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The effects of agricultural policy reform on poverty in Brazil

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1. Introduction

The objective of this paper is to motivate and introduce an approach being developed by the OECD Secretariat in conjunction with a research team at the University of São Paolo for measuring the disaggregated (household-level) impacts of agricultural policy reform in the case of Brazil. Two elements of the reform process are of interest: first, the impact of reforms undertaken by other countries either individually or at the multilateral level; and second the effects of national policy reforms. The former should lead to improved market access for Brazilian products and reduced competition from subsidised rival suppliers; the latter to lower prices for import-competing products. In each case, the principal concern is with the effects that these reforms will have on poor (or potentially poor) households. In this regard, two questions dominate. On the export side, how widely diffused are the gains from improved market access, and to what extent do they benefit poor households either directly or indirectly? On the import side, how are poor households affected by lower market prices for import-competing products, either as producers or consumers, and how are households that are adversely affected able to adjust?

With this focus in mind, the paper is structured as follows: Section 2 summarises the main policy changes that have taken place in the past 10 years, looking at both changes in the global policy and market environment (as it affects Brazil) and changes to Brazil's own policy regime. This section seeks to provide some context in terms of the kinds of policy changes that need to be analysed. Section 3 summarises the impacts that these policy changes have had at the sectoral level, in terms of their effects on prices, supply and demand balances and productivity, while Section 4 looks at attempts that have been made the measure consequences of these impacts at the household level. In each case, the aim is not to provide an exhaustive description of events, but rather to identify the main sectoral and household connections that need to be accommodated within a prospective modelling framework. In the light of this assessment, Section 5 sketches out a methodological approach that integrates the measurement of global and national market impacts with household level responses.

2. Policy reforms in the 1990s

The 1990s saw important policy changes at the global (multilateral) level, the regional level and within Brazil itself. These reforms were all of a liberalising nature, the chief landmarks at each level being the conclusion of the Uruguay Round in 1994 (and the subsequent establishment of the WTO), the creation of a common South American Market (MERCOSUL) in 1991, and the consolidation of national reforms following the abandonment of import substitution policies in the late 1980s.

[1] The views expressed in this paper are those of the authors and are not those of the OECD or of its member governments.

Until the late 1980s, indirect policies – notably an overvalued exchange rate and industrial protection – taxed agriculture in Brazil more than direct policies may have benefited it (Krueger, Schiff and Valdés, 1988). Moreover, direct policies varied by sector, with exportables typically taxed, importables protected, and a generally cushioning against discrimination through input subsidies. This fits a general pattern for developing countries at that time, with the exception that Brazil's subsidised credit programme was larger than elsewhere.

Starting in the late 1980s, the government liberalised trade, privatised state owned enterprises, deregulated markets and helped create MERCOSUL. However, in contrast with the speed of trade liberalisation, the evolution of domestic price and credit policies was slow and uneven. In broad terms, however, agricultural policies switched from being designed for a closed economy with substantial state intervention to those compatible with an open economy and a reduced role for the state (Helfand and Rezende, 2003).

Helfand and Rezende stress four main aspects of the reform process that were unexpected or did not receive sufficient attention. First, conditions beyond agriculture were very important for the performance of the sector, and for the timing and sequence of reforms. Exchange rate overvaluation and industrial protection were key factors, as were the general difficulties that Brazil had in achieving macroeconomic stability. Indeed, Helfand and Rezende suggest that agricultural policy reforms were driven more by the quest for price stability and the shift away from import substitution policies than by explicit agricultural policy objectives.

Second, policy reform involved far more than trade liberalisation, which happened quickly and broadly, and extended to deregulation and the reform of credit and price support policies. The deepest reforms were for those products which were most heavily regulated, notably wheat, milk, sugar and coffee.

Third, policy reform had a major impact on input markets and productivity. By lowering the relative prices of imported inputs (and so making higher quality inputs more affordable), and by exposing domestic producers to greater competition, reforms contributed to higher productivity. This was particularly notable in the livestock sector which made relatively greater use of imported inputs.

The final factor that was insufficiently stressed, and is particularly important in the context of OECD's current work, is the differential impact of reform. The impact of reform varied by, among other things, product (e.g. importables were affected differently to exportables), by region, and by farm size (e.g. with larger farms better able to take advantage of liberalisation in input markets). These are all factors that will need to be accommodated within the proposed modelling framework.

How can the effects of these reforms (and further reforms of a liberalising nature) be gauged? In broad terms, Brooks (2003) proposes a simplified sequential schema for tracing the impacts of reform down to the household level (Figure 1). This schema involves measuring the direct market impacts of global and own policy reform, estimating the transmission of world market impacts across the border of domestic market impacts within the country, and then modelling the effects on and response of households to these market changes.

The modelling task is complicated by the need to account for the two-way interaction between Brazil's market and the world market for those commodities where Brazil's net trade position can have an effect on the world market, and (most importantly) to capture the links between product and factor markets.

3. Sectoral impacts of agricultural policy reform

Sectoral information is typically easier to obtain than the necessary household-level data, and in many cases the availability of a considerable time series facilitates *ex post* analyses. This section describes the

major changes to (i) prices; (ii) supply and demand balances; and (iii) productivity that accompanied the policy changes of the 1990s.

3.1. What happened to prices?

The real prices of all the main agricultural products fell considerably between the mid-1980s and the end of the 1990s (Figure 2). In 1999/2000, real prices for the major crop products were less than 40% of their average levels between 1980 and 1985, while for livestock products the fall was even more pronounced. The relaxation of exchange rate controls in 1999, and the subsequent depreciation of the currency, have since led to some strengthening of prices over the last few years.

Helfand and Rezende use a price decomposition methodology to quantify the impact of policy changes on domestic agricultural prices. Under this methodology, the percentage change in a product's real domestic price is attributed to one of three components: the real international price, the real exchange rate, and a residual that captures policy changes and other factors.

Table 1 reports the results of this decomposition exercise. The key points that stand out are: (i) all real agricultural prices fell dramatically throughout the period; (ii) the real exchange rate was the principal factor causing prices to fall; (iii) unfavourable international price movements more than offset the impacts of policy reform on the relative prices of most exportables; and (iv) the products that had been heavily regulated were affected most by policy reform. It is instructive that the effect of policy reform on the price of exportables was positive, but was outweighed by other factors.

These results provide important context in terms of understanding the effect of policy changes on market prices. Essentially they demonstrate that while policy and non-policy factors have historically impeded the transmission of world price changes onto domestic markets, these have been relatively minor influences compared with the structural tendency of prices to decline and macroeconomic factors as captured by the real exchange rate.

It should be possible to further decompose the residual into formal policy changes (principally to applied tariffs) and another residual which would indicate the extent to which "non-policy" (and indirect policy factors) impede world to domestic price transmission. Furthermore, national price changes could be further decomposed at the regional level. This is probably a valuable exercise given strong regional variations in prices.

On the input side, the 1990s saw a significant adjustment in relative prices. The falling price of tradable inputs relative to non-tradable inputs (land and labour) led to relatively more use of pesticides, fertiliser, seeds and other such inputs, but a contraction in agricultural employment. Despite lower relative prices for tractors and machinery, consumption of these items fell due to high interest rates and a dearth of investment credit.

3.2. What happened to output and trade?

Brazil is exceptional in that over the last twenty years agricultural growth has outpaced growth in other sectors, causing agriculture's share of GDP to rise (Figure 3). This contradicts the general pattern whereby rising incomes are accompanied by a declining share of agriculture in total economic activity. Key forces driving sectoral growth were advances in research and the application of new technologies in the 1980s, and the liberalisation of trade, price and exchange rate policies in the 1990s, the latter prompting a significant reallocation of resources within agriculture.

Output growth was most rapid in the livestock sector, with poultry production increasing dramatically (Figure 4). This growth was attributable mostly to increased animal numbers (Figure 5).

Plantings to exportable crops, notably soybeans and sugar cane, increased significantly. The overall supply response was nevertheless restrained by several factors, including the shift into livestock, higher prices for imported inputs (as the real exchange rate weakened), and other product specific factors such as weak market conditions (notably for coffee) and plant diseases (for cocoa). In contrast, there was a significant reduction in the area planted to importable crops from the mid-1980s, with wheat acreage declining by more than 50%. These declines were more than offset by higher yields, except in the case of wheat, where production fell accordingly (Figure 5).[2]

As Brazil's pattern of specialisation came to reflect more closely its pattern of comparative advantage, receipts from agro-food exports and spending on agro-food imports both increased accordingly (Figure 6).

3.3. What happened to productivity?

Total Factor Productivity (TFP) rose by an estimated 20% between 1980 and 1995 (Barros, 1999). Most of this gain came from the late 1980s onwards, coinciding with major policy reforms affecting agriculture, including the withdrawal of industrial protection, the abolition of export taxes, the lowering of tariffs and the removal of non-tariff barriers. The shift of resources into more productive activities is one explanation of TFP Improvements. Others are technological change, and the exploitation of economies of scale in the growth region of the Centre-West.[3]

Gasques and Conceição (2001) note that between 1970 and 1995 improvements in the productivity of capital lagged well behind gains in labour and land productivity (Figure 7).[4] This may reflect a general lack of access to capital among small and medium sized farms.

In the case of the Centre-West, Helfand (2003) estimates that technical efficiency first falls and then rises with farm size (the converse of what is normally believed). He finds that differences in efficiency across farms are further explained by ease of access to institutions, credit and modern inputs, and argues that easier access in these areas would make small and medium sized farms (around 20-200 ha) more efficient.

4. Household-level impacts

Hertel et al. have examined the disaggregated consequences of reform in Brazil as part of a comparative study of 14 countries.[5] Each of these uses household survey data designed in conformance with the World Bank's LSMS approach. In the case of Brazil, that survey is the Pesquisa Padrão de Vida (PPV) of 1996.

For each country, households are divided into five categories:

- agriculture specialised households (where at least 95% of income comes from agricultural production);

[2] In the context of our current work, it is important to note that the exportables / importables distinction is not a neat one. For example, cotton and maize production is increasingly competitive in the growth regions of the Centre-West, as is rice production in parts of the South.

[3] A key feature of Brazil's agricultural development in the past two decades has been a shift of production from traditional coastal regions (North East, South East and South) to inland area (Centre-West and, to a lesser extent, the North). Innovations in agro-chemical treatment of the *cerrado* soil have made it possible to bring into agricultural production approximately 66 million hectares of land previously considered infertile (Rezende, 2002).

[4] One implication is that yield improvements are a poor proxy for TFP increases.

[5] Bangladesh, Brazil, Chile, Colombia, Indonesia, Malawi, Mexico, Peru, Philippines, Thailand, Uganda, Venezuela, Vietnam, Zambia.

- self-employed non-agricultural households (95% or more of income from profits of non-agricultural enterprises)
- labour specialised household (95% or more of income from wages or salaries)
- households dependent on transfers (95% or more of income)
- diversified (less than 95% of income from any one of the four sources above).

The advantage of such stratification is that it represents a significant step beyond the measurement of average impacts, by acknowledging the heterogeneity of households and the relative representation of poor households within each strata. Importantly, it takes account of the income side, whereas most poverty research has tended to focus on the consumption side, which is easier to measure and tends to be less volatile (Reimer, 2002).

The results of this study are useful in terms of general results. For example, across the 14 countries considered, the majority of the poor are found to have relatively specialised earnings patterns and would therefore be expected to be more strongly affected by trade liberalisation and other policy reforms. Moreover, corroborating other studies, it turns out that the poor are particularly strongly represented in agriculture-specialised households.

The approach is arguably even more useful in illustrating how individual country situations may not correspond to these general patterns. For example, Brazil does not conform to the generally positive correlation that exists between the share of agriculture-specialised households in the total population and their share in total poverty. Whereas self-employed agricultural households comprise just 4% of Brazil's total population, this stratum accounts for nearly one-quarter of the country's poor.

The modelling approach adopted by Hertel et al. involves mapping the results of GTAP simulations onto household models constructed around these datasets. Specifically, policy changes in the form of a removal of tariffs and quotas generate changes in national product and factor prices. Given changes in relative prices and incomes, an AIDADS demand system is used to compute the change in utility for each group. The results in the case of Brazil are shown in Table 2.

Agricultural trade liberalisation at the global level provides a substantial reduction in the overall poverty headcount (-13%). This would appear to counter the some of the concerns that the welfare benefits from reform are limited to non-poor households earning profits or wage income from the commercial farm sector. Other disaggregated effects are consistent with expectations.

While these results are of considerable interest, there are nevertheless important insights to be obtained from adding additional detail to the specification of products, sectors, household types and regions, and from allowing more behavioural responses at the household level and within the national economy.

Hertel et al.'s specification contains a reasonable product specification at the GTAP level (approximately 12 agricultural commodities), but this is mapped onto relatively broad household classifications, so it is not possible to assess, say, the effect of a change in the wheat price on different types of poor farm household (wheat is grown almost exclusively in the South of the country). Similarly, the result that for poor agricultural households the cost of removing agricultural protection is mostly offset by the benefits from the removal of non-agricultural protection may not hold for the poorest agricultural households within that strata. In other words, even this level of disaggregation may not be enough.

The model has a similarly broad classification of factors (land, unskilled labour, skilled labour, capital and natural resources) and assumes that these factors are homogeneous. Thus, for example, land is not

differentiated according to its potential uses, nor are agricultural wages differentiated from wages in other sectors.[6]

Finally, the model incorporates some optimising behaviour (in the form of changes in demands) but does not capture some of the key ways in which agricultural households respond to shocks to their incomes, such as changing their crop mix or diversifying their income sources. For that, a farm household model, of the general form described by Singh, Squire and Strauss (1986) is needed. Hence, the specification of Hertel et al. comes closer to measuring the incidence of reform rather than the medium to long term impact once behavioural responses are factored in. There is also evidence to suggest that second round effects are important, and for these to be accommodated household responses need to be fully embedded within a general equilibrium model (Löfgren and Robinson, 1999). In policy terms, these gaps are important, because although the incidence of reform is important, it is also useful to be able to distinguish between those households which can adjust under the pressures of reform and those which cannot (or have greater difficulty).

Although not entirely satisfactory, the PPV dataset contains much of the information needed to build richer models of farm household behaviour. So far, this survey has been conducted only once, so it is only useful for *ex ante* applications. At the same time, there is annual information from the Pesquisa Nacional por Amostra de Domicílio (PNAD) survey, although this dataset is weak in terms of its information on the sources and levels of non-wage income and therefore not especially suitable for analysing agricultural and rural households (Lanjouw, 2001).

Lanjouw notes that poverty in Brazil is sometimes mistakenly perceived to be an urban phenomenon. This is because (a) only 21% of the population lives in rural areas; (b) urban slums are widespread; and (c) data collection and analysis has been predominantly urban-focused. But Ferreira et al. (2000) observe that the incidence of poverty is higher in rural areas, and higher in small urban areas than in larger cities and metropolitan areas. Using a probit analysis of the PPV dataset, they also find that race, employment status and – above all – education are key correlates of vulnerability.

Lopez and Romano (2001) have exploited the PPV to provide more structural information on poor households, notably poor farmers. Their study establishes a clear link between farm size and household income (Table 3). This subdivision can be used to shed light on potentially important variations in impacts within specific categories (such as the agriculture-specialised households in Hertel et al.).

5. A suggested methodology

The study of Lopez and Romano uses PPV data to model a farm revenue function, and then estimates how price policy changes will affect the revenues of farms in different size classes. Another study by Harrison et al. (2003) also uses the PPV survey, embedding twenty household types (rural and urban, ordered by income decile) within a multi-region trade model. 23 products are specified according to the GTAP breakdown and households receive income from five factors: skilled labour, unskilled labour, rent from capital, rent from land and transfers. But there is no specific modelling of structurally distinct types of agricultural household, as defined by product

[6] A further difficulty is that agents' responses to changes in domestic prices vis-à-vis imports are driven by the Armington assumption, whereby each country produces unique products, which differ according to whether they are destined for the home market or overseas, and which are different from those of all other countries. Thus each product has its own price, and it is difficult to build in the concept of price transmission, which presumes product comparability and a unifying "world" price.

Our project aims to provide a distinct representation of different categories of agricultural, rural non-agricultural and urban households – recognising that agricultural policy reform will have fundamentally different effects on different household types within each of these categories. A key challenge lies in specifying those household types (most crucially several different types of agricultural household) in such a way that the distinct effects of agricultural policy reform can be captured. From this perspective, neither of the studies referred to above is sufficient.

The ideal modelling structure would be a CGE model with fully embedded agricultural household models (as in the proposed specifications of Hanson and Somwaru for the United States, Perali for Italy, and Taylor and Yúnez-Naude for Mexico). At this stage, however, we propose a sequential development which combines the benefits of household-level analysis with insights that come from an economy-wide perspective. A benefit of such a pragmatic approach is that the marginal returns from model development should become clear.

Data

The intended focus on household-level impacts and responses necessitates the combined use of information on farm level activities with broader information on household incomes and expenditures. Unfortunately, this information does not reside in one single survey. The 1996 Agricultural Census is the main source of farm level information, while the PPV Survey is the only reliable source of income data for agricultural households.

However, the PPV survey has two fundamental shortcomings. The first is its small sample size, with a total of 4,940 households, and just 880 agricultural households. The second is the fact that observations are confined to metropolitan areas in the North-East and South-East regions, and cannot be considered as nationally representative. Against this, the survey is well constructed using the World Bank's LSMS methodology and the data are considered to be reliable (Ferreira et al.). Moreover, these regions contain much of Brazil's small scale agriculture and rural populations, and are therefore a good source of information for household level analysis focusing primarily on poor agricultural and rural households.

Based on information in the agricultural census, a Ministry of Agrarian Reform and FAO study (2000) divides agricultural households into "family" and "commercial" ("patronal") operations. A farm qualifies as a family farm if the following criteria are all met: (i) the farm is smaller than 450 ha.; (ii) the family manages the business; and (iii) the use of family labour exceeds the use of hired labour. All other farms are classified as *patronal*.

Within the family farming category, operations are divided into 4 categories based on farm income. For each state a Value of Opportunity Cost (VOC) is defined as median household income adjusted upwards by 20% to account for the lower cost of living of agricultural households. Specifically, the four categories are: A: total income $> 3 \times$ VOC; B: VOC $<$ total income $\leq 3 \times$ VOC; C: VOC/2 $<$ total income $\leq$ VOC; D: total income $\leq$ VOC/2. Non-family farms are divided into two categories (E and F) based on total income.

The elements defining these six categories are common to both the Census and the PPV dataset. Thus, based on these common criteria, it is possible to examine the extent to which the PPV represents a good sample for the Census. A comparison of the two datasets is presented in the Tables 4 and 5. The important thing to note is the similar distribution in terms of the number of farms falling into each category and the size of those farms.

As an initial classification, we propose to stick with these six categories and examine their structural attributes. However, if the PPV is considered to be a good sample of the census, it is possible to reorganise the data according to other characteristics, and analyse differences in household behaviour accordingly.[7]

For each household type (but not for individual households), we propose to combine information from the two datasets. Specifically, we can distribute product-specific information from the census to each household type, and obtain very detailed information on both sources of income and patterns of expenditure. By shocking prices, we can thus obtain useful information on how different categories of household will be affected – on average – by reforms to specific sectors.

In addition, this household level information can be integrated into a Social Accounting Matrix, which provides valuable information on the links between product markets, factor markets, and household incomes and expenditures. The team at the University of São Paolo already have a SAM which they intend to adapt to incorporate up to 63 products and sectors with an emphasis on agricultural activities (Annex Table 2), disaggregated agricultural households as described above, as well as rural non-agricultural and urban households (whose direct links to the farm economy come only through the expenditure side). Information for rural households' incomes and expenditures comes from the PPV dataset, while data for urban households' incomes and expenditures comes from other national household surveys.

Model specification

With households suitably specified, we intend firstly to measure the incidence of reform, calculating how the incomes and expenditures of different categories of household are affected by given price changes. In terms of analysing the impacts of reform on poor households, this could provide immediate insights. These insights could be usefully complemented by descriptive data on socio-economic and demographic variables for each category of household.

A second and straightforward task, given the existence of a SAM, is to shock household expenditures according to the change in income for each group, and trace through the multiplier impacts. This can provide an early indicator of the relative magnitude of different second round (general equilibrium) effects, such as the effects of agricultural households' expenditures on the wider rural economy.

Third, we intend to model household level adjustment using farm household models of the type developed by Singh Squire and Strauss (1986). The difficulty here is that we are unlikely to be able to estimate econometrically demand and supply elasticities, or elasticities of substitution between outputs, inputs, and farm and off-farm income. Rather, in accordance with the "pragmatic" approach suggested by Sadoulet and de Janvry (1995), we will likely need to rely on estimates obtained extraneously from market based information. Azzoni et al. (2003) suggest that suitable panel data exist to estimating price and income elasticities on the demand side, and output supply and factor demand elasticities.

However, we face an important dilemma, in that as useful as the product level detail we have is, it does not apply to *individual* households, and there will likely be a need for consolidation of some of these product accounts to obtain representative households for which a broad shock can be introduced (i.e. one covering the prices of an aggregate such as "staples"). In Brazil, the diversity of products produced is huge. For

[7] For example, for the 1365 households in rural areas, the status of the head of household is defined according to seven categories (numbers in each category in parentheses, definitions need to be clarified): employee and landless (206); self-employed (owns land and receives income from it) (402); agricultural employer (as above, also has employees) (40); employee elsewhere in agriculture, but also owns land with production on that land (250); agricultural landowner with non-agricultural production (147); agricultural landowners with no occupation (e.g. retired) (41); rural non-agricultural (279).

example, wheat is produced by poor households in the South but not in the North. Thus, if we shock the price of wheat, we are in danger of recording a low average impact on the incomes of poor farm households because of the product's low share in that group's income, but missing out on important local impacts.

Furthermore, the household models will likely have to start with the assumption that all households have the same basic supply response characteristics. In the context of this application, the specification of household models is most valuable if those models provide information beyond the incidence measures to be reported in Stage 1 – this means not just accommodating rudimentary behavioural responses, but also acknowledging the possibility of market failures for poorer households.

As we start to parameterise linkages beyond the household level, it will be necessary to build a link between product and factor markets (e.g. through a zero profit condition), and ensure that sectoral supply and demand responses equate to the sum of responses at the household level.

Such analysis has potential to provide important policy insights. However, it is also important to maintain a link to product specific detail, given that this offers us the opportunity to ask precise policy questions (what happens at the household level if the tariff for wheat is eliminated), and provides a link to our complementary work on price transmission and market integration.

References

Azzoni, C.R., T.A. Menenes, H.C.E. Carmo, F.G. Silveira (2003). "The Impact of Structural Reforms on Poverty: Exploring Available Databases in Brazil". Paper presented to the OECD Global Forum on Agriculture, 19-20 May 2003.

Barros, A.L.M. (1999). "Capital Productividade e Crescimento da Agricultura: O Brasil de 1970 a 1995". Ph.D. dissertation, University of São Paolo, 1999.

Brooks, J. (2003). "Agricultural Policy Design in Developing Countries: The Case for Using Disaggregated Analysis". Background paper for the OECD Global Forum on Agriculture.

Ferreira, F.H.G., P. Lanjouw and M. Neri (2000). "A New Poverty Profile for Brazil using PPV, PNAD and Census Data". Departamento de Economia PUC-RIO, Texto Para Discussão No. 418.

Gasques, J.G. and J.C.P. Conceição (2001). "Transformações Estruturais da Agricultura e Produtividade Total Dos Fatores". In *Transformações da Agricultura e Políticas Públicas*, Brasília: IPEA, 2001.

Harrison, G. W., T.F. Rutherford, D.G. Tarr and A. Gurgel (2003). "Regional, Multilateral and Unilateral Trade Policies of MERCOSUR for Growth and Poverty Reduction in Brazil". World Bank.

Helfand, S.M. (2003). "Farm Size and the Determinants of Productive Efficiency in the Brazilian Centre-West". Contributed Paper. 25th International Conference of Agricultural Economists, August 16-22, 2003, Durban, South Africa.

Helfand, S. M. and G.C. de Rezende (2000). "The impact of Sector-Specific and Economy-Wide Policy Reforms on the Agricultural Sector in Brazil: 1980-1998". University of California, Riverside.

Hertel, T.W., P.V. Preckel, J.A.L. Cranfield and M. Ivanic (2002). "OECD and Non-OECD Trade Liberalisation and Poverty Reduction in Seven Developing Countries". In: *Agricultural trade and Poverty: Making Policy Analysis Count*. OECD, Paris.

Hertel, T.W., M. Ivanic, P.V. Preckel and J.A.L. Cranfield (2003). "Trade Liberalisation an the Structure of Poverty in Developing Countries". Paper prepared for the Conference on Globalisation, Agricultural Development and Rural Livelihoods, Cornell University, Ithaca, N.Y., April 11-12, 2003.

Krueger, A.O., M. Schiff and A. Valdés (1988). "Agricultural Incentives in Developing Countries: Measuring the Effect of Sectoral and Economywide Policies". *The World Bank Economic Review*. Vol. 2, No. 3.

Lanjouw, P. (2001). "Poverty and Non-Farm Employment in Rural Brazil". In: *Rural Poverty Alleviation in Brazil: Towards an Integrated Strategy*. World Bank Report No. 21790-BR.

Löfgren H. and S. Robinson (1999). "To Trade or Not To Trade: Non-Separable Farm Household Models in Partial and General Equilibrium". TMD Discussion Paper No. 37. IFPRI, Washington D.C.

Lopez R. and C.B. Romano (2001). "Determinants of Farm Revenues and Factor Returns for Poor Farmers in Brazil". In: Rural *Poverty Alleviation in Brazil: Towards an Integrated Strategy*. World Bank Report No. 21790-BR.

Ministry of Agrarian Reform (2000). Novo Retrato da Agricultura Familiar, O Brasil Redescoberto.

Reimer, J. (2002). “Estimating the poverty impacts of trade liberalisation”. GTAP working paper No. 20. Purdue University, USA.

Rezende, G.C. de (2002). “Technological Change and Agricultural growth in the Brazilian Cerrado: A Theoretical Analysis”. Mimeo.

Sadoulet, E. and A. de Janvry (1995). *Quantitative Development Policy Analysis.* The Johns Hopkins University Press, Baltimore and London.

Singh, I., L. Squire and J. Strauss, eds. (1986). *Agricultural Household Models*. The Johns Hopkins University Press, Baltimore and London.

Figure 1. **A simplified schema of market, household and policy linkages**

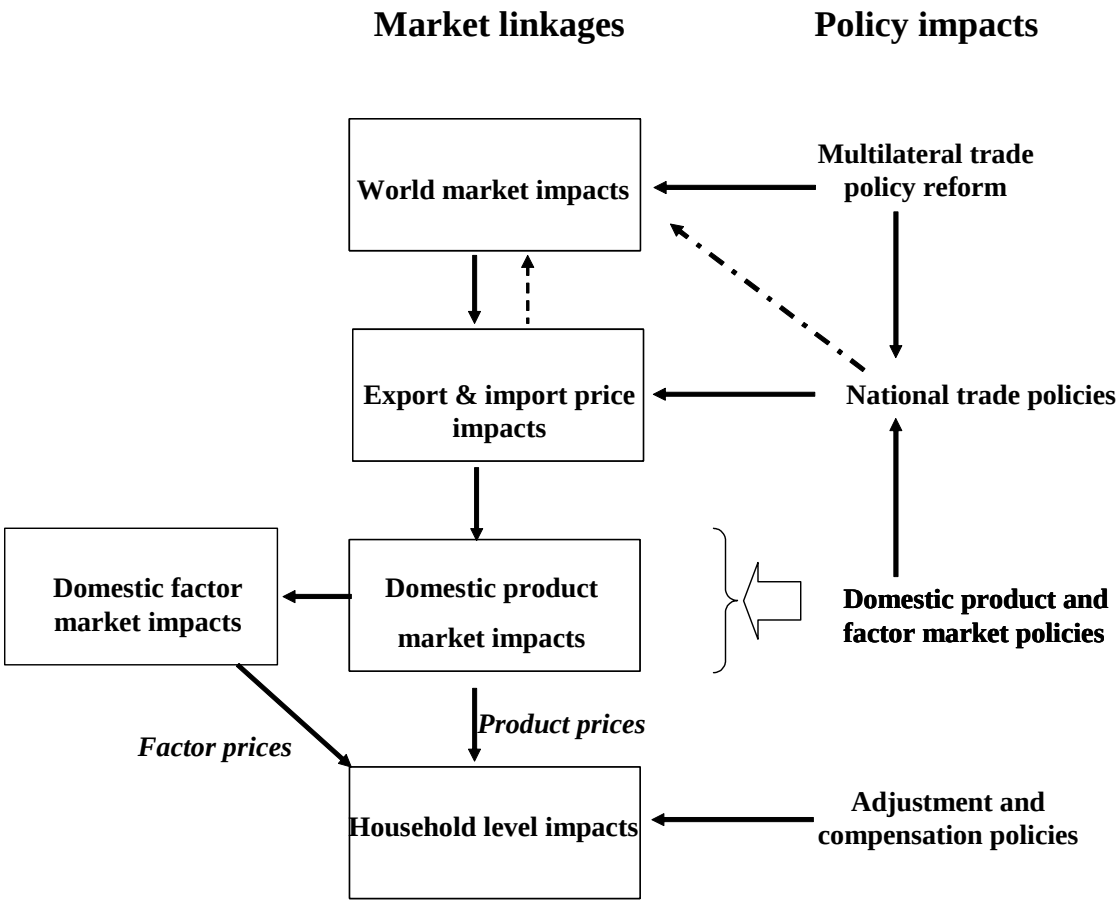
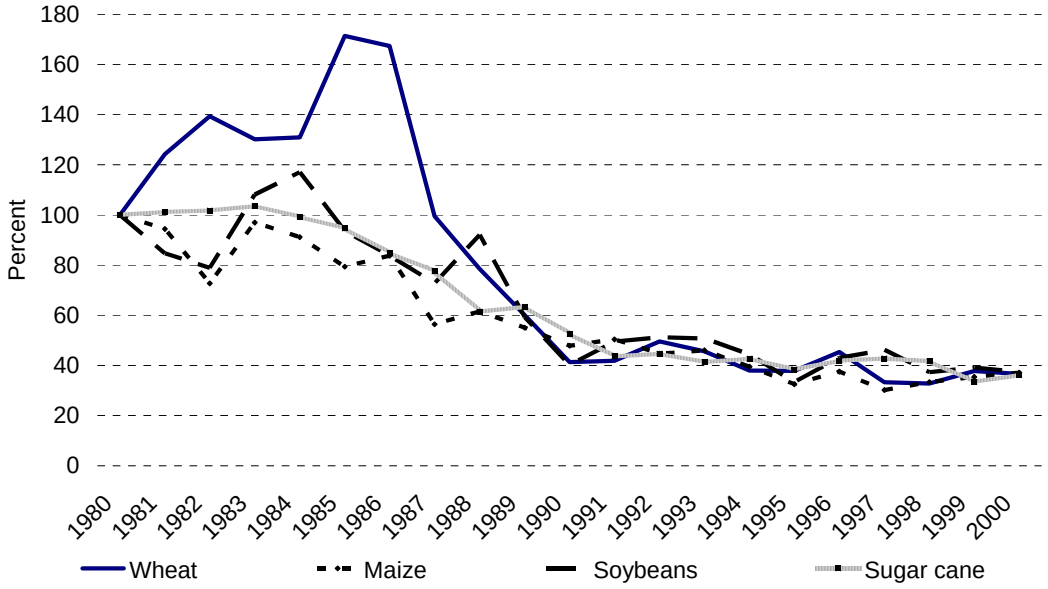


Figure 2. **Real producer price indexes for main agricultural commodities**

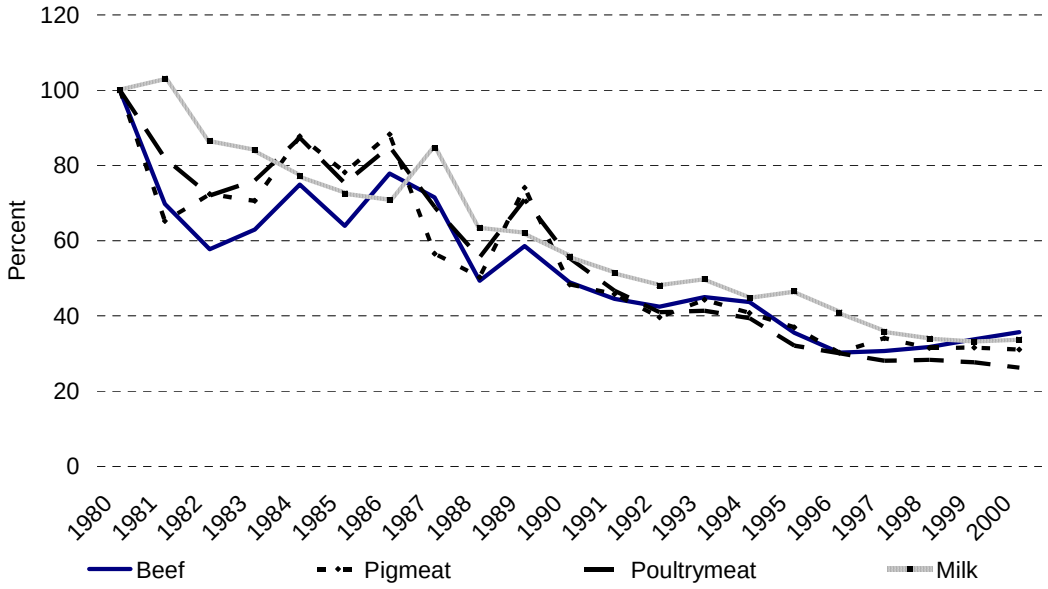
1980=100

2.1. **Crop products**



Source: FGV

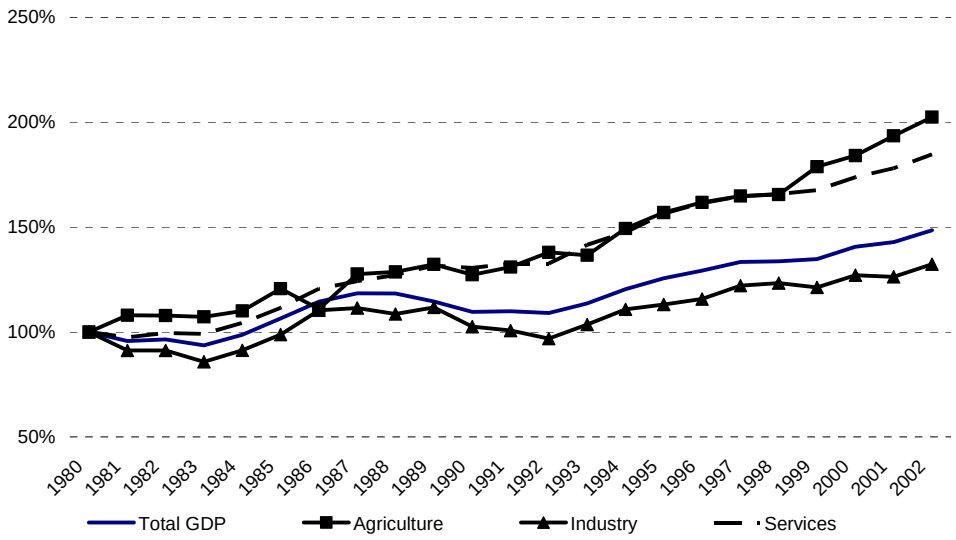
2.2. **Livestock products**



Source: FGV

Figure 3. **GDP growth by economic sectors in 1980-2002**

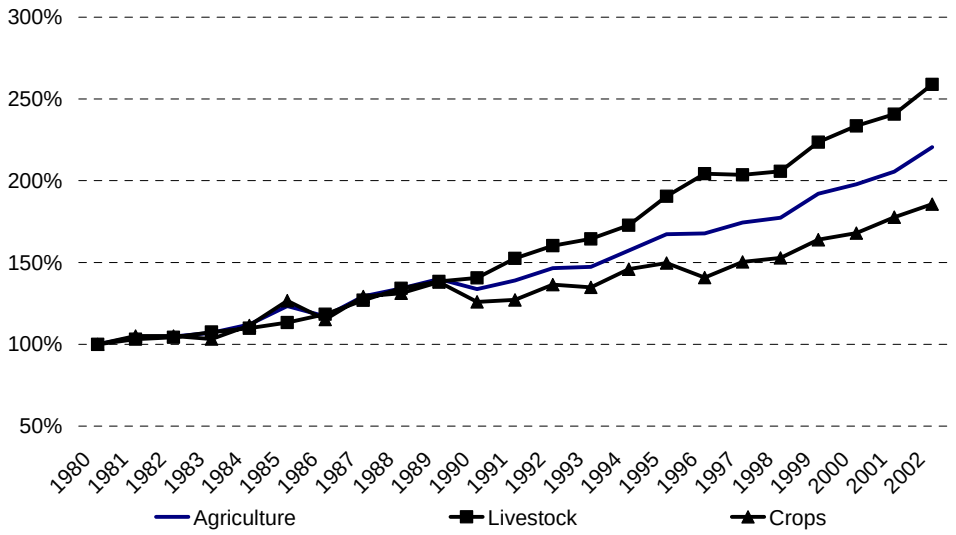
1980=100



Source: IBGE

Figure 4. **Changes in agricultural output in 1980-2002**

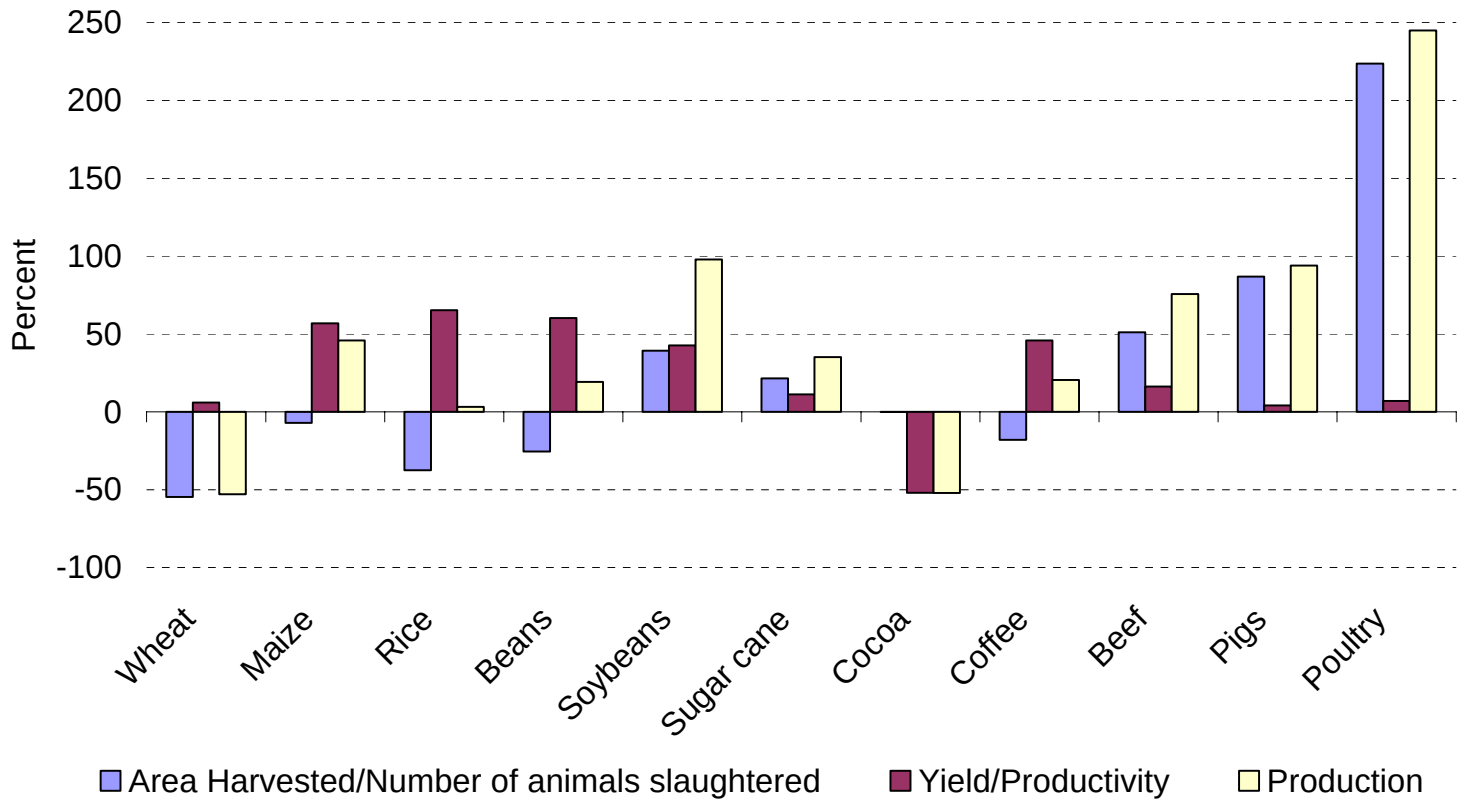
1980=100



Source: FAO

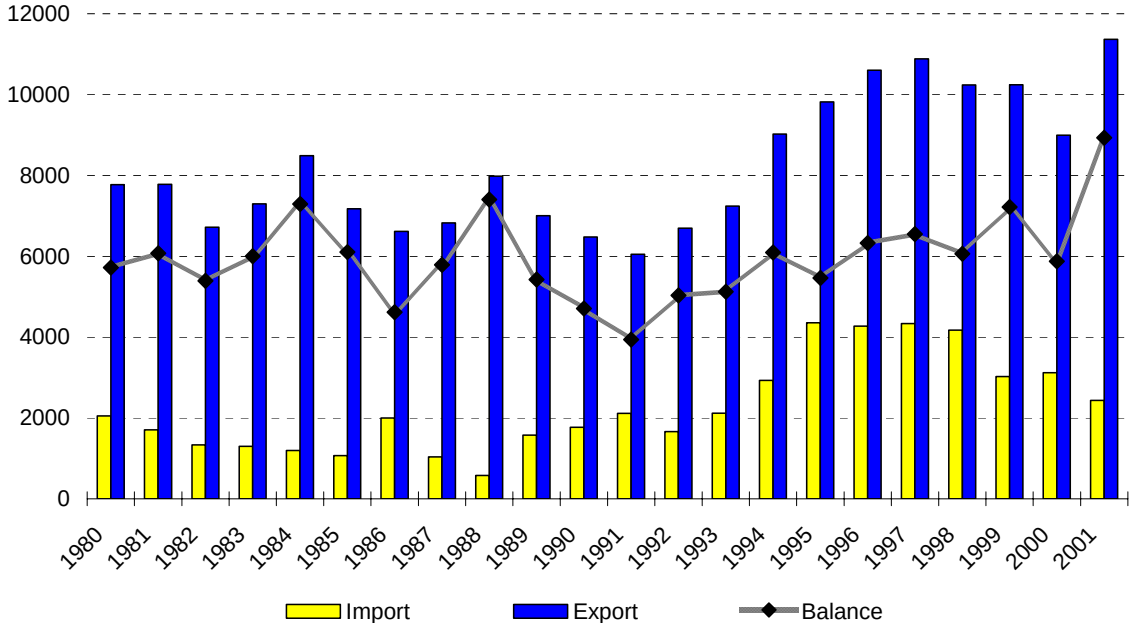
Figure 5. **Changes in production, productivity, area and slaughtered livestock numbers**

1999-2002 compared to 1985-1989



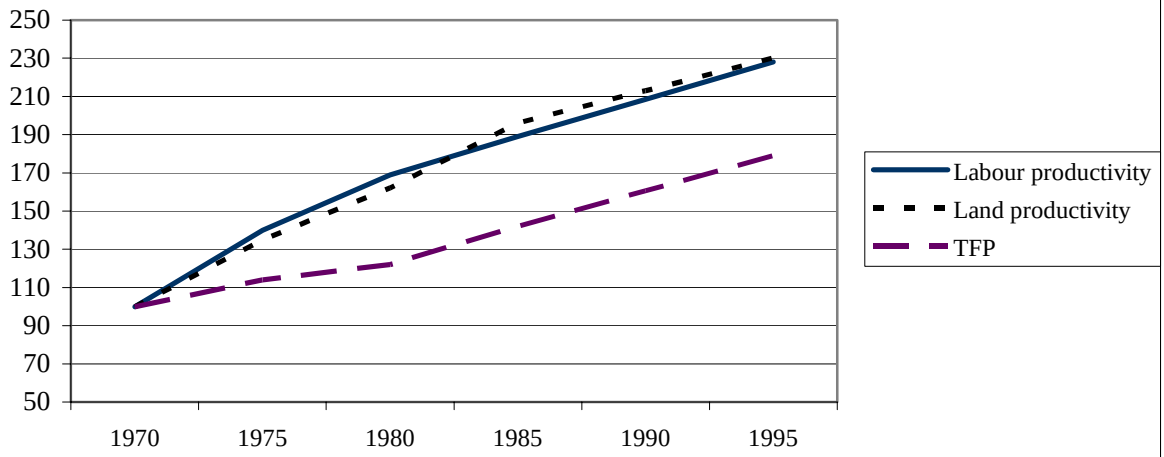
Source: FAO, IBGE

Figure 6. **Evolution of Brazil's agro-food trade** (1,000 US $)



Source: FAO

Figure 7. **Total Factor Productivity in Brazil, 1970-1995**



Source: Gasques and P.R da Conceição (2000). 1990 values are extrapolated.

Table 1. **Decomposition of changes in real domestic agricultural prices**

Products	Period	Real domestic price	Real international price	Real exchange rate	Policy and residual[1]
		percentage change			
Importables:					
beans, maize, cotton, and rice	1982-86 - 1987-89	-32	-4	-21	-8
	1987-89 - 1990-94	-22	-3	-24	4
	1990-94 - 1995-98	-17	4	-29	8
wheat	1982-86 - 1987-89	-46	1	-21	-26
	1987-89 - 1990-94	-45	-16	-24	-9
	1990-94 - 1995-98	-14	11	-29	7
Exportables:					
cocoa, oranges, and soybeans	1982-86 - 1987-89	-21	-7	-21	6
	1987-89 - 1990-94	-42	-28	-24	3
	1990-94 - 1995-98	-16	8	-29	7
coffee[2]	1982-86 - 1987-89	-29	-20	-21	8
	1987-89 - 1990-94	-34	-32	-24	14
	1990-94 - 1995-98	41	49	-29	35

[1] The residual is presented net of interaction between the real international price and the real exchange rate in order to isolate the impact of policy.

[2] The 1986 coffee prices were excluded because this was an atypical year. Prices were more than double those of 1985 and 1987.

Source: Helfand and Rezende (2000)

Table 2. **Sources of poverty headcount change (%), by liberalising sector/region**

Country/Source of Liberalisation		Agr.stratum	Nonagr. stratum	Labour stratum	Transfer stratum	Diversified stratum	Total
Brazil							
Country's own	in agr. com.	4.95	-1.51	-0.69	-0.49	-0.06	-0.26
	in nonagr. Com.	-4.69	1.98	1.62	0.87	0.24	0.84
Rest of Latin America	in agr. com.	-6.09	1.39	0.56	0.06	-0.93	-0.24
	in nonagr. Com.	0.99	-0.76	-0.42	-0.35	-0.22	-0.31
Other countries	in agr. com.	-7.58	2.51	1.06	0.48	-0.78	0.09
	in nonagr. Com.	0.23	-0.47	-0.23	-0.22	-0.20	-0.21
Total		-13.45	3.11	1.86	0.32	-1.96	-0.18

Source: Hertel et al. (2002).

Table 3. **Income and demographic characteristics by farm size category** [1]

	Minifundia (up to 2ha)	Small (2.1 – 10ha)	Medium (10.1 – 50ha)	Large (50.1 – 2000ha)
Household size	4.7	5.0	4.7	4.5
Household income	5,807	9,382	17,511	43,769
% of farm (self-employment) income in total income	58.5	75.7	72.4	69.5
% wage income in total income	15.7	5.5	2.5	10.0
% non-agricultural labour and capital income in total income	9.5	7.1	12.4	13.2

1. Money values in 1996 Reais. Tabulation based on PPV sample.
Source: Lopez and Romano (2001).

Table 4. **Comparison of Census and PPV data: land and income characteristics**

Farm types	Holding size		Income/Value added		Shares, %					
	Total farm area	Cultivated area	VA per farm	Income* per farm	Area		Number of farms		Number of persons	
					Total farm area	Cultivated area				
	Census	PPV	Census	PPV	Census	PPV	Census	PPV	Census	PPV
Family										
A	16.50	4.54	8.17	131.58	10.90	11.30	40.80	38.40	76.90	39.70
B	22.10	3.97	110.83	313.82	4.20	4.30	17.50	16.80	…	17.30
C	34.00	9.36	290.92	555.78	11.70	11.80	21.10	22.20	…	20.60
D	59.40	13.80	1332.17	1753.79	7.30	9.80	8.70	10.50	…	8.70
total family	-	-	-	-	**34.10**	**37.20**	**88.10**	**87.90**	…	**86.30**
Non-family										
E	…	14.60	…	1056.70	8.80	7.90	…	8.50	…	9.90
F	…	249.14	…	2227.34	57.10	54.90	…	3.70	…	3.80
total non-family	**432.90**	…	**1590.42**	…	**65.90**	**62.80**	**11.80**	**12.20**	**23.10**	**13.70**

* Excluding income of household heads with non-farm job and the farm area limited to cultivated land.
Source: University of Saõ Paolo

Table 5. **Comparison of Census and PPV data: Energy use in 6 farm groups**

	Use of energy (% of farms using)					
	Manual*		Animal		Other	
	Census	PPV	Census	PPV	Census	PPV
Family						
A	59.10	76.17	18.90	9.99	22.00	13.84
B	52.30	72.52	25.50	8.73	22.20	18.75
C	39.50	66.18	28.10	14.54	32.40	19.28
D	26.70	54.63	21.20	6.93	52.10	38.45
total family	**44.40**	**67.38**	**23.43**	**10.05**	**32.18**	**22.58**
Non-family						
E	…	45.33	…	20.69	…	33.98
F	…	21.78	…	39.06	…	39.16
total non-family	**9.80**	**33.56**	**21.90**	**29.88**	**68.30**	**36.57**

* Definition of "manual" in PPV is more restrictive, leading to a larger count of farms in this group.
Source: University of Saõ Paolo