumption of this input in 1990-2000 (Figure 27).
267. The expansion in the supply of agricultural credit observed during the second half of the 1990s (Figure 2) contributed significantly to this performance. As highlighted in Chapter III, as part of the policy reforms of the late 1980s and early 1990s, the share of the credit provided by Government in the total supply of credit was reduced while that of private sources increased. Therefore, the expansion in the investment in fertilizer use in 1990-2000 was due in a large extent to the substantial financing provided by the private sector, especially by the input suppliers, trading companies and exporters (F. P. Silva 2012).
268. Further to the above policy measures, the investment in fertilizer use in 1980-2000 was influenced also by two other elements: (i) the macroeconomic stability which resulted from the implementation of the Real Plan; and (ii) the positive impact that the public policies caused in agricultural activities in the savannah region of the country, especially on the cultivation of soybeans and corn.
269. As shown by Figure 27, farmers' investment in fertilizer use also expanded significantly (46%) in the 2000-2008. Several public policies contributed to this fact: the positive impact to the price of agricultural commodities brought by the devaluation of the national currency which took place in the first years following the adoption of the free floating exchange rate system in late 1999; the tax incentive provided by the governments of the States of Bahia and Mato Grosso for the expansion of cotton production; and the major expansion in the provision of public investment credit managed by the National Economic and Social Development Bank (BNDES) during the 1998-2007 period (Rezende and Kreter 2008).

³² See item 3.2 of Chapter III for a summary of the adopted policy reforms.

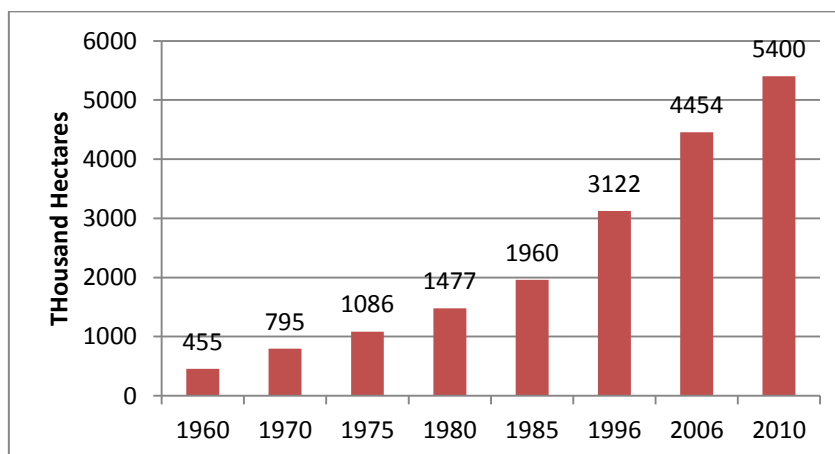
According to (Goncalves, Souza and Ferreira September 2008.), farmers' investment in fertilizers was somewhat limited during the first decade of 2000 because the high value of outstanding farm debt that they faced.

4.4 - Investments on irrigation

270. Notwithstanding its importance as a good alternative for increasing agricultural production under less risky climatic conditions and the excellent potential existing in the country for its expansion, irrigated agriculture developed moderately in Brazil. According to the literature, the development of this activity started in the early decades of the 1900s in the south of the country, particularly in the States of Rio Grande do Sul (irrigation of rice) and in Sao Paulo (coffee production). However, since the 1960s a new picture started to emerge as a result of Government actions aimed at promoting the growth of irrigated agriculture, fighting poverty in the Northeast, expanding agricultural production and productivity in this semi-arid region of the country, and creating opportunities for a greater participation and interest of private sector investment in irrigation.
271. Specifically, by the end of the 1960s the government created the Group for Integrated Studies on Irrigation and Agricultural Development (GEIDA) with the objective of enlarging the overall knowledge of natural resources. As part of its activities, this Group established a new policy orientation regarding irrigation development, i.e. the conception and implementation of national programs. In this context the Pluri-annual Irrigation Program (PPI) was created in 1969. Its objective was to undertake studies, implement projects and carry out irrigation and drainage work in the semi-arid region in order to benefit from the existing small and large dams. This program was complemented with the National Integration Program (PIN) which defined and initiated the construction of the major Federal roads that would facilitate the transportation of goods between different regions of the country.
272. Further to the above, specific programs were established in the 1970s and early 1980s to promote farmers' investment on irrigation and drainage. These programs include the National Program for Rationale Use of Flood Plains (PROVARZEAS) which was established first in the State of Minas Gerais in 1974 and then extended to the entire country in 1981 (National PROVARZEAS). Through this program the government provided credit at low interest rates for farmers' investments on drainage and land preparation for crop growing as well for the purchase of machineries and equipment needed for the systematization of floodplains.
273. In addition to this program, the government implemented irrigation projects in the Sao Francisco River Basin through the Company for the Development of the Sao Francisco Valley (CODEVASF) created in 1974. Its main role was implementing federally funded irrigation infrastructure. Following the finalization of the infrastructure construction, the Company allocated small plots (4 to 8 ha) to poor and/or landless farmers, medium-size plots (8 to 32 ha) to professional farmers and large-size plots (32 to 500 ha) for enterprises. The water charge paid by the owners of these plots included two components, one to recover the investment cost of the irrigation and drainage system and the other to cover the operation and maintenance costs.

274. As shown by Figure 28, the implementation of these public programs together with other government policies indicated in the previous items above as well as in Chapter III (they include the development and diffusion of improved crop varieties proper for irrigated areas), resulted in a substantial increase in farmers' investment in irrigation during the 1960-1980. Specifically, the irrigated area expanded 225% during this period increasing from 455 thousand ha to 1.5 million. In the South, Southeast and Center-West regions of the country the irrigation was used mainly for the growing rice and grain crops. In the Northeast the focus during that period was on corn and edible beans.

Figure 28 - Irrigated area in Brazil, 1970-2006



Sources: IBGE – Agricultural Census, various issues; Agência Nacional de Águas (ANA), *Conjuntura dos Recursos Hídricos no Brasil, Informe 2012*.

275. Following those two decades, the government continued promoting the expansion of irrigated agriculture. Therefore, in 1982 it established the Program for Financing Irrigation equipment (PROFIR). Moreover, in 1986 it created the National Irrigation Policy with two implementing arms, the Northeast Irrigation Program (PROINE) and the National Irrigation Program (PRONI). The first of these programs was in charge of the coordination and promotion of irrigation activities in the Northeast, while PRONI was responsible for carrying out the same functions for the rest of the country.

276. Through these programs investments were made in irrigation infrastructure and energy transmission and distribution. In addition financing was provided for equipment purchasing and day-to-day expenses. State-level Irrigation Coordinating Committees were established also to facilitate the implementation of these programs. In the case of public irrigation projects, water tariffs were charged. They included the cost of both, public capital investment in the project's infrastructure, water use and operating and management costs.

277. The initial goal of the National Irrigation Policy was to increase the total irrigated area by 3 million ha in the 1986-1990 period. However, due to the macroeconomic crisis, cut backs in the availability of federal and state funding and technical and institutional constraints the target had to be scaled back. Despite the impact of these factors, farmers' investments in irrigated area more than doubled in 1980-1996 increasing from 1.5 million ha to 3.1 million.

278. Between 2000 and 2010 the investments in irrigated agriculture continued to expand, however at a relatively lower rate of growth than in previous periods. According to the data available (see Figure 28), the area under irrigation in Brazil increased 73% in 1996-2010. The main elements behind this expansion include a favorable evolution of the ratio between the price of agricultural products and of the inputs used as well public policies and programs. Among these last elements the most notable ones are national credit programs like MODERINFRA, which promotes investments in irrigation and storage facilities and specific programs carried out by certain States. For instance, in Rio Grande do Sul where approximately 33% of the irrigated area is located, the local government has been carrying out a specific credit policy to support the expansion of irrigated rice. This policy has been complemented with major research and technical assistance efforts carried out at state level by Rio Grande do Sul Rice Institute (IRGA).
279. In addition to Rio Grande do Sul other state Governments like the one of Tocantins has been implementing special programs to promote investments in irrigation. In the case of this last state, the Government borrowed USD99 million from the Inter-American Development Bank to finance the activities of the Development Program of Southeast of Tocantins (PRODOESTE). The objective of this program is to promote the expansion of irrigated agriculture through public-private partnership. In this regard it provides credit to finance the approved projects.
280. In closing this item it should be noted that, traditionally most of Brazilian irrigation development has been carried out by the private sector³³. In 1996 for instance, about 95% of the total irrigated area was developed by farmers or private companies with technical support from government programs (e.g. PROVARZEAS) and financial assistance through targeted credit lines. An additional aspect of Brazil's experience with irrigation development is that the focus of public projects evolved from socially based efforts to sustainable entrepreneurial activity. Moreover, they changed from conventional to modern localized and precision irrigation techniques and towards the cultivation of fruits and other high value products.

4.5 - Investments in farm tractors

281. According to Chapter III, in the mid-1960s the Brazilian government started to implement a strategy of agricultural modernization. As part of this process, it adopted several policies aimed at promoting the utilization of modern inputs such as tractors and combines. In the eyes of the government these policies would serve two complementary purposes: first, assist farmers to expand the supply of agricultural products through the use of better inputs and the cultivation of relatively larger tracts of land; and second, to stimulate the development of the national industry through the sales of machineries and equipment. The main policy instrument utilized to pursue these objectives was the provision of large volumes of investment credit at subsidized interest rates (item 3.1 – a.1 of Chapter III).

³³ The investments made by the government have been mainly in the North-East of Brazil where there is a large concentration of poor population and a semi-arid climate.

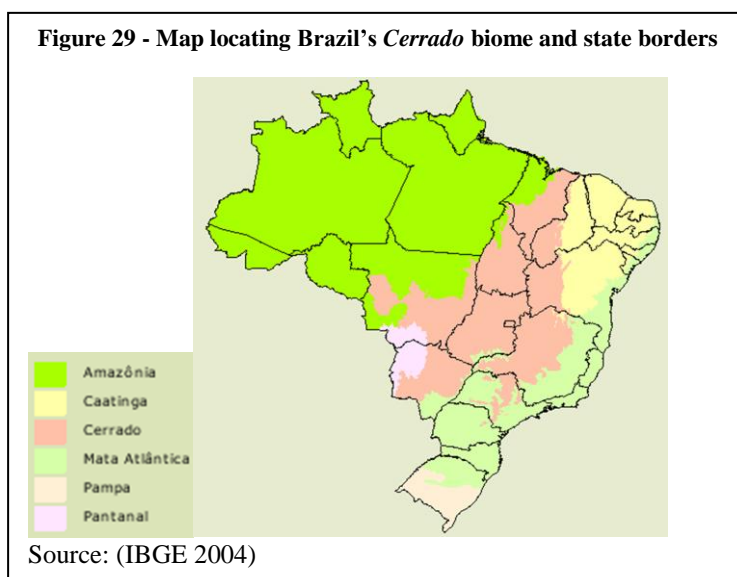
282. As shown by Figure 11, the implementation of the above-mentioned policy in 1961-1980 impacted significantly on farmers' decision to investment in tractors. Specifically, the sales of this machinery expanded approximately 30 times during that period increasing from 1,679 tractors to 50,195.
283. Following this period of credit abundance a new situation emerged in the early 1980s as a result of the macroeconomic crisis experienced by the country, which led the government to reduce drastically the financing of agricultural production and investment. In this context, as the data on tractors sales suggest, farmers' investment in this machine fell from 50,195 tractors in 1980 to less than 28,000 in each of the years of 1981-1983 (Figure 11).
284. In 1985 and especially in 1986, when the *Cruzado* Plan was adopted, the government expanded the supply of agricultural credit vis-à-vis the previous years. Reflecting the impact of this measure as well as the temporary positive climate created by this macroeconomic plan, the investments in tractors pick up again reaching 40,736 units in the first of these years and 45,297 in the second. After these two years, the investments in tractors followed a downward trend until reaching the lowest level in 1996 (10,312 tractors). This path follows quite closely the trajectory registered by the supply of agricultural credit during the 1987-1996 period (Figure 2).
285. As indicated in Chapter III, in 2000 the government started to implement a new program aimed at promoting farmers' investment in tractors and farm machinery, the MODERFROTA. The adoption of this program, which enhanced substantially the provision of investment credit to large, medium and small farmers, contributed to increasing markedly the purchase of tractors. Specifically, as shown by Figure 11, the implementation of this program together with other factors such as a favorable evolution of the prices received by farmers, resulted in an increase in farmers' investments in tractors from 24,591 units in 2000 to 56,240 in 2010 (i.e. 129%).

V. Public policies and farmers' investment in the Brazilian savannah: a successful example.

286. This chapter³⁴ tries to describe the process of agriculture development of the Brazilian Savannah, the *Cerrado* biome region, the role of public policies and their influence on producers' investments. This region of the country has not been important for agriculture production historically. However, in the past 50 years or so it has received major investments in the sector converting it into one Brazil's principal food producing regions.

287. The *Cerrado* biome is located in the Brazilian Central Plateau. It covers approximately 200 million ha distributed in 11 states, and represents 24% of the country's total land area (Figure 29).

288. Starting in the 1960s, the *Cerrado* began receiving public and private investments in selected sub-regions and policy interventions which boosted agricultural production in the region.



289. After overcoming its soil acidity, low fertility, and other hurdles, and adopting less harmful and more sustainable technologies, the *Cerrado* is nowadays responsible for more than half of the soybean production in Brazil (Barros and et al 2007) (Mueller and Martha Jr. 2008) (Correa and Ramos 2010). Agriculture occupies around 22 million ha. It is estimated that in the *Cerrado* there are around 50 million heads of cattle, almost 33% of the national herd, on 54 million ha of grassland. This growth of agriculture investments in the region has resulted in substantial economic and social impacts (Mueller and Martha Jr. 2008) (The Economist 2010).

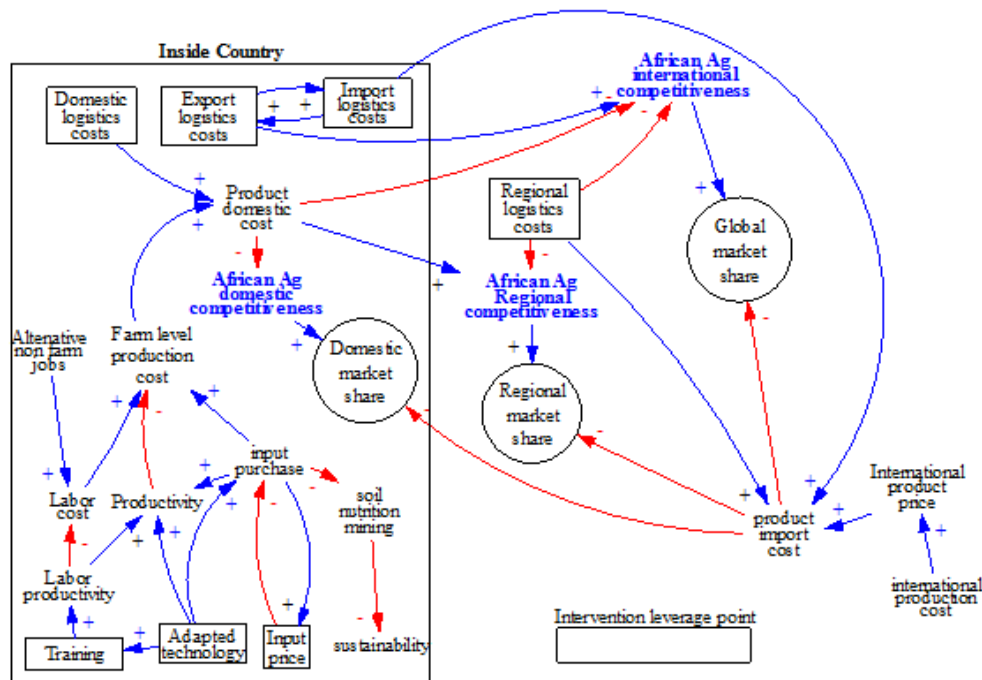
290. The case of agriculture investments in the *Cerrado* region illustrates well how these investments depend on investors' perception of how factors influencing the climate for agribusinesses affect the ERR of their future investment projects in a given location. The financial profit an investor or farmer may obtain from a project to produce food or fiber depends on the stream of costs and revenues that such agricultural project is expected to generate under the contingencies of the land area where the project will be undertaken. It depends also on the business climate the

³⁴ This chapter was based heavily on (J. R. Nascimento 2009).

investor faces and expects to face during the execution period of the agricultural investment project and their impacts on costs and revenues.

291. Instead of repeating the detailed discussion of policies and investments made over time and linking them to investments in agriculture investments as presented in other chapters, here we will discuss two causal models that summarize the main variables, factors, policy interventions, and their relationships and how they influence investments in agriculture as analyzed by recent studies. It helps to demonstrate how the greater the expected rate of return of an agriculture-based business project as compared with alternative investment opportunities, leads to a greater investment level in agriculture. It is important to notice, as shown elsewhere in this paper, that these investments and policy interventions evolved over time and indeed did not affect equally all sub-regions of the *Cerrado* biome (Mueller and Martha Jr. 2008).
292. Several studies have been undertaken in recent years to describe the process of agriculture based development of the Brazilian Savannahs. Here, two of those studies were found to be most useful for the purposes of the present study and are reviewed.
293. The first study published by FAO and the World Bank in the form of a book (World Bank 2009) can be summarized by the model presented as Figure 30. This model was prepared based on the revision made by the book's authors of the agriculture based development that happened in the savannahs of Brazil and of Northeast Thailand with the purpose of identifying main lessons and patterns useful for the case of the African Savannahs. In these cases, a series of factors that affect the domestic production cost were identified; as well as the impacts of domestic, export, and import logistic costs on the competitiveness of agriculture products in the domestic, regional and global markets. Farm level production costs in the *Cerrado* are affected by the use and cost of purchased inputs, labor costs, and the productivity of the land resulting from the use of suitable technology. Labor productivity also is affected by the workers limited capacity of applying more efficient technologies which can be improved by training.

Figure 30 - Factors affecting agriculture competitiveness in developing countries



Source: (J. R. Nascimento 2009). See footnote 1 for an explanation on how to interpret arrows.

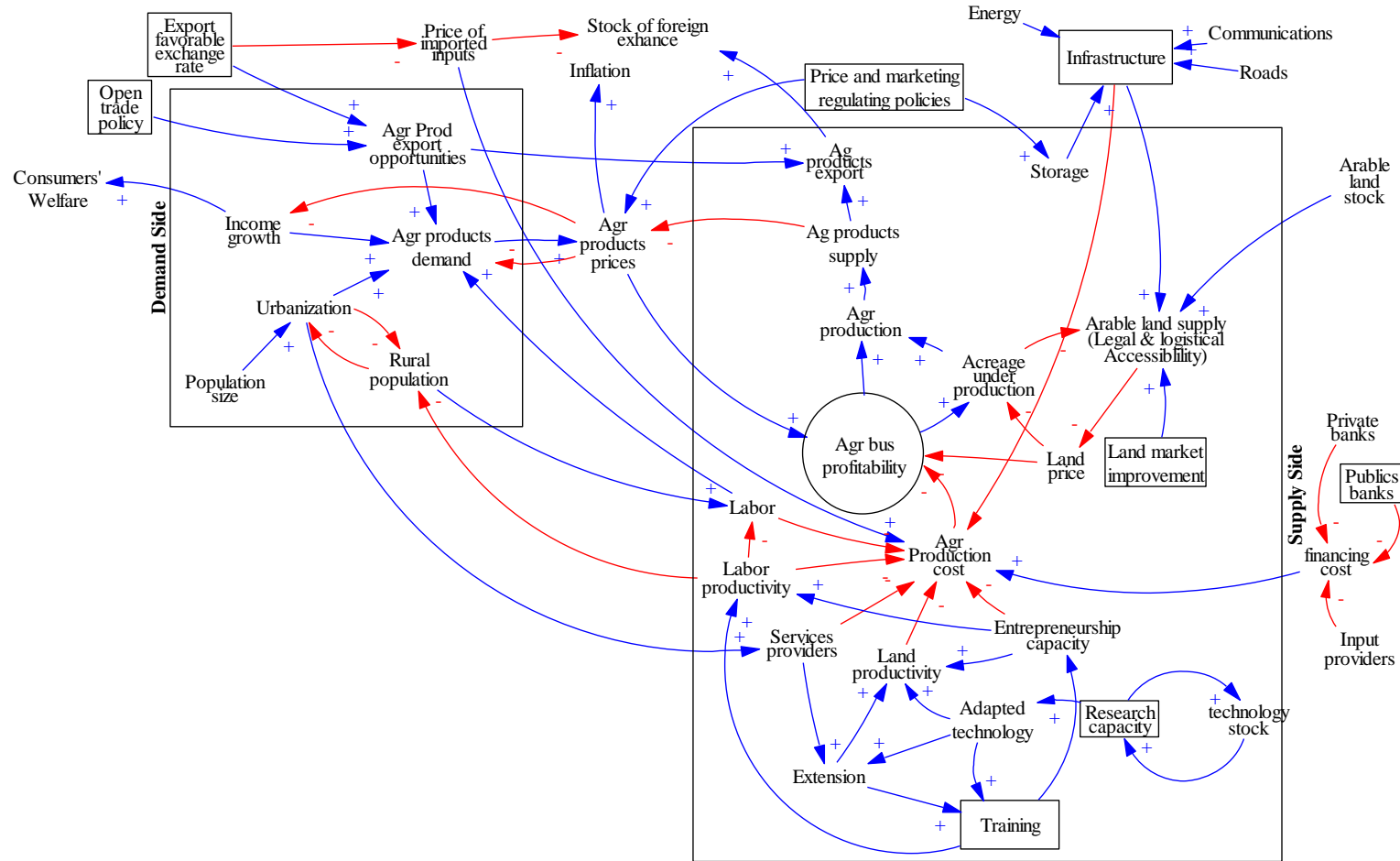
294. High domestic logistics costs to bring agriculture products to domestic urban markets or for export increase the price of such products. These higher prices for domestic production often reduce its competitiveness when compared to imported products leaving the domestic producers with a smaller share of these markets. For some products, however, domestic production costs plus domestic and regional logistics costs may still be small enough to compete successfully and take share of regional and local markets.

295. Policy makers in Brazil have invested in transport services (Mueller and Martha Jr. 2008) (especially road network) to reduce logistics costs in several selected sub-regions of the *Cerrado* through special development programs³⁵. One of the largest of ones, POLOCENTRO (Cerrados' Development Program), is estimated as having invested around USD 868 million in the 1975-84 period ((Coelho, 2001) and (Pessoa, 1988) cited by (Correa and Ramos 2010)). It is beyond the scope of this chapter to analyze the details and results of these programs, many of them explained elsewhere in the paper. It suffices here to mention that they represented substantial investments in transportation, warehousing, energy, rural credit, technology development, and extension that benefited selected investors by reducing their costs and risks, increasing their revenues and improving their ERR in the beneficiary locations and sub regions of the *Cerrado*. While at the beginning of the development promotion interventions in the region transportation investments were found to be fundamental and strategic, their importance is still critical to maintain where they are available or improve the competitiveness of agriculture investors in sub-regions still poorly accessible. Although the agriculture production is cost

³⁵ Other programs include POLOAMAZONIA (Agriculture and Mineral Poles Program for Amazonia); POLONOROESTE (Brazil's Northwest Integrated Development Program); PRODECER; PRODEGRAN (Grande Dourados Development Special Program); PRODEPAN (Pantanal Development Special Program); and Geoeconomica (Brasilia Geo-economic Region Development Special Program). For further details of these programs, see (Correa and Ramos 2010).

effective within the farm gates, their competitiveness is substantially reduced when logistics costs are included in the profitability calculation especially when compared with other major producers costs such as Argentina and the United States of America (Correa and Ramos 2010).

296. The book clearly establishes the importance of the adaptation and adoption of highly productive technologies which often requires competitively priced inputs, including labor. As mentioned elsewhere, the GoB has been making substantial investments in agriculture research and development since the mid-1970s when it created EMBRAPA. These public investments have resulted in the availability of appropriated technologies that have reduced costs and risks and increased revenues and productivity (Salim 1986).
297. It also stresses the importance of training to improve the productivity of labor. The authors, however, show the impact of the costs of logistics (domestic, regional, for imports and for exports) in the competitiveness of agriculture products and the shares that they can have of the domestic, regional, and global markets.
298. The authors clearly showed the importance of intervening on leverage factors such as the adoption of technology, the training of labor, and the reduction of logistic costs. These types of interventions, as mentioned in the main model described in chapter II, demonstrate the role of the resulting increase in the agriculture investments profitability and their attractiveness to investors.
299. The study by (Tollini ND), on the other hand, concentrated in explaining the factors that resulted in the impressive growth of agriculture production in the *Cerrado*. His explanation, summarized in Figure 31, helps to identify key issues and intervention strategies that were instrumental to the transformation of the region.
300. Tollini's analysis of the factors that contributed to the agriculture based development of the Brazilian Cerrados classified them into two basic groups: those that affected the supply of agriculture products, and those involved with the demand. He described the real and potential impact of the growing demand for these products on price formation and inflation pressures. He showed that government authorities were motivated to act by the need to control inflation in Brazil.



Source: (J. R. Nascimento 2009). See footnote 1 for an explanation on how to interpret arrows.

Figure 31 - Factors that contributed to the agriculture based development of the Cerrado

301. Besides the growth of foreign demand under an increasingly open economy and export favorable exchange rate, agriculture producers' revenues were growing due to food price increases due to a growing domestic demand resulting from population and income growth, especially in urban areas (Mueller and Martha Jr. 2008).
302. On the other hand, urban immigration also reduced the supply of labor in rural areas for agriculture production increasing labor costs and creating incentives for labor saving technologies, including mechanization.
303. Income growth contributed as well to the increase in demand as poorer members of society became more able to buy different types of food they were used to and meat as well as goods and services. These demand pressures indicated to producers that agriculture output prices would remain attractive over time generating important profitability incentives for investors.
304. Government recognized that to control the inflationary pressures from agriculture products it needed to promote the greater growth in the supply of those products. Such an increase could also result in the generation of jobs, income, foreign exchange, and the reduction of poverty, therefore, providing an important contribution to the development of the nation.
305. Although not explicitly discussed by Tollini, it is clear that the authorities understood the critical role of the private sector and the importance of improving or maintaining the profitability of agriculture based entrepreneurs and investors as the basic strategy to achieve the growth in supply.
306. Government interventions were mainly designed to reduce cost and risks for producer and other related entrepreneurs as well as to increase factor productivity so that they would not need to rely on high prices to make their businesses profitable and investing in this sector attractive. Among the interventions³⁶ taken that supported this business climate improving strategy, Tollini highlighted:
- a. Investments to improve economic infrastructure in the areas of transportation, energy, and communications (see also (Mueller and Martha Jr. 2008) and (Correa and Ramos 2010));
 - b. Measures that improved the works of the land market, assuring the increased availability of securely titled and accessible lands at a reasonable price;
 - c. The mobilization of public and private banks in the financing of agriculture production at reasonable costs;
 - d. Increased and sustained investments in research and development so as to generate new technologies that could overcome the agronomical limitations of the *Cerrado* soils and increase productivity. Although these technologies might have raised costs of production, producers would be more than compensated by the increase in output (see also (Salim 1986));

³⁶ The supply box in Figure 31 includes variables and factors normally associated with the rural or agriculture branches of government responsibility at the time. Several other extra sectorial policy instruments were also used by the government in a mostly coordinated effort.

- e. Creation of business opportunities for service providers to help in the several operations direct or indirectly associated with agriculture production;
- f. Mobilization of southern agriculture producers (*gauchos*³⁷) to bring to the *Cerrados* their production skills, knowledge, entrepreneurship, and capital; and
- g. Measures to support the training and education of labor and professionals to contribute to increase productivity.

307. Tollini recalls that

... a point to note is that Brazil received support of bilateral and multilateral agencies in its effort to promote institutional development. For instance, EMBRAPA, over the years, has benefited from projects financed in part by the World Bank and by the Inter-American Development Bank. The Inter-American Institute for Cooperation on Agriculture, IICA, also assisted EMBRAPA during its first years with the allocation of some professionals to help with the installation and initial research planning and programming. EMBRAPA, recognized as a good administrator of resources received through these projects, has been able to benefit from several sequential projects, each adding new objectives as the research program develops.

308. It must be reminded that the more favorable business climate measures were taken in varied degrees and sequencing which were contingent to the situation found in the region at the time (Mueller and Martha Jr. 2008). The results of these interventions were not immediate nor always in the right direction. Different government administrations, with the active motivation provided by stakeholders, withstood the general course during more than 4 decades. The improvement of competitiveness requires continuous and incremental efforts to give investors the incentives to make life changing decisions and take risks.

309. Both studies discussed here and the supporting references show that agriculture investments in the *Cerrado* region depend on investors' perception of how factors influencing the climate for agribusinesses affect the ERR of their future investment projects. The financial profit an investor or farmer may obtain from a project to produce food or fiber depends on the stream of costs and revenues that such agricultural project is expected to generate under the contingencies of the land area where the project will be undertaken. It depends also on the business climate the investor faces and expects to face during the execution period of the agricultural investment project and their impacts on costs and revenues. Government interventions can significantly affect the factors that influence investment profitability by creating an improved business climate as shown in the case of the *Cerrado*. Although not always effective or at the right timing or direction, these interventions overwhelmingly were favorable to increase the profitability of agriculture investments and attract investors.

³⁷ *Gauchos* are the decedents of early Europeans that migrated to Southern Brazil t the end of 1800's and early 1900's. They have been key for the development of Brazilian *Cerrados*.

VI. Implications of policy induced investments to agriculture performance, food security and poverty alleviation

310. As highlighted earlier, the policies followed by Brazil during the 1960-2010 period influenced significantly farmers investment in agriculture. Therefore, major changes took place throughout these years bringing outstanding results to the national economy. As discussed below, the country changed from a food importer to a major world exporter of a number of agricultural products. In addition, food production expanded at higher rates than food demand resulting in relatively lower domestic prices. This contributed to low inflation rates and consequently, to Brazil's macroeconomic stability and greater food security.
311. Moreover, the increased investment on agricultural research and the larger use of modern agricultural technologies changed the source of agricultural production from land expansion to productivity growth. Among other aspects, this produced major land-savings effects. Besides these positive achievements, the investment process promoted by the policies in place resulted also on a geographic concentration of agricultural production, as well as on much greater participation of medium and large producers on the total output of the sector.

6.1- Evolution of agricultural production and trade

312. According to Table 10, in the last three decades the domestic production of agricultural products expanded substantially, placing Brazil among the ten top world producers of rice, soybeans, sugar cane, maize, coffee, cotton, cassava and sorghum. Examining the data provided in this table, it can be observed that with the exception of soybeans and sugar cane, the main factor behind the production growth of the selected products was yield increase vis-à-vis area expansion. However, all selected crops have experienced substantial increase in yield. Currently, Brazil is among the main producing countries³⁸ with the highest yield level of soybeans, cotton, sorghum, coffee and maize. In addition, it is also noteworthy that in the case of rice, cotton, cassava and edible beans the level of production increased significantly while the harvested area fell.
313. Table 10 also shows that the domestic consumption of the selected crops and sugar expanded significantly in the last decades reaching very high levels in 2008. The increase in the consumption of soybeans, maize and sorghum is due largely to the expansion in the local livestock and oilseed industries. On the other hand, the main factors behind the expansion in the consumption of the other products include population growth, economic stability and relatively higher income levels, especially of less favorable income groups.
314. In addition to meeting the growth in the domestic consumption, the expansion in the production of the above-mentioned products enabled Brazil to increase further its participation in the export market during the 1978-2008 period. According to the USDA, in 2008 Brazil was the leading exporter of coffee, the number two foreign

³⁸ The group of countries which together are responsible for 80% of the world production of the products under consideration.

seller of soybeans seed, and a major participant in the largest five export group of maize, cotton and sorghum.

315. The country, however, is not self-sufficient in wheat, rice and edible beans; rather, it has relied on the international market to meet part of its domestic requirements (Table 10). Among these products, wheat is notable for the large quantities imported by Brazil. Despite following a downward trend in 1998-2008, the imports of this product reached 6 million tons at the end of this period, keeping the country among the two largest importers in the world.

Table 10 - Brazil: production, harvested area, yield, consumption and trade – selected agricultural products, 1978 - 2008

Products	1978	1988	1998	2008
Cassava				
Production (ton)	25,459,408	21,673,849	19,502,717	26,703,039
Harvested area (ha)	2,148,707	1,752,026	1,578,879	1,888,859
Yield (kg/ha)	11,849	12,371	12,352	14,137
Coffee				
Production (ton)	1,267,662	1,368,830	1,689,366	2,796,927
Harvested area (ha)	2,183,673	2,975,245	2,070,409	2,222,224
Yield (kg/ha)	581	460	816	1,259
Consumption (ton)	n.a.	348,419	732,000	1,059,600
Exports (ton)	621,301	904,357	995,833	1,566,921
Cotton				
Production (ton)	1,108,396	2,435,487	1,172,017	3,983,181
Harvested area (ha)	1,471,092	1,822,868	825,029	1,063,817
Yield (kg/ha)	753	1,336	1,421	3,744
Consumption (ton)	n.a.	838,000	782,900	1,009,200
Exports (ton)	n.a.	35,000	3,100	532,900
Edible beans				
Production (ton)	2,193,977	2,808,639	2,191,153	3,461,194
Harvested area (ha)	4,617,259	5,781,248	3,313,621	3,781,908
Yield (kg/ha)	475	486	661	915
Consumption (ton)	n.a.	2,600,000	2,500,000	3,650,000
Imports (ton)	n.a.	10,000	211,300	209,700
Maize				
Production (ton)	13,569,401	24,748,036	29,601,753	58,933,347
Harvested area (ha)	11,124,827	13,169,003	10,585,498	14,444,582
Yield (kg/ha)	1,220	1,879	2,796	4,080
Consumption (ton)	15,028,500	25,320,000	35,000,000	44,500,000
Exports (ton)	21,485	740	1,783	6,370,665
Rice				
Production (ton)	7,296,142	11,809,467	7,716,090	12,061,465
Harvested area (ha)	5,623,515	5,959,100	3,062,195	2,850,670
Yield (kg/ha)	1,297	1,982	2,520	4,231
Consumption (ton)	n.a.	10,500,000	11,750,000	12,800,000
Imports (ton)	n.a.	190,000	2,009,000	589,900
Sorghum				
Production (ton)	227,502	302,001	589,827	2,004,005
Harvested area (ha)	104,361	195,427	349,547	844,662
Yield (kg/ha)	2,180	1,545	1,687	2,373
Soybeans				
Production (ton)	9,540,577	18,016,170	31,307,440	59,242,480
Harvested area (ha)	7,782,187	10,519,972	13,303,656	21,057,302
Yield (kg/ha)	1,226	1,713	2,353	2,813
Consumption (ton)	n.a.	14,626,000	22,400,000	34,750,000
Exports (ton)	658,527	2,597,364	9,189,576	24,493,693
Sugar cane				
Production (ton) – (1)	129,144,950	258,412,865	345,254,972	645,300,182
Harvested area (ha) – (1)	2,391,455	4,117,375	4,985,819	8,140,089
Yield (kg/ha)	54,003	62,762	69,247	79,274
Sugar consumption (ton)	n.a.	n.a.	9,150,000	11,400,000
Sugar exports (ton)	1,347,416	2,575,289	8,371,312	19,472,458
Wheat				
Production (ton)	2,690,888	5,737,971	2,269,847	6,027,131
Harvested area (ha)	2,811,189	3,467,556	1,408,852	2,363,893
Yield (kg/ha)	957	1,655	1,611	2,550
Consumption (ton)	n.a.	n.a.	8,367,000	9,418,000
Imports (ton)	4,334,832	941,273	6,395,200	6,032,691
Beef (equivalent carcass)				
Production (ton)	n.a.	3,993,500	5,794,300	8,834,100
Consumption (ton)	n.a.	3,716,300	5,513,100	6,944,600
Exports (ton)	n.a.	302,200	382,600	1,919,500

Beef - data from CONAB. n.a. = not available. Refer to sugar cane used in the production of sugar, ethanol and other uses (e.g. production of fodder and brandy).

Sources: selected crops - IBGE for production, harvested area and yield; CONAB for consumption and trade.

316. The Brazilian production, consumption and exports of beef have also grown remarkably in the last decades. Beef production jumped from 4 million tons

equivalent carcass in 1988 to 8.8 million tons in 2008; several factors contributed to this expansion including: favorable policies (Chapter III), major technological developments (e.g. introduction of new fodder cultivars, better herd management systems, artificial insemination and improved sanitary measures); economic stabilization of the national economy; greater availability of certified fodder seeds and good marketing opportunities. This expansion enabled the local consumption and exports of this product to record similar performance during the same period: domestic consumption increased from 3.7 million to 6.9 million tons equivalent carcass and exports grew from 302,000 to 1.9 million tons.

317. Historically agricultural exports have played a notable role in the Brazilian economy by contributing significantly to the country's balance of payments. However, in the last two decades this contribution increased remarkably. The trade balance of this sector expanded from USD 11 billion in 1989 to USD 64 billion in 2010. This expansion (486% during the period) has consolidated the contribution of agriculture as the main responsible sector for the performance of Brazil's trade balance. As shown by Figure 19, the trade balance of agriculture more than compensated the deficit registered by the difference between the exports and imports of the other sectors of the economy during almost all years of the 2001-2010 period. This performance reflects the impact of the domestic policies followed by the government during those years, as well as the effects of the relatively high international prices on farmers' decision to invest in agriculture.

6.2- Concentration of production by main classes of producers

318. Agricultural production in Brazil comes from the activities of three main classes of producers: i.e. small, medium and large, defined according to specific levels of annual production (Table 11). The first of these classes comprises a very large number of producers with low levels of production per year. The group of large producers consists of a smaller number of producers with high levels of annual output. The class of medium producers, in turn, has number of farmers and level of production between those of the other two classes.

Table 11 - Main classes of agricultural producers according to specific levels of annual production

Classes of producers	Coffee ton/year	Edible beans ton/year	Maize ton/year	Milk litres/year	Rice ton/year
Small	(0 to 5,000]	(0 to 5]	(0 to 20]	(0 to 18,000]	(5 to 10]
Medium	(5,000 to 15,000]	(5 to 30]	(20 to 200]	(18,000 to 72,000]	(10 to 200]
Large	> 15,000	> 30	> 200	> 72,000	> 200

Source: Defined by the authors

319. As discussed below, the total number of farms corresponding to the three classes of producers has been falling through time. Moreover, the share of the respective classes of producers in the total production of specific agricultural activities has been changing towards a greater participation of the class of large producers.

Therefore, as a result of this process, agricultural production has been concentrating significantly in this class of producers³⁹.

320. According to the 2006 Agricultural Census, approximately 8% of the total number of reported farms with monthly value of production above ten minimum wages (i.e. BRL 3,500)⁴⁰ were responsible for 85% of the aggregated value of agricultural production in that year. A similar concentration trend to this one is also observed when examining the participation of the main classes of producers in both level of production and total number of farms producing rice, edible beans, maize, coffee and milk during the 1995-2006 period.
321. As shown in Table 12, the total number of rice-producing farms reported by the 1995-96 and 2006 Agricultural Census fell 57% during this period dropping from 928,000 to 397,000. This reduction resulted mainly from the decrease in the number of farms managed by small producers. The number of rice-cultivating farms runs by medium and large producers increased respectively, by 12% and 20% between 1995-96 and 2006. Given these changes, the share of the class of small producers in the total production of rice fell from 17% in 1995-96 to 5% in 2006 while that of the large producers increased from 66% to 73%.
322. A similar picture to the one above has also been observed in the production of maize and edible beans. The total number of maize-producing farms fell from 2.5 million in 1995-96 to 2 million in 2006 and those cultivating edible beans dropped from 2.1 million to 1.5 million. As in the case of rice, the main factor behind this change was the reduction in the number of maize (538,000) and edible beans (625,000) producing farms operated by small producers.
323. The number of farms managed by medium and large producers of these crops increased significantly especially the latter. This resulted in a boost in the participation of the large producers' class in the total output of maize between 1995-96 and 2006, i.e. an expansion from 48% to 68%. Regarding edible beans, the observed increase in the share of this same class of producers was a rise from 24% in 1995-96 to 57% in 2006. The participation of the small producers' class growing maize and edible beans in the total output of these crops fell substantially during this period dropping from 25% to 10% and from 57% to 19%, respectively.
324. Coffee production also experienced a substantial reduction (44%) in the total number of farms engaged in the cultivation of this crop, as reported by the 1995-96 and 2006 Agricultural Censuses. Specifically, it dropped from 318,000 to 178,000 farms in that period. This reduction was due mainly to a fall in the number of coffee-producing farms managed by small producers. However, unlike what was observed with rice, maize and edible beans, the number of coffee-cultivating farms associated with the classes of medium and large producers suffered also major reductions during the period 1995-96 to 2006, i.e. 31% and 34%, respectively. However, despite the above changes, the share of the different classes of producers in the total output of coffee during this period remained more or less the same, maintaining the concentration trend towards the class of large producers.

³⁹ As highlighted earlier, the definition of the different classes of producers used here is based on level of production. Therefore, the output produced by these classes can come from different sizes of cultivated area.

⁴⁰ Considering an exchange rate of BRL 1.7 per US Dollar this value corresponds to USD 2,059.

Table 12 - Participation of the different classes of producers in both total production of selected crops and number of farms reported in the 1995-96 and 2006 Agricultural Censuses

Class of Producers	1995-96 Agricultural Census			2006 Agricultural Census		
	Number of farms	Share in the total number of farms (%)	Share in total production (%)	Number of farms	Share in the total number of farms (%)	Share in total production (%)
Coffee						
Small	236,136	74.4	10	123,360	69.1	9.7
Medium	48,416	15.2	15	33,399	18.7	15.7
Large	33,016	10.4	75	21,700	12.2	74.6
Total	317,568	100	100	178,459	100	100
Edible beans						
Small	2,093,943	97.9	56.56	1,436,518	94.9	18.6
Medium	39,778	1.9	19.26	60,202	4.0	24.1
Large	4,053	0.2	24.18	16,555	1.1	57.3
Total	2,137,774	100	100	1,513,275	100	100
Maize						
Small	2,384,595	93.9	24.8	1,847,052	91.0	10.0
Medium	139,303	5.5	27.6	150,984	7.4	21.7
Large	15,994	0.6	47.6	31,858	1.6	68.3
Total	2,539,892	100	100	2,029,894	100	100
Milk						
Small	1,586,667	87.6	36.1	1,084,944	80.4	26.7
Medium	189,530	10.5	35.9	250,852	18.6	53.2
Large	33,844	1.9	28.0	13,530	1.0	20.1
Total	1,810,041	100	100	1,349,324	100	100
Rice						
Small	889,438	95.9	16.9	353,387	89.1	4.6
Medium	32,302	3.5	16.7	36,139	9.1	22.2
Large	5,878	0.6	66.4	7,034	1.8	73.2
Total	927,618	100	100	396,560	100	100

Source: Agricultural Census, IBGE

325. The production of milk has shown a similar trend to that presented by the above crops in terms of reduction in the total number of farms involved in this activity. According to the 1995-96 and 2006 Agricultural Censuses, the total number of farms engaged in milk production decreased from 1.8 million to 1.3 million. In contrast to what was observed in the case of the previous products, this reduction resulted from a fall in the number of farms operated by small and large producers. Given these changes, the share of the classes of small and large producers in the total production of milk decreased during the period 1995-2006 while that of the medium producers' class increased significantly, rising from 36% to 53%.

326. In summary, between the mid-1990s and 2006 there was a substantial reduction in the number of farms producing rice, maize, edible beans, coffee and milk. This trend was largely influenced by a fall in the number of farms managed by small producers of these products. In addition, the participation of the classes of medium and large producers in the total production of those products increased significantly. Therefore, the domestic production of agricultural products has been following a

concentration path towards classes of producers with larger annual output. This trend, which is similar to that observed in several developed countries, may continue in the next decades. This has several implications, including the need to identify policy alternatives capable of making the option of living in rural areas attractive to members of the small producers' class. This is particularly important to about 11 million people who in 2006 lived in 3.8 million farms with monthly income below two minimum wages (i.e. 73% of the total number of farms recorded by the 2006 Agricultural Census).

327. According to (Alves and Rocha 2010), the solution to the above challenge involves adopting public policies of general nature as well as specific measures aimed at improving the income level of those families. These measures go beyond agricultural matters; they include also income transfer programmes, access to education, transport to urban areas, rural retirement schemes and simplification of labor legislation to enable part-time employment in agriculture. The national and local governments have some experience with these policy measures and several others. Nevertheless, additional efforts will be needed to overcome the challenge brought by a continued trend towards the concentration of agricultural production in the class of large producers.

6.3- Spatial dynamics of agricultural production and cattle raising

328. The spatial dynamics of agricultural production can be analyzed through several methods. One of these, which has been employed here, is based on the determination of the location of the gravity center⁴¹ of production at different points in time, and the calculation of the terrestrial distance (in km) between them. The gravity centre can be considered as the simplest weighted average related to the geographic distribution of an additive variable⁴². The trajectory of the estimated gravity centre summarizes the dislocation of the variable in question. The distance between the centres of gravity can also be used to obtain an approximate measure of the intensity of the observed phenomenon, in terms of speed (in km/year). In this study, the variables considered in calculating the gravity centre are crop production and cattle stock.

329. Table 13 presents the distances between the gravity centres calculated for the different products in 1978 and 2008. The distance between the gravity centres in these two years for soybeans, sorghum, cotton, rice and sugar cane exceeded 500 km, which indicates a major spatial shift in the production of these crops.

⁴¹ In physics this term is known centre of mass; in statistics gravity centre is widely used.

⁴² It is worth noting that being a weighted average a gravity centre may be located in an area with little or no presence of the product.

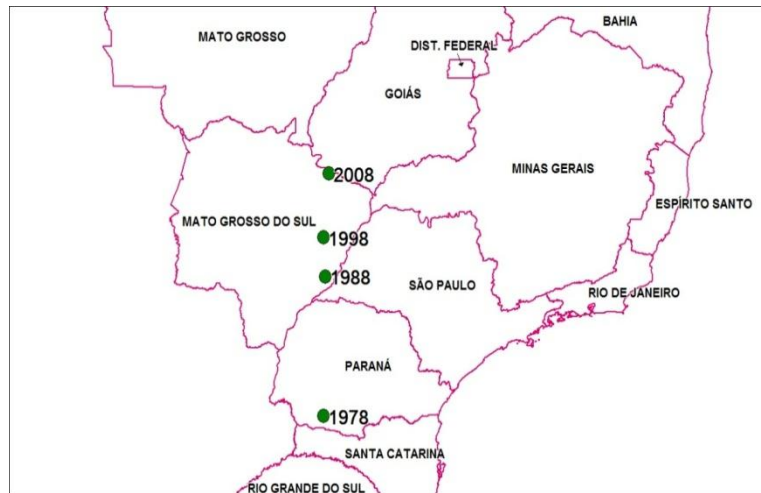
Table 13 - Terrestrial distances (in km) between gravity centres of selected products, 1978 and 2008

Product	Distance (Km)
Rice	605
Cotton	672
Beans	88
Wheat	160
Cassava	379
Coffee	353
Maize	246
Soybeans	792
Sugar cane	582
Sorghum	941
Livestock	401

Source: Garagorry and Chaib Filho, 2010

331. Soybean production followed a geodesic trajectory (that is, a terrestrial ‘straight line’) moving from the South region towards the Centre West of the country (Figure 32). The reasons behind this change include: high soybean prices, development of soybean varieties suitable to be grown in tropical regions, favorable credit policies and introduction of new technologies which improved soil fertility (e.g. nitrogen fixation). The know-how brought by experienced soybean producers (the *gauchos*) who migrated from the South to the Centre West contributed also to this trajectory (EMBRAPA-CNPSO 2004).
332. Sorghum production followed a similar trajectory as soybeans, moving from the South to the Centre West. At the beginning of the period, sorghum was mainly produced in Rio Grande do Sul during the summer. Through time, the production of this crop lost competitiveness in this state to other crops such as maize and soybeans. In addition, it started to be cultivated as a second crop (i.e. planted right after the harvesting of the main crop) in the Southeast and especially in the Centre West. The possibility of growing sorghum under no-tillage after soybean cultivation, and the fact that during the dry season, sorghum is more resistant than maize were important reasons behind the expansion of this crop into these regions (Tsunechiro, Mariano and Martins 2002).

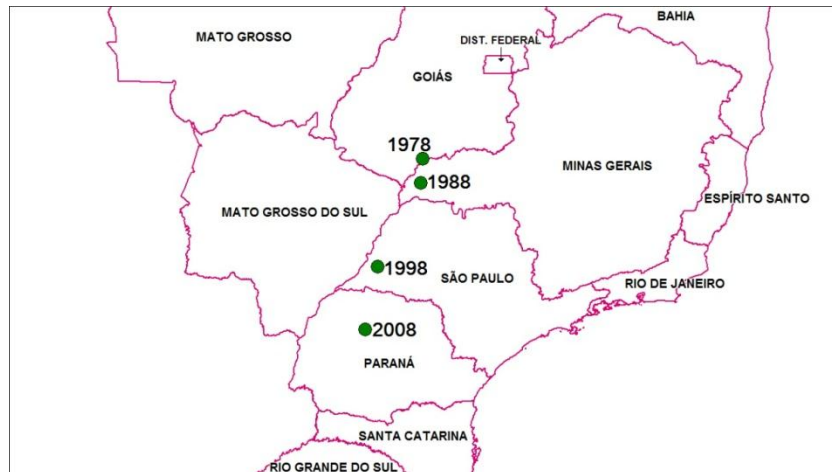
Figure 32 - Soybean gravity centres



Source: (Garagorry and Chaib Filho 2010)

333. In 1978 and 1988, the gravity centre of cotton production was located in the Southeast region. In 1998, it moved to the south of the Centre West region, and in 2008 it was located in the north of that region, more specifically in the state of Mato Grosso. According to (Melo Filho 2003), the Centre West has better climate and topography for that crop. Moreover, serious frost events in Paraná affected significantly its production in this state. Therefore, cotton producers were attracted to grow this crop in the Centre West, displacing production from the South and Southeast to this region.
334. Compared to cotton, rice production moved in the opposite direction. In 1978, the gravity centre was in the Centre West. After that year, rice production followed a path towards the South, resulting in a concentration of production in Rio Grande do Sul and Santa Catarina in 2008 (Figure 33). Rice produced in the South is irrigated, while that in the Centre West is mainly rain-fed. Also, upland rice was largely used in the Centre West as a first crop, after clearing the original savanna vegetation (*Cerrado*), in order to prepare the soil for pastures or other crops. Besides, in the Centre West there is a strong competition among grains, particularly soybeans, cotton and maize. Depending on prices, producers change their production among these crops. This has made rice production in the Centre West very volatile. On the other hand, the South, due to its humid climate, does not have many alternative crops (Miranda, et al. 2007). As a result, rice production in this region is fairly inelastic to price changes. These facts explain the return of rice production to the South.

Figure 33 - Rice gravity centres



Source: (Garagorry and Chaib Filho 2010)

335. The gravity centres calculated for sugar cane production moved 582 km between 1978 and 2008. However, they remained inside the same state, i.e. Minas Gerais. Specifically, the gravity centres moved from the northeast of Minas Gerais towards the southwest of the state, closer to São Paulo (Figure 34). According to (Garagorry and Chaib Filho 2010), this trajectory captures the fact that the Northeast region is decreasing its share of sugar cane production while those of the Southeast and Centre West are increasing.
336. The main factors explaining the expansion of sugar cane production are: first, government incentives to increase its production in order to produce ethanol; secondly, in some areas, (i.e. the west of São Paulo, east of Mato Grosso do Sul and north of Paraná), land was largely used for pasture, but producers realized that they could make higher profits through sugar cane production. Therefore, they started to cultivate it. According to (Palomino, et al. 2007), sugar cane production should continue to expand in these regions because they have favorable climate conditions, better infrastructure, and are close to main consumer markets.
337. According to Table 13, between 1978 and 2008, coffee production and cattle ranching, experienced an important, but less intense change in the geographical location where these activities were carried out. The differences between the gravity centres for these activities, during this period, varied between 353 and 401 kilometers.

Figure 34 - Sugar cane gravity centres

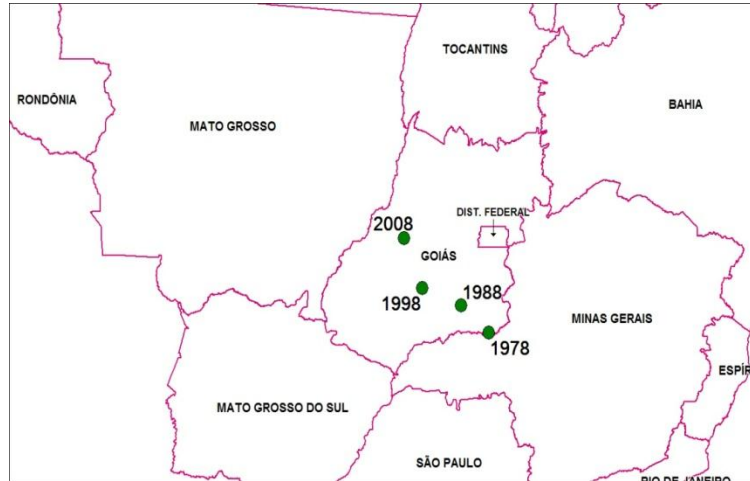


Source: (Garagorry and Chaib Filho 2010)

338. Coffee production registered a major geographical shift, moving from São Paulo towards Minas Gerais, while remaining in the Southeast region. The distance between the 1978 and 2008 gravity centres (353 km) and the path followed by them corroborates the fact that São Paulo and Paraná are decreasing their share in coffee production while those of Minas Gerais, Espírito Santo and Bahia are increasing.
339. Changes in Brazil's coffee production started at the end of the eighties with market deregulation and the end of an international coffee agreement which maintained high prices through export quotas for member countries. As a consequence of market changes, there was a decrease in domestic production between 1991 and 1995; only in 1998, due to the 1997 higher prices, coffee production increased again. These events, plus some severe frosts in the state of Paraná, changed the geographical location of coffee production. There was a substantial drop in cultivated area in São Paulo and an increase in Minas Gerais. With the implementation of the sugar cane programme, sugar cane producers started to rent land from coffee producers, particularly in São Paulo.
340. According to Figure 35, the gravity centres calculated for cattle stock moved from the border of the Southeast region towards Mato Grosso following practically a straight line. Examining the cattle stock by region, it is found that, in 1978, about 20% of the total was located in the South, 33% in the Southeast, 23% in the Centre West and 5% in the North. In 2008, the situation was quite different: 14% was in the South, 19% in the Southeast, 34% in the Centre West, and 19% in the North. It highlights the increase in the share of the North and Centre West regions and the significant fall in the participation of the South and Southeast.
341. In contrast to other crops, maize, wheat and, particularly, edible beans production experienced relatively small spatial changes in 1978-2008. The gravity centres of maize production remained inside the state of São Paulo during the entire period. The only observed change was that they moved from the north to the northwestern part of the state, towards the Centre West region.

342. As in the case of other grains, product price is one of the main determinants of maize production. In this regard, soybeans are displacing maize production in the Centre West region, and in the states of Paraná and São Paulo. Recently, there has been an increase in the second crop of maize, which is grown after the harvest of soybeans. This form of land-use intensification compensated part of the land lost to soybeans in the above-mentioned region and states (Garcia, et al. 2006).

Figure 35 - Livestock gravity centres



Source: (Chaddad and Jank 2006)

343. Wheat production was concentrated in the South region during the entire period of analysis. The only observed change was a shift in the main producing state in the region. In 1978 the gravity centre was located in Santa Catarina. In the following years it moved towards the north of Paraná. Most of the wheat consumed domestically comes from abroad, and imports are generally greater than national production.
344. The country does not have a comparative advantage in wheat production as a single crop. Brazilian production in the eighties was a result of government support through policies such as minimum prices, agricultural credit and public purchases of local production. According to (Brum and Müller 2006), among the reasons why wheat is still produced is the need for crop rotation to cover the soil during the winter, and to share the fixed costs of summer crops.

6.4- Geographic concentration of crops and cattle stock

345. The analysis above showed that the Centre West is attracting the production of several commodities as well as livestock. It also indicated that some states in other regions, such as São Paulo, Minas Gerais and Paraná, are main producers of several commodities. These results reveal that the policies adopted by the government, together with other factors such as the quality of the local natural resource endowments have contributed to a significant concentration of production in this geographical area, but the situation may be different for some products (e.g., rice and wheat, which are concentrated in the South). In order further to investigate this

concentration, Gini coefficients were calculated for the regional distributions of volume in the years of 1978, 1988, 1998 and 2008.

346. According to Table 14, in 2008 seven products had Gini coefficients higher than 0.590, showing production concentration in certain regions. Through time, the coefficients calculated for rice and cotton showed the largest increase, highlighting the increasing concentration of rice production in Rio Grande do Sul and of cotton in the Centre West. On the other hand, soybeans presented a substantial decrease in the Gini coefficient, from 0.892 to 0.596, which highlights the behavior of a crop that is expanding to new areas, but still persists in the old ones.

Table 14 - Geographic concentration of production - selected crops and cattle raising Gini coefficients of regional distributions

Product	1978	1988	1998	2008
Rice	0.340	0.331	0.534	0.693
Cotton	0.519	0.501	0.637	0.797
Beans	0.460	0.444	0.386	0.357
Wheat	0.970	0.897	0.972	0.950
Cassava	0.533	0.492	0.350	0.408
Coffee	0.806	0.808	0.871	0.820
Maize	0.557	0.498	0.583	0.507
Soybeans	0.892	0.668	0.636	0.596
Sugar cane	0.752	0.743	0.707	0.704
Sorghum	0.731	0.419	0.733	0.751
Cattle stock	0.31	0.25	0.26	0.23

Source: (Garagorry and Chaib Filho 2010)

347. Beans and cassava had the smallest Gini coefficient in 2008, corroborating the fact that they are produced in many states. The Gini coefficients calculated for livestock followed a downward trend, dropping from 0.306 in 1978 to 0.230 in 2008. Therefore, compared to commodities, livestock production is much less geographically concentrated. Even though the Centre West region is responsible for the largest livestock share, cattle-raising is spread throughout the country.
348. The concentration of agricultural production in Brazil is observed not only in geographic terms, but also with respect to the number of rural properties that contribute to the total value of agricultural production. According to (Alves and Rocha 2010), about 8% of the total number of rural properties recorded in the Agricultural Census of 2006 was responsible for 85% of the declared production. These authors also showed that this concentration is larger in the Centre West, South and Southeast regions. Specifically, the annual average production value by rural properties in the Northeast, in 2006, was USD 6,362. The corresponding figures for the other regions are: North USD 7,101; Centre West USD 34,338; Southeast USD 28,577; and South USD 22,643.

6.5- Agricultural productivity

349. Table 15 below shows the evolution of the total factor productivity (TFP) indexes calculated for the Brazilian agriculture for the 1970-2006 period on the basis of the Agricultural Census data of 1970, 1975, 1980, 1985, 1995/96 and 2006⁴³. As can be seen, the TFP followed an upward trend during the 36 years of analysis increasing steadily from 100 in 1970 to 224 in 2006. This suggests that agriculture has grown continuously during that period.

Table 15 - Brazil: total factor productivity, product and inputs indexes, 1970-2006

YEARS	Product Index	Inputs Index	TFP (100)
1970	100	100	100
1975	139	122	114
1980	173	142	122
1985	211	149	142
1995	244	137	178
2006	343	153	224

Source: (Gasques, J. G., et al. 2010)

350. The table also shows that the product index increased 243% between 1970 and 2006 while the inputs index expanded 124%. Therefore, the growth of Brazilian agriculture took place mainly on the basis of productivity. However, plotting the evolution of the TFP, the product and the inputs indexes on a graph, it results that between 1970 and 1995 the input index line is above the TFP index line. Thus, agricultural production during that period was driven by the increase in the use of inputs. This result is consistent with the period when the incorporation of large parts of the savannah region was incorporated into production. Moreover, it reflects the impacts of the large volumes of subsidized credit provided by the government, especially until the early 1980s, and the style of growth which emphasized a greater use of modern technology in agriculture (J. G. Silva 1998).

351. Analyzing the results not on the basis of the indexes themselves, but rather on their annual rates of growth it can be seen that the product index increased 3.48% per year between 1970 and 2006 and 3.14% in the 1995-2006 period (Table 16). The corresponding annual rates of growth for the TFP index in those two periods were 2.27% and 2.13% respectively. Giving these estimates, if one examines how much of the output growth was due to productivity, it is observed that in the 1970-2006 period 65% of the agricultural product was due to the increase in TFP and 35% to the expansion in the quantity of inputs. The figures for the 1995-2006 period are 68% of the output growth due to productivity increase and 32% to increase in the quantity of inputs. Therefore, as highlighted before, productivity has been the main underlying force behind the growth of Brazilian agriculture.

⁴³ The methodology is based in Tornqvist index, as proposed by (Jorgernson 1996) and (Christensen 1975).

Table 16 - Brazil: Growth Rates of TFP, Product and Inputs Indexes, selected periods

Specification	2006/1970	2006/1995
Product Index	3.48	3.14
Inputs Index	1.19	0.99
TFP	2.27	2.13
Land Productivity	3.32	3.16
Labor Productivity	3.53	3.40

Source: (Gasques, J. G., et al. 2010)

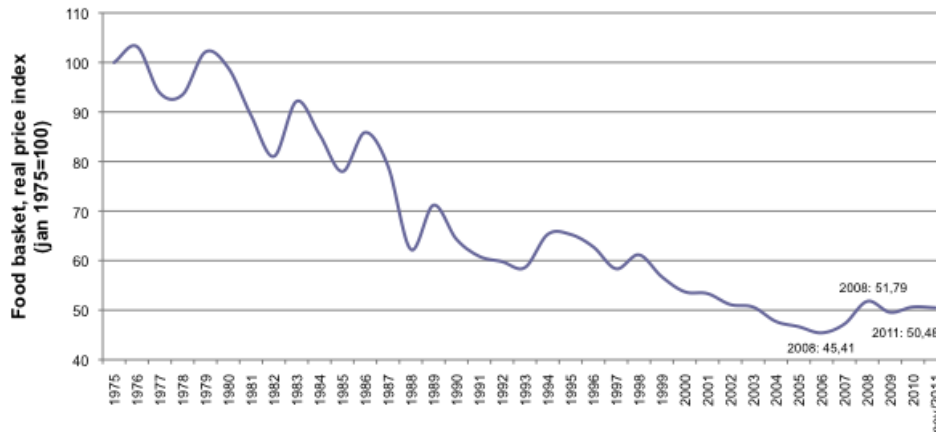
352. According to Table 16, the growth rate of labor productivity was higher than that of land productivity in both periods. This means that the increase in the productivity of labor was more important than the expansion in land productivity in determining the growth of TFP in those years. Studies such as (Del Grossi and Graziano da Silva 2006) and (Balsadi 2009) have shown that the qualification of the labor employed in agriculture has been improving, therefore implying an increase in labor productivity.
353. The increase in the efficiency of agricultural machineries and equipment observed in the last decades has also contributed to the expansion of labor productivity in agriculture. The growth of land productivity in turn is associated among other factors, to government policies which promoted the incorporation of new land into production with relatively higher productivity and to increased public investment in agricultural research, particularly through EMBRAPA.

6.6- Food security and poverty

354. The investments made by domestic farmers and the public sector in Brazilian agriculture, together with other factors, contributed significantly to enhancing food security and reducing poverty in the country. As highlighted previously, the production of agricultural products expanded above the national requirements enabling the nation to play a major role in the international market. Besides contributing to a more than sufficient availability of food for national consumers, the output from the investments made in agriculture resulted in a major fall in the real price of the food basket during the 1975-2011 period.
355. As shown by Figure 36, the price of the food basket in the city of Sao Paulo fell throughout those years representing in November 2011, in real terms, approximately 50% of the price paid by consumers in January 1975. In other words, during this 36 years period, the price of food for consumers decreased by half.
356. This fall in the real price of food represents an important income effect, especially for the poor who spend a large portion of their income on the purchase of food. This is also important for the economy as a whole since, when food prices

decrease a larger part of the income is allocated to buy non-food items, boosting other sectors in the economy.

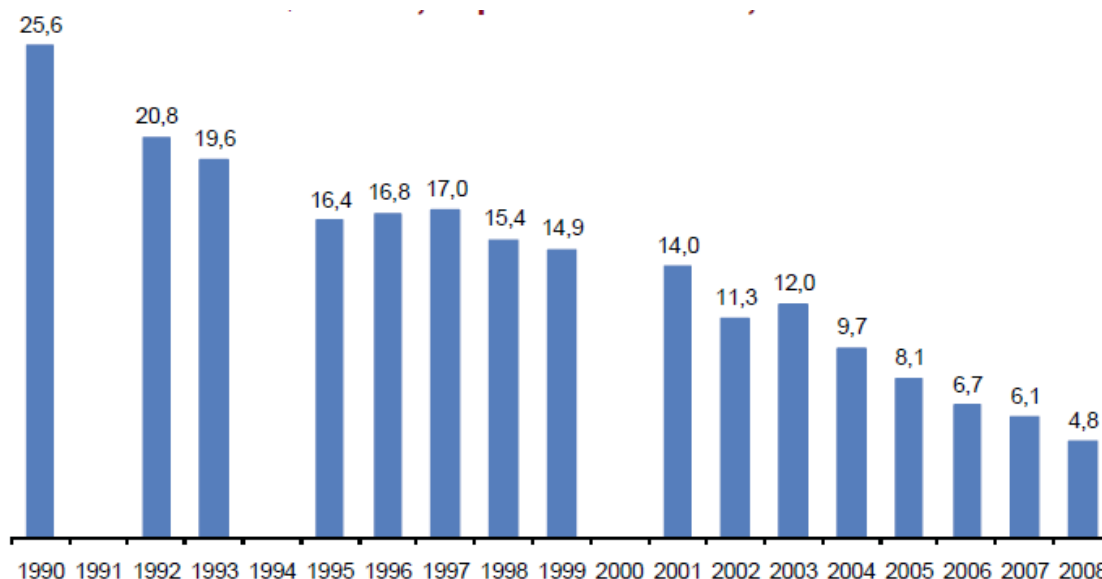
Figure 36 - Real monthly price index for a food basket in the city of Sao Paulo, January 1975 to November 2011



Source: FAO (2011), www.fao.org/worldfoodsituation/wfs-home/foodpricesindex/en

357. The impacts of the benefits brought by the investments in agriculture by farmers and the Government as well as by other factors are reflected also on the notable improvement in the level of food security of the Brazilian population. The goal established by the participating countries at the Millennium Summit was to cut by half the proportion of hungry people in 2015 vis-à-vis the level observed in 1996. The main indicator of this goal is the percentage of children with up to four years old which weighs less than the expected weight of children in that age interval. In 1996, this indicator was 4.2% for the existing Brazilian population of children with up to four years old. Ten years latter this indicator reached 1.8% of the corresponding population of children in that age span.
358. Therefore, given this reduction, Brazil has already achieved the Millennium Development Goal (MDG) of reducing by half the proportion of hungry people. However, the goal established by the Government goes beyond the one agreed at the Millennium Summit, that is, to eradicate hunger from the country by 2015. According to (IPEA 2010), recent indicators point out that Brazil is close to eradicate under nutrition among young children and consequently achieve the national goal.
359. In addition to the above, the investment in Brazilian agriculture, together with other elements, contributed also to achieving another MDG, i.e. reducing the extreme poverty by half by 2015 in comparison to the observed level in 1990. As shown by Figure 37, in 1990, about 26% of the Brazilians had a per capita household income below the international poverty line (USD 1.25 per day). However, after that year the country experienced a major reduction in the extreme poverty level. Thus, in 2008 only 4.8% of the population was considered extremely poor according to the above-mentioned international criteria. During this 18 years period, the country succeeded in reducing the poverty to less than one fifth of the level observed in 1990. Therefore, it achieved not only the MDG but also the national goal of reducing the extreme poverty to one fourth of what was observed in 1990.

Figure 37 - Share of Brazilian population leaving with less than USD 1.25 per day, 1990-2008 (values in percentage)



Source: IPEA – *Objetivos de Desenvolvimento do Milênio*. Relatório Nacional de Acompanhamento, Brasília: IPEA, 2010.

360. A similar picture to the one above emerges when the data of the National Household Survey (*Pesquisa Nacional por Amostra de Domicílios – PNAD*) is examined. Specifically, between 2003 and 2009 about 36 million people were lifted from lower income classes and incorporated into others situated at the top two places of the pyramid, i.e. 7 million people ascended to classes A B and 29 million moved to class C. Moreover, 2.4 million people left class D and 20.4 million move out of class E.
361. Even though Brazil has accomplished a notable result in terms of poverty reduction, the national figures hide some internal imbalances. For instance, despite the fact that the number of poor in rural areas decreased from 51.3% in 1990 to 12.5% in 2008, in relative terms the poverty level in these areas has been more than three times higher than in urban centers.
362. Major differences are observed also between geographic regions of the country. The reduction in the poverty level in the poor regions of the country has occurred at a similar rate as in the rich ones maintaining therefore, the observed disparities. In 2008 the percentage of poor in the northeast region was more than five times larger than in the south and more than twice the national average. However, the northeast experienced a major poverty reduction. In 1990 almost half of the people in the northeast were below the poverty line, in 2008 this rate fell to only one tenth. Moreover, the reduction in the number of undernourished children in the northeast to similar levels observed in more developed regions of the country is also a notable aspect. It suggests that the poverty experienced by those currently living in the Northeast is not as hard as in the past.
363. Before closing this session, it should be highlighted that, as mentioned earlier, the achievements above cannot be attributed to a single factor. In reality they result from a number of elements. They include among others, the following: (a) the impacts of domestic policies on farmers investments in agriculture; (b) food access

policies such as *Bolsa Família*, National School Feeding Program, Food Basket Distribution Program to Specific Groups of Population, Continued Benefit Provision (*Benefício de Contribuição Continuada*) to elderly and people with disability, Minimum Wage and social security (includes the provision of retirement pension to rural workers); and (c) agricultural programs like the Family Agriculture Food Procurement Program (PAA), More Food Program (*Programa Mais Alimentos*), and National Program for Family Agriculture (PRONAF).

VII. Lessons learned from Brazil's experience

364. The modernization of Brazilian agriculture was a relatively fast and successful process. Within approximately 35 years (1965-2000), the country changed its condition of food importer to a major world producer and exporter of agricultural and agroenergy products. The development of the sector contributed significantly to enhance the national food security and to reduce poverty. The process is also notable for placing Brazil in a global leading position in terms of technology generation for tropical agriculture. However, besides positive aspects there were also some negative ones, e.g. the approach followed resulted in a major concentration of agricultural production in the group of large producers as well as in the South, Southeast and Center-West regions of the country. In addition, until the mid-1990s little attention was given to integrate small farm holders into the economy.
365. According to the previous chapters, several factors contributed to the above results, for instance, the entrepreneurship capacity of farmers, investments in agricultural research and the implementation of public policies, which established a favorable environment for farmers' investment in agriculture. Regarding this last element, several lessons can be learned from the observed experience. Recognizing that there are no blueprints neither "one size fits all", perhaps some of them could be useful for other countries; among others they include the following.
366. Given the low development level of agriculture in the early 1960s, the path followed by Brazil to modernize the sector consisted of a two stage policy approach. First, to kick start the process by focusing the policy measures on three major elements: establishment of an agricultural credit system, which provided large amounts of subsidized credit to domestic producers, particularly to those with higher capacity to respond to policy incentives, i.e. medium and large farmers; increased investment in agricultural research; and provision of agricultural extension and technical assistance service. The first and the third of these measures contributed to moving the sector from the interior of the production possibility frontier to its border. The investment in agricultural research takes some years to generate results; therefore, its function was to shift the production possibility frontier outwards. Those three policy measures were complemented with several others including public investments in road construction, electrification and education.
367. The second stage of the policy approach consisted in taking the opportunity created by the macroeconomic crisis of the 1980s and 1990s and the strong pressure placed by the IMF and the World Bank to carry out a major policy reform which emphasized the role of market forces as the main mechanism for resource allocation. Therefore, starting in the 1980s, the intervention of the government in the sector followed a sharp downward trend including reducing substantially the previous role of major agricultural credit provider. In this context, the risk of public intervention crowd out private sector development was eliminated.
368. Only the first phase of the above-mentioned policy approach was planned by the Government. The second resulted from circumstances which emerged along the way such as the foreign debt crisis; oil price shock, low economic growth and high inflation rates that required the adoption of strong economic measures to bring back the economy to its path and foster economic growth (see section 3.2.).

Notwithstanding the unplanned nature of the second stage of the approach, the experience lived by Brazil suggests that, the two stage policy process summarized above with some adjustments, could be a reasonable alternative to consider for modernizing agriculture in countries with low agricultural development.

369. Another element which comes out from Brazil's experience is that, the policies followed to modernize agriculture between 1960 and mid-1990s created a major distortion, i.e. a small participation of the group of farmers with monthly value of agricultural production smaller than two minimum wages in the total value of production generated by the sector. This group, which represented 73% of the total number of farm holdings identified by the Agricultural Census of 2006 was responsible for approximately 4% of the total value of agricultural production in that year (Alves and Rocha 2010). In contrast, the farmers with monthly value of production greater than ten minimum wages (i.e. 8% of the total number of farm holdings) contributed with 85% of the total. The remaining difference, i.e. 11% of the total value of agricultural production corresponded to the group of farmers with monthly value of production between two and ten minimum wages.
370. The lesson learned from the above result is that, the strategy of establishing a policy framework which creates a favorable environment for investment of farmers' groups with greater response to policy measures should include not only general policies but also specific measures aimed at promoting the development of low income farmers' groups with a potential to grow economically within the agricultural sector. The specific policies for this group of farmers could include financing mechanisms, insurance schemes, extension services, agricultural product acquisition programs specially designed for them. Some examples of these policies and programs are those adopted by Brazil since the mid-1990s, i.e. PRONAF, More Food Program⁴⁴, Family Farming Insurance (SEAF), the National Technical Assistance and Rural Extension Program for Family Farming and Land Reform (PRONATER), the Food Acquisition Program (PAA). As highlighted earlier, the limitation of the policy approach followed by Brazil was that these and other specific policies were adopted only after the problem of leaving small farm holders out of the modernization process became evident.
371. As highlighted earlier, the limitation of the policy approach followed by Brazil was that specific policies like those just mentioned and some others were not adopted earlier in the modernization process when the policies which benefited medium and large producers were established. The lesson then is that the policy framework should include general policies which establish a favorable investment climate for medium and large farmers (i.e. for those which in general have a better comparative advantage to respond to the incentive structure) and at the same time, specific policies for those farmers that are in less advantageous situation but can grow economically within agriculture.

⁴⁴ This program is a special credit line of PRONAF which provides resources to finance activities such as the purchase of machinery, cargo transportation equipment and vehicles; the remediation of soil; irrigation; storage; the creation of orchards; the development of agroforestry systems; and genetic improvement.

372. In the case of Brazil, and most likely in other countries as well, there is a group of farmers that cannot develop economically in agriculture⁴⁵. Therefore, the policies for them should be specific measures aimed at improving their income level and helping them to leave agriculture and establish themselves in urban centers. These measures go beyond agricultural matters; for a country like Brazil they have included income transfer programs, access to education, transport to urban areas, rural retirement schemes and simplification of labor legislation to enable part-time employment in agriculture.
373. A third lesson from Brazil's experience is the relevance of including special attention to investment in agricultural research early on in the enabling policy framework for increased farmers investment in agriculture, and maintaining it as a priority measure throughout the years. The expansion of agricultural production and productivity requires, among other elements, the use of modern technologies and innovations which demands several years to be generated.
374. In the case of Brazil, it was noticed that it was no longer possible to continue expanding agricultural production in the traditional areas of cultivation with the existing stock of technologies. It was necessary to incorporate new land into production. The alternative chosen was to explore the large areas of the "unproductive" savannah. This required a major boost in technology development. The Government faced the challenge of creating EMBRAPA and maintaining its strong support to the R&D activities of this institution until today.
375. Several factors contributed to this sustained political support to EMBRAPA. They include the following: increased production of important research results generated by its researchers; priority on short-term research goals coupled with attention to the dissemination of existing results; investment in professionals able to create strong ties with the media, making EMBRAPA's results well publicized, both in Brazil and abroad; presence of EMBRAPA's units throughout the national territory what helped to attract the interest of the state governments and the National Congress; productive relations with politicians while guaranteeing independent management of the institution and competent leaders; independent reviews and evaluations of the impacts caused by the technologies generated.
376. Another lesson from Brazil's experience is that the sophistication of the policy instruments used to build a positive environment for farmers' investment in agriculture should be incremental. Examining the policies followed by Brazil during the 1960-2010 period, it is observed that the Government relied initially on relatively simpler instruments like investing directly in the provision of key services such as credit, technical assistance and extension as well as in agricultural research. After some years, with the gradual development of the sector, it introduced more sophisticated policy instruments like Agricultural Certificate of Deposit, Agribusiness Credit Note, Rural Promissory Note, Certificate of Agribusiness Receivable, Certificate of Agribusiness Credit Rights and rural insurance scheme run by the private sector. The implementation of these types of financing and risk minimizing instruments require among other elements, the development of private

⁴⁵ According to (Alves and Rocha 2010), in 2006 this group was comprised of farm holdings with monthly value of agricultural production between zero and two minimum wages. This group amounted to 3.8 million farm holdings corresponding to 73% of the total number of farm holdings identified by the Agricultural Census of 2006.

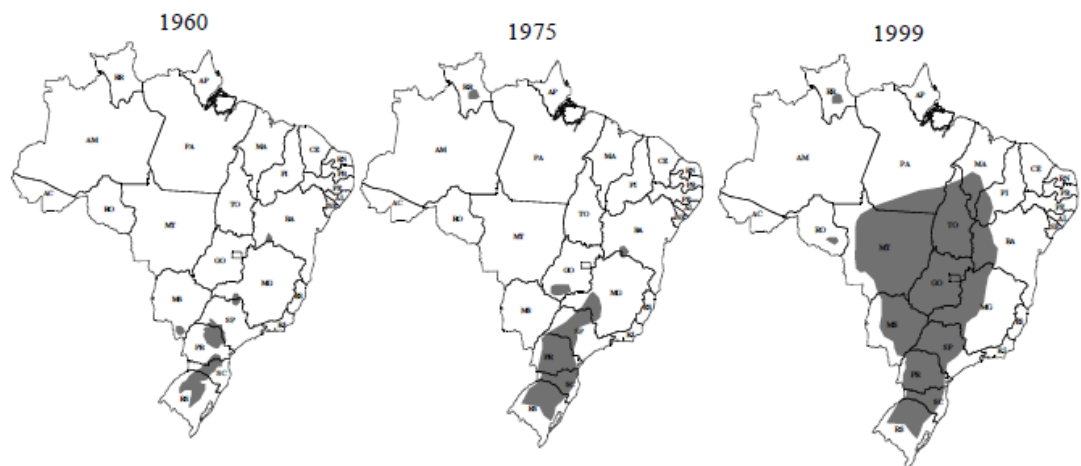
rural insurance companies, the creation of a futures market, the establishment of an institutional arrangement to regulate the functioning of securities market and the existence of specific purpose societies that undertake securitization business.

377. The complexities associated with the use of these instruments suggest that it is not feasible to utilize them in countries that are at the early stage of the agricultural development process. Thus, the construction of the policy framework in these countries involves putting in place relatively simple policy instruments initially and gradually introducing more sophisticated ones.
378. An additional lesson regarding the content of a policy framework aimed at creating an environment conducive for farmers' investment in agriculture is that it should involve a set of complementary policies which address key areas that influence the expected rate of return of investment. Thus, despite the importance of a single policy like public investment in agricultural research or the provision of agricultural credit, they should not be adopted in isolation.
379. The policy framework should be comprehensive and systemic in the sense of including policies which enables the establishment of attractive product prices by the market; contribute to reducing costs; facilitates the marketing, transport and storage of products by the private sector; and assist in the development of technical and managerial abilities of farmers and workers. The challenge is defining the extent of government intervention in the sector. In this regard several experiences have shown (including Brazil's) that, unless the circumstances require a specific and temporary policy support, the framework should not involve a strong government intervention in the sector. The policies should give priority to promoting private sector participation and the role of market forces as the main mechanism for resource allocation.
380. Further to the above elements, the Brazilian experience corroborates several lessons provided by various other countries; for instance, the relevance of a macroeconomic stability for a conducive policy environment to increased investment and economic growth. As highlighted earlier, in the late 1980s the Government adopted a wide range of reforms including macroeconomic stabilization, structural reforms and trade liberalization. Macroeconomic stability was achieved in the mid-1990s. It benefited agriculture as well as the other sectors of the economy by providing a more stable investment climate and stimulating economic growth.
381. Another lesson corroborated by Brazil's experience concerns the importance of farmers' human capital to maximize their resource endowment, the opportunities created by the national policy framework and hence, to modernize agriculture and to expand its production and productivity. In the case of Brazil, the relevance of this human capital factor to increased investment in agriculture was demonstrated by the abilities and performance of a relatively large group of farmers from the State of Rio Grande do Sul known as *gauchos*.
382. These farmers, most of them descendants from European families (mainly for Italy and Germany), are known for having a good capacity to manage their business, to adopt new technologies, to respond to public policy incentives and to adapt to

new challenging environments. Given these abilities, good part of this group of farmers moved gradually from the South region of Brazil towards the Center-West and latter to the North of the country, starting new agricultural activities. Some of the *gauchos* sold their farms to finance their investments in the establishment of their new agricultural business in these regions. However, almost all of them relied on the agricultural credit provided by the financing system to complement the financial resources needed.

383. Most of the activities carried out by the *gauchos* in the new frontier were associated with soybean cultivation. The expansion of this crop from the southern region to tropical parts of the country was made possible by public research investments in the development of cultivars and technologies suitable to this region (Figure 38). The government policies and the existence of a land market with land prices relatively cheaper in the Center West and Northern regions of the country were also important contributing factors. Therefore, the existence of the *gauchos* and of other groups of farmers with similar capabilities (e.g. framers from the State of São Paulo - *paulista* farmers) comprised a good base of human capital. This capital base is essential for a rapid modernization and expansion of agriculture production in a country.

Figure 38 - Brazil: evolution of soybean cultivation, 1960-1999



Source: (M. A. Lopes 2012)

384. In summary, these are the main lessons which emerge from Brazil's experience in terms implementing a policy framework which has contributed to creating a favorable environment for farmers' investment in agriculture. They are neither a panacea nor best practices to follow blindly. However, their positive and negative aspects provide some elements which could be useful to policy makers in some countries.

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