Commodity price changes and their impacts on poverty in developing countries: the Brazilian case

Carlos Azzoni, Joaquim Guilhoto, Eduardo Haddad, Tatiane Menezes, Fernando Silveira
Department of Economics, University of São Paulo, Brazil

Abstract

The objective of the paper is to provide an estimate of the impacts of changes in international prices of agricultural commodities on income distribution and poverty in Brazil. A Social Accounting Matrix is be applied, using the Leontief-Miyazawa model framework. A 38-sector I-O table is used, highlighting 19 food products (17 agricultural; 12 manufactured). Households are allocated to 10 groups, 6 agricultural (4 types of family farmers, commercial farmers, and agricultural labor), and 4 urban (income quartiles). Demand elasticities for food products are considered, as well as limitations on the supply of agricultural inputs (input supply elasticities). The knowledge of the possible impacts of changes in international commodity prices on income distribution and poverty is very important for policy design within developing countries. Given the estimated impacts on different groups of producers, different sorts of cushioning policies can be designed.

1. Introduction

Producers and households in developing countries are affected by the prices of products involved in international transactions. The impacts of agricultural policy and structural reforms leading to changes in international prices of goods and services are expected to be differentiated across households and producers, depending on how they are involved in the circular flow of goods and services within the country of residence. As such, it might be expected that these reforms will affect income distribution and poverty levels within those countries. Considering the supply side, units producing commodities facing price increases in the international markets will benefit, since their product will become more valuable; those using imported inputs whose prices increased as a result of the structural reforms will lose. As for households, those working in sectors with increased international prices could experience income gains, and those working in other sectors could rest unaffected in terms of income. However, since some prices would rise, households not working for gaining sectors could suffer a decrease in real income. A general price increase could also result, thus affecting all sorts of households.

Therefore, structural reforms that can change international prices are expected to produce important changes in income distribution in all countries involved in international trade. Since the impacts will vary according to the role played by different agents in the production and distribution of national income, it is important to produce a detailed analysis of such impacts. The objective of the paper is to provide an estimate the impacts of changes in international prices of agricultural commodities on income distribution and poverty in Brazil, considering not only the first round (direct) effects but also their spillovers (indirect effects) across the circular flow of income. The introduction of the second and higher round effects is important, for the initial effects could either be mitigated or empowered by the indirect effects. The knowledge of such compounded effects is important in the design of alternative policies for cushioning the measured adverse impacts of reforms on poor people. It is possible that an increase in the price of a very important export product of a country does not necessarily benefit all households equally. As a matter of fact, some may be badly hurt, if the prices of products with high participation in their consumption basket increased as a result of the second and higher order effects in the national economy, and if they do not work in sectors benefited by the initial price increase.

The paper is organized in 6 sections, including this introduction. In section 2 with present details of the SAM and sectoral disaggregation. The next section deals with the procedures followed to solve the model. In section 4 we discuss the estimation of input supply restrictions and of demand elasticities. Two examples of how the model can be used to estimate distributive impacts of price shocks are presented in section 5. Finally, in the last section we present concluding remarks.

2. Methodology and data sources

Given the study objectives, the SAM makes a distinction between the agricultural and nonagricultural activities and agents in the economy, and take into consideration the relations that occur between them. At the same time, the SAM takes into consideration the relationships of agricultural and nonagricultural activities and agents with the rest of the world economy. The structure of SAM is described below, and is portrayed in Figure 1. The first two columns show, among other elements, the inputs from agricultural and nonagricultural goods and agents that are needed to produce the agricultural and nonagricultural goods available in the economy (rows 1 and 2). Rows 3 and 4 show the destination of the agricultural and nonagricultural goods (columns 3 and 4). Rows 5 to 9 show how income generated by the domestic activities is allocated among factors of production, and columns 5 to 9 show how this income is allocated to institutions in the economy. Rows 10 to 14 show the different sources of income of institutions, while the corresponding columns 10 to 14 show how this income is spent. Columns 15 and 16 show the composition of the total value imports, while rows 15 and 16 show the destination of imports. The composition of total value of exports is displayed in columns 17 and 18, which are allocated to the rest of the world, in rows 17 and 18. Rows 19 to 22 show the source of taxes received by government, while columns 19 to 22 show that these values are allocated directly to government row (row 14). The transactions with the rest of the world are displayed into row 23 and column 23. Accumulation is displayed into row 24 and column 24, closing in this way the values for the SAM. It must be emphasized that the aggregate values are taken from the official National Accounts for the country, so that any row or column sum will provide the official figure for that case.

Previous applications of models of this type for the Brazilian economy can be found in Fonseca and Guilhoto (1987), and Guilhoto, Conceição, and Crocomo (1996). The input-output matrices released by the Brazilian Statistical Institute (IBGE) only take into consideration Agriculture as a whole and 7 food processing industries, of a total of 42 sectors. The most recent data released from IBGE refers to 1996; this matrix was up-dated to the year 1999, following the methodology developed by Guilhoto et al (2002), based on Brazilian national accounts. Given data constraints, ariculture was broken down into 17 sectors, and food-processing industries were disaggregated into 12 sectors, including alcohol, that is treated separately from the chemical sector. The other sectors are the same as in the official national input-output matrix.

Sectors representing agribusiness activities in Brazil account for only 15.3% of total national production, in spite of the fact that Brazil is a major world producer of several products. This reflects the fact that Brazil presents a large and diversified economy. Export-oriented sectors, such as coffee, sugar, and soybean, compete in the international market and are prone to be the first affected by different conditions in the world food market. On the other hand, sectors oriented towards the local market, such as rice, beans, manioc, beef, dairy, etc., will lead important internal distributional impacts in case of changes in world prices.

SAM Structure for the Brazilian Model				Domestic Activities		Domestic Products		Factors					Households		Enterprises		Gov	Imports		Exports		Ind Taxes on Products		Other Taxes		ROW	Acc.	Totals
								Capital		Labor		Land																
				Ag	Nag	Ag	Nag	Ag	Nag	Ag	Nag	Ag	Ag	Nag	Ag	Nag		Ag	Nag	Ag	Nag	Ag	Nag	Ag	Nag			
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Domestic Activities		Ag	1			$S_{1,2}$	$S_{1,3}$																					S_1
		Nag	2			$S_{2,2}$	$S_{2,3}$																					S_2
Domestic Products		Ag	3	$S_{3,1}$	$S_{3,2}$								$S_{3,10}$	$S_{3,11}$			$S_{3,14}$			$S_{3,17}$							$S_{3,24}$	S_3
		Nag	4	$S_{4,1}$	$S_{4,2}$								$S_{4,10}$	$S_{4,11}$			$S_{4,14}$				$S_{4,18}$						$S_{4,24}$	S_4
Factors	Capital	Ag	5	$S_{5,1}$	$S_{5,2}$																							S_5
		Nag	6	$S_{6,1}$	$S_{6,2}$																							S_6
	Labor	Ag	7	$S_{7,1}$	$S_{7,2}$																							S_7
		Nag	8	$S_{8,1}$	$S_{8,2}$																							S_8
	Land	Ag	9	$S_{9,1}$																								S_9
Institutions	HH	Ag	10							$S_{10,7}$	$S_{10,8}$				$S_{10,12}$	$S_{10,13}$	$S_{10,14}$									$S_{10,23}$		S_{10}
		Nag	11							$S_{11,7}$	$S_{11,8}$				$S_{11,12}$	$S_{11,13}$	$S_{11,14}$									$S_{11,23}$		S_{11}
	Firms	Ag	12					$S_{12,5}$	$S_{12,6}$			$S_{12,9}$					$S_{12,14}$									$S_{12,23}$		S_{12}
		Nag	13					$S_{13,5}$	$S_{13,6}$			$S_{13,9}$					$S_{13,14}$									$S_{13,23}$		S_{13}
	Government		14																			$S_{14,20}$	$S_{14,20}$	$S_{14,21}$	$S_{14,22}$	$S_{14,23}$		S_{14}
Imports		Ag	15	$S_{15,1}$	$S_{15,2}$								$S_{15,10}$	$S_{15,11}$													$S_{15,24}$	S_{15}
		Nag	16	$S_{16,1}$	$S_{16,2}$								$S_{16,10}$	$S_{16,11}$													$S_{16,24}$	S_{16}
Exports		Ag	17																							$S_{17,23}$		S_{17}
		Nag	18																							$S_{18,23}$		S_{18}
Ind Taxes on Products		Ag	19	$S_{19,1}$	$S_{19,2}$								$S_{19,10}$	$S_{19,11}$				$S_{19,15}$		$S_{19,17}$							$S_{19,24}$	S_{19}
		Nag	20	$S_{20,1}$	$S_{20,2}$								$S_{20,10}$	$S_{20,11}$					$S_{20,16}$		$S_{20,18}$						$S_{20,24}$	S_{20}
Other Taxes		Ag	21	$S_{21,1}$									$S_{21,10}$		$S_{21,12}$													S_{21}
		Nag	22		$S_{22,2}$									$S_{22,11}$		$S_{22,13}$												S_{22}
Rest of the World			23															$S_{23,15}$	$S_{23,16}$									S_{23}
Accumulation			24										$S_{24,10}$	$S_{24,10}$	$S_{24,10}$	$S_{24,23}$	$S_{24,23}$									$S_{24,23}$		S_{24}
Totals			25	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}	S_{15}	S_{16}	S_{17}	S_{18}	S_{19}	S_{20}	S_{21}	S_{22}	S_{23}	S_{24}	

Figure 1: Schematic View of the Brazilian SAM

The definition of farm types is based on two different data sets: the Agricultural Census of 1996/97 and the Pesquisa Padrão de Vida (PPV) of 1996 (Living Standard Survey), both from IBGE. The first source is more comprehensive and allows for more information across states, farm sizes, technology, etc. The second source provides more information on household characteristics, consumption structures, etc. Our definition of household types is be based on a study by the Ministry of Agrarian Reform/Incra and FAO, in which Brazilian farms were split into family and non-family based on size, use of hired labor, market orientation, income levels etc. Based on the objectives of this study, and on our analysis of characteristics of family and non-family farms, we have decided to work with four groups of family farms, and to deal with non-family farms as a group. Since consumption structures will come from a different surveys, it is important to analyze the matching of those two in terms of general characteristics of farmers. Comparing the proportions of area, number of farms and number of people working in the different farm types, it can be seen that the distributions in the two data sets are quite similar. In other words, PPV consists of a good sample for the census results.

It was pointed out before that different sectors present different linkages within the production system, be it through technical relationships with other sectors, or through income generation and distribution, and, hence, through consumption, as a feed-back mechanism. Therefore, it is important to take into consideration how wages and value added are distributed to different groups of income. As an example, from all wage income received by the lowest income group, farm sectors are responsible for 20%, increasing to 24% in the next decile, and decreasing there on. For rich people, wages coming from farm producing sectors are less important. The participation of different income groups in food manufacturing sectors is quite different, with the very poor receiving a smaller portion of income from these sectors. This contrast in the two types of sectors producing food products illustrates the need to consider how different sectors can influence income distribution. It is also clear from the data that food directed to the consumption of the local population are more important in the income generation of poor people, both in terms of wages and value added. Soybean production is more important for employees and producers in the middle-income range. Therefore, a price shock in this sector tends to affect this group of households more intensively than poor households, at least in the first round of effects.

Since income is distributed differently across sectors, households associated to each sector are expected to have a different consumption structure. This is especially true when considering the differences in consumption between urban and rural families. Therefore, an important step towards constructing a SAM is the consideration of how families spend their income. The data sources for this part of the study are the 1987 and 1995/96 Household Expenditure Surveys developed by IBGE. For urban households, we use the household surveys of 1987 and 1995/96 (POF); we consider 4 groups of households, defined according to income levels. For rural households, we use the 1996 PPV. The five categories of farms presented before will be considered. Thus, we have consumption structures for 10 types of consumers, 6 rural (5 farmers, 1 employees), and 4 urban. The data show that poorer households spend a higher proportion of their income on agricultural raw food. As expected, rural households present more self-consumption than urban households, and the proportion decreases from family farms 1 through 4; urban households spend a larger share of their income with housing. In general, both housing and education expenditure shares rise from low-income households to high-income ones.

3. Model Solution

As a result of structural reforms in international trade, prices of commodities traded by the Brazilian economy are expected to change. It is expected that the international supply curve of protected commodities will shift upwards, leading to increases in international prices, as portrayed in Figure 2 below.

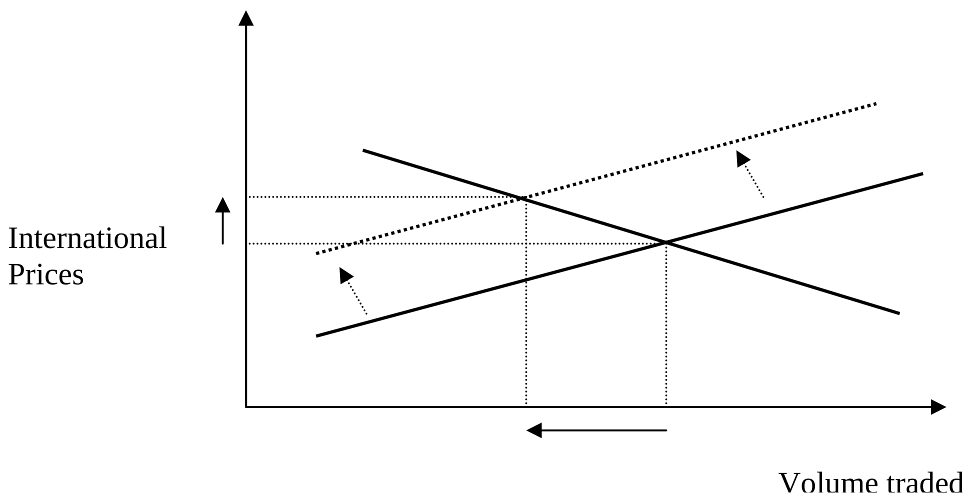


Figure 2 – Expected effects on international prices

Some countries will be negatively affected by the changes, some countries positively. It is expected that the demand for Brazilian exports will increase, as portrayed in Figure 3 below. The effects on internal prices will depend on the elasticity of supply. In the case of a flat supply curve, such as S_1, there will be no increase in the internal price of the commodity, and thus no reduction in internal consumption, and total production will increase by the amount of exports (arrow a in the figure). In the most probable case of some price transmission to the internal market, such as in the case of a positive slope supply curve such as S_2, the internal price is expected to increase (arrow c in the figure), leading to a reduction in the internal consumption. Thus, the final increase in production will not be the full amount of exports, as before, but a smaller amount (arrow b in the figure). It will be equal to the increased amount of exports, less the decreased amount of internal consumption (admitting that this internal price increase will not affect the country's competitiveness in the international market).

In order to estimate the impacts of this chain of events, the First Stage of the model estimation will simulate a situation in which the supply curve is such as S_1, that is, the whole increase in exports will be used to shock the model, ignoring any price increases. No restriction will be imposed on the supply of inputs either.

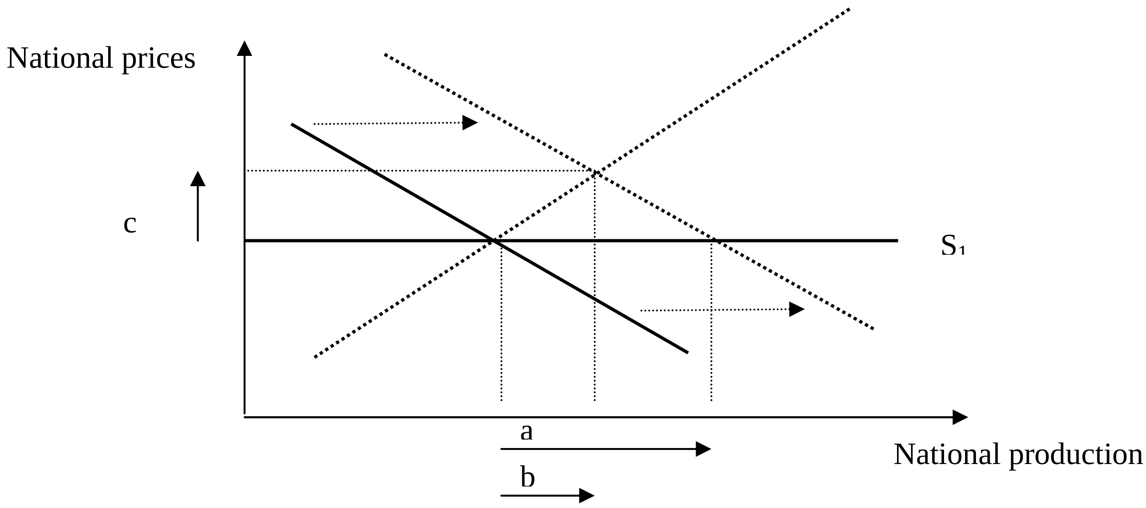
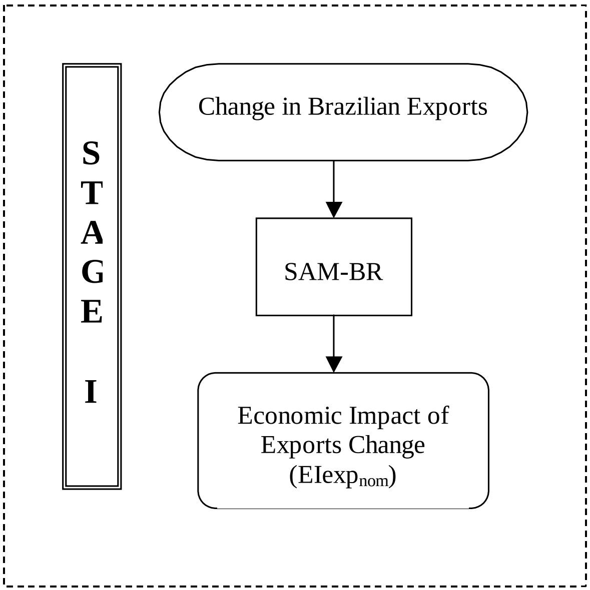


Figure 3 – Effects on the internal market

The results of this stage will indicate the upper bound effect on national production, admitting that the additional production would not cause any price effect on the internal market. Additional exports will be added to the previous production, imposing direct, indirect and induced effects on the system. Figure 4 displays the mechanism.

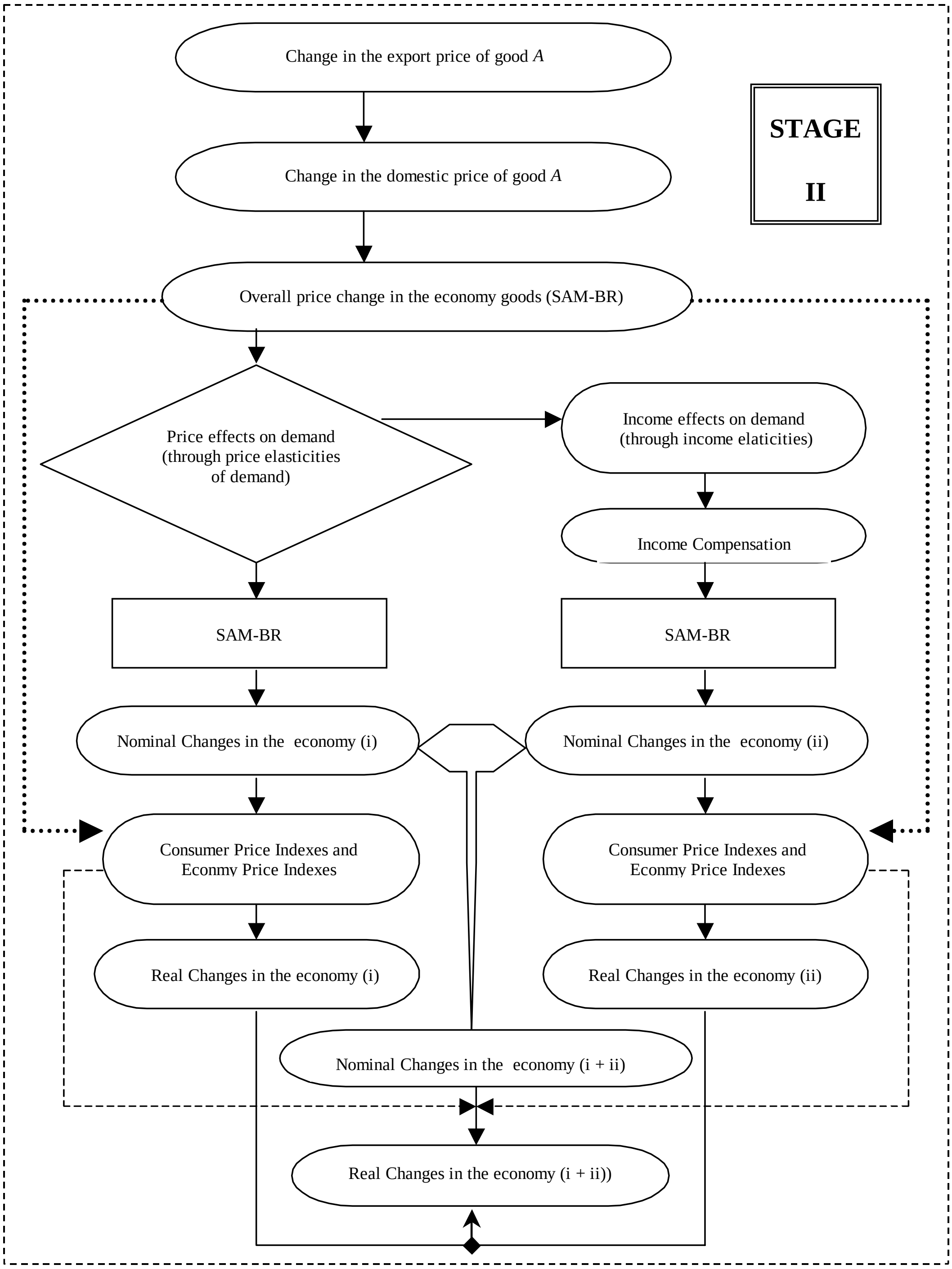
Figure 4



Some scenarios for price transmission (pass-through) will be considered: a) Perfect price transmission - if the international price of soybean is increased by 10%, the price of soybean in the Brazilian market will increase by the same percentage. This is an extreme case, with the situation simulated in Stage I being the other extreme. It is expected that the real world will be in between these two cases; b) Use of price transmission scenarios from OCDE studies. Alternatively, we can: c) use of the SAM shares of exports – if 35% of soybean production is exported, than the final increase in soybean prices will the international price increase multiplied by this share; d) use and intermediary situation in between cases a) and c) above.

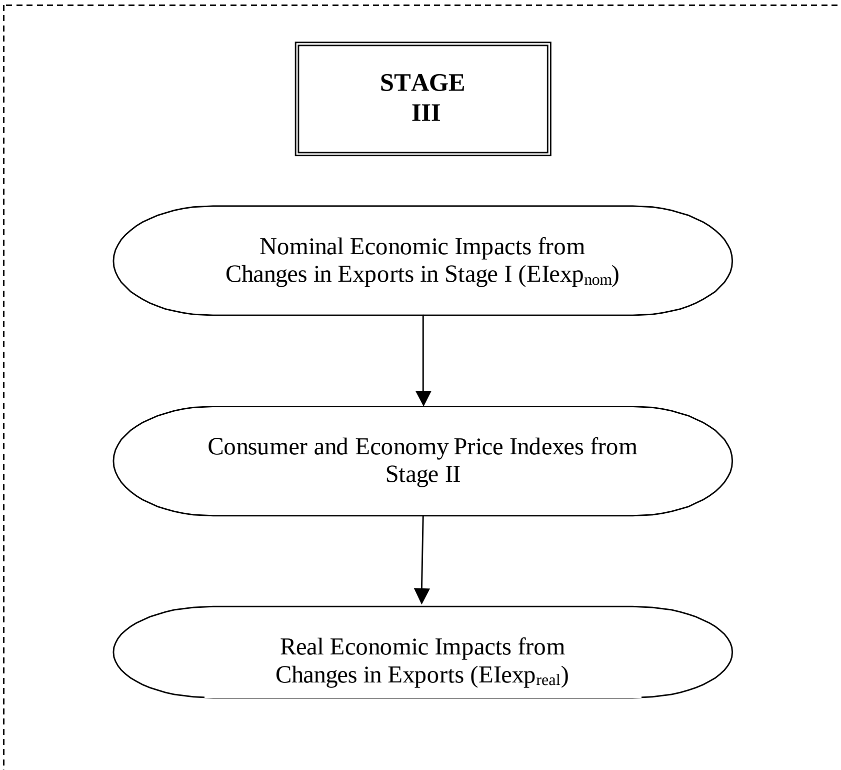
Given the international price change for a product, the above scenarios will determine a price change in the national market. This initial price change will spread throughout the national economy, and the final result will be measured as Figure 5 portrays. Using price and income elasticities, nominal and real income changes are introduced. At this stage, still no factor supply restriction is imposed.

Figure 5 – Stage II flow chart



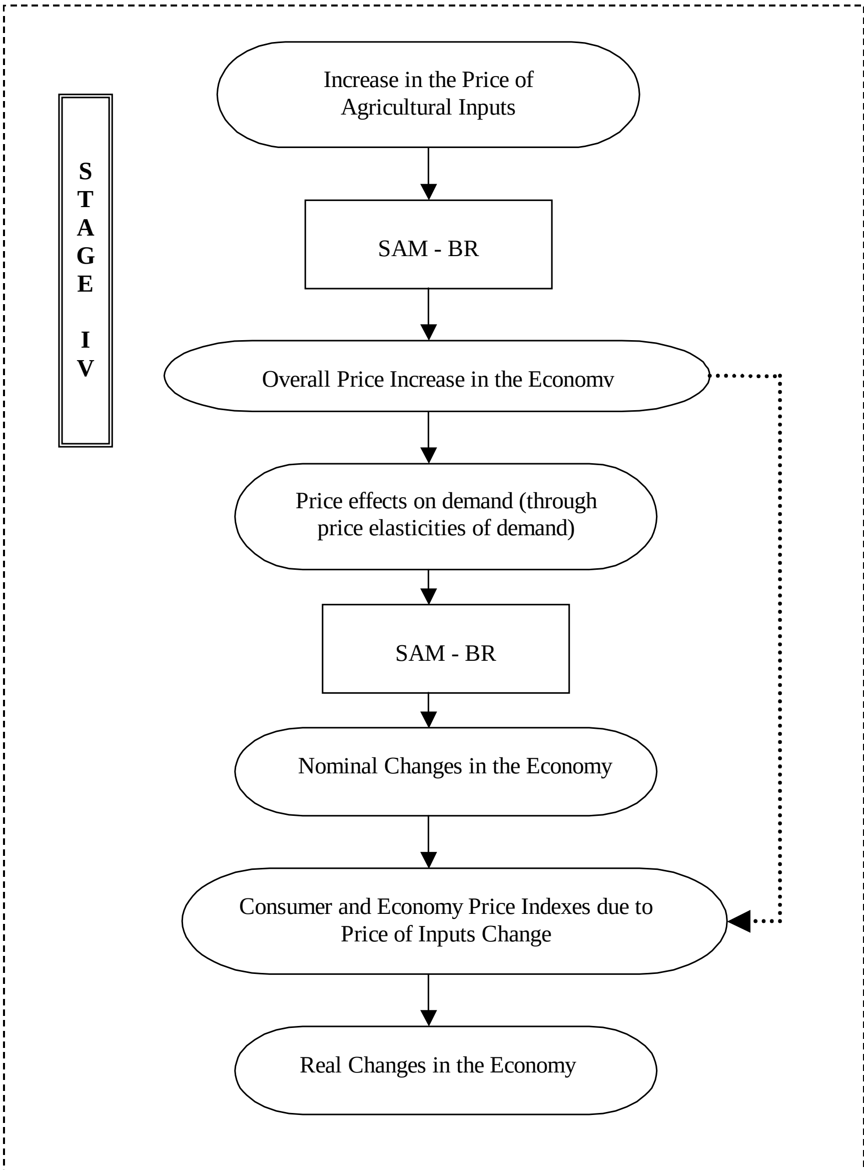
So far two results have been obtained. The first indicates the maximum effect of increased exports without any restriction on the supply side of the economy. Price effects have been introduced in Stage II, indicating the negative impacts on economic activity of the estimated price increases. Stage III uses both results to come up to the net results, still ignoring input supply restrictions. Figure 6 portrays the situation.

Figure 6



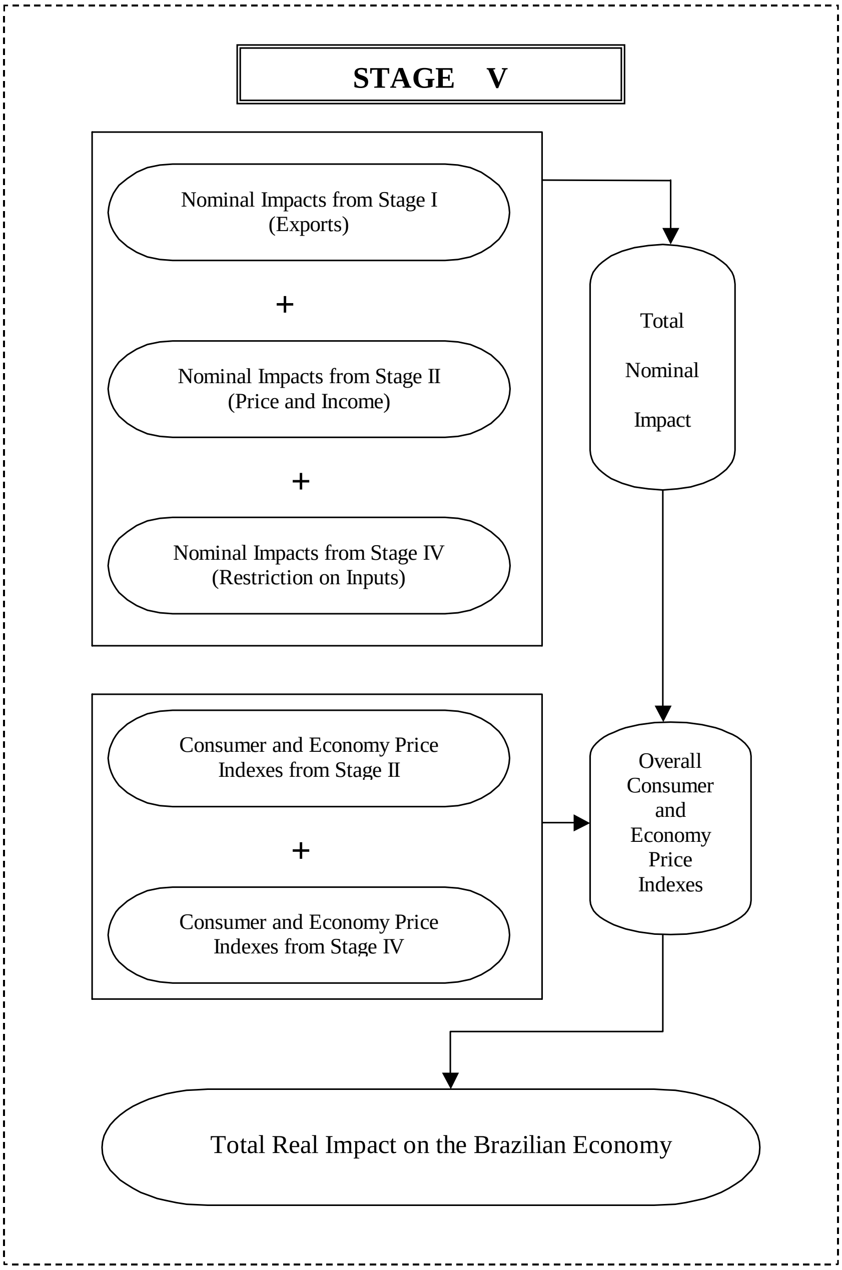
In order to introduce limitations on the input supply conditions of the economy, in Stage IV input price increases are introduced, as described in the next section. These determine product price increases, through the input-output chain. The later are simulated as in Stage III, causing modifications in economic activity. Figure 7 describes the mechanism.

Figure 7



Up to this point, three separate effects have been calculated: the upper-bound effect of Stage I, the influence of price transmission, and the influence of input limitations. The fifth stage consolidates them, coming up with the net effects on the national economy. The upper-bound effect calculated in Stage I is be discounted by the counteracting effects of Stages II-IV, as figure 8 exhibits.

Figure 8


STAGE V
Nominal Impacts from Stage I (Exports)
+
Nominal Impacts from Stage II (Price and Income)
+
Nominal Impacts from Stage IV (Restriction on Inputs)
Total Nominal Impact
Consumer and Economy Price Indexes from Stage II
+
Consumer and Economy Price Indexes from Stage IV
Overall Consumer and Economy Price Indexes
Total Real Impact on the Brazilian Economy

4. Input supply and product demand elasticities

4.1. Input supply

According to the mechanism described above, input supply restrictions are incorporated in the Fourth Stage. Given the additional input demand calculated in Stage III, input price changes are estimated, based on estimates of input supply price elasticities. The overall effect of these price changes are considered in the economy as a whole, diminishing the restriction-free previous income estimates.

Land is abundant in Brazil. It is true that quality varies (location included in quality), but nevertheless one should bear in mind that, contrary to developed country cases, the supply of land should be more price-elastic in Brazil. The last available agricultural census, referring to the year 1995, revealed that less than 50 million hectares were cultivated. In this same year, the amount of idle productive[1] area, including resting land, amounted to almost 25 million hectares. A study by Olivete et al (2002) indicates that the main supplier of area to production-expanding products in the last part of the 90s was natural pasture. The study also shows that the main area-demanding product is cultivated pasture: soybean demanded 2,165 million extra hectares, while cultivated pasture demanded 9,773 million. Adding to this supply of idle area, total pasture area in 1995 amounted to almost 178 million hectares. That is, at that time, expanding production could very easily use idle area without concerns with price increases, suggesting a flat land supply curve. In the year 2003, the amount of cultivated area grew to almost 57 million hectares, 14.5% higher than in 1995. This land use increase produced a 56.2% increase in the amount of production (in tons), revealing that the recent increase in Brazilian agricultural production was produced mainly by productivity growth. As Gasques et all (2002) show, Total Factor Productivity grew 4.51% in the 90s, and 4.25 between 2000 and 2002. As for land prices, a sharp decrease was observed from 1995 to 2000, when the price of a hectare costed only 45% of the price in 1995. Since then, prices are increasing steadily, with a jump between 2002 and 2003.

These numbers allow for the calculation of an estimate of land supply elasticity. Taking the period 1996-2003 (skipping the relatively high land prices in 1995), the price-elasticity of land supply would be of 1. Considering the 2000-03 period (including the peak prices of 2003), it would be 0.43, in line with the numbers used by OECD for European countries, USA and Japan. Eliminating the peak year of 2003, the number would be 0.54. Considering the mechanics of simulation within the model, the results of stages I-

[1] Idle productive area does not include forests or land inadequate for cultivation.

III will be expressed in output variations (monetary values). Therefore, it is necessary to associate input price increases to output variations. For a 56.2% increase in production between 1996-2003, cultivated area expanded by only 15%, providing an area-production elasticity of 0.27 (for every 1% increase in production, area increased by 0.27%). During this period, land supply price-elasticity was unitary, implying an output price-elasticity of 0.27. Considering more recent years, in which land price-elasticity was lower, the output elasticity would also be lower, between 1.35 and 1.69. For the purpose of calculations, an output elasticity of 2 will be used. This elasticity will only apply to agricultural products. No land price increase will apply to poultry and eggs, cattle ranching, hog and pig farming and other animal production.

As for manufactured inputs, the model considers fertilizers, defensives, and tractors. The first two are mainly imported, and tractors are even exported. Considering the evolution of fertilizer prices and quantities between 1996 and 2003, it is observed that quantities increased by 86%, while real prices increased by 24%. The implied elasticity in these numbers is 3.62. Ignoring the strong variations of 2003, and computing averages of initial and end years, the elasticity would be slightly higher, 3,85. Contrary to the case of land, in which the area-production elasticity was lower than unity, in the case of manufactured input it is higher. Between 1996 and 2003, for every extra 1% in production, the quantity of fertilizers increased by 1.53%. Considering the supply price-elasticity of 3.62, the output elasticity would be of 2.36. For the period 2000-2003, any 1% extra production caused an increase of only 1.03% in input use. This additional input use was accompanied by a 0.49% increase in input prices, leading to an output-elasticity of 2.0. These numbers are clearly influenced by the values for 2003. Considering the sensitivity of results to the period chosen, a number of 2.5 for the output elasticity should be chosen. Due to lack of data for other manufactured inputs, the same elasticity will be used for defensives and tractors.

There is a long lasting decreasing trend in labor absorption in Brazilian agriculture. Even in the 70s, when employment in general was growing strongly, agriculture released workers. In recent years, with the already demonstrated growth in production, employment is not following. That would be only a partial view, if other sectors were demanding labor from agriculture. However, that is not the case, for unemployment rates are widespread across sectors and regions of the Brazilian economy, at high levels. For an increase of 56.2% in agricultural production between 1996 and 2003, the number of employed persons in agriculture decreased by around 10%, and real wages decreased by around 4%. It is reasonable thus to suppose that any additional worker needed in agriculture in the near future will be available at the current market wage level.

In summary, the price effects due to input supply limitations used in the model will be

Input	A 1% increase in agricultural output will increase input prices by
Land	0.5%
Manufactured inputs	0.4%
Labor	0

4.2. Demand elasticities

A pseudo panel was constructed to calculate own-price, cross-price and income elasticities for a disaggregated list of food products, as well as for aggregated groups of non-food products. A two-stage demand function model commonly used in agricultural studies was constructed, with a more sophisticated estimation procedure. Household expenditure data were used to construct a three-dimension pseudo panel with: time, region and income bracket. This procedure allows for the control for effects that vary with time, but are constant across regions (random effects), as well as for effects fixed in time, but which vary across regions (fixed effects), effects which, when not specified, are included in the omitted variables, biasing the parameter estimators.

Data used came from the 1987/88 and 1995/96 POF – Pesquisa de Orçamentos Familiares, household expenditure surveys produced by IBGE, the Brazilian official statistics office. They consist of surveys covering expenditure of 14,000 families in 1987/88 and 16,000 families in 1995/96, for the most important metropolitan areas in Brazil: Belém (North), Fortaleza, Recife and Salvador (Northeast), Belo Horizonte, Rio de Janeiro and São Paulo (Southeast), Curitiba and Porto Alegre (South), and Brasília (Center-West). Only families with some expenditure with some of those items were included in the study, resulting in samples of 404.366 observations in 1987/88 and 347,569 in 1995/96. The product groups are as follows: home maintenance - cleaning items, such as soap, detergents, etc.; accessories - bags, belts, wallets and bijouterie; transportation - urban bus, fuel and labor; personal care - shampoo, soap, toilet paper etc.; personal expenditure - maids, hairdresser and sewing professionals; recreation - movies, clubs, magazines and non-academic books; and education - tuition for elementary and high schools, books and stationery.

In the first stage a pseudo panel was constructed aggregating consumption items into those 13 groups, with observations for 10 income brackets (income deciles), 10 metropolitan regions and 2 years.

In the second stage expenditure with the 19 food products was also disaggregated into the 10 x 10 x 2 fashion. Therefore, each step considered 200 observations. Within the TSBS, it is assumed that, in the first stage, consumers chose how to spend their income among the following groups of products: food, housing, home maintenance, apparel, shoes, accessories, transportation, health services and drugs, leisure and tobacco, personal hygiene, personal expenditures, and education. In the second stage, the expenditure allocated to food products will be attributed to 19 food products: sugar, rice, banana, potato, coffee, onion, wheat flour, manioc flour, beans, chicken, orange, milk, pasta, margarine, vegetable oils, bread, cheese, and tomato.

The estimation method employed is the Interactive Seemingly Unrelated Regression (ISUR), which is equivalent to the Full Information Maximum Likelihood method (FILM). When ISUR is employed to estimate a LAIDS model, the property of additivity of the demand function makes the variance and covariance matrix singular. To solve for that, any one of the equations is taken off of the system. In order to keep the homogeneity property, all prices must be normalized by the price referring to equation excluded. The coefficients for this equation are recuperated, given the additivity property. Symmetry is imposed in the estimation process.

Table 1 below presents the estimated own-price, cross-price, and income elasticities for 19 commodities. Both own-price and income elasticities present the expected signs, with all but one commodity in the inelastic portion of the demand function (wheat flower shows a price elasticity of –1.172). As expected, the cross-price elasticities are low, and complementarity and substitutability among goods are observed in general. As for income-elasticity, all commodities present low values, which was expected for food products. The higher values for the elasticities are observed for cheese (0.942), orange (0.853), and beef (0.651), which are relatively more expensive than the other items. Beans and manioc flower, very basic products in the typical diet of the Brazilian poor, exhibit negative income elasticities, although very close to zero.

Table 1 – Own-Price, Cross-Price, and Income Elasticities

	Sugar	Rice	Banana	Potato	Coffee	Meat	Onion	Manioc Flower	Wheat Flower	Beans	Chicken	Orange	Milk	Pasta	Margarine	Oil	Bread	Cheese	Tomato
ei1	-0.77																		
ei2	-0.21	-0.83																	
ei3	0.11	-0.05	-0.94																
ei4	0.12	-0.03	-0.05	-0.88															
ei5	0.27	0.14	0.02	0.14	-0.45														
ei6	0.18	0.30	0.05	0.46	-0.83	-0.58													
ei7	0.05	-0.01	0.01	-0.07	0.11	-0.01	-0.74												
ei8	0.17	0.16	-0.03	0.06	-0.03	-0.08	0.32	-0.68											
ei9	-0.21	0.06	-0.07	-0.25	0.09	-0.02	0.39	0.11	-1.17										
ei10	0.09	0.06	0.08	0.30	0.04	-0.08	-0.08	-0.11	0.21	-0.74									
ei11	0.14	-0.14	0.17	-0.44	0.19	0.05	0.15	0.20	-0.33	-0.05	-0.90								
ei12	0.06	-0.02	0.05	-0.04	0.03	0.00	-0.06	0.11	-0.02	0.07	0.05	-1.08							
ei13	-0.49	0.13	-0.21	0.35	0.35	-0.22	-0.19	0.72	0.58	0.12	0.13	-0.01	-1.07						
ei14	0.05	0.03	-0.05	0.17	-0.01	0.01	-0.37	0.02	-0.46	0.03	0.02	0.08	0.04	-1.08					
ei15	0.08	-0.08	0.02	-0.33	0.02	0.13	-0.21	-0.39	-0.11	-0.14	0.00	0.01	0.02	0.14	-0.92				
ei16	0.16	-0.14	0.07	0.10	-0.01	0.09	0.07	-0.19	-0.08	-0.08	0.01	0.10	0.05	-0.01	-0.18	-0.92			
ei17	-0.03	-0.02	0.32	0.04	0.09	-0.04	0.10	0.36	-0.24	0.28	0.00	-0.20	0.05	-0.07	0.13	-0.34	-0.52		
ei18	0.13	0.00	0.09	0.05	-0.08	-0.04	-0.06	0.09	-0.25	0.29	0.11	-0.09	-0.13	0.28	0.18	0.27	-0.08	-0.79	
ei19	0.23	0.00	0.03	0.06	0.09	0.02	0.01	0.17	0.01	0.11	0.05	0.00	0.00	-0.06	-0.16	-0.01	-0.02	0.10	-0.99
Expenditure Elasticities																			
Ei	0.19	0.16	0.62	0.59	0.24	0.65	0.51	-0.06	0.42	0.00	0.30	0.85	0.56	0.32	0.59	0.42	0.16	0.94	0.52

5. Some simulation results

In order to illustrate the functioning of the model, we have estimated the impacts of some hypothetical changes: a) a 10% increase on the international prices of soybean and poultry, with a 100% price-through to the internal market, and b) a 5% decrease in the prices of rice and beans. In case a) soybeans are mainly produced by commercial farms, and around 30% of total production is exported; chicken is produced mainly by family farms, and only 15% is exported. In case b) we consider the most important food items, in volume, in the Brazilian diet, especially for the poor. Beans are mainly produced by family farmers, while rice is mixed between commercial and family farmers. Therefore, we have two cases of export goods with different participation of commercial x family farmers, and with different importance in consumption structures, and two cases of food products highly important for the local consumption.

Figure 9 below portrays the results of the first case. As it can be seen, the total effect is more important for soybean than for poultry, with a 0.33% decrease in the production value for the first, and 0.16% for the latter. In both cases family farmers will suffer higher drops in production value than commercial farmers. Poor urban households will suffer the highest income decrease, even higher than the poorest family farmers.

Figure 9 - Effects of a 10% increase in the prices of Soybean and Poultry

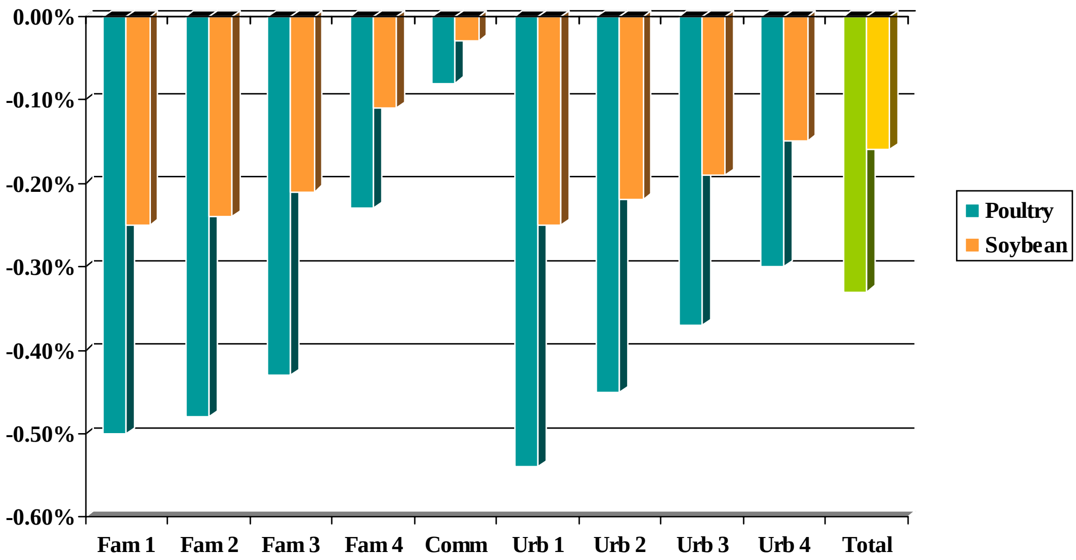


Figure 10 presents the results of the second case. Given a 5% decrease in the internal prices of rice and beans, total real income will increase by 0.07% in the case of rice, and .04% in the case of beans. In general, the impacts of changing the price of rice are higher than for beans, given its higher share in household budgets. The impacts are clearly differentiated across household types. For beans, urban household benefit the most, but for rice the rural ones are better off. Commercial farmers have their income decreased by lower selling prices, and since they consume a small amount of their budgets on rice and beans (and food in general, for the model is capturing direct, indirect and induced effects), their benefits in reduced buying prices do not compensate their losses in production.

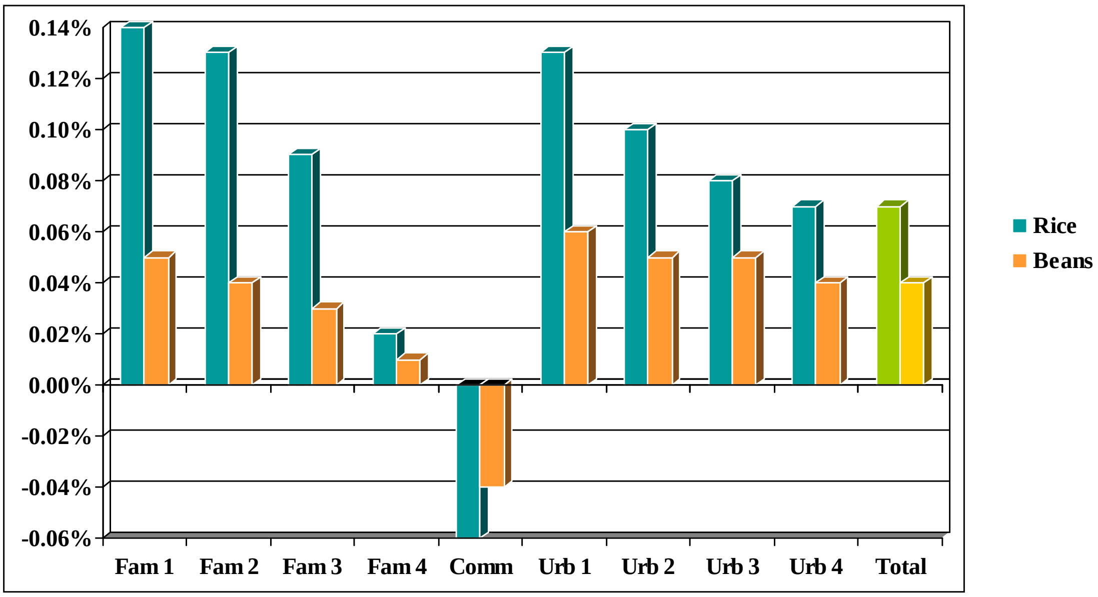


Figure 10 - Effects of a 5% decrease in the price of local consumption food products

6. Concluding remarks

These are just two examples of how the model can be used to simulate impacts of commodity price changes on poverty and income inequality. By including different farm types, their differentiated products mix, their received income, and consumption structures, it is possible to estimate how changes in specific prices will affect income distribution within the rural sector. Considering the urban sector, it is also possible to estimate how different groups of urban households will be affected by the price changes, given their income sources and consumption structures. As a result, after any price change in the system, the model will provide a new picture of the income distribution in the country. This information is very important for assessing the consequences of trade liberalization, for example, for in that case international prices will tend to change, with consequences for inequality and poverty in developing countries. Given the estimated impacts on different groups of producers and consumers, different sorts of cushioning policies can be designed.

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