IRIBA Working Paper: 01

The Economics of the Brazilian Model of Agricultural Development

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July 2014

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Summary

This paper analyzes the transformation of Brazilian agriculture from a backward and dysfunctional sector to one of the breadbaskets of the world, focusing on those elements that might carry over to other developing countries seeking to make a similar transition. Today, Brazil is one of the major producers of a series of agricultural commodities, such as soybeans, sugar, orange juice, maize, cotton, chicken, meat and pigs, with strong participation in a long list of others. This has been achieved not by simply incorporating more land but by dramatic improvements in productivity, led by technological research that developed methods and inputs specifically suited to the country's conditions. Whereas the total area of land in agriculture has remained basically the same since the mid-seventies, production has increased by nearly 300%.

The success of Brazilian agriculture in increasing production and productivity in a relatively short period of time has attracted much attention to what policies and programs have been behind this transformation. Interest has centered on the fact that the transformation was achieved starting from a relatively backward agricultural setting, similar to that found in many other poor and developing countries. The Brazilian example sparked the notion that south-south cooperation in agriculture could fare better, given the similarities involved and a purported lack of colonial vestiges. The fact that the changes in Brazilian agriculture were achieved simultaneously with a significant and unprecedented drop in poverty and inequality since 1995, made the lure of a Brazilian model even more enticing for poor countries. In particular a sense arose that the Brazilian model would be particularly well suited for Africa.

This paper provides an overview of the evolution of Brazilian agriculture analyzing its transition from low productivity and backwardness to its current status as major player in international markets and role model for other developing countries. Yet, rather than simply looking back and trying to find an ex-post reasoning that explains what has taken place, the analysis highlights the fact that throughout this path policy had very limited control over what actually took place and most agents had, and still have, a very poor understanding of how thing actually work. Admitting to the fact that the Brazilian experience in agriculture is still not entirely understood does not mean that it cannot be useful for countries such as those in Africa. On the contrary, doing so may preclude making rash transplantations of policies that may not have the intended effect in different circumstances. Similarly, examining the Brazilian agricultural experience through this lens will help to sort out what elements can be usefully emulated and how that can best be accomplished.

We highlight the importance of the underlying institutional setting on the impact of agricultural policy. The remarkable transformation in Brazilian agriculture only really emerged when inclusive institutions – strong presidentialsm subject to strong checks and balances – created a fiscal, monetary and political environment in which those policies could succeed.

Keywords

Agricultural development, agricultural research, Brazilian agriculture, EMPRABA

Acknowledgement
This document is an output from a project funded by the UK Aid from the Department for International Development (DFID) for the benefit of developing countries. However, the views expressed and information contained in it are not necessarily those of or endorsed by DFID, which can accept no responsibility for such views or information or for any reliance placed on them.

Content

1. Introduction

For much of its history Brazil was believed to have a predominantly agricultural vocation. Its massive land area, suitable climates and water availability made the country one of the major producers of several agricultural commodities over extensive periods of time. Yet, at the same time its agriculture has traditionally been recognized as backward and inefficient, marred by low productivity and wasteful and primitive practices. As Brazil industrialized after the 1930s the notion of an agricultural vocation was set aside and the sector assumed a distinctively subsidiary role in the nation's policy agenda. Its task became that of supporting the industrialization effort through the production of inputs and foodstuffs as well as the generation of foreign currency. Especially since the 1960s, the low productivity of traditional agriculture, together with the sector's resistance to political and technological change, was diagnosed as a major impediment for the country's economic growth and development. During the decades that followed the government actively intervened through myriad programs and reforms (which will be detailed in later sections). Although these did manage to create a modern agricultural sector in some areas and for some products, this was only a partial success, as many problems remained unaddressed and new ones were created by those very policies. By the end of the 1990s productivity had increased but only modestly and although there were conflicting diagnoses and policy recommendations, there was consensus that the sector was highly dysfunctional and in need of further and deeper reform.

In the ensuing years, after decades of disappointing results from erratic agricultural policy had instilled a sense of hopelessness that the situation could actually change, things suddenly started to fall into place. And by the end of the first decade of the new century, Brazil found that, against all odds, it had turned into one of the breadbaskets of the world. Not only did it produce and export significant proportions of several major agricultural commodities, but this time this was done through highly productive technology and efficient use of inputs and resources. The endemic backwardness and archaic nature of Brazilian agriculture had undergone a remarkable and largely unforeseen transformation in what amounted to the highest growth of total factor productivity in agriculture among all countries in the world since 1960 (we provide detailed data below).

As the world went through a long period of quickly growing commodity prices culminating in two episodes of food price crises in 2007-2008 and 2010-2011, interest piqued in understanding how Brazil had achieved this spectacular agricultural transformation. Increasing output, as Brazil had done, primarily through higher total factor productivity rather than the incorporation of new land and more labor, seems to be exactly what is needed to feed an increasing and more prosperous world population, with its greater demand for food, fuel and meat, under the increasingly constraining prospects of a crowded world and climate change. In particular, this interest centered on the fact that the transformation was achieved starting from a relatively backward agricultural setting, similar to that found in many other poor and developing countries. Whereas many technological

and organizational packages from developed countries have been tried throughout the world, the results have often been disappointing. The Brazilian example sparked the notion that south-south cooperation in agriculture could fare better, given the similarities involved and a purported lack of colonial vestiges. The fact that the changes in Brazilian agriculture were achieved simultaneously, though not necessarily causally, with a significant and unprecedented drop in poverty and inequality since 1995, made the lure of a Brazilian model even more enticing for poor countries. In particular a sense arose that the Brazilian model would be particularly well suited for Africa. A good example of this 'sense' can be found in the following quote from a 2010 article in the Economist extolling the changes in Brazilian agriculture:

> "If you were asked to describe the sort of food producer that will matter most in the next 40 years, you would probably say something like this: one that has boosted output a lot and looks capable of continuing to do so; one with land and water in reserve; one able to sustain a large cattle herd (it does not necessarily have to be efficient, but capable of improvement); one that is productive without massive state subsidies; and maybe one with lots of savannah, since the biggest single agricultural failure in the world during past decades has been tropical Africa, and anything that might help Africans grow more food would be especially valuable. In other words, you would describe Brazil." (The Economist, Aug. 28th, 2010: 59)

Similar assessments abound. The World Bank project *Study on Competitive Commercial Agriculture in Africa (CCAA)* sees Brazil as an "example where challenging agro-ecological conditions similar to those faced today by many African countries have been overcome, with impressive results in terms of agricultural development, economic growth, and poverty reduction" (World Bank, 2009: 13) In 2013 the Institute of Development Studies released a publication called *China and Brazil in African Agriculture* which considers the potential for adapting these two countries' models to African contexts (Scoones, Cabral and Tugendhat, 2013). And in fact, Brazil has already initiated a series of involvements with several countries in Sub-Saharan Africa, not only in agriculture, where one of its aims is to replicate the successful experience in the Brazilian savannah (*cerrado*), but also tropical medicine, vocational training, energy, social protection and other areas. Some of these initiatives are described in the report of another World Bank project tellingly called "Bridging the Atlantic: Brazil and Sub-Saharan Africa, South-South Partnering for Growth," (World Bank and IPEA, 2012). In 2010, EMPRABA (the Brazilian Agricultural Research Corporation), responsible for much of the technological innovation behind Brazil's agricultural transformation, started 12 cooperation projects in 11 different African countries, though the total budget allocated for this purpose by the company was still relatively low at R$ 1.5 million (IPEA, 2013: 36).

This paper too is motivated by the notion that the transformation of Brazilian agriculture might provide knowledge and greater understanding that can be useful for developing other poor and emerging countries' agricultural system so as to emulate some of those successful

results. This may be especially the case for Africa, where some important conditions and circumstances are comparable. Given that Africa holds much of the last remaining unused agricultural land in the world, Brazil's experience in turning its large savannah regions from barren wastelands (from the agricultural perspective) into an area that has achieved world class yields and total production levels, is particularly relevant. It is obvious that in order to extract those lessons from the Brazilian experience it is necessary to have a good understanding of how Brazilian agriculture changed and evolved over time, which policies worked and how. Yet, although there is a large and well established literature on Brazilian agriculture, both by Brazilian and foreign experts, we contend that there is still much confusion and misconception of how and why this sector followed its convoluted trajectory to its current position at or near the top of so many rankings.

The central hypothesis of this paper is that the virtuous evolution of Brazilian agriculture in the past 15 years cannot be traced back to specific polices, which could then be replicated elsewhere, but rather to the more general institutional environment which arose since the mid-1990s creating circumstances where the government simultaneously reduced its interference in agriculture and provided the backdrop of rule of law and greater predictability where the private sector felt secure and able to invest and produce. By refraining from the previous tendency to micromanagement markets and focusing instead on broader issues such as monetary stability and reducing market failures (e.g. agricultural research), policy ceased distorting markets and creating perverse incentives and unleashed an unprecedented cycle of investment and growth.

A major perspective throughout this paper is that Brazil's agricultural system has an unsettling tendency to evolve in unexpected ways, defying accepted diagnoses and conventional explanations, and repeatedly frustrating prediction. This characteristic has meant that time and again in the past, government policy and programs have sought to achieve a given result only to see a slew of unintended consequences emerge. Many times massive amounts of effort and resources were applied to achieve a given outcome, only to see something entirely different and unexpected unfold, leading to frequent policy reversals and volatility. Other times a situation that is seen as too hopeless and complex, sorted itself out independent of government intervention. In the 1960s there was even a drawn-out academic debate whether agricultural supply in Brazil was sensitive to prices (Pastore, 1968). In section 3 we expand on this claim about the undirected nature of Brazilian agriculture and provide several examples. We will show that it is not just that in many instances policy has been misguided, but rather that even the criticism of the policies has also often got it wrong and in the end what emerged was surprising and unexpected all around.

If Brazilian agriculture does in fact defy easy interpretation and control, then the use of its experience as a model for other countries must proceed with caution. There is the risk of looking back and inferring intention and purpose when the actual experience may have been much more convoluted and accidental. A superficial reading of the Brazilian case might

lead the successful outcomes to seem preordained or easy to replicate, when in fact they might have emerged for reasons that are not fully understood. In many instances improvements came about not because of the policies that were implemented, but rather 'despite' those very policies.

The contribution of this paper is to provide an overview of the evolution of Brazilian agriculture analyzing its transition from low productivity and backwardness to its current status as major player in international markets and role model for other developing countries. Yet, rather than simply looking back and trying to find an ex-post reasoning that explains what has taken place, the analysis highlights the fact that throughout this path policy had very limited control over what actually took place and most agents had, and still have, a very poor understanding of how thing actually work. Admitting to the fact that the Brazilian experience in agriculture is still not entirely understood does not mean that it cannot be useful for countries such as those in Africa. On the contrary, doing so may preclude making rash transplantations of policies that may not have the intended effect in different circumstances. Similarly, examining the Brazilian agricultural experience through this lens will help to sort out what elements can be usefully emulated and how that can best be accomplished.

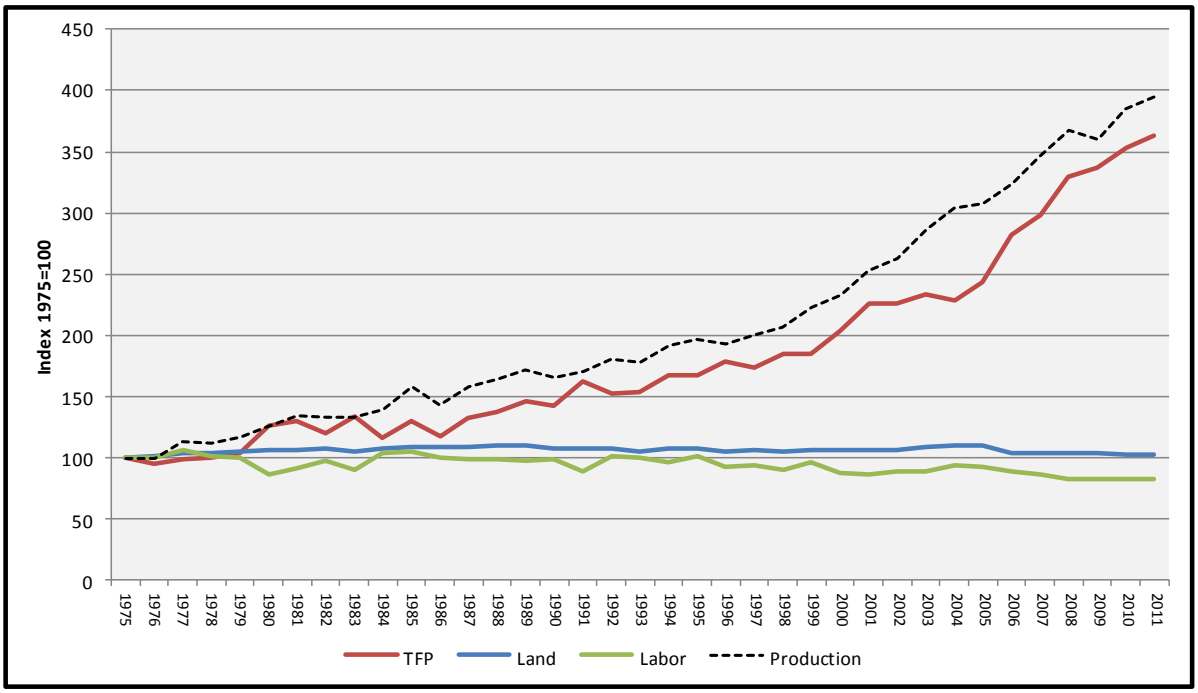
This paper proceeds as follows. In the next section we start by showing some stylized facts and data that document the recent transformation in Brazil's agriculture. We show that in terms of outcomes, this experience is truly remarkable and actually deserves to be considered as a template for other counties. Section 3 then elaborates the argument that the Brazilian transformation was not planned or controlled and is not fully understood even today. Several examples are given of how widely held expectations about this sector have been frustrated and how it continues to surprise observers and participants even today. This will set the lens through which the details of the evolution of Brazilian agriculture will be analyzed. Section 4 establishes some concepts and definitions that will be used in subsequent to analyze the policy making process. We divide the Brazilian agricultural experience in three periods, each covered by a different section. Section 5 analyzes a phase of horizontal expansion, from the end of the World War II to the beginning of the 1970s, in which the growth of agricultural production was mainly due to the expansion of the agricultural frontier. Section 6 covers a phase of conservative modernization, from the early 1970s to the early 1990s in which the exhaustion of fertile lands in the frontier led to the implementation of a system for technical change and to the configuration of active policies of agricultural credit and price support. Finally, Section 7 describes the phase of low governmental intervention, which began in the early 1990s, and of increasing participation of a substantially modernized and diversified agricultural sector in agribusiness complexes with growing importance in supplying domestic and international markets. The final section concludes by considering what lessons can be derived from the Brazilian experience as a model for other countries.

2. The Transformation in Brazilian Agriculture

The previous section made some bold claims about the 'transformation' that Brazilian agriculture has undergone in recent years. But most countries tend to experience improvements over time in their capacity to produce more and better agricultural products with less input, as technology, capital and experience disseminate and accumulate over time. So what is so remarkable about the Brazilian experience? In this section we provide evidence and data that in fact Brazil did undergo a distinctively exceptional transition from being a low productivity producer of a few basic commodities into a major front-runner both in terms of volume and productivity. The purpose is not to provide a comprehensive account of the state that Brazilian agriculture has reached, but simply to establish the fact that its experience has been exceptional and merits being singled out. Also, in this section we simply portray what was achieved, leaving the explanation of how and why those results emerged to later sections.

Perhaps the single most compelling evidence of Brazil's agricultural success is the evolution of total factor productivity, shown in Figure 1. Whereas the total area of land in agriculture has remained basically the same since the mid-seventies, production has increased by nearly 300%, which was achieved through the dramatic improvements in total factor productivity.

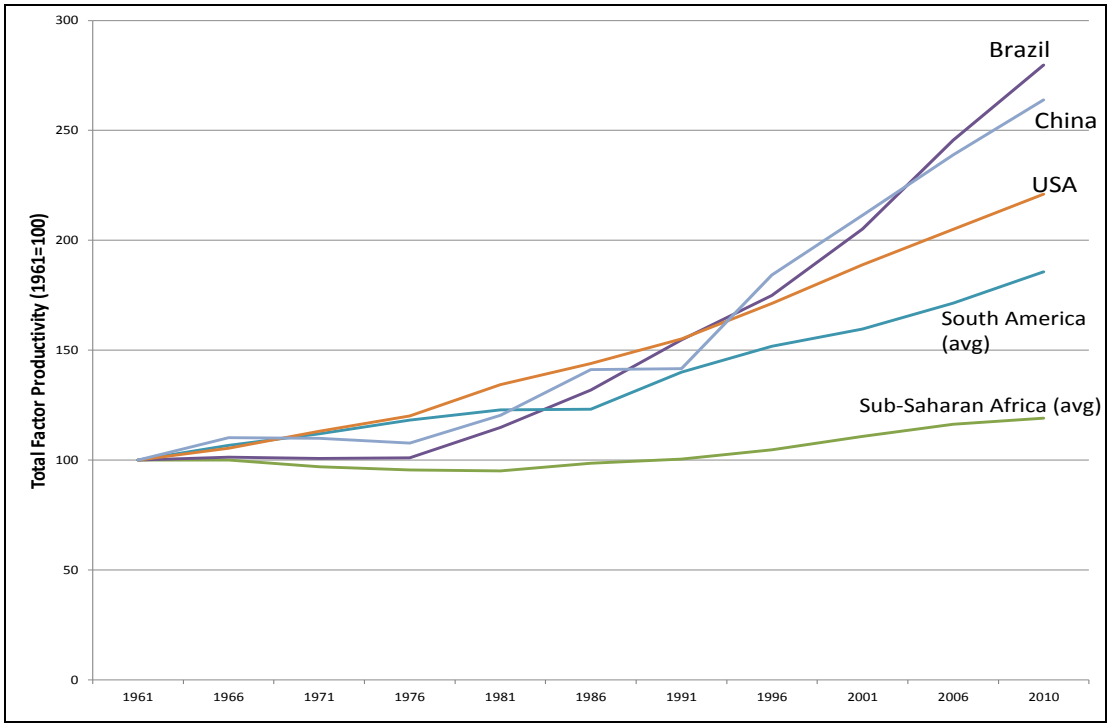
Figure 1: The Evolution of Production, Land, Labor and TFP in Brazilian Agriculture



Source: Data from Gasques, Bastos, Valdez and Bacchi (2012).

In order to show that this performance is in fact outstanding relative to that of other countries, Figure 2 plots the evolution of total factor productivity in Brazil together with an arbitrary selection of countries (using USDA data). Over the period shown Brazil has the highest increase in TFP. Note that the data in the figure is normalized to 1961=100, so the curves show each country's TFP growth relative to the level in that country at that year. Both China and Brazil exhibit very strong productivity growth over the period, with an upward inflexion around 2000 allowing Brazil to surpass the Chinese by a significant margin. Surprisingly both Brazil and China achieved higher rates of TFP growth than the US since the early 1990s, despite that country's availability of technology and infrastructure. This indicates that whereas the US has already realized most of the currently available margins for productivity growth, Brazil and China still have room for improvement. The figure also shows that the evolution of TFP in other South American countries and especially in Sub-Saharan Africa was dramatically weaker than in Brazil, suggesting that there might in fact be lessons from the Brazilian experience for these countries.

Figure 2: Total Factor Productivity in Agriculture for Selected Countries 1961-2010



Source: USDA (2013)

Today Brazil is one of the top producers of a long list of products, including sugar, orange juice, soybeans, coffee, chicken, beef, pork, maize and cotton. Table 1 shows how its participation has increased dramatically in world markets by listing its percentage of world production and its rank for the top 10 products by value in the world in 1990 and in 2011. Whereas both in 1990 and in 2011 it was the largest producer of sugar cane, its share of total world production increased from 25% to 42%. Also, while in 1990 it was one of the top

5 producers of only 4 products, this list increased to 7 products in 2011. For livestock Brazil went from being the 3rd, 3rd and 13th, producer of cattle, chicken and pork in 1990, to being 2nd, 3rd and 5th in 2011. More importantly, its share in each of these products increased from 8%, 7% and 2%, to 14%, 13% and 3%. These increases are all the more impressive when one considers that during this period most other countries were also increasing their levels of production so that any gain is relative to this generally improved performance.

Table 1: Brazil´s Rank in the Top 10 Products Globally by Value: 1990 and 2011.

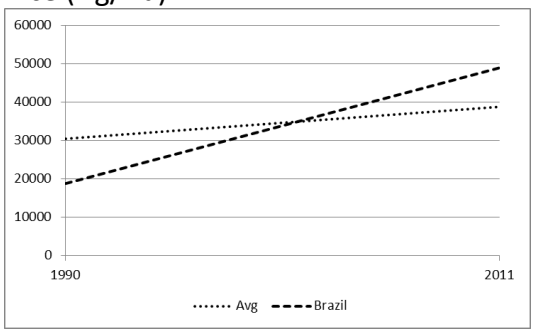
Year	Commodity (top ten by value)	Brazilian Production (Int $1000)	% of World Production (Value)	Rank
2011	Rice (paddy)	3,704,682	2%	9
2011	Milk	9,915,772	5%	4
2011	Meat, cattle	24,637,781	14%	2
2011	Meat, pig	5,179,187	3%	5
2011	Meat, chicken	16,346,908	13%	3
2011	Wheat	-	0%	>20
2011	Soybeans	20,082,317	30%	2
2011	Tomatoes	1,632,236	3%	8
2011	Sugar cane	23,879,265	42%	1
2011	Maize	2,753,011	5%	3
1990	Meat cattle	11,071,095	8%	3
1990	Milk	4,613,538	3%	8
1990	Rice (paddy)	1,978,453	1%	11
1990	Meat, pig	1,614,064	2%	13
1990	Wheat	460,456	1%	>20
1990	Meat, chicken	3,355,988	7%	3
1990	Grapes	460,023	1%	19
1990	Sugar cane	8,349,600	25%	1
1990	Potatoes	-	0%	>20
1990	Eggs	1,020,481	4%	5

Source: FAOSTAT (2014)http://faostat.fao.org)

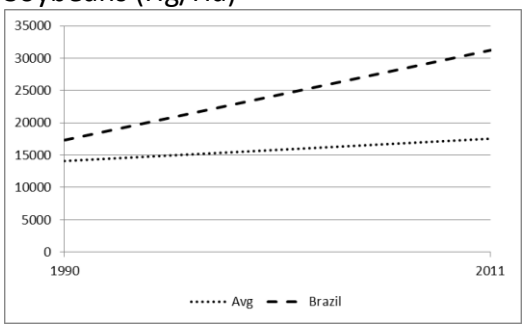
Although yields depend on comparative advantages and although the data does not control for differences in quality, a comparison of how yields change over time can also reveal relative improvements in agriculture across countries. Figure 3 shows that in addition to total production Brazil has also undergone significant improvement in yields for most products relative to other countries. The graphs plot the change in yields in Brazil from 1990 to 2011 together with the change in average yields across all countries that produce that product.

Figure 3: Yield growth 1990-2011:

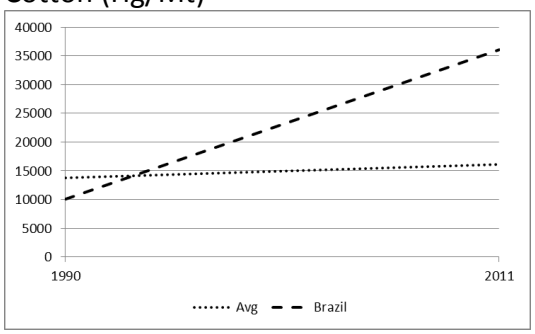
Rice (Hg/Ha)



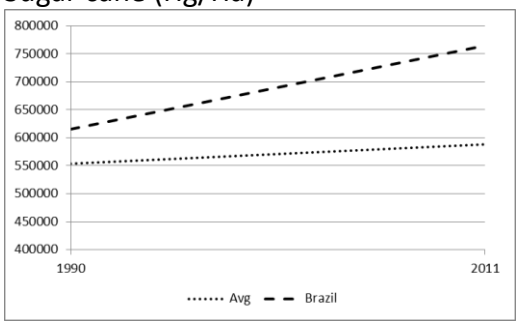
Soybeans (Hg/Ha)



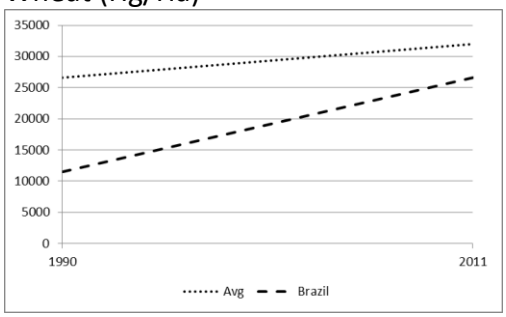
Cotton (Hg/Mt)



Sugar cane (Hg/Ha)

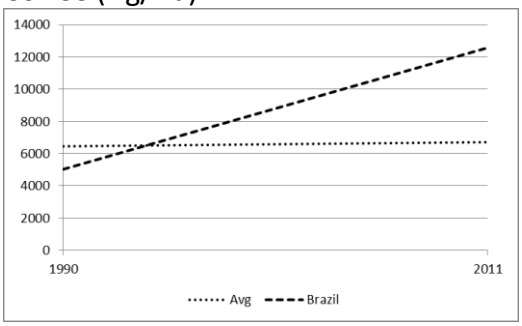


Wheat (Hg/Ha)

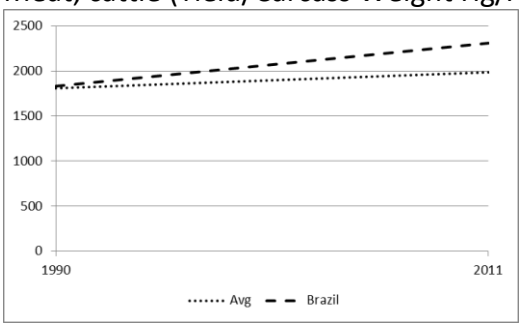


Brazil vs World Average

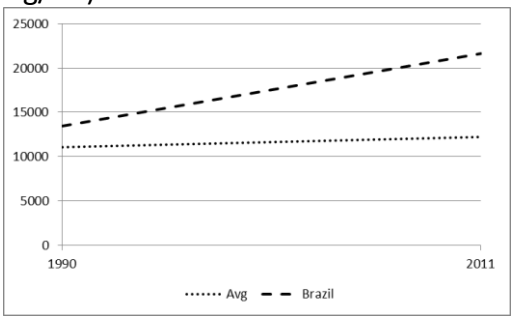
Coffee (Hg/Ha)



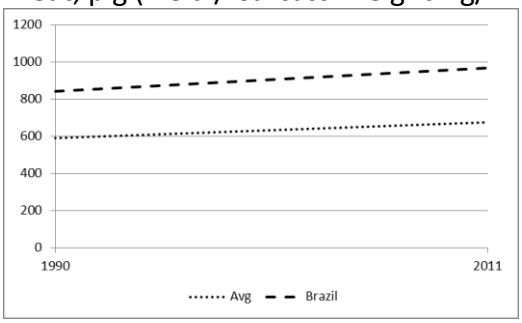
Meat, cattle (Yield/Carcass Weight Hg/An)



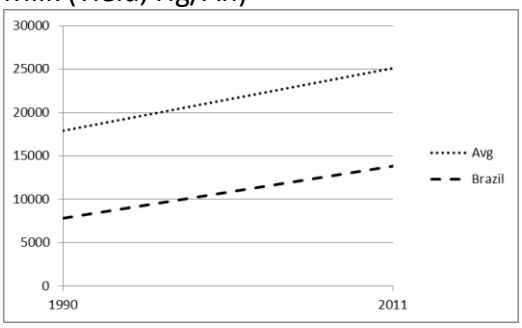
Meat, chicken (Yield / Carcass Weight Hg/An)



Meat, pig (Yield / Carcass Weight Hg/An)



Milk (Yield, Hg/An)



Source: FAOSTAT (2014) http://faostat.fao.org

Whenever the slope for the Brazil data points is steeper than that of the average, Brazil's yields have increased faster than the average. This was dramatically the case for rice, coffee and cotton, where Brazil improved its yields from below the world average to well above. For soybeans, chicken meat and sugar cane Brazil was already above the average and improved the lead over time. Even in wheat, which is not a traditional strength of Brazilian agriculture yields have improved significantly, gradually approaching the world average. Only for pigs, cattle and especially milk have yields not improved, though it should be noted that these are measures per animal and not by cost.

The evidence provided in this section substantiates our claim that Brazil has truly undertaken a remarkable transformation of its agricultural sector. Subsequent sections will provide more evidence and will describe how and why this was achieved. One may question, however, at what cost these economic achievements have been realized and whether there is room for further growth and improvements? That is, how sustainable is the current model of Brazilian agriculture? This question involves issues of the environmental impact of agricultural activity, but it involves also social issues related to the equity of access to land and resources such as water, credit, technology and infrastructure. These are complex issues that we do not have space to address comprehensively here (though many will be touched upon in the upcoming sections.) Nevertheless, it is relevant to note that there is considerable room for further expansion of agriculture in Brazil, as it is the country with the most available unused arable land in the world (FAO data cited by The Economist, 2010: 60). This does not include land in the Amazon or other environmentally sensitive biomes. Most of the room for expansion is in the form of degraded pasture that can be brought relatively easily into production. According to IBGE data, of the total land area of the country in 2006 50% (425 m hectares) was preserved public area and 11% (96 m. hectares) was in other uses (such as cities), leaving 39% (330 m. hectares) of the total area under some form of agricultural production, of which 11% (94 m. hectares) were privately preserved (Senado Federal do Brasil, 2011: 25). Of the agriculturally used land, 180 million hectares are currently under pasture, half of which is already under some stage of degradation. This implies that in the coming decades there is the potential for recuperating and bringing into more productive forms of production approximately 90 million hectares, equivalent to the area of Nigeria or one and a half France. Similarly, Brazil is one of the best placed countries in terms of water availability, with the largest renewable water resources in the world, almost by a factor of two relative to the second placed country (Brazil – 8,233 cubic km vs. Russia 4,508 cubic km) (The World Factbook, 2013).

Other important inputs for agricultural production also bode well for Brazilian agriculture's prospects for coming decades. Infrastructure has always been a major impediment for producers and exporters, inflating costs and retarding the expansion to further areas. The silver lining of this situation is that there is therefore considerable room for improvements in efficiency and productivity as government and private investment to ports, roads, trains,

energy, storage and others areas are realized in the future. The sorry state of current infrastructure is not due to a lack of understanding of its importance to economic activity and social well-being, but rather a deliberate political choice of prioritizing monetary stability and social inclusion (Alston et al., 2009). Only at times when these political imperatives were secured and budgetary resources permitted were infrastructure projects pursued. As the country grows it should be the case that a greater emphasis will be placed to slacken these infrastructure constraints, although it is true that environmental and social regulation (e.g. Indian land vs. dams) will increasingly complicate these investments. On the other hand problems with property rights insecurity, which traditionally hindered investment in agriculture, have in recent years by and large ceased to be a major issue as land reform and the very success of agriculture have practically eliminated the existence of true landless peasants. Finally, Brazil is a major recipient of foreign direct investment, including in agriculture. In 2005-2007 the country received the third largest inflows of agricultural FDI, after China and Malaysia (UNCTAD data in Nascimento, 2011). Together with the availability of domestic financing, this suggests that lack of capital should also not be a major impediment for the continued expansion of Brazilian agriculture.

3. The Perils of Planning, Managing and Controlling Brazilian Agriculture

The success of Brazilian agriculture in increasing production and productivity in a relatively short period of time has attracted much attention to what policies and programs have been behind this transformation. In the Introduction we warned that there is a danger of looking back and assuming that whatever arrangements were in place during this period are therefore responsible for the observed outcomes. We suggested that instead, much of what transpired was unplanned and uncontrolled or even accidental, and even today is not clearly understood. If that is in fact the case, then it is important to bear in mind this characteristic of the Brazilian experience when drawing lessons for other countries. This perspective therefore permeates our analysis of the evolution of Brazilian agriculture in this paper. In order to substantiate this perspective, in this section we provide several examples of policies, programs or diagnoses in recent Brazilian history that defied the intent of their formulators, leading to unintended consequences and sometimes even having the exact opposite effect than that which was sought. The examples will be described briefly and with few details due to space limitations. They necessarily involve our own interpretation of events and are by nature controversial. The point is not to provide a definitive account of each case, but rather to underscore the often unwitting component of Brazil's path to becoming a major agricultural power.

The first example involves the sharp change in agricultural policy in the late 1980s and early 1990s in which the government strongly reduced its level of intervention and the sector lost much of its protection, especially in the form of highly subsidized credit (these policies will be described in greater detail in the next sections.) These changes were prompted by macroeconomic problems related to government expenditure and distress in public finances

and not by a belief that freer markets would help agriculture. On the contrary, together with the opening up to foreign markets, it was expected that agriculture would suffer. But instead, these events mark the start of the great transformation described in the previous section. As Dias and Amaral (2001) note, "there is some **surprise** in the fact that production maintained its growth trend without presenting the profound adjustment crises that have been seen in other countries undergoing such structural change." The purpose of these authors' paper is to explain what they call "this **peculiar** performance of the Brazilian agricultural sector" (p. 8). The point here is not to delve into this debate but rather to highlight the sector's elusive nature.

A second example involves the highly concentrated nature of land and production in Brazilian agriculture. This has been recognized as a problem that should be addressed through policy at least as early as 1946 when a new Constitution explicitly spelt out the need and the rules for land reform. Since then to the present day redistributive land reform has been a prominent part of all governments' programs, including those in the military period that saw it as a means to combat traditional rural elites' obstruction of efforts to modernize agriculture. Yet all the efforts to reverse the concentration of land systematically floundered. Rezende (2006) notes that there are two dominant explanations for why this characteristic of Brazilian agriculture has been so pervasive and resistant to change. The first is that it is a historical legacy dating back to colonial times when large slave-based holdings producing commodities for exports set the country on this inexorable path by locking it into a pattern of *latifundia* that concentrated wealth and political power. The second explanation asserts that the pattern of large farms is technologically determined as this would be the best use of resources, so that any attempt to impose a less concentrated and less mechanized system would necessarily have large efficiency costs.

In contrast to both of these explanations Rezende (2006) posits that the current pattern of agriculture was crucially determined by policies instituted in the 1960s, whose objectives were precisely the opposite of what effectively emerged. The Rural Labor Statute of 1963, the Land Statute of 1964 and much subsequent legislation were motivated by a desire to protect small farmers, rural laborers and landless peasants from exploitation and oppression given the unequal nature of their power *vis-à-vis* large landowners. This highly pro-worker legislation set the rules promoting redistributive land reform and extended to the rural sector labor benefits already held by urban workers, such as holidays and the 13th salary. De Janvry and Sadoulet (1989) argue that the unintended effect of land reform legislation in much of Latin America in the 1960s was to push some landowners to become productive so as to preempt losing the land, which was often accomplished by evicting tenants and substituting workers for mechanization. At the same time the government started to provide highly subsidized credit for mechanization in an effort to increase productivity. The result was that despite this being a country where labor was abundant and capital scarce, the factor prices got distorted, signaling cheap capital and expensive labor. This induced the adoption of a pattern of technology and organization that resulted in large mechanized

agriculture that did not absorb much labor (Hayami and Ruttan, 1985). Alston and Mueller (2010) argue similarly that this legislation had the effect of hindering the use of tenancy contracts in Brazil. As tenancy is one of the traditional paths for landless rural workers to accumulate capital and experience so as to gain access to their own land, the legislation has also in this regard had the opposite of the intended effect.

The way land reform has been implemented is another example of how difficult this policy area is to manage and even to fully understand in Brazil. Although land reform efforts achieved few results until the early 1990s, since then much land has been redistributed from large unproductive holdings (as well as much public land) to landless peasants. By 2013 an area equivalent to France, Portugal, Ireland and Austria had been transferred to over one million families that represent approximately four million land reform beneficiaries. Surely that sounds like a successful and impactful land reform. But is it? On closer inspection one perceives that although much effort and resources were put into the land reform programs, actual results were quite disappointing. Because land reform is such a controversial and politically charged issue in Brazil, the debate between the Landless Peasants' Movement (MST), farmers and government has systematically been kept in the limelight by the media. But this debate has almost exclusively centered round a single and imperfect metric of whether and how much land reform was being done: the number of families settled by the government. Because this was the gauge of whether the government was or was not fulfilling its campaign promises, the incentives were for the government to put all its efforts into obtaining land and transferring it to beneficiaries and to skimp on efforts to make sure they were able to become emancipated and productive (Alston et. al., 2010). In order to reach the ambitious targets government resorted, for example, to redistributing distant and low quality land to poor but agriculturally inept beneficiaries, many of whom eventually sold or abandoned their plots. The upshot is that although on the surface a huge land reform appears to have been accomplished, in reality the concentrated structure of land holding and the nature of agricultural organization remains largely unchanged. So much so that Table 2 shows the shocking fact that under 1% of the farms in Brazil produce over half of the gross income in agriculture, while nearly 3 million farms (66% of the total) generate just 3.27% of the gross income. The fact that so much effort and resources could have been expended in land reform programs over the years, with their additional cost in terms of environmental degradation (many settlement projects are in the Amazon), violence and human suffering, to have such little impact in their intended objectives, reiterates our point that policymaking in this area in Brazil is not a trivial pursuit. Looking back, it is apparent that direct transfers to the intended beneficiaries in the style of the *Bolsa Familia* or similar programs, would have probably been less wasteful and more impactful, while reaching the same results in terms of affecting the organization of agriculture.

Table 2: Gross Income per Farm by Farms Size (2006)

Brackets (in min. wages)	Number of farms	%	Gross Income %	Gross Income per farm
0 to 2	2,904,769	66.01%	3.27%	0.52
2 to 10	995,750	22.63%	10.28%	4.66
10 to 200	472,702	10.74%	35.46%	34.49
> 200	27,306	0.62%	51.19%	861.91
Total	**4,400,527**	**100%**	**100%**	**10.45**

Source: Alves and Rocha (2010) using IBGE data, cited in Navarro and Campos (2013: 15)

The extreme level of concentration of production in a few highly productive farms side by side with a large mass of uncompetitive units that is shown in Table 2 flies in the face of the massive efforts over the years to counter this trend. But even now it is not clear if government policy fully understands how this situation was reached and what to do about it, apart from continuing the same type of land reform program of the past decades based on redistributing land through expropriation and settlement projects. Buainain et al. (2013) criticize the perspective that underlies much of current agricultural policy which classifies agents as either 'family farms' or 'agribusiness' for the purpose of policies such as credit. The authors argue that this is an ideological and outdated view of Brazilian agriculture, as both categories are present in the productive and unproductive groups. They state that this view of agricultural policy "does nothing to modify the accelerated process that is making a very large number of establishments competitively unfeasible, that could be viable if they received support through policies that are consistent with the actual structural changes that Brazilian agriculture has undergone" (Buainain et al., 2013: 13).

As a final example we cite the recent evolution of deforestation in the Amazon. Deforestation is one of the most difficult issues for policy makers to tackle in any country. Home to the largest tropical forest in the world Brazil has always struggled to manage these areas. Even once it switched from viewing the forests as resources to be exploited to resources to be conserved, the Brazilian government has had little control over what actually takes place on the ground. The yearly deforested area increased year after year from 1997 to 2004: from 13,227 sq. km in 1997 to 27,423 sq. km in 2004, foreboding an inexorable trend that seemed set to extend into the future, especially given the healthy pace of economic activity in the country at that time. Nevertheless, contrary to most predictions and diagnoses, since 2004 the yearly deforested area has fallen almost every year, reaching an area of only 4,571 sq. km. in 2012. Ex-post many explanations for these trends have been thrown about and some may even be correct. But as Susanna Hecht, one of the foremost experts in tropical development and deforestation noted in a lecture at the London School of Economics (Hecht, 2013) "… no one would have bet in the year 2000 that the deforestation rate would decline after 2004 by 84%." And even more unexpectedly, this decline has come about not through some top-down comprehensive government program,

but rather through the decentralized and varied actions of local politicians pressured by competitive elections, voters influenced by environmentalist beliefs, a free press, independent public prosecutors, NGOs and even market forces working through corporate social responsibility (see Economist, 2013).

The point, once again, is that when it comes to agriculture in Brazil, unexpected turn of events have a knack of taking place when we are most confident in our understanding of how thing work and what will happen next. This perspective is important in trying to read from the Brazilian example lessons for other countries. Certainly there are lessons. But they must be perceived having this perspective in mind.

The next section sets out the theoretical lens through which each of the three phases of Brazilian agriculture will be subsequently analyzed in sections 5, 6 and 7.

4. The Roles of Strategies and Public Policies in the Transformation and Modernization of the Brazilian Agriculture after World War II

In order to provide an accurate appraisal of the development of the Brazilian agriculture it is important to set up clearly the theoretical scaffold adopted. Given its influence on the way events are interpreted, we outline our approach to the theory of policy formation employed. In short, the main segments involved in the process are, on the one hand, the governmental institutions that constitute the regime with its objectives, and on the other, the various sectors of society with which the regime interacts in the process. It is fair to consider that, in setting up public policies the regime usually has two central objectives: that of remaining in power, and the attainment of a given view of 'good society'. There are, in turn, influential sectors of society with policy demands, which have both resources and conceptions of 'good society', consistent or not, with those of the regime. The regime has resources – not only economic, but also political and social – which it uses in pursuing its objectives. Similarly, influential sectors have resources, which they can offer in exchange for policies they value.

Policy making results in the exchanges of resources between the regime and influential sectors. Which are these resources? Economic resources (goods, services; money) are often emphasized, but political and social resources play important roles. The political and social resources of the regime comprise authority, influence, threats, information, coercion (or the suspension of coercion), status, prestige; those of the sectors include legitimacy, regimentation, information, violence (or the restraint of violence), threats, status, prestige and support. The endowments of political and social resources of the regime and of influential sectors are important in shaping an often overlooked dimension of policy making: the dimension of power.

Policy making constitutes, therefore, a process involving basically two major dimensions: a dimension of rationality which stands out when the regime endeavors to optimize the

effects of policy initiatives; and a dimension of power which stands out when we focus the ultimate objectives of the agents which participate in policy making. Policy formation tends to be a dialectical process (Marsh and Smith, 2000). Certain agents in the policy environment are empowered to initiate a policy proposal (the thesis), but influential agents, with differing views on the contents of the proposal and with power to affect the decision, are able to offer suggestions to 'improve' it (the antithesis), usually leading to a new proposal (a synthesis), containing elements of the 'thesis' and of the 'antithesis', with a higher likelihood of being approved. Vital elements in this process are policy networks. A policy network is basically a set of policy agents participating in policymaking; they comprise elements both of the private and public sectors with well-defined views regarding issues demanding policies, and capable of affecting decisions (Marsh, 1998). Policy networks are not static; they undergo changes, the pace of which is influenced by transformations taking place in the political environment. They are active in the bargaining for support the regime carries out with agents of the network and with other policy networks, in the pursuit of its main objectives – that of remaining in power while pursuing its view of 'good society'.

Special social structures influence and condition the configuration and the operation a policy network. They are essential elements of the institutional endowment of society – the existing model of government, the legal system, the conformation of the executive-legislative relations, the degree of independence and the efficiency of operation of the judiciary, electoral rules and bureaucratic structures and capabilities. The institutional endowment may change – as a rule slowly. It is essential to acknowledge these changes since they can significantly impact the policy process.

Significant elements in shaping agricultural policies in the Brazil case

The conceptual overview above is more inclusive than that of the conventional policy analysis, which tends to emphasize the rationality dimensions. But we feel that it is wrong to assume all policy environments as similar, treating differences as irrelevant. In the case of Brazil, a set of events played decisive – often unique – roles in the transformation of the country's agriculture in the post WWII period, which can only be meaningfully analyzed if such events are acknowledged. The more important of those – examined in more detail in our appraisal are:

- The prevalent hierarchical position of agricultural strategy and policies.
- The nature of agricultural policy networks.
- Restrictions imposed by urban-industrial development strategies.
- The availability of unoccupied land in the frontier.
- The nature of commercial (export) crops and of their markets.
- The process of technical change in agriculture.

Some of those events are endogenous; they have to do with elements of the, so to speak, development model of different moments in time. Others, although exogenous, were vital in the transformation of the Brazilian agriculture after WWII.

Additionally our appraisal adopted the approach suggested by Buainain et al. (2013): we established **when** the most important events occurred, that is the time span of dominant events in the three main phases analyzed; **who,** the main agents and institutions involved in the central events and transformations that took place; and **how** these transformations occurred. The **when** dimension is sketched in the overview below, and detailed in the subsequent analysis; the methodological posture delineated above is essential in explaining the **who** and **how** dimensions in the appraisal.

Overview of the when dimension: the post WWII agricultural development of Brazil

Examining the performance of Brazilian agriculture since the end of WWII, three distinctive phases stand out:

1) Phase of horizontal expansion, from the end of the war to the beginning of the 1970s, in which the growth of agricultural production was mainly due to the expansion of the agricultural frontier. Outside a few limited islands of modernization, Brazil then exhibited a primitive, low yield agriculture. Paradoxically, however, the sector produced enough food to avoid shortages with destructive inflationary impacts and it also generated both saving and foreign exchange, which were captured for the promotion of the urban-industrial expansion then emphasized in the country. And this occurred in spite of the virtual absence of an agricultural development strategy and of dysfunctional agricultural policies.

2) A phase of conservative modernization, from the early 1970s to the early 1990s. The exhaustion of unused fertile lands in the frontier led to the erection of a system for technical change and to the configuration of active policies of agricultural credit and price support. The result was a gradual modernization and diversification of agriculture, achieved without a preceding land reform. The roles attributed to agriculture by the official development strategy – the provision of adequate domestic supplies and the generation of foreign exchange – were attained fairly effectively but at increasing costs. At the end of the period it was clear that this agricultural strategy could not be sustained and considerable changes were introduced, leading to the next phase.

3) A phase of low governmental intervention, which began in the early 1990s, and of increasing participation of a substantially modernized and diversified agricultural sector in agribusiness complexes with growing importance in supplying domestic and international markets.

These three periods are analyzed in more detail below. The policy environment and the set of events were quite distinctive in each of these periods.

5. The Performance of Agriculture in the Phase of Horizontal Expansion (1946-1970)

An analysis of the performance of Brazilian agriculture in the 1st phase must consider the urban bias of the import substitution industrialization strategy (ISI) adopted after WWII

(Baer, 2008). The agricultural sector was then identified with backwardness, deserving attention only because of some of the key roles it played in the ISI strategy. Accordingly, the hierarchical position of agricultural strategy and policies was subdued. In fact, the urban bias strategy resulted in a considerable transfer of income—achieved by the dominant urban-industrial policy network – from agriculture to the urban-industrial sector (Bacha, 1975; Oliveira, 1981). This was done chiefly through the manipulation of relative prices against agriculture. In the period foreign exchange – primarily generated by agricultural exports, especially coffee – was maintained consistently overvalued, and real prices of agricultural products for the domestic marked – especially those of food products – were artificially compressed, via export restraints and by price fixing by decree. In contrast, prices of domestically produced industrial goods – the object of considerable protection – were free to increase.

This notwithstanding, the performance of agriculture was adequate; production increased enough to assure that, by and large, the sectoral terms of trade would not negatively affect the then very rapid pace of import substitution industrialization (foreign exchange was essential for input and equipment imports), with its ensuing fast boost of urban demand for food (Mueller, 2011). In fact, regardless of a consistently overvalued foreign exchange, agriculture originated most of the country's export earnings. To unravel this apparent paradoxical behavior it is important to focus elements of the ***who*** question; thus we outline briefly the policy networks that affected agriculture more significantly.

Policy networks relevant to the performance of agriculture in the period

In the period Brazil didn't have an all-inclusive agricultural policy network. The Ministry of Agriculture, created in the early 1930s was never important for the conformation of an agricultural strategy. It dealt mainly with regulatory aspects such as plant and animal health; policies such as rural credit and minimum prices – both virtually of no consequence in the period – were controlled by governmental organizations of the urban-industrial policy network with no concern with agricultural development. This led to policies with potentially negative effects on agriculture.

The absence of an overall agricultural policy network did not preclude the evolution of influential agricultural commodity policy networks, mostly those of coffee and of sugar, which were able to successfully demand policies regarding the production and trade of these commodities. An interesting example is that of the coffee policy network; since the late 19th century it was extremely active and, with varying success, decisive in channeling public resources for the sector. In the years of the Great Depression, for instance, as the reduction of the world demand and the enormous excess capacity of the sector led to sharply declining coffee prices, the National Coffee Department was created to carry out measures to contain the decline in prices, safeguarding the foreign exchange earnings from coffee exports. However, this organization had virtually no links with the Ministry of

Agriculture; in fact, the ultimate command of the coffee policy was placed firmly in the Finance Ministry, which the coffee policy network was nevertheless able to influence (Delfim Netto, 2009). The urban-industrial development policy network, already involved in the promotion of incipient import substitution industrialization, was concerned mainly with the foreign exchange derived from coffee exports, but the coffee policy network was able to avoid devastatingly low coffee prices.

This policy arrangement did not markedly change after the end of WWII. Coffee and other commodity policy networks continued influential up to the late 1980s; and up to then, pressure for governmental action was usually exerted over institutional channels outside the Ministry – controlled by the urban-industrial development policy network.

After WWII the coffee policy network continued unable to restrain a considerable transfer of resources for ISI. What prevented the overvalued exchange rates that prevailed in the period from producing havoc to the coffee sector was primarily the sharp increase in the international coffee demand after the end of WWII, leading to substantial increase in world coffee prices. Making the average 1942/45 import prices of coffee in the United States equal to 100, the index increased sharply, reaching 202 in 1948, 360 in 1950, peaking at 530 in 1954; after this year the international coffee price index started to decline but it remained at much higher levels than that of 1942/45 over the rest of the period.[1] The recovery of world markets after WWII resulted also in substantial increases in the volume exported. The average annual exports increased from an average of 10.8 million coffee bags in the 1940-44 period to an average of 16.3 million bags in 1945-49; in the 1950-59 period the volume of coffee exports declined to an average of 15.0 million bags annually – caused to a large extent by the devastating frost of 1953, which reduced substantially the 1954 harvest – but it remained considerably larger than that of the WWII period.[2]

Although unable to prevent large transfers of resources to the urban-industrial sector the coffee policy network exerted weight over important issues for the coffee economy; it secured, for instance, the adoption of measures to contain the pace of decline in world coffee prices which began in the second half of the 1950s (Mueller, 1971).

The supply of food and the nature of the coffee frontier

The transfer of resources from the export sector was fundamental for the ISI strategy of this period; however, it was also extremely important for an adequate performance of agricultural production for the domestic market. This can be examined looking at the

[1] Indexes calculated from average annual international coffee prices in the United States, compiled by Delfim Netto, 2009, p. 278. The average international price of coffee for a given year in the US was obtained dividing the total value of coffee imports by the number of coffee bags imported in this year.

[2] Data of coffee exports from IBGE, Estatísticas Históricas do Brasil, 2a. edição, 1990, table 6.43, p. 350.

growth of agricultural production in the 1st phase, sketched out in Table 3, showing the average weighted rate of growth of the physical output of the major groups of agricultural crops, in the 1950s – the decade in which the ISI strategy was dominant in Brazil. Considering all crops included in the calculations, the rate of growth was an impressive 5.7% annually; moreover, the expansion of supply was comprehensive, encompassing the production of food items (5.0% annual growth), that of agricultural inputs (6.6 % growth), and that of export crops (6.2% growth). It should be noted that the 5.0 % average annual rate of growth of production of food items exceeded considerably the high rates of population growth of the decade (averaging 3.0 % per year, IBGE, 1990).

The crop growth rates of the 1950s were significantly higher than those of the 1940s, affected by difficulties stemming from WWII; and the overall rate of growth of the 1960s was lower than that of the 1950s mainly because of the mentioned setback suffered by the coffee sector.

The satisfactory performance of the production of crops for the domestic markets of the 1960s may seem paradoxical, especially considering the very high demographic expansion n and urbanization of the period (Baer, 2008), the virtual absence of agricultural support policies – except for export commodities (Nicholls, 1970), and the prevalence of measures to hold down nominal increases of prices of food products (Mueller, 2011).

Table 3: Brazil: average weighted annual rates of growth of the physical production of agricultural crops (% per annum)

Period	All crops included	Food (a)	Agricultural inputs (b)	Tradables (c)
1940-50	3.1	4.6	3.2	-0.4
1950-60	5.7	5.0	6.6	6.2
1960-70	5.4	5.8	5.8	1.9

Source: Mendonça de Barros et al (1977).

(a) Rice, sweet potatoes, onions, beans, manioc, corn, bananas, oranges, coconuts;
(b) Cotton, sugar cane, tobacco, peanuts and soybeans.
(c) Coffee, cocoa, mamona and agave.

Table 4 presents information on the nature of agricultural expansion in the period. It provides an overview, established by Patrick (1975), of the increase in crop production for the domestic market during the first phase. Working with the sum of the physical production of 23 major crops (production of coffee was excluded), Patrick obtained a 4.8% annual rate of growth for the 1950s, consistent with the estimates of Table 2.[3] Employing

[3] The higher rate of growth of agricultural crops for the same period (the 1950s) of Table 2 (5.7 % per year) than that of Table 3 (4.8%) is due to the fact that the former included coffee, a crop which

shift share analysis the author determined the weights of the main factors in this behavior: the area effect (the growth of output due to the incorporation of land in the agricultural frontier); the yield effect (growth of output brought about by changes in yields); and the composition of production effect (change determined by variation in the composition of production). Moreover, he examined the regional performance which, in part, is also revealed in Table 4.

Table 4: Growth of crop production and its main determinants (1949-1960)

	Growth rates of aggregate production of major crops (% per annum)	**Area effect (%)**	**Yield effect (%)**	**Composition of production effect (%)**
Brazil	4.8	76.5	12.8	10.7
São Paulo	3.1	23.0	58.8	18.2
Paraná	13.1	50.5	8.5	41.0
Northeast	3.8	123.6	-16.4	-5.2

*Calculated from data of the physical production of 23 major crops, excluding coffee.
Source: Patrick, G. (1975: 89-110)

We see that in the 1st phase the area effect explained 76.5% of the period's 4.8% annual growth in production in Brazil as a whole. In other words, production expanded basically as a result of the incorporation of land in the agricultural frontier; the yield effect, (brought about by technical change) explained only 12.8% of the rate of agricultural growth.

The information in Table 4 reveals substantial regional differences. The 3.1% annual growth of production of the state of São Paulo – an important agricultural state with an already mature coffee sector – was lower than the national average; in fact, the prosperity of its coffee economy in the 1950s restricted somewhat the availability of idle production factors (land, labor) for the cultivation of crops for the domestic market. The importance of the yield effect in this state is noteworthy: it accounted for almost 59% of its rate of growth of production; there the area effect explained only 23% of the state's growth rate.

An interesting – and contrasting – case is that of the state of Paraná, an area endowed with highly fertile lands in which the coffee frontier was then expanding vigorously (see below). The growth of non-coffee production (13.1 % per year) was very high, and this was mainly due to the area effect (50.5 %). The yield effect explained a mere 8.5% of the growth in Paraná during the decade. It is important to note that, in spite of the coffee expansion there, the contribution of this state for de supply of agricultural products for the domestic market was sizeable in the period. Differently from São Paulo, the prosperity of the coffee economy in Paraná did not limit its production of these crops; quite to the contrary.

expanded rapidly in the 1950s; Patrick (1975) excluded this crop from his calculation, focusing on production destined chiefly for the domestic market.

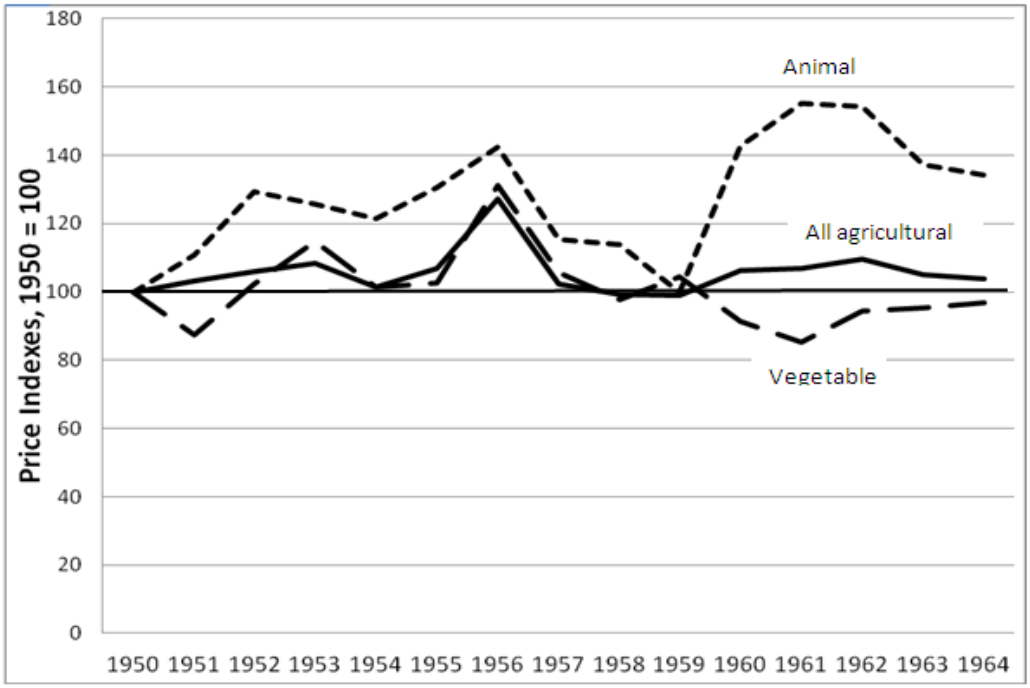
Another important regional difference is that of the Northeast; it was included in Table 4 as a representative of the precarious state of traditional agriculture in Brazil. It not only grew at a rate below the national average (3.8 % per year in the period,) but this was only possible because of a sizeable increase in the area of land cultivated (the area effect was 123.6 %), to compensate for marked reductions in yields (the yield effect was -16.4%). Admittedly, the case of the Northeast—a region prone to devastating droughts—is extreme, but as shown by Patrick's state estimates, in many states the cultivated area had to expand to compensate for declining yields. In fact, technological change was virtually absent from the agriculture outside the state of São Paulo.

The above discussion presented elements indicating a considerable expansion of agricultural production for the domestic market during the 1st phase. But was this enough? In considering this, it becomes important to examine the possible impacts of agricultural prices on inflation. According to *Conjuntura Econômica* of the Vargas Foundation,[4] in the 1950s, the average annual rate of inflation in Brazil was 17.3%; and focusing the 1959/60 biennium, this average reached 30.7% per annum, revealing the upward trend of the rate. The question is to what extent was this behavior significantly affected by a slow expansion of the supply of food? Were the rates of growth in production sufficient to prevent inflationary pressures in an economy experiencing a fast urban-industrial expansion?

To check this we compare the evolution of price indices of agricultural products and of sets of food products in the period to that of the wholesale price index (Figure 4). If the production of food fell systematically short of the growing domestic demand, its prices would tend to rise faster than the wholesale price index; and vice versa in the case of a favorable performance of the supply of food.

[4] In the 1950s the Vargas Foundation of Rio de Janeiro was the main source of economic data in Brazil – including that of inflation. It published such information in its reputable monthly journal, the *Conjuntura Econômica*.

Figure 4: The path of real agricultural prices 1950-1964



Source: Fundação Getúlio Vargas, *Conjuntura Econômica*, various issues. (Indexes of: 'agricultural prices'; of 'agricultural prices of vegetable origin'; and of 'prices of products of animal origin' deflated by the wholesale price index).

Figure 4 shows that the behavior of prices of 'agricultural products' (excluding coffee) and of 'products from vegetable origin' was quite satisfactory in the 1st phase. In the few years in which the ratio 'prices of products from vegetable origins/wholesale prices' exhibited sharp peaks, this was mainly due to extreme weather conditions. Since the importation of food was not an option, given the priority of the destination – by an official monopoly -- of foreign exchange for the importation needs of the ISI strategy (Baer, 2008) the domestic production of food and related products played a key role on the behavior of agricultural prices.

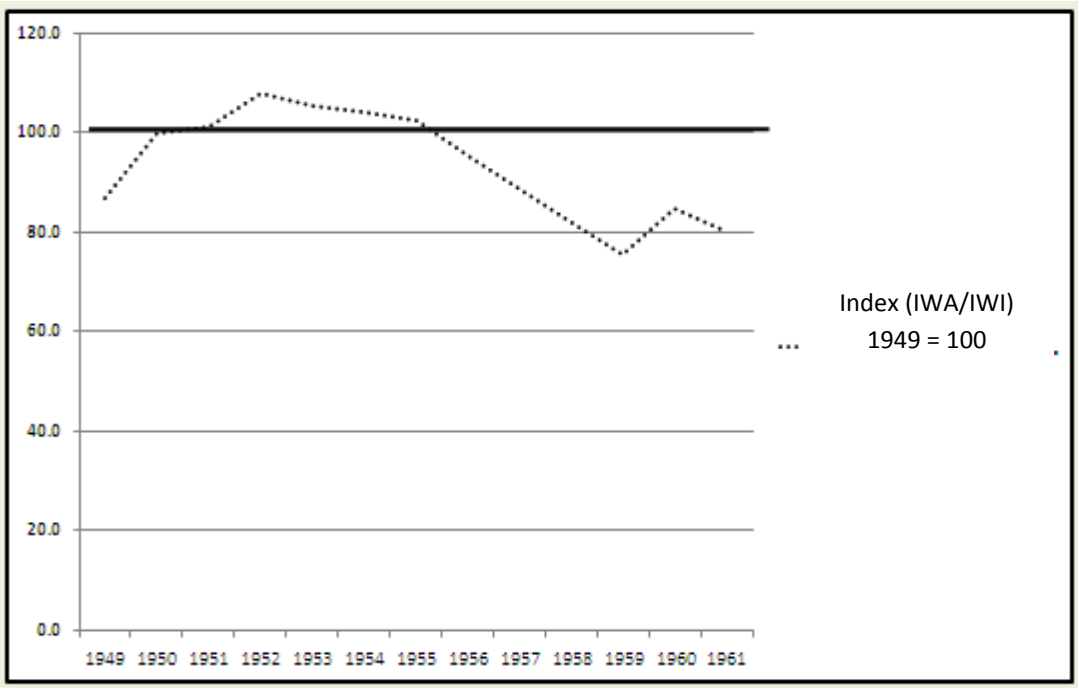
Not all segments of agriculture appeared favorably in the period. The output of products of animal origin, notably beef, remained laggard. In spite of the country's significant beef cattle herd,[5] the Brazilian production of beef expanded slowly, and this was reflected on beef prices. This can be seen in the behavior of the index of 'real agricultural prices of animal origin' in the period of Figure 4. The shape of this line was basically determined by the impacts of the beef cattle price cycle – the prices of beef were dominant on the index of 'real prices of products of animal origin'. The sharp decline over the second half of the 1950s resulted from high rates of slaughter of heifers caused by measures to control domestic beef prices; the long term effect was the ensuing decline in births, with negative impacts on the price of beef, beginning at the end of the decade and reaching high levels on the first

[5] According to the 1950 agricultural census, in this year Brazil had a cattle herd of 47.1 million heads (IBGE, 1990, p. 320).

half of the 1960s. It should be noted, however, that in this period prices of agricultural products of vegetable origin were increasing below the rise of the overall wholesale price index.

It is important to stress that the adequate expansion of agricultural production for the domestic markets – notably that of food – helped to generate unfavorable terms of trade between the agricultural and the industrial sectors. Figure 5 shows the evolution between the late 1940s and the early 1960s – a period of intensification of the ISI strategy – of the ratio between the index of the wholesale price indexes of agricultural (IWA) and industrial (IWI) products.

Figure 5: Index of the ratio of wholesale price indexes of agricultural and industrial products (IWA agro/IWI Ind) 1949 – 1961



Source: *Conjuntura Econômica*, FGV, various issues.

At the beginning of the period agricultural prices increased faster than those of industry, but by the mid-1950s, at the height of the implementation of the ISI strategy – in spite of the official measures to try to hold down agricultural prices – the IWA/IWI index moved clearly against agriculture. Initially, climatic events (droughts; devastating frosts; floods) brought about episodic shortages in agricultural supplies, increasing prices, but as the situation normalized, these supplies increased noticeably, and agricultural prices declined in real terms. Naturally, the very high protection of industry of the ISI strategy – and not only the behavior of agricultural supplies – helped to shape the (IWA/IWI) line. And the behavior of the agricultural/industry terms of trade highlights an aspect of the transfer of resources between these two sectors.

Summing up, most of Brazilian agriculture remained extremely primitive during the 1st phase; yields were very low by world standards and remained so throughout the period

(Nicholls, 1970). Policies to modernize agriculture were almost non-existent, an exception being the efforts to advance the production of coffee, cotton and sugar cane by organizations of the state government of São Paulo, the impacts of which were mostly limited to the agriculture of portions of that state (Pastore et al., 1976). The main policy favoring the expansion of production in this period were the road building programs (Nicholls, 1970); new roads enabled farmers to bring more land into cultivation, under practically the same methods.

Factors in the expansion of food for the domestic market

It is noteworthy that the expansion of the supply of agricultural products for the domestic markets in a situation of prosperity of the coffee economy was largely adequate. As shown by Mueller (1983, chap. V) from the late 19th century to the early 1930s – a period in which free trade prevailed – the domestic production of food in Brazil tended to move in the opposite direction of the prosperity of the export economy (especially of coffee). In phases of export prosperity productive resources were mostly channeled to the production of export commodities; the domestic production of food remained at low levels, being supplemented by imports made possible by plentiful foreign exchange earnings. Conversely, in phases of difficulty of the export sector, productive resources in the commodity export sector became partly idle. Since the export declines limited the availability of foreign exchange, these resources were partly used to produce agricultural products for the domestic markets; the internal production of food increased and their imports declined. However, during the coffee boom of the 1950s the contrary occurred. As shown, the prosperity and expansion of the coffee economy was accompanied by a considerable growth of the domestic supply of agricultural products – notably those of vegetable origin. To untangle this paradox we examine the following elements that characterized the progression of agriculture in this phase: the availability of land in the agricultural frontier; and the nature of the main export crop (coffee).

The considerable coffee expansion in the 1940s and 1950s, stirred by a growing world demand and high prices, occurred by way of the incorporation of highly fertile land, basically in the agricultural frontier of the state of Paraná, not far from major ports and from the urban-industrial ISI core in the center-south. And certain features of the formation of coffee plantations there favored the production of food crops such as corn, beans and rice, regardless of the often inauspicious market conditions of the period.

One of these features had to do with characteristics of the process of construction of coffee farms in new areas; then it took around five years for a coffee plantation to mature, originating commercial harvests (Delfim Netto, 2009). Farmers had to remove the native vegetation – in Paraná, mostly a lush tropical forest –, prepare the soil and plant the coffee seedlings in wide rows, allowing for the growth of the coffee trees and leaving enough space for the care of the plantation and for the harvest of coffee. Given the extended period of

waiting, the wide areas between coffee rows were habitually used to produce annual food crops; this was done as long as their sale could be expected to cover variable costs, usually quite modest. Obviously farmers wanted more than this, in order to help finance the coffee formation, but in unfavorable moments this surplus might not occur as anticipated. The hope was, however, that something would remain at the end of each harvest along the period of formation.

This was typically the case with the coffee expansion in the state of Paraná, but during the 1st phase similar processes took place in other frontier areas, albeit not as significantly. An instance was the opening of land for pasture formation in the Northwest of São Paulo, the Southwest of Minas Gerais and the South of Goiás states. As a rule, there the native vegetation was removed and the land prepared, but pastures were planted only after a period of roughly two years in which dry land rice was cultivated (Rezende, 2003a). Again, this crop would withstand low prices, as long as they covered usually modest variable costs.

As can be observed in Table 5, in the 1950s there was a substantial expansion of coffee in Paraná. From 1949 to 1959 this state's area in coffee increased by almost one million hectares and production by nearly 1.3 million tons. As for the frontier food crops, we see that in 1939 their production was quite modest; but in 1949 these crops already occupied 234 thousand hectares in the case of corn, 81.2 thousand hectares in the case of beans and 54.4 thousand hectares in the case of rice. In 1959, the production of corn covered 749.2 thousand hectares, of beans 301.7 thousand hectares and of rice 160.8 thousand hectares. In 1959, the production of corn of the Paraná frontier had reached 1.021 million tons, that of rice 131.7 thousand tons[6], and that of beans, 155.1 thousand tons, amounting to 13.2%, 3.2% and 10.0%, respectively, of the national total production.

Table 5: The Paraná coffee frontier – the frontier production of coffee, corn, rice and beans

	Coffee		**Corn**		**Rice**		**Beans**	
	Area (000 ha)	**Prod. (000 ton)**	**Area (000 ha)**	**Prod. (000 ton)**	**Area (000 ha)**	**Prod. (000 ton)**	**Area (000 ha)**	**Prod. (000 ton)**
1939	*	61.58	*	241.2	*	9.3	*	23.9
1949	232.0	276.9	234.0	478.5	54.4	68.3	81.2	103.4
1959	1231.8	1585.7	749.2	1021.4	160.8	131.7	301.7	155.1

Source: Mueller, 2011. Basic data from IBGE, Agricultural Census of 1940, 1950 and 1960
*Municipal data necessary to compose the area of the 1939 Paraná Frontier aggregates were not available; the 1939 line shows only the production data, in 1000 tons. Municipal data allowed the composition of area information for 1949 and 1959.

[6] The state of Paraná was never an important rice producer. Brazil's main producer of irrigated rice was the state of Rio Grande do Sul but a significant production came from areas of land cleared for the formation of pastures in the agricultural frontier in central Brazil.

It is interesting to note that social scientists of the period often placed the blame of the Brazilian sluggish growth of agricultural productivity on the fashionable structuralist view, then prevalent, according to which the problems agriculture was then facing stemmed from of an inbuilt failure on the part of Brazilian large farmers to respond to the demands from the growing urban industrial sector. The main structuralist policy prescription was that of a drastic agrarian reform, involving the confiscation of land from large landholdings, placing it in the hands of small farmers which were seen as more responsive to the requirements of urban-industrial development.

The structuralist view was demolished by one of its ranks (see Castro, 1969) but it took considerably longer for the truth to be accepted. In fact, the highly concentrated land ownership distribution of the period (which remains to the present) had mostly distributive effects; the expansion of production occurred without the need of an agrarian reform. And an important contributing factor was the process of frontier expansion in the center-south region of Brazil.

6. The Period of Officially Induced Conservative Modernization (1965 - early 1990s)

By the end of the 1st phase the availability of unoccupied fertile lands in the agricultural frontier had diminished significantly. There were abundant unused lands in the *Cerrado* (central-Brazil's huge savannas and in the Amazon), but technologies for their productive exploitation had still to be developed. Fearing problems from an inadequate performance of agriculture, the 1964-85 military governments began promoting conditions for a more intensive use of land in the already settled areas and in the *Cerrado* portions not too far from the main markets; the occupation of land in the *Cerrado* and Amazon frontier continued but now mostly with geopolitical motivation (Mueller, 2012).

The conformation and changes in Brazil's policy environment along the 2nd phase

This segment focuses the agents and institutions mainly involved in the transformations that took place in the 1965-90 period, and the forms by which such agents and institutions carried out these transformations, stressing their main results. To begin with, it is important to keep in mind that when sharp changes in the political regime take place discernible alterations in the policy environment tend to occur. In Brazil, for instance, such discontinuity occurred at the end of WWII; in 1945 an authoritarian regime was overthrown and a liberal democratic phase was set in motion, prevailing until the 1964 military coup. During this period the main alterations in the policy environment had to do with the implementation of the post WWII Import Substitution Industrialization strategy. Following the 1964 coup, however, there was a 21 year period of authoritarian rule, ending in 1985 with the country facing a sharp external debt crisis and a very high inflation. We focus on the changes during the latter period in the development of agriculture and the policies involved, endeavoring to draw attention to aspects of the **who** and **how** issues.

Regarding the **who** issue, the basis of the development strategy of the military regime was that of an import substitution strategy taken to a very high level, which aimed at the transformation of the country into a modern industrial powerhouse. This was the essence of the view of good society of the regime. After a period of institutional reform, the policy instruments of the regime were intensively used to promote this strategy. Moreover, the governmental inducements and incentives were proficient in attaining the support from a considerable portion of the urban-industrial elite. As outlined by Cardoso (1975), the policy environment was affected by the regime's vision of good society; the formation of policies involved the interactions between the regime and influential sectors of the urban-industrial elite, usually taking place out of view of the public. Policy negotiations conducted in this fashion involved members of the regime's techno-bureaucracy and agents both of the private sector and – it is important to stress – of public organizations competing for resources at the command of the regime. The process entailed both the dimensions of rationality and of power.

What was, in broad terms, the agricultural strategy of the military regime? Apart from the commodity policy networks (coffee, sugar), at the outset of the 2nd phase Brazil did not yet have an agricultural policy network endowed with a modicum of influence, but this changed considerably along the 2nd phase (Mueller, 2009). An agricultural strategy was never central to the import substitution model adopted, but the regime realized the strategic role of an adequate performance of agriculture in terms of production for the domestic market and as a vital source of foreign exchange. However, the agricultural policies the 2nd phase saw the consolidation of an overall agricultural policy network involving representatives of the modernizing farm segments, pressuring increasingly for resources for the credit and minimum price policies, for investments in roads and storage capacity in rural areas, and for the creation of new policy instruments (e.g. a rural insurance policy), and most of the institutions of the agricultural public sector, which were reformed and reorganized. The commodity policy networks continued to operate but the diversification of production and exports, together with the growing formation and consolidation of agribusiness complexes led to increasing pressure for broader policies for agriculture. However, even late in the period the increasingly influential agricultural policy network was far from capable to easily attain the policy objectives they favored. In the policy negotiations they had to contend with a highly influential group: that composed by the macroeconomic techno-bureaucracy which often acted as a policy network. Regarding the agricultural sector the latter group had two sometimes conflicting goals: that of a good performance of production and exports, seen as crucial for the control of inflation and for the generation of foreign exchange; and the control of public expenditures on policies, often regarded – by way of unrestrained monetary expansion – as a threat to macroeconomic stabilization. When considerations of production, supply and exports prevailed, the agricultural policy network and the macroeconomic techno-bureaucracy tended to act in tandem. However, when the threat to stabilization became pervasive the two policy networks usually diverged but, in times of economic crises the considerable power of the macroeconomic techno-bureaucracy led to

the restriction – and sometimes the distortion – of policies dear to the agricultural policy network.[7]

With the restoration of democracy in 1985 the policy formation processes began to go through some transformations, but over the remainder of the 2nd phase (the 1985 - 1990 period) they did not significantly alter agricultural policy. Brazil's almost constant state of macroeconomic crises along this period and the protracted approval and implementation of a new Constitution – the new charter was approved in 1988 and went into effect in 1989 – prevented significant reforms of the policy; they came to fruition only in the 1990s, during the 3rd phase.

Regarding the **how** issue, the fundamentals of the conservative modernization agricultural development model of the military regime, with impacts which were felt much beyond the 2nd phase, were:

- The implementation of a broad based research system in tropical agriculture – leading to the EMBRAPA system. The first steps towards this were taken at the beginning of the 2nd phase but the emphasis on technological development of agriculture was more strongly felt after the 1970s. At any rate, in the beginning of the 2nd phase it was clear that important effects of this set of actions would be felt only in the long term; therefore substantial resources were immediately offered to agricultural producers to step up production with more advanced technology then available – or with a few short term advances in this area.
- The institution of a rural credit system – the National System of Rural Credit (NSRC) –, which provided, especially along the 1970s, abundant financing, in very generous terms, to commercial agriculture. It aimed basically at promoting the use of modern inputs (agricultural equipment, fertilizers, pesticides and insecticides), much of which initially imported.
- Improvement of the administration of the minimum price policy, which became dominant in the agricultural strategy in most of the 1980s.
- The provision of inducements – incentives, subsidies – for the formation and the expansion of agribusiness complexes.
- It was assumed that, with the implementation of the above instruments, a dynamic rural entrepreneurial class would emerge and perform as expected in the agricultural modernization process. This assumption proved correct.
- There were marked changes in the legislation governing land reform, but which did not generate effective results. Modernization was to be achieved without major changes in the distribution of land. It was this that branded the agricultural strategy as 'conservative'.

[7] The clashes between the agricultural policy network and the macroeconomic techno-bureaucracy in the context of the minimum price policy in the 1980s are discussed in Mueller (1988).

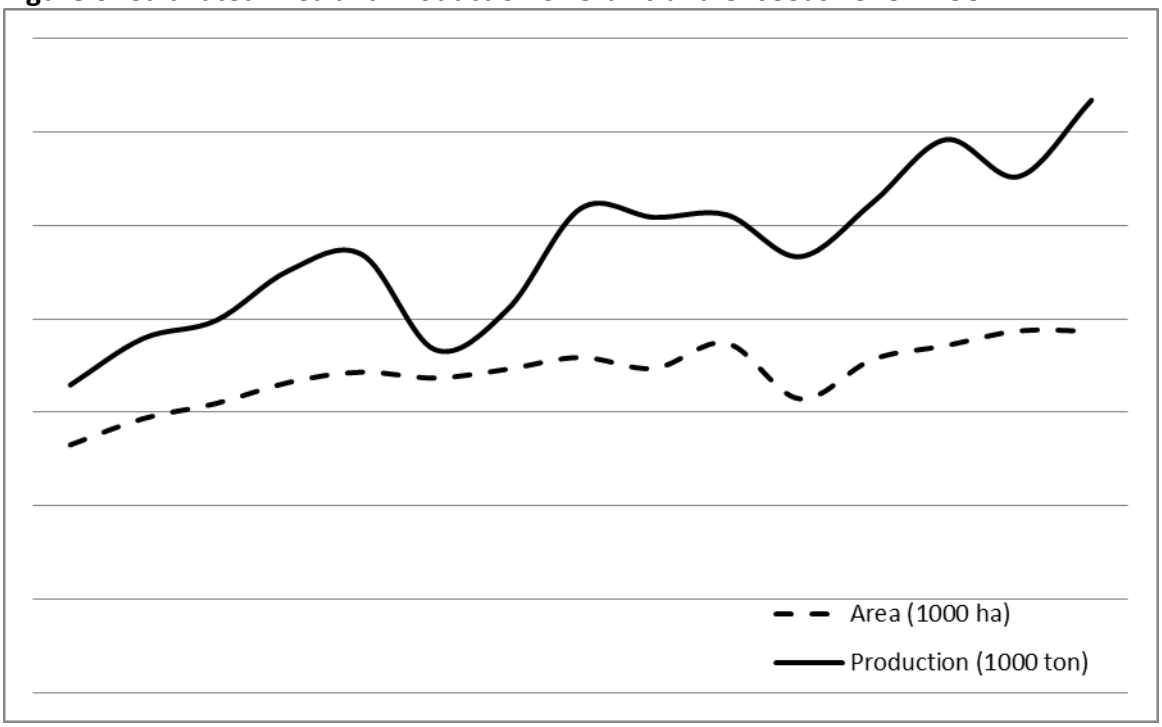
In sum, having performed a broad reform of the agricultural support infrastructure, the regime decided to adopt market incentives instruments to assure an aceptable growth in agricultural production and exports.

Incentives policies and the performance of agricuture in the 2nd phase

The technocrats in charge of policies to promote consistent increases in agricultural production recognized that, after a long period of disregard and of discriminatory policies, short term results would only follow if farmers were offered abundant financial resources at very low costs. In what follows we examine the more important incentive policies adopted.

The credit policy: Subsidized agricultural credit was, by far, the main instrument employed in the 1970s and in parts of the 1980s. Agricultural loans, furnished by financial institutions of the National System of Rural Credit (NSRC) at interest rates below the rate of inflation, expanded very considerably. The ultimate financial resources necessary for this were usually provided, almost automatically, by the Treasury. The overall progression of the loans can be observed in Figure 6. There was a significant growth in agricultural production, with a considerably modest increase in the area of land incorporated. The two periods of decline in production shown in Figure 6 were brought about by different main causes: the fall in production in the late 1970s was mostly the effect of climactic conditions; but that of 1982-83 resulted, to a large extent, from sharp cutbacks in incentives policies imposed by an austerity agreement with the IMF, in a period in which Brazil was at the brink of international insolvency. The result was both a decline of production and of the cultivated area.

Figure 6: Cultivated Area and Production of Grains and Oilseeds 1973 – 1987



Source: Brazil, IBGE, 1990 (Instituto Brasileiro de Geografia e Estatística (IBGE), *Estatísticas Históricas do Brasil, 2ª. edição*, Rio de Janeiro, IBGE). Products included: cotton seed, peanuts, rice, beans, corn (maize), soybeans and wheat. The aggregates of data on area cultivated and production of this group are commonly used as proxies for the state of agricultural production in Brazil. Due to the data difficulty, coffee, sugar cane, oranges and other fruits were not included. Similarly with minor crops of local importance, such as oats and barley.

The 2nd phase saw a considerable diversification of production and of exports; there were gains in productivity, stimulated by the credit and incentives policy but such gains became more significant only at the end of the period, and especially along the 3rd phase.

The diversification in production and trade was one of the effects of policies to stimulate the implementation of agribusiness complexes. During the 1st phase, Brazilian agriculture was notoriously limited to a few unprocessed commodities but this began to change during the 2nd phase.

Table 6 shows that the financial resources drawn by the agricultural credit policy were far from modest. After 1970, the annual value of loans (expressed in US$), increased markedly, reaching almost US$ 16 billion in 1974, and remained above US$ 20 billion in all years of the 1975-82 period (this period's annual average was 23.1 billion US$). Rural credit lines were of basically three classes: credit for operational expenditures such as the purchase of seeds, fertilizers and agrochemicals, of fuel for farm equipment and the hiring of labor (the so called *custeio* credit); investment credit (for the purchase of tractors, combines and other farm equipment, and for farm construction); and credit for the commercial phase of the production cycle (the so called *comercialização* credit). And, within these three classes there were special credit lines for depressed regions, for the opening of land in the agricultural frontier and to stimulate the production of special commodities, among others.

Table 6: Rural credit loans and real rates of interest 1970 - 1982

	Credit (US$ billion)	**Real interest rate (% a. a)**
1970	6.2	-3.9
1971	7.3	-4.0
1972	9.0	-1.5
1973	12.8	-1.4
1974	15.9	-15.1
1975	23.1	-11.5
1976	23.7	-21.9
1977	21.2	-16.7
1978	20.7	-17.7
1979	26.8	-34.4

1980	25.6	-37.7
1981	22.2	-27.0
1982	21.5	-28.7
1983	16.2	-23.4
1984	9.9	-5.1
1985	14.2	-2.3
1986	21.1	-33.3
1987	16.6	7.0

Source: Central Bank of Brazil. Data worked by Goldin & Rezende, 1993, Table 3.1.

The totals in Table 6 seem impressive. It should be noted, however, that as shown by Mata (1982), agriculture was not the only sector of the economy receiving abundant financial subsidized official incentives. Brazil's very high growth rates of the 1968-73 period and in years of the world petroleum crises (1974-80), involved massive use of credit to stimulate industries and large infrastructure projects, including governmental enterprises considered essential for the success of the ISI strategy that prevailed throughout the period (Baer 2008). In fact, the magnitudes of the resources provided for industrial ventures were usually much larger than those channeled into the agricultural incentives policies.

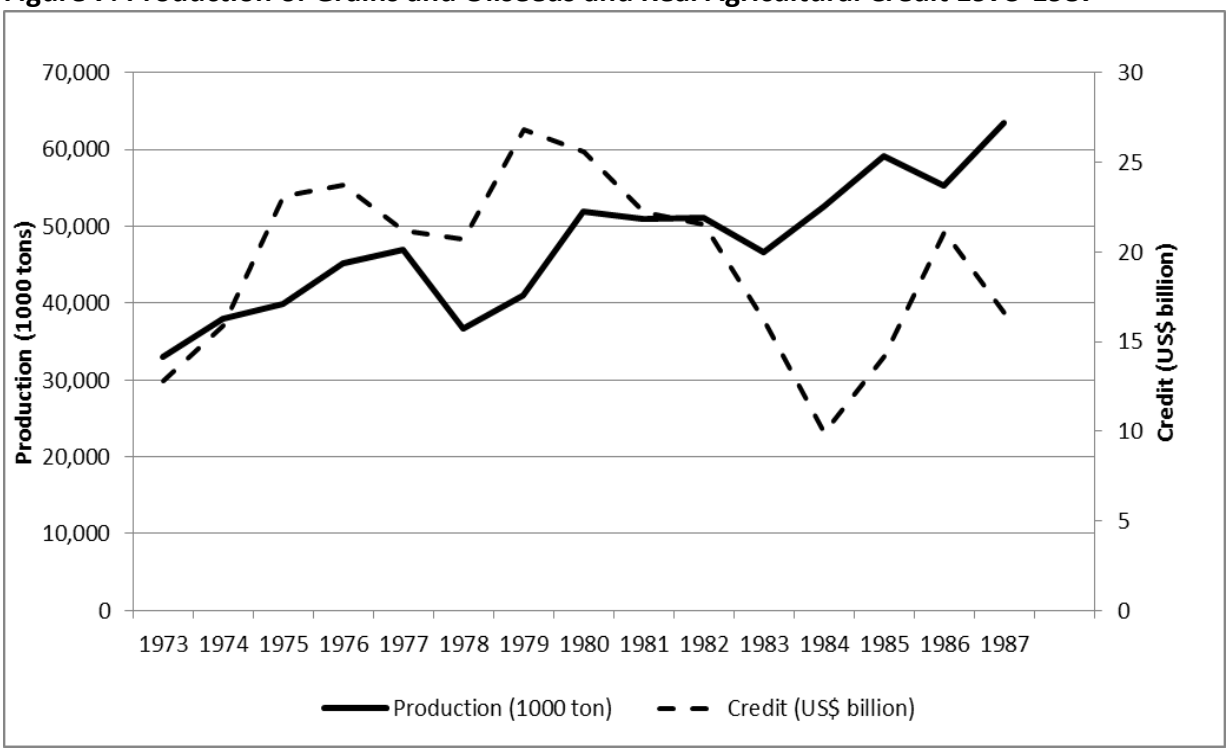
In the period considered in Table 6, the proportions of rural credit allocated to the three broad classes of credit lines fluctuated considerably, with a dominant share of the credit for operational expenditures; but the shares of credit for investment purposes and for the commercial phase were far from negligible. The duration of loans were quite different: the credit for the commercial phase was usually repayable a few months after the harvest (the duration of loans was determined by the characteristics of the commercial stage of each commodity); the loans for operational expenditures usually covered longer periods, depending on the nature of the production cycle; but the repayment horizons of investment credit tended to be very large, reaching, in many cases, 15 years or more.

The duration of loans was important since it established significant portions of the large agricultural subsidies of the 2nd phase. During most of the period they were determined essentially by the effects of the rate of inflation in the transfer of resources to the takers of loans. Until the late 1970s the rates of interest of rural credit loans were fixed, usually at levels considerably below the rates of inflation in the corresponding loan periods. In fact, nobody knew beforehand what the loan subsidies would be, since the rate of inflation tended to vary unpredictably from year to year; and in the 1980s inflation accelerated very substantially. Since in most of the period the rates of interest were substantially lower than the corresponding rate of inflation, the rural credit policy was an important source of rent seeking by those with access to the loans of the NSRC. Over most of the period the amounts due were not indexed to correct for inflation. This assured that the longer the duration of a

loan the less relevant became concerns over the viability of the projects for which the credit was obtained. And even in the late 1970s, when partial indexation was introduced, the subsidies were far from eliminated, as can be seen by the progression of negative interest rates in Table 6. Full indexation was introduced only in the final years of the period.

An important characteristic of the rural credit policy, which rendered it quite convenient, both for influent farmer groups and for the governmental institutions involved in agricultural stimulus was that financial resources for the policy were easily obtained by the creation of means of payment. In the period, most of the rural credit was extended by the *Banco do Brasil* or by other publicly owned banks, and most of the resources for this were made available by the Treasury, with almost no regard to issues of fiscal equilibrium. Banks extending NSRC credit were compensated by the Treasury for the losses in real terms they incurred by the discrepancy of the policy's interest rates and the rate of inflation, and whenever the Treasury needed resources in excess of those available through taxation, there was a lifeline linking the Treasury to the Central Bank, which provided for the needs of the credit policy. Moreover, this was done by executive edict, avoiding the burdens involved in obtaining legislative authorization.

Figure 7: Production of Grains and Oilseeds and Real Agricultural Credit 1973-1987



Sources: Production: IBGE, 1990. Credit: Central Bank of Brazil (see Table 5, and Goldin et. al., 1993, Table 3.1).

As can be observed in Figure 7, in the 1970s the effects of the credit policy on agricultural production were noticeable. The output of grains and oilseeds – a proxy of the country's agricultural performance – initiated in an significant growing trend. As was shown in

Section 2 of this paper, the expansion of production in the 3rd phase was more striking but it was far from irrelevant in the conservative modernization period. We saw that this increase in production took place without a marked expansion in the area planted. Figure 7 also shows that until the early 1980s credit and production followed a similar path, but in the 1983-85 period, as a result of the adoption of a policy of monetary austerity, agricultural credit was often curtailed. Interestingly, production continued to increase, but the main factor in this were the inducements and subsidies of the minimum prices policy (see below).

In the early 1980s the use of the credit policy was curtailed as a result of the monetary restraint then imposed. Real interest rates became positive and incentives of easy credit were replaced – or strongly supplemented – by incentives from the minimum price policy. But the role of agricultural credit on the performance of agriculture during the 1970s is widely recognized, although most experts considered the policy excessive and poorly conducted.[8] It was also criticized for reaching only a relatively small number of previledged large farmers; for its regional concentration in the Center-South of Brazil, disregarding depressed areas such as the Northeast; for focusing mostly on export commodities; for promoting rural unemploynent by liberally financing investment in agricultural equipment; and – perpassing these aspects – by its effects on the concentration of income in rural areas.

Agricultural incentives: the minimum price policy: It is important to stress that financial incentives were considered essential by policy makers – and indeed, by the agricultural policy networkas a whole – along the entire period of the 2nd phase. However, due to a raging and escalating inflation over most of the 1980s pressures for the control of monetary variables by international institutions, notably the IMF was intense. This led to the decline in the use of subsidized official credit to stimulate agriculture in several years of the decade. Nevertheless, it was considered vital to continue extending subsidies to agriculture. But worries created by the effects of an inadequate performance of the sector led to the diversion of incentives policy to instruments that were not readily monitored – mainly to the minimum price policy (Goldin and Rezende (1993), Dias and Amaral (2000) and Rezende (2003b: chapter 1)).

In fact, the minimum price policy was the first broad agricultural policiy institutionalized at the level of the federel government in Brazil. This occurred during WWII; fearing the dire consequences that would result from shortages of domestic agricultural supplies in a world at war – when the importation of food was very difficult – an organization to implement and manage a policy to stimulate production through price incentives was created (Oliveira, 1977). However, the war ended before the institutionalization of the policy was completed and it was rendered superfluous. In the 1950s there were attempts at making the policy operational, but with the absence of a concerted agricultural strategy it was used merely to guard the interests of regional producers and traders of a few commodities (Oliveira and

[8] See, for instance, appraisals in da Mata (1982), Sayad (1984), Goldin and Rezende (1993) and Rezende (2003b).

Albuquerque, 1977). As a result, the initial impact on agricultural development of the policy was almost negligible.

In the 1970s, however, the incentives strategy of the 2nd phase saw a place for a broad minimum price policy; consequently there was an extensive reform of the *Comissão de Financiamento da Produção* (CFP) – the organization in command of the policy. Moreover, significant investments in training and in hiring was undertaken in order to modernize the CFP and at improve its operational capability.

The reform instituted basically two types of instruments. The purchase by the federal government of production not absorbed by the market at established minimum prices (the so called AGF policy: Acquisitions by the Federal Government); and the financing of retentions by farmers, imediately after harvest, of part of their production to avoid seasonably depressed prices (the so called EGF policy: Loans by the Federal Government). The main publicized target of the policy was to prevent long term (the AGF policy) and short term (the EGF policy) volatilities of agricultural prices, contributing to a more efective organization of production and to the devepompent of agriculture.

Conceptually, the AGF policy would set periodically 'equilibrium' prices – based on cost estimates – of the agricultural commodities covered by the policy. In cases of overabundant crops, the federal government would purchase and store the excess supplies at the minimum prices; and in cases of excess demands at the minimum prices, the government would use its stocks or import and sell in markets products, suplementing supply (Oliveira, 1977). This way the long run prices of agricultural products would be kept from significant fluctuations; the cobweb effects would, to a large extent, be avoided. As for the EGF policy, the idea was to avoid considerable short run price fluctuations by providing farmers with credit to allow them to retain part of their production during the harvest period. The policy called for public investment in storage capacity; Brazil had huge defficiencies in this respect, which needed to be overcome for an adequate functioning of the minimum price policy.

A review of the details of the implementation and changes of the minimum price policy along the 2nd phase reveals a baffling maze of alterations and amendments.[9] As a rule, when there was the threat of an inadequate performance of agriculture, abundant resources were made available for the policy's two basic instruments, but in times of acute macroeconomic restrictions, there were usually cuts in the financial resources. But when, in the 1980s, the stabilization guidelines required shrinkages of the credit policy, the minimum price policy became – in a haphazard fashion – the main instrument of agricultural incentives (Mueller, 1988; Rezende, 2003b).

A feature of the implementation of the minimum price policy after its reform in the 1970s was that it soon lost its long run outlook. Factors affecting the financial requirements of the policy, led to a dominance of immediate concerns. Conceptually, in periods of abundant

[9] For a detailed discussion see Goldin and Rezende (1993).

harvest of a commodity, the policy would require the maintenance of its minimum price at fairly high levels to avoid sharp reduction in cultivation in the following harvest period; without the 'right' implementation of the policy the low prices resulting from the copious harvest would discourage planting. But the large expenditures for the purchase of the excess production tended to induce the macroeconomic techno-bureaucracy to successfully press for low minimum prices, discouraging production. And conversely, in a period of deprived harvest of a commodity its price would tend to be unusually high, coming to be seen as inflationary threat; in this case, the macroeconomic techno-bureaucracy would usually press for high minimum prices for the next harvest season, reinforcing instead of avoiding the resulting cobweb effect. As shown by Mueller (1988), in the 1980s the macroeconomic techno-bureaucracy was actually in command of the minimum price policy. CFP's influence in technically managing the policy became clearly subdued and it became considerably distorted.

The minimum prices policy provided incentives to commercial agriculture in the 1980s especially when credit restrictions set in, but this occurred outside the policy's conceptual foundations. Then it came to be regarded as an instrument in the concession of incentives in times of restrictions on the credit policy. This occurred not only with the macroeconomic techno-bureaucracy but also with private components – not only farmers – of the overall agricultural policy network. They were mainly concerned with short term gains gathered by the distorted administration of the policy.

A growing damaging result from the administration of the policy was the formation of large inventories of products together with ensuing logistical problems and the mounting public expenditures with the policy. When this occurred the macroeconomic techno-bureaucracy tended to limit minimum prices, imposing restrictions on the purchase of surpluses. And there were also attempts to dump portions of the surpluses on the market as an instrument to help control inflation. When these events occurred, there were clashes between the macroeconomic techno-bureaucracy and the overall agricultural policy network.

Another unusual turn of events in the administration of minimum price policy was its growing use as an instrument of regional development policy (Rezende, 2003a). By setting up nationally unified – and usually remunerative – minimum prices of commodities, the government stimulated the expansion of agriculture in frontier areas of the *Cerrado* – the large savannas of central Brazil. The tropicalization of soybeans, cotton and corn achieved by the EMBRAPA technical development setup made it possible for the successful cultivation of these crops in the *Cerrado*, previously considered unsuitable for commercial agriculture (Mueller, 2012). The main difficulty for the expansion in cultivation there resulted from high transportation costs brought about by a deficient transportation infrastructure. To overcome this, remunerative minimum prices assured the frontier producers much the same prices as those received by producers located near markets or export channels. Of course, in most of the frontier areas the minimum prices tended to substantially exceed market prices after the deduction of transportation costs so producers

would sell their output to the government through the minimum price policy. Thus, along the 1980s most of the production of the frontier areas became publicly owned and the government had to shield high cost in the transportation and storage of increasing amounts of products which ended up being disposed at considerable losses. But the overall agricultural policy network was increasingly on guard to prevent the dumping of products at low market prices.[10]

By the end of the 1980s the government had realized that the minimum price policy could not be sustained in this fashion and that a deep reform should be undertaken. In fact, a significant reform of the policy was carried out, but only early in the 3rd phase.

In sum, along the 2nd phase there was the creation of important steppingstones for the expansion and modernization of the Brazilian agriculture but the process advanced in an somewhat hectic fashion, with the reliance on incentives policies often announced with base on theoretical principles but carried out far from those principles and at increasing costs. At the end of the period it was clear that these policies could not continue to be applied in this fashion; thus, changes began to be implemented leading to more adequate conditions for the recent agricultural expansion.

7. The Consolidation of a Modern, Dynamic Agricultural Sector in Brazil

As shown in section 2 above, against all odds along the period of the 3rd phase Brazil turned into one of the breadbaskets of the world. Not only did it produce and export significant proportions of several major agricultural commodities, but this was done through highly productive technology and efficient use of inputs and resources. The endemic backwardness and archaic nature of Brazilian agriculture had undergone a remarkable and largely unforeseen transformation. We found it redundant to present again the evidence of this, contained above. Instead this section discusses the main exogenous and endogenous determinant factors of this transformation.

The main exogenous factor was, undoubtedly, the expansion of the international demand for agricultural commodities which led to a long period of quickly growing commodity prices. In contrast to the world crisis ridden 1980s and 1990s, in which the demand for commodities stretched out only slowly, with ups and downs, the situation reversed and there were even episodes of food crises. If at the end of last century Brazilian agriculture had to rely mainly on the growth of the domestic markets, in the more recent period the evolution of world demand provided an important dynamic thrust to its expansion. This situation of mostly favorable markets played undoubtedly an important role in the evolution of the sector but a set of internal events were essential in assuring its performance.

[10] The policy network frequently complained about the pressure on prices of the large inventories.

Three basic constituents of the expansion and modernization of agriculture in Brazil

We saw that, along the 2nd phase significant changes began taking place in three constituents of the **who** category – that of the main agents and institutions affecting the sector. Special emphasis should be given to: a) the formation of an effective broad system of technological development; b) the expansion of an important class of professional, entrepreneurial, farmers; and c) the constitution and expansion of a dynamic agribusiness sector. The joint impact of the evolution of these three constituents of the **who** category had central roles in the development and modernization of Brazilian agriculture, which gathered speed along the 3rd phase.

1) The construction of an overall research system in tropical agriculture

As indicated, early in the 2nd phase the need to raise the productivity and modernize the Brazilian agriculture was prioritized. This was successfully executed and major results began to be felt towards the end of the period. In short, the main characteristics of the technical change system established involved the construction of the physical infrastructure of the system (research facilities built in central parts of the major producing regions or focusing on special themes), the hiring and training high level personnel sorely needed to advance the process, and the establishment of a scheme to coordinate, manage and continuously oversee and improve the system.

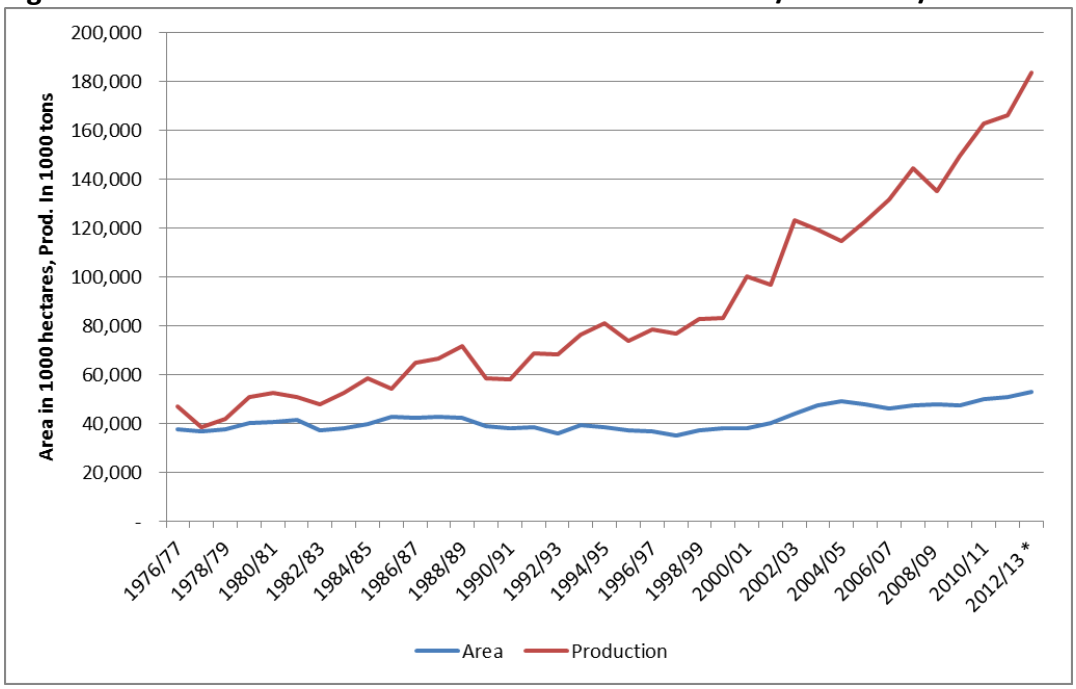
The construction of the research network involved the establishment by the federal government of a public corporation – *the Empresa Brasileira de Pesquisa Agropecuária* (EMBRAPA) to coordinate the process and make it advance. Today EMBRAPA is quite large (see Alves, 2010a; Marhta Jr et al, 2012) but it is far from a centralized, monolithic organization. Having in view the considerable geographical size of Brazil, and the diversity of the country's habitats and social design, EMBRAPA was erected as a decentralized research network, composed of different centers spread throughout the country; there are regional organizations (such as centers for the savannas, humid tropics and dry lands), agricultural product organizations (such as centers for corn (maize), rice and beans, soybeans, beef cattle, and milk), and special thematic centers (such as the centers for genetics and for remote sensing). They were established in different geographical areas, guided by the characteristics of the agricultural research needs and problems. Furthermore, from the beginning EMBRAPA endeavored to acquire the collaboration of universities, of public institutions such as state research organizations, and of organizations of the private sector. And it also conquered the support of international organizations.

Evidently, in spite of the correct configuration of the network, it took some time for it to start to generate significant results. Technical change in the scale sought after is complex and time consuming. New technology on plant varieties, inputs and involving changes in production processes generated results in terms of increases in agricultural productivity, which gained momentum by the end of the 2nd phase, but more complex 'products' such as

the development of plant varieties adapted to the actual conditions of specific regions and of adequate techniques for their cultivation became available more significantly along the 3rd phase. The impressive modernization of the Brazilian agriculture that took place then owes a lot to the technological research efforts carried out from the beginning of the 2nd phase. Technological progress was also fundamental in allowing the spread of commodity production into new areas – such as the *Cerrados* of central Brazil – and allowing more productive uses of degraded lands, such as significant portions of the country's planted pastures.

The main result has been the development of technologies which have led to the very considerable expansion of production of grains and oilseeds in the 3rd. phase, with quite low increases of the areas under cultivation (see Figure 8). Similar gains in productivity reached also other crops and the production of meats (beef, poultry, and pork). However, as a rule the more important advances were intensive in capital (equipment, purchased inputs) benefiting mostly large agricultural undertakings.

Figure 8: Area and Production of Grains and Oilseeds 1976/77 – 2010/11



Source: CONAB. www.conab.gov.br

2) The expansion of a responsive class of entrepreneurial farmers

If the typical agricultural producers of Brazil were the absentee landlords motivated chiefly by political power, as sketched by many in the social sciences during the 1950s (for an interesting critical survey see Castro, 1979), the impacts of the research effort and of the monetary stimuli policies discussed above, would be of almost no consequence as far as the development of agriculture was concerned. However, in the south and southwest of Brazil

and even in areas in which coffee prospered such as parts of the state of São Paulo, there was an important reserve of professional, generally full time farmers, well disposed to innovate; this was vital for the modernization that took place and which accelerated during the 2nd phase. The availability of land in the agricultural frontier or that extensively used, but with high improvement potential under appropriate technology in already occupied lands fairly well served by transport infrastructure, tapped from this reserve. Sons of farmers and former small landowners in the south, and of other parts of Brazil, composed waves of migrants which, responding to the financial incentives lavishly provided by the government in the 2nd phase, purchased land in new agricultural areas. They took advantage of the incentives policies and perceived the potential of some of the new production methods made available by the research network. Moreover, this growing entrepreneurial reserve also started to occupy and cultivate land in the *Cerrado*, the huge savannas of central Brazil. In this they were prompted not only by cheap lands, but by special governmental regional development incentives (Mueller, 2012) and – significantly – by the results of the research effort by the EMBRAPA network destined to create conditions for the productive cultivation of the acid, low natural fertile land in the *Cerrado* (Rezende, 2003). Due to this, by the end of the 1980s the *Cerrado* began to be regarded as an important potential area of expansion of Brazil's modern agriculture. Waves of professional, entrepreneurial farmers were fundamental for this and for the advances of other types of agricultural ventures (in livestock, in forestry, in sugar cane) and in other parts of the country.

3) The constitution and expansion of a dynamic agribusiness sector

The concept of agribusiness began receiving attention in the 1950s prompted by the work of Davis and Goldberg (1957) focusing on the changes in the agriculture in the United States after WWII. For these authors the relevant analytical segment should not be the agricultural sector alone, but also the overall set of economic activities linked more directly to agricultural and livestock production.

Agribusiness involves basically three segments: the enterprises and activities that provide inputs and services to farms, such as fertilizers, agrichemicals, tractors, harvesters, technical assistance and financial services to farms; the agricultural enterprises proper (encompassing family farms, small and large commercial farms, formally constituted enterprises growing crops and/or livestock, producer cooperatives); and enterprises furnishing transportation services, and selling services related to agricultural and livestock producers, processing enterprises such as textile plants (cotton, wool), producers of leather products, of vegetable oils and of margarine, producers of dairy products, meat packing firms, bakeries, and commercial ventures of various types, focused both on domestic and international markets, and the financial services related to these activities.

At the end of the 2nd phase Kageyma et al. (1990) applied the concept in an analysis of the budding modern agribusiness sector in Brazil (they called agribusinesses 'agroindustrial

complexes'). From the standpoint of the more advanced agricultural areas of state of São Paulo and from the south of Brazil, there were clearly striving agribusiness complexes affecting the modernization of the respective agricultural or livestock segments. Indeed, as observed by Mueller (1992), by the end of the period the crops that showed clear and significant rising trends in productivity – cotton (herbal), rice, sugar cane, corn, soybeans and wheat) – were associated with rising agribusinesses complexes. And crops of stagnant productivity – such as tree cotton, peanuts, bananas, beans and manioc) were chiefly produced outside the new modern agribusiness mold. As shown by Montoya and Guilhoto (2000) by the end of the 2nd phase Brazil's agribusiness sector as a whole was already well established and its progress was strongly reflected in the more modern segment of the Brazilian agriculture. By the end of the 1990s it was responsible for nearly a quarter of the country's Gross Domestic Product.

As for the origin of the private enterprises that compose the agribusiness complexes in Brazil, an important role has been played by multinational corporations, particularly in the production of inputs such as farm machinery and agrichemicals, and in the transformation of agricultural commodities; but the sector has seen the rise of domestic conglomerates some of which became multinationals, particularly in the area of meat processing. As for the provision of financing, a central position has been occupied by public banks, mostly of the federal government.

It should be observed that, in the 2nd phase, agribusiness complexes came forward stirred by market conditions and by incentives provided by the import substitution policies of the period, but primarily due to the increasing availability, both of advances of technology for the farms generating agricultural products in these complexes, and of entrepreneurial farmers willing to make use of technologies employing modern inputs, producing crops under special specifications, taking opportunity of the demand or the processing and trade phases of their complexes. The expansion of these three vital constituents of the **who** category has occurred in an intertwined fashion.

A sketch of the changes in incentives policies

We now examine briefly the main changes in the two major incentives policies which had such an important role in the 2nd phase – the rural credit and the minimum price policies. It is worth stressing at the outset that there was no blueprint, no basic plan for the reforms that took place starting in the late 1980s and that proceeded along most of the 3rd phase. A fundamental factor in them was that the federal government endeavored to reduce its burden in terms of the resources required by the policies. We saw that at the end of the 2nd phase the credit and minimum prices policies were becoming unmanageable and, especially, unaffordable; moreover, the 1998 Constitution and other legal and macroeconomic policy edicts curtailed the ability of the federal government to finance policies with the creation of means of payment through the NSAC (National System of Agricultural Credit). But most of

the changes in these two policies took place in an ad hoc, trial and error fashion (Dias and Amaral, 2001; Rezende, 2003b: ch. 5-6).

Inflation-generated credit subsidies were drastically curtailed and not only the public NSAC agricultural credit shrank substantially over most of the period, but it also became directed mostly to small family farmers (Rezende, 2003b, ch.6; Rezende and Kreter, 2007). Commercial agriculture was led to take other forms of financing. There were several forms of non-NSAC loans, such as credit from sellers of inputs and from purchasers of commodities such as trading companies (the latter often purchased agricultural products before a crop was planted) – of course, along the years 2000 this was favored by the often abundant availability of international financing. Additionally innovative instruments were created, such as the *Cédulas de Produto Rural* (CPR) a security devised to attract further non-bank loans.

In the beginning of the 3rd phase the lack of rural financing was clearly limiting agricultural expansion; the 1990-01 harvest, for instance, was one of the worse in the country's recent history; the early 1990s austerity measures were robustly applied. After this many of the above mentioned more flexible sources of financing were put in place and agriculture production resumed a high and increasing course.

Initially, however, investment credit was seen as insufficient. Investment in farm machinery, construction and durable equipment was seen as decisive for the persistent expansion of modern agriculture so that a source of lines of credit was devised. It consisted basically in the transfer of official funds of several origins to the federal investment bank – the *Banco Nacional de Desenvolvimento Econômico e Social* (BNDES) who then administered a system to provide lines of long term credit for agricultural investment (Rezende and Kester, 2007). Long term loans by this system grew rapidly becoming an important factor in the performance of agriculture. These loans were offered at very low (often negative) interest rates but the government subsidized the system by reimbursing the financial institutions involved for their losses. Together with the BNDES the banks in the system were chiefly the *Banco do Brasil* together with other publicly owned banks.

This favored a sharp expansion on investment financing; but it also led to high indebtedness by farmers. In favorable agricultural periods this tends not to be discussed, but when markets are slow and prices low, "debt crises" crop up, with the agricultural policy network pressuring for official measures to transfer the unpaid debt to the government or at least to obtain very favorable terms of payment.

As for the price support policy, there were considerable changes since the late 1980s. One of the government's main concerns regarding this policy was the increasing resources required for purchasing and disposing of agricultural commodities; this in a period of resource restrictions associated with critical macroeconomic constraints. In fact, the concern about a high and escalating inflation led to recurrent dumping of parts of the official stocks of agricultural products in the domestic markets in order to help contain

increases of food prices. In fact, as shown by Dias and Amaral, 2000, there was a lack of connection between the administration of minimum prices and that of official stocks of products accumulated by the policy, generating incongruent effects that increased instead of containing the uncertainty of agricultural producers. At the end of the 1980s a reform was introduced, linking the two. A system of price bands was introduced; the government announced that whenever the price of a product exceeded the ceiling of the band the government would supplement market supplies from its inventories; if the availability of official stock were not enough the importation of the product would be authorized. And in case of excess production of a product pushing its price below the floor of the price band, the reverse was to occur; in order to raise the price the government would purchase part of the production adding it to its inventories. If well executed this policy could be proficient in providing long term signals for economic agents involved in production and trade of agricultural products. In practice, however, frequent ad hoc interventions prevented this from happening. The main problems stemmed from the lack of resources imposed by macroeconomic austerity policies of the late 1980s and early 1990s. The policy became largely unreliability (Dias and Amaral, 2001, p. 235), disrupting the minimum price support scheme.

As shown by Del Bel Filho and Bacha (2005), along the early 1990s the support price policy reverted to the use of its two basic programs: the Acquisition of the Federal Government (AGF), and the Federal Commercialization Loans (EGF) programs; the fiscal burden to the government remained considerable. In 1991 an institutional reform led to the creation of CONAB, an organization in charge of simultaneously carrying out the functions of price support, of administering the official inventories of agricultural products and of managing food security initiatives. After a record high in federal government's inventories in 1995, in 1997 it instituted two new programs, which remain active to the present: the *Prêmio de Escoamento de Produtos* (PEP), and the *Contrato de Opções de Venda de Produtos Agrícolas* (COVPA); the object of both was to streamline the policy while taking the government out of the burden of holding and managing large inventories.

With the PEP program the federal government subsidizes the acquisition by elements of the private sector of parts of the excess production at the minimum price set for a product of, say, a given agricultural region. Producers at this region receive the minimum price but purchasers –traders; processing enterprise in another region – obtain the right to buy the product at the market price. The difference between both prices is paid by the federal government. As for the COVPA program, it is basically a price insurance which can be acquired by the producer of a given commodity. Through this program the farmer assures the sale of his production at a remunerative price, which takes place through the sale by CONAB – at auction – of a document assuring the producer of the remunerative price at a given date. The producer is not obliged to sell his production at the market price In fact, he would do so only if, when the date of the document arrives, the market price is below the

price set in the document. If this occurs, he will be allowed to sell his production to the government (Del Bel Filho and Bacha, 2000).

The new measures calmed down, so to speak, the policy environment of the price support policy. It reduced the need of the federal government acquiring large inventories of surplus agricultural products and reduced the pressure for setting minimum prices at unrealistically low levels, reducing the pressure of the agricultural policy network; but, of course, the network tends to press for unrealistically high minimum prices.

In sum, over the 3rd phase the impressive development and modernization of Brazilian agriculture was the fruition of several initiatives, notably that of technical change and the incentives for the expansion of an advanced agribusiness sector. It was also positively affected by the availability of entrepreneurial farmers and of new or degraded lands in which new technologies and modern inputs could be profitably applied. As for incentives policies, their role in the period declined significantly. They had important impacts in the transition stage of the 2nd phase, but more recently we saw the government struggling to disengage itself from their burdens, transferring to the private sector part of the functions of the price support mechanism, and of the financing of agricultural production. Of course, many distortions still remain, and there are considerable task to be performed – such as large investments in infrastructure – to assure the continuation of the fruitful evolution of the sector, and even to prevent stagnation or regression. To conclude a last observation: much of what occurred had little to do with well-defined plans and strategies of agricultural development. A good deal owes to circumstances and unpredictable turns of events.

8. Conclusions

In section 2 we argued and showed evidence that Brazilian agriculture has undergone an impressive transformation in the last fifty years from low productivity and backwardness to a frontrunner in the production and export of large portfolio of products. This success has led many other countries as well as international agencies to consider what lessons and recommendations the Brazilian experience might have for their own agricultural efforts. In particular the Brazilian case has been suggested as a template for many sub-Sahara African countries given several geographical and economic similarities. In sections 5, 6 and 7 we detailed the evolution of Brazilian agriculture over three distinct phases in which different policies were tried and different results achieved. The transformation proper of Brazilian agriculture into its current modern and dynamic state took place since the early 1990s, but the earlier periods of conservative modernization (early 1970s to early 1990) and the frontier expansion period from World War II to the 1970s, were the path taken to the point where things started to fall into place, and as such are crucial for understanding the determinants of Brazil's current agricultural model. In section 3 we stressed that this path did not take a straight pre-planned course, but rather moved along through trial and error, through many reversals and was full of surprises and unintended consequences. This does

not imply that there are no lessons from the Brazilian case. Clearly the history does confirm the crucial role of technological research, as done by EMBRAPA, to produce knowledge that is adapted to local circumstances. It underlies also that this must be a long-term and continuous endeavor centrally coordinated by the government given the public goods nature of the output it produces. Similarly, the narrative has shown that policies have to be understood in the context of the country's political economy as they necessarily redistribute rents, benefits and costs across myriad social and economic groups that will in turn preemptively and subsequently try to affect those policies. In this sense the Brazilian experience cannot be closely transplanted and emulated. Each country has their own idiosyncratic configuration of power, institutions and local circumstance, so that what worked in Brazil probably will have a very different effect elsewhere. Nevertheless, the Brazilian experience does suggest that agricultural policies work best when they do not try to steer the various related markets too closely following some specific pre-conceived notion of what outcomes are desired. If it is true that this sector defies easy apprehension, as we argued in section 3, then many of these efforts will tend to go astray and in some cases completely backfire, as we have illustrated for Brazil (e.g. with the extreme concentration of production in a very small fraction of all farms). Instead, Brazilian agriculture only really took off once agricultural policy became less interventionist, removing many restrictions, passing on to the private sector many tasks that these could perform better and concentrating on those area where market failures remained, such as research, insurance, coordination, precautionary stocks, etc. This might seem rather obvious advice, but as the Brazilian case has shown, it is a lesson that many governments are reluctant to recognize.

So what lessons might be drawn from the Brazilian agricultural experience from an African perspective? The innovative agricultural technologies for tropical climates and savannahs are the more direct lesson that are already being adapted and adopted to the African context. More generally, the importance of long-term and perpetual investment in country-specific agricultural research and development is advice that emerges from the Brazilian example. Yet, even the success of the EMBRAPA model illustrates one of the main themes of this paper, that is, the convoluted, unpredictable and non-linear evolution of agricultural policy in Brazil. Although EMBRAPA is currently recognized as a central element in Brazil's agricultural strategy, its trajectory up to this point was never guaranteed and preordained, rather subject to many fluctuations and stumbling points. It would be a mistake to think that this was a policy that was devised and implemented with vision and control from the get go.

More generally still, the Brazilian case highlights a fundamental tension that pervades agricultural policy and development, which is certainly also important in the African context. This fundamental tension arises because agricultural in a developing country is always mired in myriad market failures so that there is a constant need for government policy to remove or mitigate those impediments for investment and growth to take place. However, governmental action is contingent on the country's political and institutional context, and in

general that context does not necessarily provide incentives conducive to a thriving agricultural sector. We have shown that in Brazil, since the mid-20th century agricultural policy was always subservient to other priorities, such as industrial policy or the control of inflation. Not only did other governmental priorities distort agricultural policies, but these were also affected by special interests (such as exporters, landowners and landless peasants), as well as by ideologies. Furthermore, we have argued that in addition to these many factors there was never a truly clear understanding of the actual working of the system so that policy was marked by significant mistakes and unintended consequences.

If government intervention is crucial but at the same time cannot be expected to be adequate and effective, this poses a dilemma for a developing country in determining how to set up its agricultural policy. Brazil eventually got it right after many mistakes and misses. It did so not because it suddenly realized what it was doing wrong and what had to be done instead in agriculture, but rather as a consequence of the strong institutions at the general level that it developed since the mid-1990s. These institutions promoted strong presidentialism, which allowed for reform and decisiveness, but crucially this was subject to checks and balance, which assured that this power was used for the greater good. This system delivered monetary stability and more effective governance, both of which created an environment where the government could reduce intervention in agriculture and the private sector felt confident to expand investment and production.

African countries similarly confront this fundamental tension in their agricultural sectors. Governments need to attenuate market failures, but have mixed incentives and competences to do so. Viewing this as an engineering problem that simply requires advice on best practices is clearly not the solution. As in Brazil governments in Africa have their political imperatives which crucially affect what they are willing and able to do in terms of agricultural policy. As in the Brazilian case things will improve only as stronger and more inclusive institutions come to predominate. In many regards this has already started happening, with great improvements having taken place in the past decade as military regimes have given way to civilian governments and more competitive political systems. But although political reform can lead to better policy and less rent-seeking, competitive elections can also induce lower macro-economic restraint and more predation by elites (Bates, 2006; 2007). In this sense a key lesson from the Brazilian experience is central role of the strong set of checks and balances that has evolved in the past decades. By curtailing governmental excesses and opportunism and by forcing government to perform its true functions, these institutional arrangements (independent judiciary, free press, strong civil society, independent public prosecutors, transparency, strong accountability, etc.) have created circumstances where agriculture could thrive. There is no reason why the same cannot happen in Africa.

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