

THE CHANGING STRUCTURE OF THE BRAZILIAN AGRICULTURAL SECTOR AND THE LIMITATIONS OF THE 1995/96 AGRICULTURAL CENSUS¹

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Abstract

This paper questions the conventional wisdom that policy reform and the economic environment of the 1990s led to an exodus out of the agricultural sector in Brazil. This view is based on problematic data from the Agricultural Censuses. We show that the 1995/96 Census is not comparable with the 1985 Census due to a change in the date of information gathering, and is not representative of the mid-1990s because 1996 was an atypical year. Based on the National Household Surveys (PNAD), we estimate a decline in the number of farms that is roughly one third of what the Census reports. We show that total agricultural employment fell about twice as fast as the number of farms, but that the decline was still less than half of what the Census indicates. In contrast to the Census, our analysis points to heterogeneous regional experiences. We conclude that considerable structural adjustment took place within the agricultural sector in this period, but that the Agricultural Censuses have obscured many of the changes.

Key Words: Agricultural Census, Structural Change, Brazilian Agriculture.

¹ This paper was written as part of a larger project on spatial economics called NEMESIS (WWW.NEMESIS.ORG.BR), based at IPEA in Rio de Janeiro. The project has been supported by a grant from the Brazilian government under a program called PRONEX, for which we are thankful. We would also like to thank Eustáquio Reis, Gervásio Castro de Rezende, and Antônio Carlos Simões Florido for helpful suggestions, and Marcos Stefan Mendonça Fazecas for valuable research assistance.

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1. Introduction

The Brazilian agricultural sector began a significant process of structural adjustment in the 1990s. Many authors have relied on the two most recent Agricultural Censuses—1985 and 1995/96—to document the extent of this adjustment process. Two frequently cited statistics point to a decline of nearly one million agricultural establishments, equal to 16% of the 1985 total, and an exodus of more than five million employed people from the sector, a figure that represents 23% of the agricultural workforce in 1985. These statistics confirm what many analysts expected to find, and thus they have been accepted rather uncritically. Slow growth, high inflation, and numerous stabilization plans, it is argued, could have caused many rural establishments to fail. Trade liberalization and a broad reduction in the role of the state could have produced a similar result. As the agricultural sector has become more exposed to international competition, the least efficient farmers could have chosen to abandon the sector in search of employment elsewhere. Simultaneously, the farms that remained could have adopted labor saving technologies in an effort to reduce costs. All of these forces suggest the possibility of a substantial decline in the number of farms and in employment within the sector.

The goal of this paper is to explore the structural changes that have occurred in the agricultural sector, and to highlight important limitations of the Agricultural Censuses for studying this period. We identify two problems that contribute to the appearance of a change in the number of establishments and employment that is more than double what in fact has occurred. These problems also create the appearance that adjustment has been relatively homogenous across regions in Brazil when in fact it has been quite heterogeneous. The first problem relates to a lack of comparability between the 1995/96 and all other recent Agricultural Censuses due to a change in the reference period of the Census and, consequently, in the date of gathering the information. The

second problem results from the fact that 1996 was an atypical year in which agricultural activity was at its lowest point in the decade. Together, these factors imply that a comparison of the Censuses paints an exaggerated picture of the long run trend of change that took place between the mid-1980s and the mid-1990s. As a consequence, the impact of policy reform is overstated.³

The paper is organized as follows. In Section 2 we discuss the problems associated with changing the reference period of the Census, and with 1996 as an atypical year. In Section 3 we devise a methodology based on the annual National Household Surveys (PNAD) to estimate the change in the number of establishments and employment in the agricultural sector between the triennia 1984-86 and 1995-97. The approach permits us to identify the effects of changing the reference period and of 1996 as an atypical year. In Section 4 we apply the methodology to Brazil and to four of the five principal regions of the country. Section 5 provides conclusions.

2. Problems of Comparison Between the 1995/96 and Previous Agricultural Censuses

The *reference period* of the 1970, 1975, 1980, and 1985 Agricultural Censuses for production data was the calendar year (January 1 through December 31). The *reference date* for structural variables such as area, employment, and machinery, was December 31. The reference period of the 1995/96 Census, in contrast, was the agricultural year (August 1, 1995 through July 31, 1996), and the

³ We are aware of three other papers that have explored the problems with the 1995/96 Agricultural Census. Vicente (1998) compares the Census to other sources for area harvested in the state of São Paulo alone. Hoffmann and Graziano da Silva (1999) compare the 1995/96 Census to the previous three Censuses. Helfand and Brunstein (2000) analyze the consistency between the 1975, 1980, 1985, and 1995/96 Censuses and the IBGE source *Produção Agrícola Municipal* (PAM) for area and production of 12 crops in 13 states.

reference date remained December 31 for most variables.⁴ One of the reasons for changing the reference period was that previous Censuses provided information about planting and harvesting that were not from the same agricultural cycle. The data in the 1985 Census, for example, referred to the temporary crops that were harvested in 1985—most of which had been planted in 1984—and those that were planted in 1985, yet would only be harvested in 1986. For economic analysis of the sector, this lack of correspondence presents substantial obstacles.

An important consequence of changing the reference period was that the period for gathering the data was altered as well. Rather than collect the data early in the calendar year that followed the reference period, as had been done for the 1970, 1975, 1980, and 1985 Censuses, the gathering of data for the 1995/96 Census began in August of 1996. We believe that counting the number of establishments in August and September—the period after most temporary crops have been harvested, but before they have been planted for the following year—is likely to lead to a substantially smaller number than if the enumeration were to have taken place between January and May, the period after the planting of most crops has taken place but before the harvest is complete.⁵ In short, a snapshot of the sector taken in the off-season is different than a snapshot taken while the crops are still in the fields. An introductory chapter of the 1995/96 Census provides an explanation for the difference:

“...many establishments are of a precarious nature, and are easily identifiable only in the period between the planting and the harvest. In the off-season, many times there are few vestiges of the agricultural

⁴ The reference date for some variables, such as the number of animals and trees, was changed to July 31, 1996. This does not affect the findings of this paper.

⁵ Data provided to us by IBGE reveal that the 1985 Census was gathered almost entirely during the 1986 harvest season, March-May. The 1995/96 Census, in contrast, had about 60% of the data gathered in August and September, with the remainder collected largely in October and November.

activity that took place on the land during the previous harvest, and frequently the person in charge of production cannot be found...”⁶

Due to the date change, a comparison of the 1995/96 Census with the 1985 Census may be misleading. The 1995/96 data should have a downward bias for the number of establishments—relative to what would have been enumerated during the harvest period—and the downward bias is likely to extend in varying degrees to all of the data in the Census. We present evidence below that suggests that the difference between counting the number of agricultural establishments in the off-season, versus during the harvest, is in the neighborhood of 5%-8%. The downward bias should be largest for those producers least likely to be present in the off-season. Thus, we would expect the bias to be larger for the producers of temporary crops in comparison with permanent crops and animals; for renters, sharecroppers, and people without title in comparison with owners; and for small producers in comparison with large producers.

A second problem with a comparison of any two Censuses is that there is always the risk that one of them may be conducted in an atypical year. Unfortunately, this is precisely what occurred in 1995/96. This does not imply that the data that were collected in 1995/96 provide an incorrect description of the reality of the moment when they were gathered. It does mean, however, that the 1995/96 Census may not be very representative of the environment of the mid-1990s. As a result, a comparison of the 1985 and 1995/96 Censuses may not provide a very accurate indication of the long trends in the sector.

Data from the National Household Surveys (PNAD) and from Municipal Agricultural Production (PAM), the official annual source of information on area planted and harvested, provide two indicators of

⁶ IBGE (1998), p.36. We are responsible for all translations in this paper.

the unusually low economic activity in the agricultural sector in 1996. In the following Section we explain how we calculate the “number of establishments” based on the employment data in PNAD. For our purposes here, it is sufficient to report that the number of establishments in Brazil (excluding the North) fell by 7.9% in 1996, and then rose by 5.1% in 1997. Between 1981 and 1999, only in 1981 and 1983 was the number of establishments lower than in 1996. The PAM data on area planted and harvested support the PNAD data on agricultural establishments. Both area planted and harvested fell by more than 10% in 1996 relative to 1995, and both increased by around 4% in 1997. The 1996 values for area planted and harvested were the lowest in the decade.⁷

3. Methodology and Description of the Data

We use the employment data in PNAD⁸ to construct two variables that are comparable to what the Census defines as the “number of establishments” and “total employment.” In spite of the many differences in the methodologies of the Census and PNAD, and in the definitions of our variables, we demonstrate below that the levels of the variables are amazingly similar when the data are gathered at the same time of year, as was the case in 1996. When the Census and PNAD data are gathered at different periods in a year, as with the 1980 and 1985 Censuses, the levels of the variables are quite different.

In order to isolate the effects of changing the date of gathering the Census data, and of an atypical census year, we conduct two

⁷ The PAM data were downloaded from the IBGE homepage in October, 2000.

⁸ The National Household Survey (PNAD) was first conducted in 1967. PNAD has taken place annually since 1971, with the exception of 1970, 1980, and 1991, when Demographic Censuses were conducted, and 1994 for exceptional reasons. The rural areas of the Center-West and North were not surveyed in the 1970s. Since 1981, the rural areas of the Center-West have been included. In 1996, approximately 105 thousand households were surveyed. See IBGE (1997) for details. The 1980-90 data were obtained from the published annual PNAD volumes. The 1992-99 data were downloaded from the IBGE homepage at the national and regional levels.

counterfactual experiments. The first seeks to answer the question: what would have happened to the number of establishments and total employment if the date of gathering the information had not been changed? The second seeks to answer the question: what would have happened to the number of establishments and total employment if 1996 had not been an atypical year? The effect due to the change in date is calculated as the difference between the absolute change in the census for a given variable and what the absolute change in the census would have been if it were to have followed the percentage change in PNAD between 1985 and 1996. This calculation takes advantage of the fact that there was no change of date that affected the evolution of PNAD. Thus, the “date effect” is calculated as

$$\text{Date Effect}^i = (X_{C,96}^i - X_{C,85}^i) - [(X_{P,96}^i - X_{P,85}^i) / X_{P,85}^i] X_{C,85}^i$$

where i = number of establishments or total employment, C = Census data, and P = PNAD data.

The effect due to an atypical year is calculated as the difference between the census evolution if it were to have followed the PNAD 1985-96 percentage change, and the census evolution if it were to have followed the PNAD percentage change between the three-year averages (1984-86) and (1995-97). Thus, the “atypical year effect” is

$$\text{Atypical Year Effect}^i = [(X_{P,96}^i - X_{P,85}^i) / X_{P,85}^i] X_{C,85}^i - \left\{ (X_{P,95}^i + X_{P,96}^i + X_{P,97}^i) - (X_{P,84}^i + X_{P,85}^i + X_{P,86}^i) \right\} / (X_{P,84}^i + X_{P,85}^i + X_{P,86}^i) X_{C,85}^i$$

The evolution of PNAD between (1984-86) and (1995-97) provides information about the long-run trend in the number of establishments or total employment between the mid-1980s and the mid-1990s. To the extent that 1985 or 1996 were unusual years, the percentage change based on only these two years would diverge from the percentage based on the three-year averages. Finally, we estimate the change in the number of establishments and total employment between the mid-1980s and the mid-1990s by using the levels of these variables from the 1985 Census and the percentage changes from the

three-year average PNAD data. In our view, this provides a reasonable estimate of the long run evolution of the sector. We now discuss how we define establishments and employment based on the Census and PNAD data.

The Census (IBGE, 1998) defines an agricultural establishment as an area where a) the production of agricultural goods takes place, and b) the production process is subordinated to a single administration. The second point is key. If a landowner administers the operations of numerous sharecroppers and renters on his property, as if they constituted a single farm, then the Census would identify a single establishment with various types of labor. If however, the sharecroppers, renters, or occupants administer their own agricultural production, then they are considered to be separate establishments. An establishment can have more than one piece of land as long as the plots are operated as a single unit—utilizing the same machines, people, and management—and are located within a single census tract.⁹

Based on PNAD employment data, we define a variable comparable to what the Census calls an agricultural establishment. It includes the number of people (10 years or older) who are employed in the agricultural sector during the reference period and who are classified as “employers” or “self-employed.” These are the employment categories that would be chosen by a person in charge of an agricultural establishment as determined by the Census. The main difference with the two definitions is likely to relate to the reference periods.¹⁰ The reference period for PNAD is a single week at the end of September. This is still the period before most of the planting of temporary crops takes place in Brazil. Therefore, it is likely to lead to a lower level of employment than if the reference week were in the planting or harvest

⁹ The requirement that plots be located within the same census tract is imposed in order to simplify the process of gathering the data. This is likely to inflate the number of establishments that would be determined based solely on the other criteria.

¹⁰ There are other (quantitatively less important) pitfalls with PNAD that relate to the classification of people with more than one type of employment. See Campanhola and Graziano da Silva (2000).

seasons. The Census, in contrast, seeks to count the number of establishments that have any sort of agricultural production at any point during the reference year. Even though the Census should theoretically identify a larger number of establishments than PNAD, in practice the Census only counts the establishments that it finds at the time when the data are gathered. Enumeration of the Census during the harvest is likely to lead to a larger difference with PNAD than enumeration of the Census at the same time of year as PNAD.

Based on the information provided by the agricultural establishments, the Census reports the total number of people employed in the agricultural sector. In 1996, the person responsible for the establishment and his or her unpaid family members accounted for 76% of the agricultural workforce. The Census data on employment includes people of all ages. 86% of the labor force was over 14 years of age in 1996.

In contrast to the Census, PNAD reports data on employment (for people 10 years and older) that come from household interviews. The definition of “work” that PNAD uses was broadened considerably in 1992 in a way that does not affect our calculation of establishments, but does influence total employment. Prior to 1992, PNAD defined work as “a) economic activity remunerated with money, merchandise, products, or solely benefits (housing, food, clothing, etc.); and b) unremunerated economic activity that is normally exercised at least 15 hours per week in the assistance of a household member who is economically active, in the assistance of a religious institution, charity, or cooperative, or as an apprentice. People who work to produce exclusively for their own consumption are not considered employed.”¹¹ As of 1992, IBGE broadened the definition of work used by PNAD in a number of ways. There were two specific changes that are relevant to our study. First, the fifteen-hour threshold for unremunerated work

¹¹ The quote is from IBGE (1989) as reproduced in Campanhola and Graziano da Silva (2000, p. 164). Our discussion of the methodological changes in PNAD closely follows the “Anexo-Notas Metodológicas” in Campanhola and Graziano da Silva (2000).

was lowered to one hour. Second, the people who worked exclusively for their own consumption, or to build their own homes, began to be considered employed as long as they engaged in at least one hour of this work per week.

The change in the definition of work that PNAD uses has both positive and negative implications for our study. On the one hand, the new definition is more like the definition used by the Census. The Census, for example, never had a 15-hour threshold in order for unremunerated household labor to be considered employed. Thus, the total employment data from PNAD and the Census should be much more similar in 1996 than in 1985. On the other hand, the definitional change implies that PNAD employment data prior to 1992 are not directly comparable with the data from 1992-99. To deal with this problem, we construct a "restricted" series for total employment that maintains the definition of work that was used prior to 1992.¹² Thus, from 1992 onward, we remove those people who worked to produce only for their own consumption or to build their own homes, and we remove the unremunerated people who worked less than 15 hours per week. In 1992, of a total of 18.5 million people employed in the sector, these two groups represented 3.2 million and 326 thousand people respectively.

In addition to changing the definition of work, the PNAD questionnaire was changed in 1992 in order to do a better job at capturing those people who did some type of work in the reference week, even if for only one hour, but were not easily identified as having been employed through their answer to the simple question used in the past: "what did you do in the reference week?"¹³ The added questions might have a small impact on our calculation of the number of establishments and do appear to affect the evolution of total employment even after we restrict the 1992-99 data to have the same definition of

¹² We follow the general approach described in Campanhola and Graziano da Silva (2000).

¹³ See Graziano da Silva and Grossi (1997, p. 259) for a discussion of the changes to the questionnaire.

work as in the 1980s. We conduct an additional experiment to test the sensitivity of our results to these changes in the questionnaire, and to ensure that our conclusions are robust. The test is explained below.

4. Empirical Analysis

4.1 An Assessment of the Reliability of the PNAD Data

The first row of Tables 1 and 2 provides a comparison of the 1996 Census and PNAD data for four of the five principal regions in the country, and for Brazil without the Northern region. For simplicity, we refer to “Brazil” throughout the remainder of the paper, even though the North is excluded.¹⁴ At the national level, the Census and the unrestricted PNAD data provide extremely similar information. Table 1 shows that the number of establishments based on PNAD (4.554 million) was 2.1% larger than what the Census reported (4.459 million). Similarly, Table 2 shows that total employment in the agricultural sector was only 0.7% larger according to PNAD (16.363 versus 16.247 million). Differences of this magnitude are not large enough to alter any of the conclusions of our empirical analysis and reflect a high degree of consistency between the two sources in 1996.

As should be expected, differences at the regional level were larger and exhibited considerable variation. In all but one case, the discrepancies were smaller than 8% and were not large enough to alter the conclusions of our empirical analysis. The one exception was total employment in the Southeast, where PNAD was 13.9% larger than the Census. Additional research is required to explore whether seasonal patterns of planting, harvesting, and labor demand that are specific to

¹⁴ According to the 1995/96 Census, the four regions of the country that we analyze contained approximately 90% of the establishments in Brazil. For consistency, we add the Northern state of Tocantins (TO) to the Center-West and to the Brazil total in the 1990s because it belonged to the Center-Western state of Goiás in the 1980s. TO is the only state in the North for which PNAD gathers rural data.

the Southeast, where most of Brazil's coffee, oranges, and sugarcane are grown, could explain this difference.

In addition to the consistency of the Census and PNAD data in 1996, the PNAD data inspire confidence as a result of their behavior over time. Figure 1, for example, shows the number of establishments in Brazil between 1984 and 1999 from PNAD and from the Census for 1985 and 1996. PNAD data reveal a fairly smooth process of evolution over time. The two biggest exceptions are 1987 and 1996, when the number of establishments fell by 7.5% and 7.9% respectively. These two years can be explained by clearly identifiable phenomena. In 1987 there was extremely poor weather in the Northeast of Brazil. The combined production of corn, rice, beans, and cotton fell by roughly 60% in that region. The decline of 278 thousand establishments in the Northeast explains 74% of the decline in Brazil in that year. The reduction in establishments in 1996 reflects the 10% contraction in area planted and harvested that affected, to varying degrees, nearly every region of the country. While the time series for the number of establishments are different for each region, in all cases PNAD data appear to paint a very consistent picture over time. PNAD employment data also appear quite consistent over time, with the possible exception of the upward shift in the series as of 1992. We attempt to control for this in our sensitivity analysis below.

4.2 The Estimated Change in the Number of Establishments and Total Employment: Brazil

The first two columns of Table 1 show the results of our two counterfactual experiments for the number of establishments at the level of Brazil. Item 3 in Table 1 shows that the number of establishments fell by 16% according to the 1985 and 1995/96 Censuses, but by only 9.1% according to the 1985 and 1996 PNAD data. The 6.9% difference between Census and PNAD data, or -365 thousand

establishments, is shown as the date effect in Item 5 of the Table. It represents the additional decline in the number of establishments that resulted from having gathered the data beginning in August, rather than during the harvest. The 6.9% date effect is of the same order of magnitude that we observe by comparing the 1980 and 1985 Censuses with their respective PNADs. The difference between the 1980 Census, gathered in early 1981, and the September 1981 PNAD, was 6.6%. Similarly, the difference between the 1985 Census and the 1986 PNAD was 5.2%. The 1996 date effect might be slightly larger because the majority of the Census data were gathered even earlier than the PNAD data in 1996.

The atypical year effect is shown in Item 5 as -220 thousand establishments. This reflects the fact that PNAD only fell by 4.9% between (1984-86) and (1995-97), rather than by the 9.1% that it fell between 1985 and 1996. The combined effect of the date change and of the atypical year is shown in Item 5 as -584 thousand establishments. This represents 69% of the establishments that the Census identifies as having disappeared between 1985 and 1996.

Based on the 4.9% fall that PNAD measures, we estimate a decline of 262 thousand establishments between the mid-1980s and the mid-1990s (Item 6). We provide an alternative estimate in order to check the robustness of our results to the changes in the PNAD methodology and questionnaire in 1992. Although we believe that these changes had more of an effect on total employment than on the number of establishments, we provide the alternative estimate in both cases. Figure 1 shows that the number of establishments rose by 0.7% in 1992 relative to 1990. This is not inconsistent with the data on area planted and harvested in 1992, which were both almost identical to 1990. Nevertheless, our alternative estimate is constructed under the assumption that the observed increase in the number of establishments did not in fact take place and was entirely due to the changes in the PNAD questionnaire. Thus, we regenerate the series for the 1990s by

forcing 1992 to be equal to 1990, and then imposing the evolution (in percentage terms) from the original series on the new 1992 level. The estimated change in establishments, -296 thousand, is shown in Item 6 of Table 1 as “scenario 2.” It is virtually the same as our first estimate. Thus, we conclude based on PNAD that the decline in the number of establishments between the mid-1980s and the mid-1990s was about one third of what the Census reports. Approximately two thirds of the apparent decline was due to the change in the date of gathering the information for the Census and the peculiarities of 1996.

Table 2 and Figure 2 show that the conclusions are similar for total employment at the level of Brazil. The Figure shows the restricted PNAD data, which has a consistent definition over time and is what we use in our calculations, as well as the unrestricted PNAD data for purposes of comparison. Item 3 of Table 2 indicates a 23.2% decline in employment between 1985 and 1996 according to the Census, whereas PNAD only registers a 12.2% drop. When the three-year averages are considered, the fall in employment according to PNAD is reduced to 7.6%. This leads to an estimated long-run decline in employment of about 1.6 million people. Item 5 shows that the combined effect of the date change (-2.3 million) and the atypical year (-983 thousand) accounts for 67% of the 4.9 million decline that the Census reports. In percentage terms, this is almost identical to what we found for establishments.

We again estimated a second long-run scenario by considering the change that would have occurred if employment were identical in 1990 and 1992. This is a more important experiment for employment because the change in the PNAD questionnaire in 1992 is likely to have had a bigger impact on total employment than on the employers and self-employed that underlie our definition of establishments. As Figure 2 illustrates, employment in the agricultural sector apparently increased by 5.1% between 1990 and 1992, even though there was no clear economic reason for this to have happened. Our new estimate

of the fall in employment (2.55 million) is considerably larger than the first estimate, but it does not alter any of the qualitative results. We conclude that total agricultural sector employment fell by somewhere between 1.60 and 2.55 million people. This only represents between 33% and 52% of what the Census reports.

4.3 The Estimated Change in the Number of Establishments and Total Employment: Regions

Tables 1 and 2 also show the decompositions at a regional level. According to the Census, the number of establishments fell between 15% to 17% in the Northeast, Southeast, and South, yet by only 8.7% in the Center-West. Similarly, employment fell by 21% to 28% in the first three regions, and by a slightly smaller amount in the Center-West. PNAD, in contrast, portrays a much more heterogeneous picture.

The Northeast is the region where the two sources of data exhibit the largest discrepancy. Item 3 of Table 1 shows that PNAD only records a 4% decline in establishments between 1985 and 1996, and a 1.4% *increase* when one considers the three-year averages from the mid-1980s and mid-1990s. Table 2 shows a similar pattern for employment, with essentially no change between the mid-1980s and mid-1990s. As a consequence, our decompositions indicate that the entire change in establishments (-16.9%) and employment (-21.4%) reported by the Census was due to the date and year effects. This is a very strong conclusion that should be viewed with caution. It suggests the need for additional research on the Northeast.

The annual PNAD data reveal that there was a large upward shift in both series in 1992. While it is possible that these increases did in fact occur as a reflection of the modest growth in total area planted and harvested that took place between 1990 and 1992, we nevertheless conducted the experiment of assuming that there was no change in the

number of establishments and employment in these two years. Item 6 of Tables 1 and 2 show that this scenario yielded a decline of 143 thousand establishments and 835 thousand people employed, or 30% and 37% (respectively) of the contractions reported by the Census. Thus, even with this scenario, roughly two-thirds of the decline reported by the Census does not appear to have taken place.

This conclusion seems plausible to us for three reasons. First, 1996 was clearly an atypical year in the Northeast. PNAD registered an 8.6% decline in the number of establishments that was fully reversed in 1997. Second, it is likely that the date effect was stronger in the Northeast than in the other regions because there are a much higher proportion of small farms and of non-owner operated farms. Both of these groups are less likely to be present in the off-season. Establishments between one and ten hectares in 1985, for example, accounted for 70% of the total in the Northeast, while they did not exceed 42% in any of the other three regions. Similarly, the establishments that were operated by non-owners—including renters, sharecroppers, and people without title (*ocupantes*)—accounted for 44% of the establishments in the Northeast in 1985. In the other three regions the non-owners were always less than 28%. A final set of reasons why persistence, rather than exodus, of farms is plausible relates to the fact that farmers in this region are likely to have been sheltered from many of the negative consequences of policy reform in the 1990s. High transactions costs due to large distances and poor infrastructure lead to large price bands that insulate farmers from movements in market prices. In addition, many small farm households are net buyers of food and would have benefited from the falling prices of the 1990s, rather than being hurt by them. Finally, many small farms rely on a portfolio of income sources, including agricultural and non-agricultural wage labor. Multiple sources of income can reduce the importance of agricultural income for the rural poor, and can be another force leading to persistence rather than exodus.

In contrast to the Northeast, the South is the region where the Census and PNAD exhibit the highest degree of consistency. Item 5 of Tables 1 and 2 show that the combined date and year effect is less than 15% (in absolute value) for both establishments and employment in this region. Furthermore, a Wald test for the equality of the growth rate implied by the Census, and obtained from a log-linear regression of the PNAD data against time in the 1984-97 period, could not be rejected for either establishments or employment (see Item 4). Thus, we cannot reject the hypothesis that both sources of information are conveying the same rate of decline.¹⁵

We can identify two factors that contributed to reducing the discrepancy between the Census and PNAD in the South. On the one hand, data on area planted and harvested show little difference between 1995, 1996, and 1997, thus eliminating the year effect. On the other hand, there are several features about the South that should have facilitated finding people to gather information from—even in the off-season—and minimized the date effect. According to the 1985 Census, the South is the region with the highest percentage of farmers who live in residence on the establishment. 76% of the producers in the South lived on the farm, while only 58% in the Southeast and 63% in the Center-West did the same. There was only a small difference with the Northeast, but as mentioned above, a much higher percentage of establishments in the South were owner operated. The view that there is little date effect in the South is supported by the fact that there was also little difference between the Census and PNAD in 1980 and 1985, even though they were gathered at different times of the year.

Item 6 of Tables 1 and 2 shows that the policy reforms of the 1990s, including the elimination of subsidies, trade liberalization, and the formation of MERCOSUL, had a powerful impact on the South.

¹⁵ Because the number of establishments and employment were both lower in 1992 than in 1990, the sensitivity test that we conducted for the other regions was not applicable.

Approximately two hundred thousand establishments and one million people left the agricultural sector in the South in this period. The annual PNAD data reveal that the process began early in the decade, with the number of establishments and total employment beginning to fall as early as 1992.

The experience of the Southeast lies somewhere between that of the South and the Northeast. Like in the South, the impact of policy reform in the 1990s on the Southeast has been substantial. Yet like the Northeast, there are important differences between the Census and PNAD. Table 1 shows that the Census reports a 15.3% decline in the number of establishments. The long run PNAD estimate is only 4.2%, or 41 thousand establishments. This leads to a combined date and year effect of 73%, which only falls to 65% under the second scenario. The discrepancy with the employment data is smaller, and the correction in the second scenario makes more of a difference. Our first estimate of the long run fall in employment, 662 thousand people, is almost exactly half of what the Census indicates. In the second scenario, our estimate rises to 877 thousand, and the combined date and year effect falls to a third. Our results suggest that employment has been falling much faster than the number of establishments in the Southeast. This is likely to be a reflection of two forces: the persistence of small farms, and the transformation of larger farms which have been adopting labor saving technologies (such as mechanical sugar-cane harvesting) and switching out of labor-intensive crops (such as cotton).

In contrast to the other three regions, the Center-West is the one region where a comparison between the Census and PNAD leads to very different conclusions for establishments and employment. As in the South, the Wald test fails to find any statistically significant difference in the growth rates of establishments (Item 4, Table 1). Both sources point to a long run decline of around 9%, or 28 thousand establishments. In spite of this consistency, Table 2 shows that the Census registers an 18.4% fall in employment in the Center-West, while PNAD points to

an 11.6% rise. Much of the increase is due to the shift up in 1992 when PNAD changed its questionnaire, and the entire increase is erased under the assumptions of our second scenario (see Item 6, Table 2). Nevertheless, there is still a substantial gap between a reduction in employment of 274 thousand according to the Census and of 7 thousand based on our second estimate. Two comments are warranted. First, the Center-West was the most dynamic agricultural region of the country in the 1990s (Helfand and Rezende, 1999 and 2001), and it is certainly plausible that employment has remained steady. Second, the data on employment from the two sources might diverge because the Census obtains this information from the employer (establishment), whereas PNAD obtains it from the employee (household). Since a much higher percentage of the agricultural labor force in the Center-West (and Southeast) is made up of hired labor, this could explain a larger discrepancy in these two regions. According to the 1985 Census, for example, 35% of the labor force in these two regions was hired labor, compared to only 17% in the Northeast and South.

5. Conclusions

The purpose of this paper was to question the conventional wisdom that policy reform and the economic environment of the 1980s and 1990s have led to a massive exodus out of the agricultural sector in Brazil. This conventional wisdom is based on data from the Agricultural Censuses of 1985 and 1995/96. We argued that the 1995/96 Census was not comparable with the 1985 Census due to a change in the date of gathering the information, and was not representative of the mid-1990s due to the fact that 1996 was an atypical year with unusually low economic activity in the sector. The combination of these two forces has led to the appearance of a change that is more than double what has actually occurred.

Based on an analysis of the data in the annual National

Household Surveys (PNAD), we estimated the decline in the number of establishments in the Brazilian agricultural sector to be in the neighborhood of 5% between the mid-1980s and the mid-1990s. According to PNAD data, the decline was only one third of what the Census reported. The fall in the number of establishments in the sector appears to have partially reversed the 12% increase that was recorded between the 1980 and 1985 Censuses. It is not clear, however, if the contraction has continued; though, the number of establishments held relatively stable between 1997 and 1999.

Our analysis showed that total employment in the agricultural sector fell about twice as fast as the number of establishments. Depending on the assumptions adopted, we estimated a contraction of somewhere between 7% and 12% between the mid-1980s and mid-1990s. But, again, this was only between one third and one half of what the Census reported.

At a regional level, the Census portrays a relatively homogenous process of contraction across regions. We believe that the distortions in the Census serve to disguise the underlying spatial heterogeneity of the adjustment process in the 1990s. Our analysis, in contrast, points to highly differentiated regional experiences. At one extreme, the South has suffered from a loss of subsidies and from intense import competition that resulted from trade liberalization and the formation of MERCOSUL. As a result, the number of establishments and employment both contracted by around 20%. At the other extreme, the number of establishments and employment in the Northeast appear to have been affected the least by the policy reforms and economic environment of this period. This conclusion contradicts the information in the Census, but seems plausible for a number of reasons. In addition to evidence that the date change and atypical year effects were especially large in the Northeast, this region continued to be partially sheltered from competition due to the high transactions costs that result from distance and poor infrastructure. The Southeast was an intermediate case. It

exhibited considerable adjustment in employment, but much less change in the number of establishments. This suggests that small farms might be surviving, at the same time as large farms are modernizing and shifting out of the production of labor-intensive crops. The Center-West, in contrast, shows no signs of a contraction in employment in spite of a fall in the number of establishments. As a dynamic agricultural region, this is consistent with the expansion of output based on rising farm size and hired labor.

In conclusion, there is evidence that the new policy environment of the 1990s has led to considerable structural adjustment within the Brazilian agricultural sector, and that this process has been quite heterogeneous across regions. Unfortunately, the 1995/96 Agricultural Census has obscured many of these changes.

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Table 1
Estimated Change in the Number of Agricultural Establishments (North Excluded):
Census (1985 - 95/96) and PNAD (1984/86 - 1995/97)

	Brazil (without North) ¹		Northeast		Southeast		South		Center-West ¹	
	Census (thousands, %)	PNAD	Census (thousands, %)	PNAD	Census (thousands, %)	PNAD	Census (thousands, %)	PNAD	Census (thousands, %)	PNAD
1. 1996 data	4.459	4.554	2.326	2.480	842	847	1.003	931	287	297
2. Absolute change										
1985 - 1996	-847	-455	-472	-104	-152	-14	-195	-275	-27	-62
(1984-86) - (1995-97)		-248		36		-37		-215		-32
3. Percentage change										
1985 - 1996	-16,0%	-9,1%	-16,9%	-4,0%	-15,3%	-1,7%	-16,3%	-22,8%	-8,7%	-17,4%
(1984-86) - (1995-97)		-4,9%		1,4%		-4,2%		-18,5%		-9,1%
4. Test of equality of growth rates ² (p-value)	Reject 0.00		Reject 0.00		Reject 0.00		Fail to reject 0,35		Fail to reject 0,75	
5. Decomposition of the change in the number of establishments										
Date effect	-365		-359		-136		78		27	
Atypical year effect	-220		-152		25		-52		-26	
Combined effect	-584		-511		-111		26		1	
Combined effect (%)	-69%		-108%		-73%		13%		4%	
6. Estimated Change (1984-86) - (1995-97)	-262		39		-41		-221		-28	
Scenario 2	-296		-143		-54		-		-	

Notes: See text for a detailed explanation of this Table.

1. The North, with the exception of Tocantins (TO), is excluded because PNAD does not gather data in the rural areas of that region. Tocantins was part of Goiás in the Center-West until the 1988 Constitution.

We have added TO to the Center-West, and to the Brazil total, in the 1990s to maintain consistency with the 1980s.

2. This is a Wald test for the equality of the implied growth rate from the Census data and a coefficient obtained from a log-linear regression of the 1984-97 PNAD data against time.

Table 2
Estimated Change in Agricultural Employment (North Excluded):
Census (1985 - 95/96) and PNAD (1984/86 - 1995/97)

	Brazil (without North) ¹		Northeast		Southeast		South		Center-West ¹	
	Census (thousands, %)	PNAD ²	Census (thousands, %)	PNAD ²	Census (thousands, %)	PNAD ²	Census (thousands, %)	PNAD ²	Census (thousands, %)	PNAD ²
1. 1996 unrestricted data ²	16.247	16.363	8.211	7.797	3.441	3.998	3.383	3.250	1.212	1.317
2. Absolute change										
1985 - 1996	-4.909	-1.846	-2.231	-491	-1.297	-520	-1.107	-876	-274	42
(1984-86) - (1995-97)		-1.116		27		-524		-728		109
3. Percentage change										
1985 - 1996	-23,2%	-12,2%	-21,4%	-7,2%	-27,4%	-13,7%	-24,7%	-24,7%	-18,4%	4,3%
(1984-86) - (1995-97)		-7,6%		0,4%		-14,0%		-21,3%		11,6%
4. Test of equality of growth rates ³ (p-value)		Reject 0.00		Reject 0.00		Reject 0.00		Fail to reject 0,10		Reject 0.00
5. Decomposition of the change in employment										
Date effect	-2.322		-1.476		-649		1		-338	
Atypical year effect	-983		-797		13		-151		-108	
Combined effect	-3.305		-2.273		-636		-150		-446	
Combined effect (%)	-67%		-102%		-49%		-14%		-163%	
6. Estimated change (1984-86) - (1995-97)										
Scenario 2	-1.604		42		-662		-957		172	
	-2.550		-835		-877		-		-7	

Notes: See text for a detailed explanation of this Table.

1. The state of Tocantins is included. See the notes for Table 1.
2. The first row of the Table presents the unrestricted PNAD data for purposes of comparison with the Census. All other calculations are based on the "restricted" PNAD data. See text for details.
3. This is a test of the implied growth rate from the Census against the growth rate from PNAD. See the notes for Table 1.

Figure 1: Number of Agricultural Establishments (North Excluded):
Agricultural Censuses (1985 and 1995/96) and PNAD (1984-99)

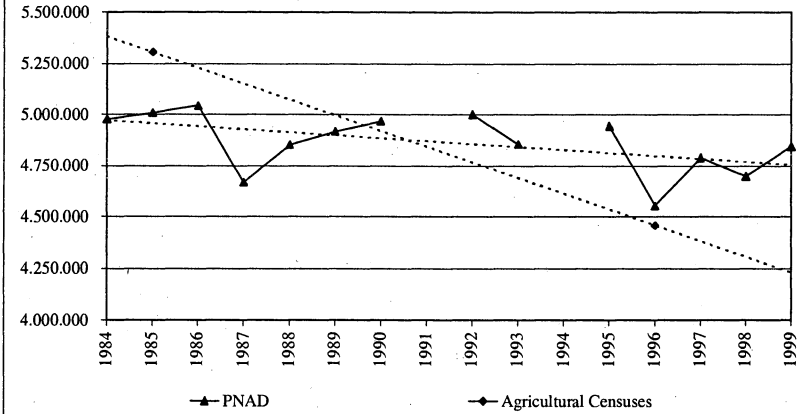


Figure 2: Total Employment in the Agricultural Sector (North Excluded):
Agricultural Censuses (1985 and 1995/96) and PNAD (1984-99)

