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**IMPACT OF THE URUGUAY ROUND  
AGREEMENT ON THE BRAZILIAN  
ECONOMY: A GTAP APPLICATION**

Erly Cardoso Teixeira

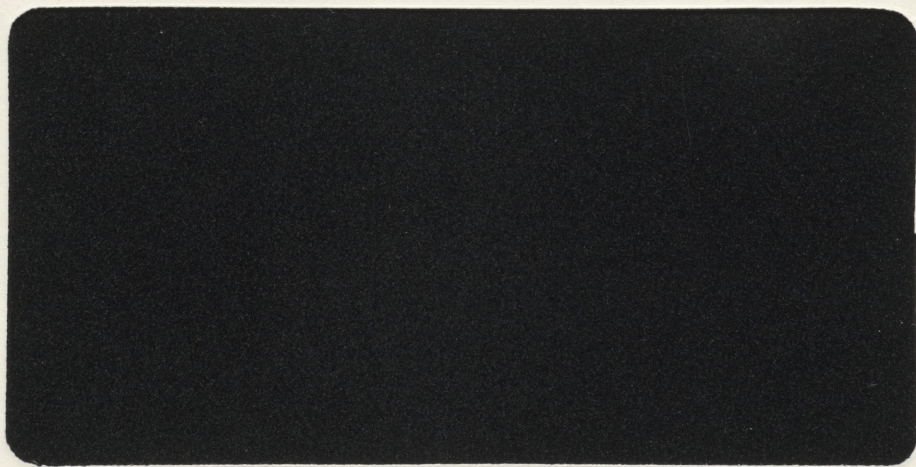
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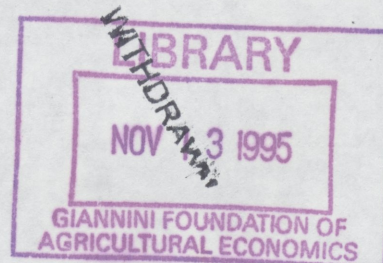
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## IMPACT OF THE URUGUAY ROUND AGREEMENT ON THE BRAZILIAN ECONOMY: A GTAP APPLICATION

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# IMPACT OF THE URUGUAY ROUND AGREEMENT ON THE BRAZILIAN ECONOMY: A GTAP APPLICATION\*

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## ABSTRACT

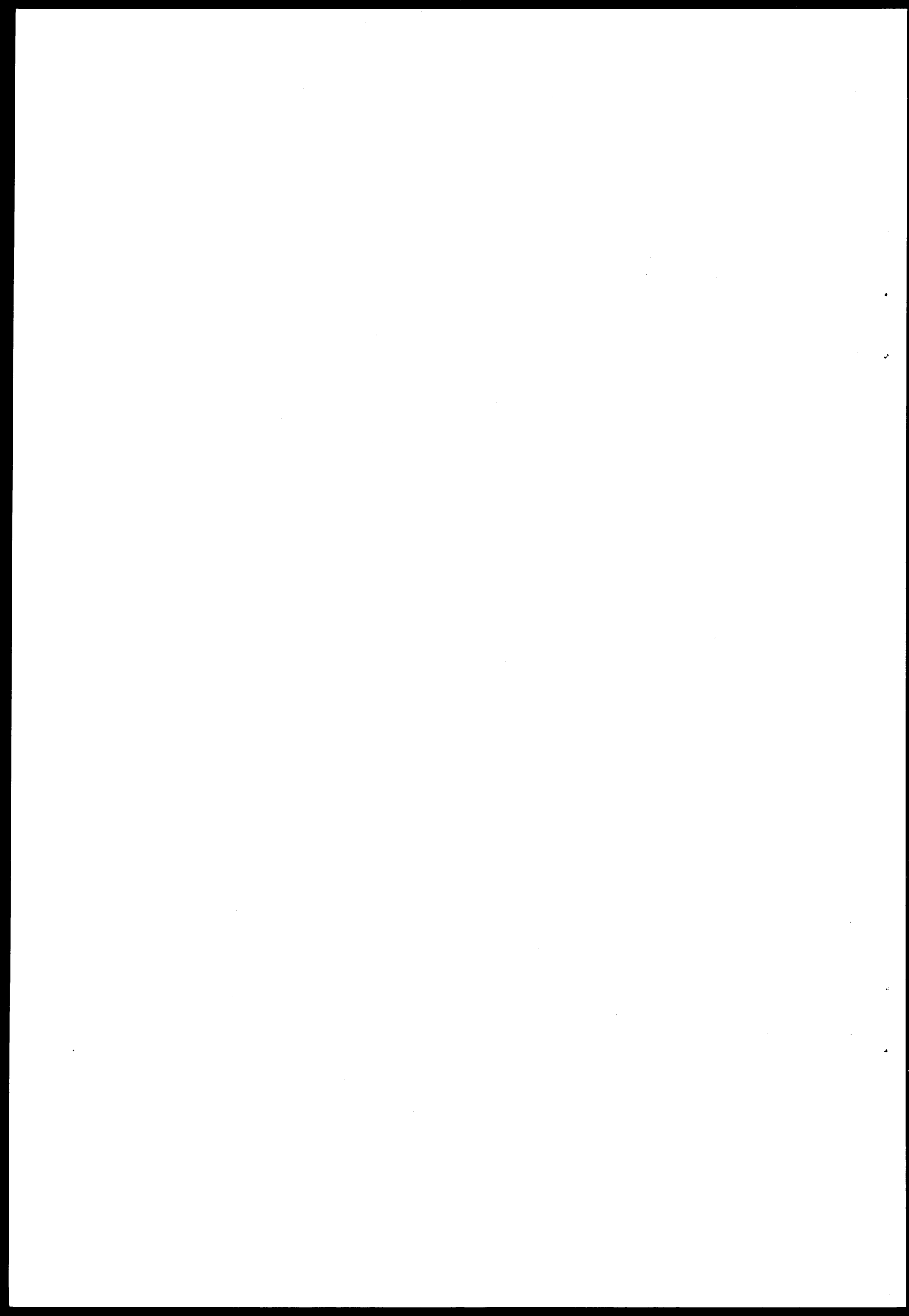
This paper evaluates the impact of the Uruguay Round Agreement on the Brazilian economy using an applied general equilibrium model. The results suggest that trade liberalization, as agreed to in the Uruguay Round has a very small effect on the production of agricultural and non-agricultural commodities. However, it has a strong impact on trade. The influence of the Uruguay Round Agreement on inflation is very small, causing an increase in price variation lower than 1.1 percent. GDP value increases by 1.24 percent, while welfare increases by more than 1.0 percent. Participation in the MERCOSUL economic block accounts for approximately half the changes in the Brazilian trade and GDP value. Further trade liberalization will have a small positive impact on economic growth.

## 1. INTRODUCTION

The Final Act of the Uruguay Round (UR) Trade Agreement requires worldwide reduction of domestic agricultural production subsidies, export subsidies, and import tariffs. The impact of this agreement on the Brazilian economy is not well known. The main objective of this research is to determine the impact of the Uruguay Round Trade Agreement on the Brazilian economy with an emphasis on the agricultural sector.

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\* Paper presented at the Department of Agricultural Economics, University of California, Davis, May 26, 1995. An earlier draft of this paper was presented at the North America Forum, Institute for International Studies, Stanford University, May 6, 1995.



Provisions in the UR agreement referring to agriculture require a reduction of 20 percent in trade distorting domestic support, aggregated across all commodities, over 6 years, from a 1986-88 base in developed countries (DVC). Developing countries (LDC) are required to reduce domestic agricultural production subsidy by 13.3 percent, over 10 years. Budget expenditures on export subsidies must be reduced by 36 percent over 6 years in developed countries. The developing countries need to reduce expenditure by 24 percent over 10 years. Import tariffs, in the same period, must be reduced by 36 percent in developed countries and by 24 percent on average in developing countries (GATT, 1994; Fagundes, 1994; Josling et al., 1994). Although those are the required reductions, a much smaller decrease in import tariffs is expected, around 15 percent, for the main traded commodities; since the developed countries will try to be close to the minimum rate of reduction of 15 percent for each tariff line. The minimum reduction required for developing countries is 5 percent for each tariff line. Also, the domestic agricultural production subsidy may not face any reduction due to the "Green Box" and Aggregate Measurement of Support (AMS) exemptions. On the other hand, quantity restrictions reinforce reductions in export subsidies and import tariffs, requiring reductions in the volume of subsidized exports by 21 percent in developed countries and by 14 percent in less developed countries. The "minimum access opportunity" requires that 3 percent rising to 5 percent of the domestic consumption must be imported by means of a reduced-tariff quota, in case of tariffication.

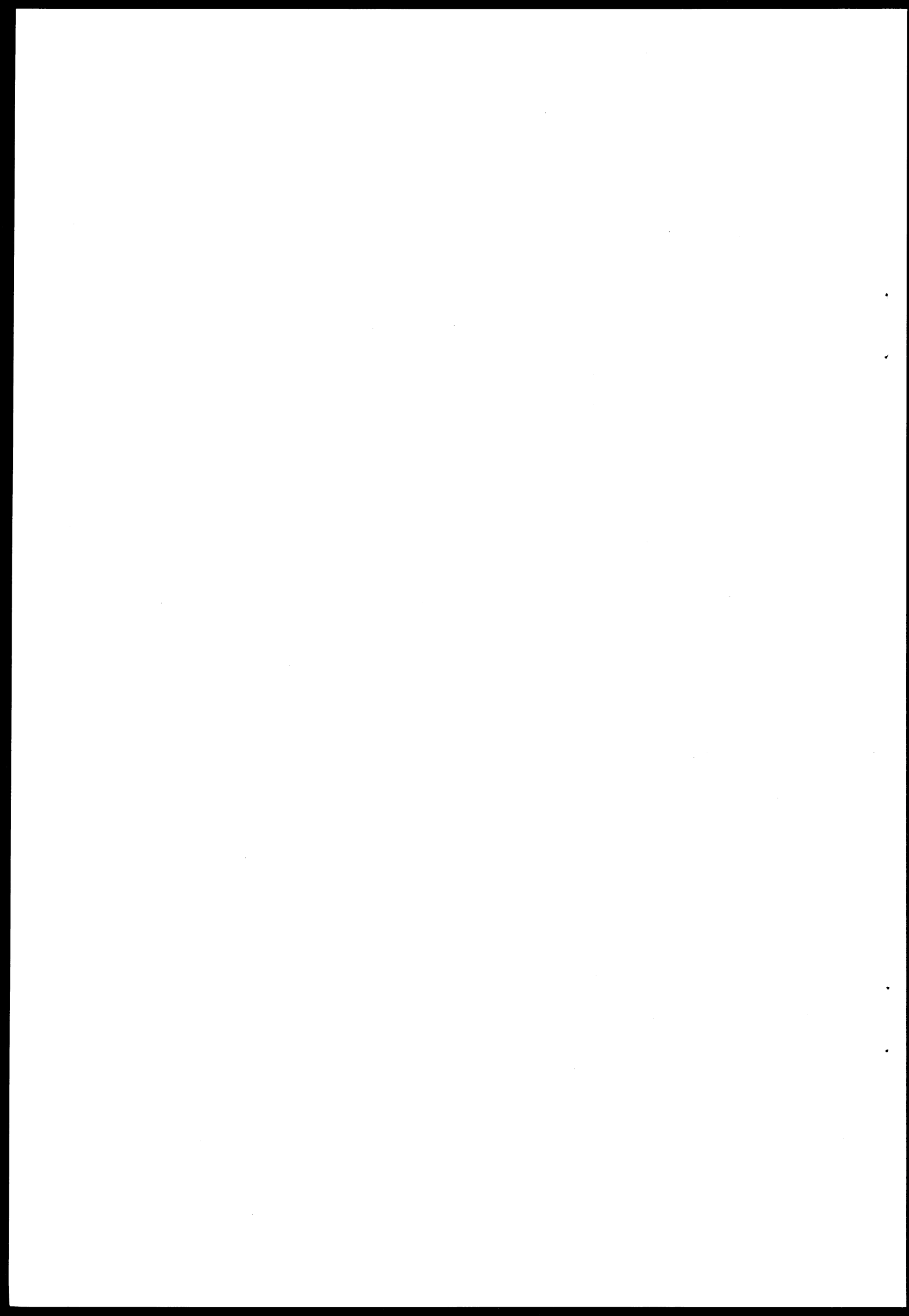
Tariffs on manufactured goods must be reduced by 38.5 percent and 37.5 percent in developed and developing countries respectively.

Tariff theory states that for small country economies any tariff level reduces domestic welfare, that is, free trade should be pursued. On the other hand, large country economies can be better off with smaller tariffs which generate terms of trade effect larger than the deadweight loss caused by a tariff (Helpman & Krugman, 1989; Vousden, 1990).

The underlying hypothesis is that tariff reduction in the lines of the Uruguay Round agreement would increase welfare and trade worldwide.

Partial equilibrium analysis has shown minor impact of the UR Agreement on trade (Josling et al., 1994). Also, Harrison et al. (1995), using a numerical general





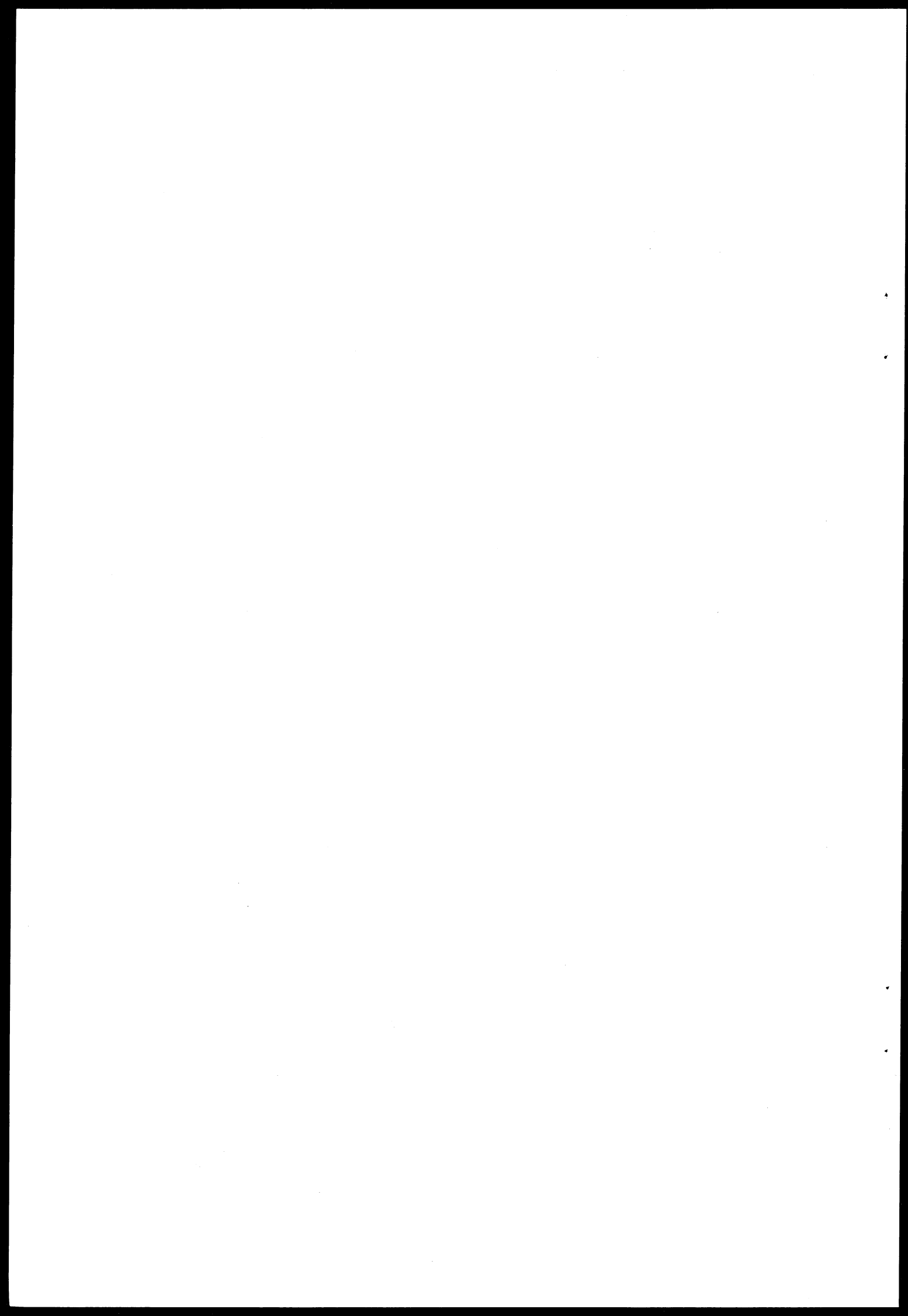
equilibrium model, found only moderate short run welfare gains from the Round. However, this welfare gain can be very large after capital stocks have adjusted optimally. They found that despite these global gains, some developing countries stand to lose from the Round. What is missing in most of these analyses is the much more trade liberalizing commitment by the countries inside regional economic blocks, such as MERCOSUL and NAFTA. Trade among countries inside MERCOSUL (i.e., Brazil, Argentina, Paraguay and Uruguay), beginning January 1995, is to become free of import tariffs and export subsidies (Fagundes, 1994; Henz, 1994). Also, trade among countries belonging to NAFTA (i.e., Canada, U.S.A. and Mexico) will be free of barriers in 10 to 15 years. This research adds this feature to the world trade picture and looks for the changes it carries on.

This paper presents next the data, the model, the simulations, and the software used to run the Global Trade Analysis Project (GTAP) model. After that comes the discussion of the results, and conclusions.

## **2. DATA, MODEL, SIMULATION, AND SOFTWARE**

This research is conducted under the framework of the Global Trade Analysis Project (GTAP) model (Hertel & Tsigas, 1996). GTAP consists of a global database and an economic model for performing simulations. Input-output matrices in the SALTER format for 24 regions and 37 commodities are the data source. The database represents economic conditions in 1992 and it contains domestic and international trade information.

Table 1 presents the aggregation consisting of the ten commodities and seven regions examined in this paper. However, this paper reports only the results for Brazil. All four crop commodities in the database are selected: paddy rice, wheat, other grains, and non-grain crops. Wool and other livestock products are aggregated in just one livestock category. The manufacturing sector is disaggregated into meat products, milk products, beverages and tobacco, and other manufactured products. Services constitute one complete aggregated category. Also, the dataset has three primary factor services (i.e., farmland, labor and capital). The chosen regions conform the three economic blocks: North America Free Trade Agreement (NAFTA), European Union (EU), and South Common Market (MERCOSUL). The EU is treated as one



single region. However, each country in the NAFTA block (i.e., USA, Canada and Mexico) can be examined in isolation. For MERCOSUL only two countries, Brazil and Argentina, are considered. The other members Paraguay and Uruguay do not have input-output tables included in the database and are aggregated with all other countries in the Rest of the World (ROW) category.

The model used is the Global Trade Analysis Project (GTAP), which is an applied general equilibrium (AGE) model (Hertel & Tsigas, 1996). Commodity supplies are based on single-output constant elasticity of substitution (CES) production functions. It is assumed that firms choose their optimal mix of primary factors independently of the prices of intermediate inputs. Thus, the elasticity of substitution between any individual primary factor on the one hand, and intermediate inputs on the other, is equal. The mix of intermediate inputs is also independent of the prices of primary factors. In other words, separability is symmetric. Furthermore, imported intermediates are assumed to be separable from domestically produced intermediate inputs, following the Armington approach to modeling import demand. Sectoral demands for intermediate inputs, and primary factor services are based on cost minimizing behavior, and they are derived from a nested CES production function. Land is employed in agriculture only and it is imperfectly mobile across sectors. All sectors employ labor and capital, which are perfectly mobile across sectors in a particular region.

Regional income consists of primary factor payments and net tax collection, and it is allocated to private and government consumption and savings in constant expenditure shares. Private household demands for consumption are based on utility maximization and are derived from a Constant Difference Elasticity (CDE) expenditure function (Hanoch, 1975; Hertel et al., 1991). Government demands for commodities are derived from fixed quantity coefficients.

International trade clears commodity markets, with each commodity being differentiated by its origin (i.e., the Armington assumption is applied at the country level). Production of new capital goods is financed by domestic savings and net capital inflow from all other regions. The price index for international capital is the numeraire.

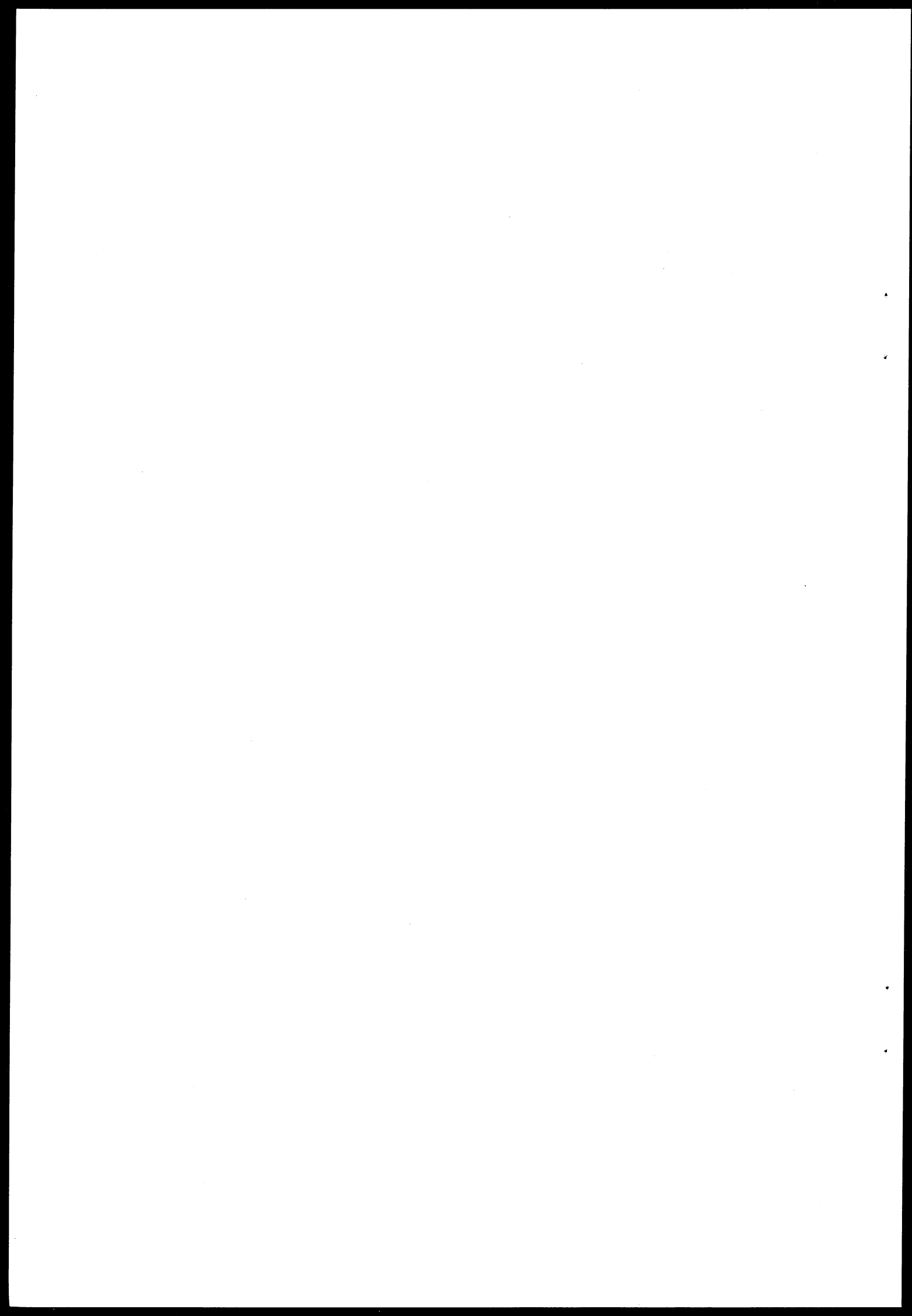
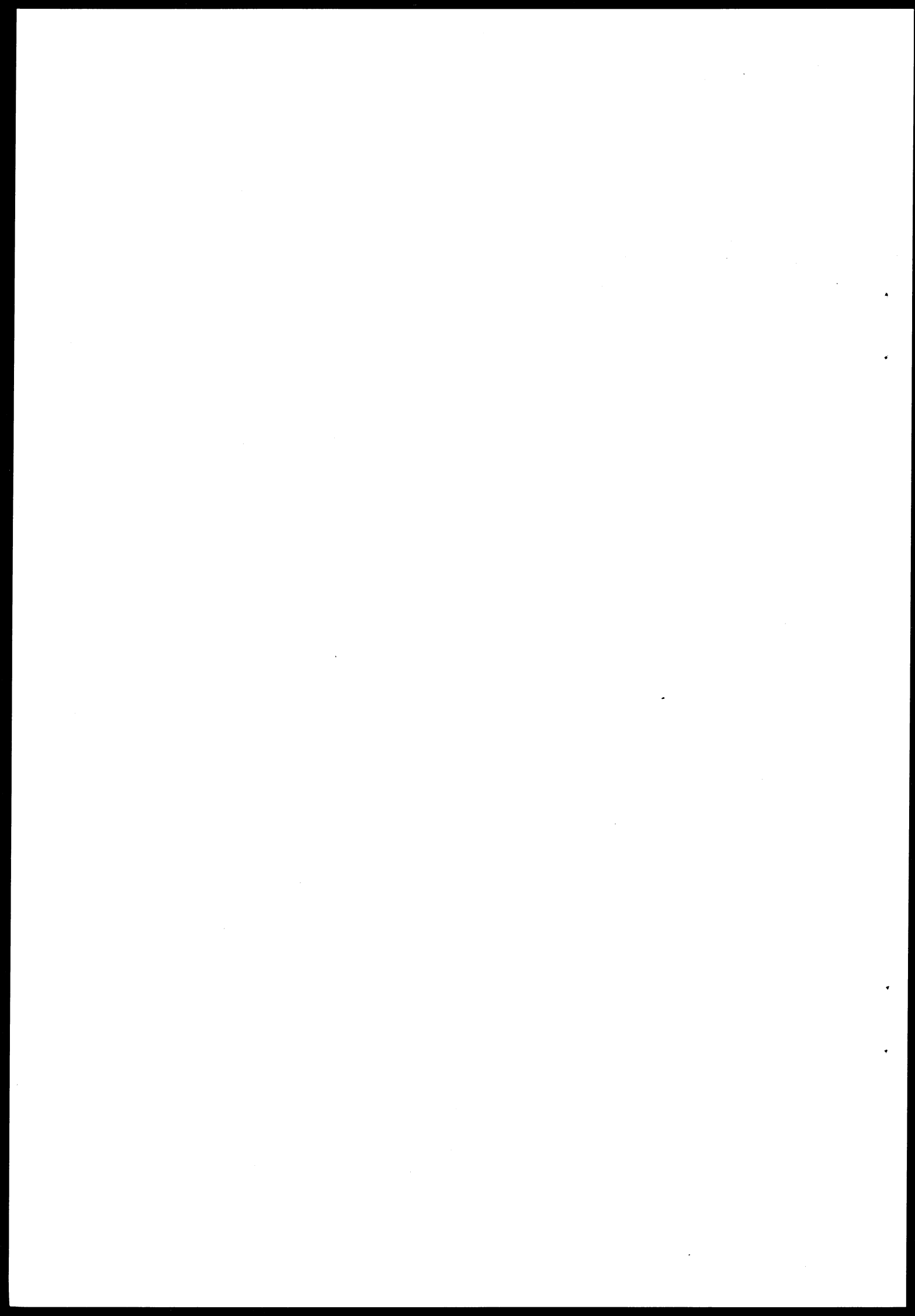


Table 1. Regional and Commodity Aggregation

Regional Aggregation	Commodity Aggregation
1. Canada (CAN)	1. Paddy rice
2. United States of America (USA)	2. Wheat
3. European Union (EU)	3. Grains
4. Argentina (ARG)	4. Non grain crops
5. Brazil (BRA)	5. Livestock
6. Mexico (MEX)	Wool
	Other livestock
7. The Rest of the World (ROW)	6. Processed meat products
Australia	7. Processed milk products
New Zealand	8. Processed beverage and tobacco
Japan	9. Manufactures
Republic of Korea	Forestry
Indonesia	Fisheries
Philippines	Coal
Singapore	Oil
Thailand	Gas
China	Other minerals
Hong Kong	Processed rice
Taiwan	Other food products
Rest of Latin America	Textiles
Sub Saharan Africa	Wearing apparels
Middle East and North Africa	Leather
Economies in Transition	Lumber
South Asia	Pulp paper
All other countries	Petroleum and coal
	Chemical, rubbers, plastics
	Nonmetallic minerals
	Primary ferrous metals
	Nonferrous metals
	Fabricated metal products
	Transport industries
	Machinery and equipment
	Other manufacturing
	10. Services
	Electricity, water and gas
	Construction
	Trade and transport
	Other services (private)
	Other services (govt.)
	Ownership of dwellings

Trade policy reform, for example a reduction of the bilateral tariff on imports, has many implications in a general equilibrium framework. This lowers the domestic price of the imported good for firms and private consumption. Cheaper imports serve



to lower the composite price of intermediates, causing excess profits at current prices. Provided the zero-profit condition is included in the model, this induces output to expand. The expansion effect induces increased demands for primary factors of production. This generates excess demand via the mobile endowment market-clearing condition, thereby bidding up the prices of these factors, and transmitting the shock to other sectors in the liberalizing region. In the country that produces the good for which the tariff has been reduced, there are many implications given the responses of individual households, production sector, and government to the tariff shock.

The simulations in this paper run through different scenarios where domestic agricultural production subsidies, export subsidies, and import tariffs are reduced as suggested by the Uruguay Round (UR) agreement (GATT, 1994) (Table 2). All shocks are once and for all, without a time schedule. The first scenario simulates a restricted trade liberalization. It considers the minimum commitment by country and by product category or tariff line. Domestic agricultural production subsidies fulfilling certain "green box" criteria need not be counted. Also, if the current Aggregate Measurement of Support (AMS) is less than 5 percent of the value of the product in developed countries and less than 10 percent in developing countries, it is exempted (Josling et al, 1994). Thus, under this scenario, production subsidy will face no reduction. The agricultural export subsidy is reduced by 36 percent in DVC and ROW, and by 24 percent in LDC. Import tariff is reduced by 15 percent in DVC and ROW, and by only 5 percent in LDC. Processed food like meat, milk, and beverage and tobacco are treated as agricultural products for reductions of export subsidies and import tariffs. Import tariff for manufacture is reduced by 38.5 percent and 37.5 percent in developed and developing countries respectively.

The second scenario adds the more liberalizing commitment under NAFTA and MERCOSUL accords to the first scenario. It simulates a 100 percent import tariff reduction in agriculture and manufactured goods for trade among members of NAFTA and MERCOSUL. Also, export subsidies are eliminated for agricultural goods and processed products (i.e., milk, meat, and beverages/tobacco) (Carriquiry, 1994).



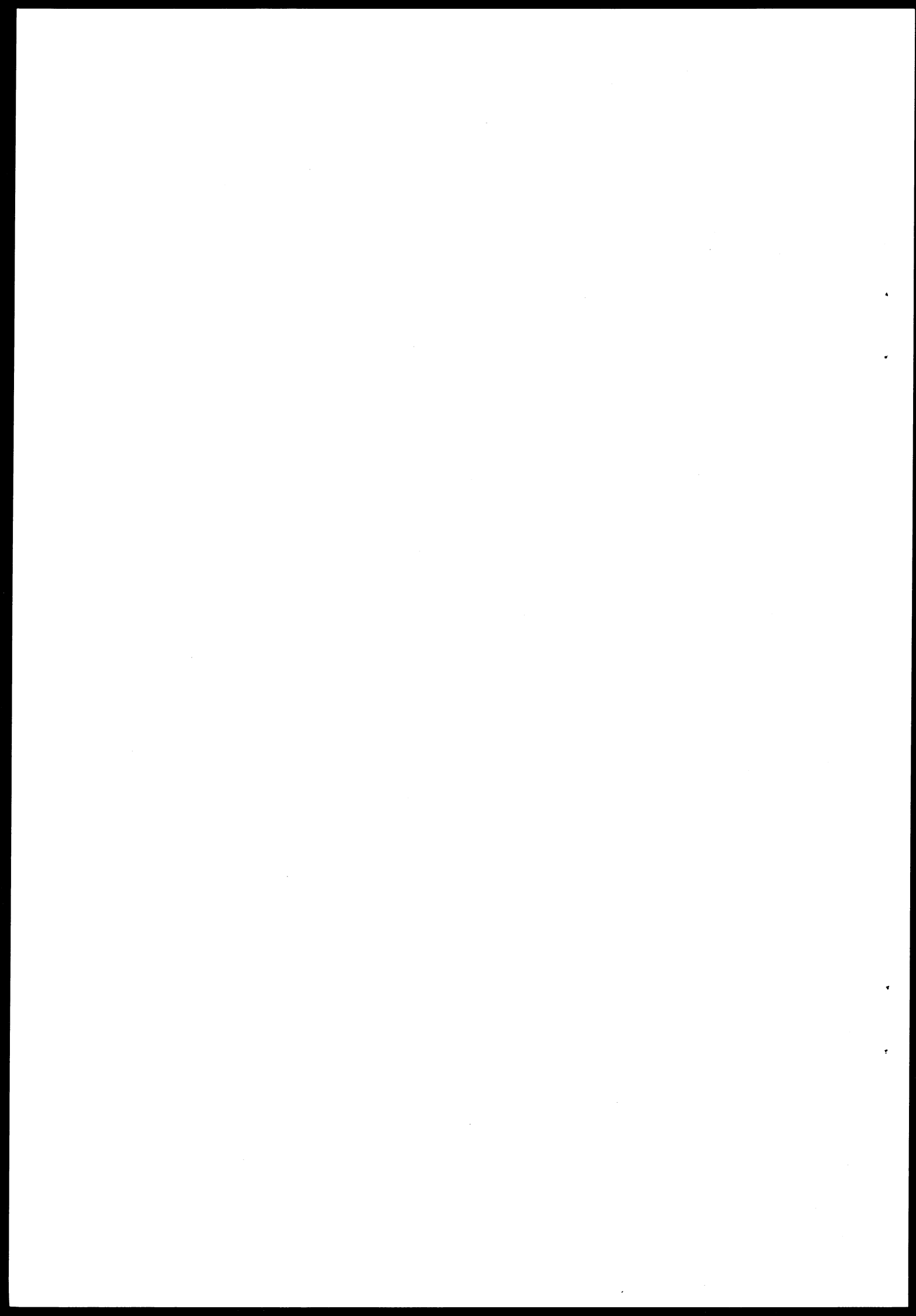
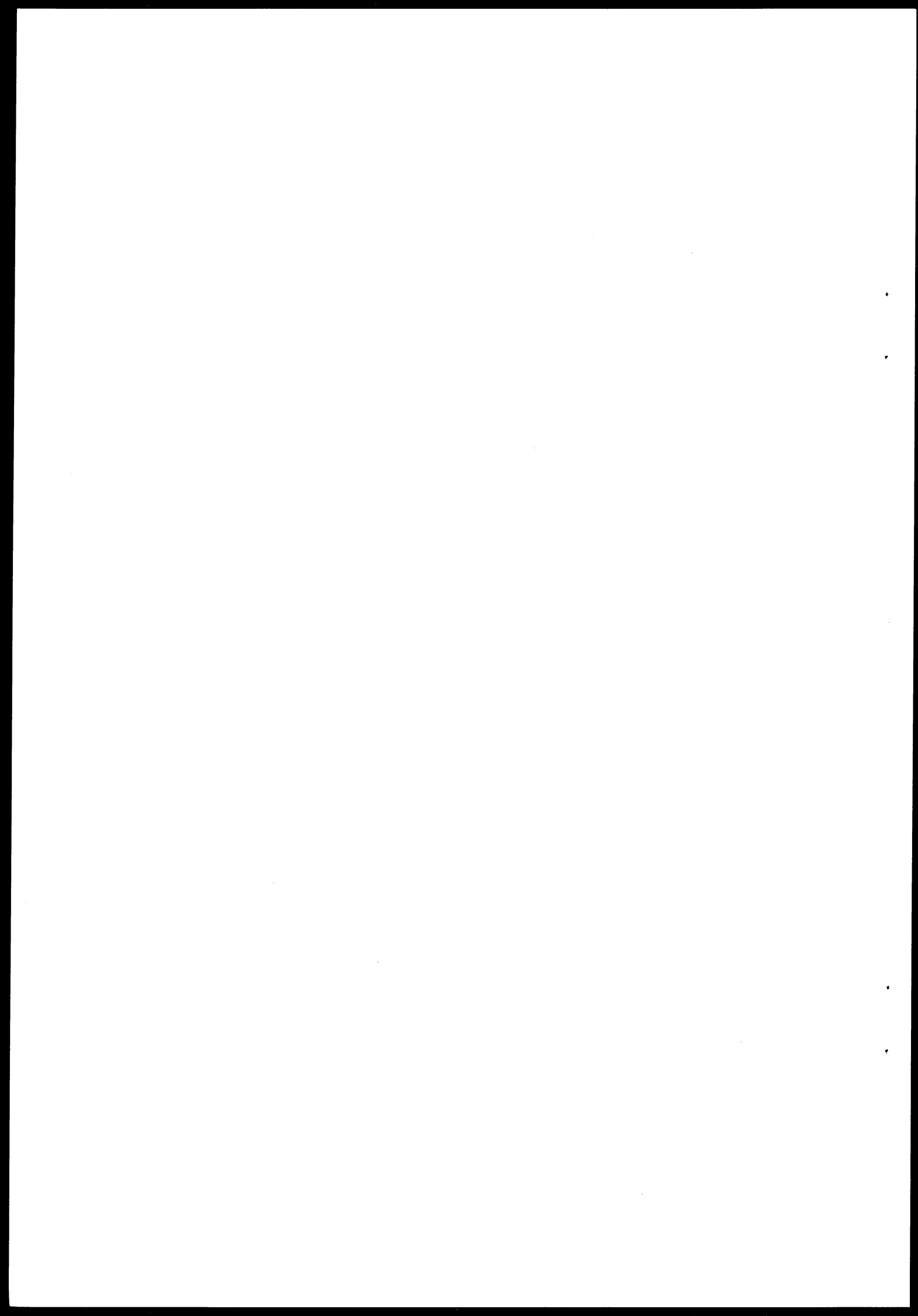


Table 2. Simulation under alternative scenarios of subsidy and tariff reduction.

Scenarios/ Sectors	Production Subsidy			Export Subsidy			Import Tariff		
	DVC	LDC	ROW	DVC	LDC	ROW	DVC	LDC	ROW
Scenario I									
Agriculture	0	0	0	-36	-24	-36	-15	-5	-15
Manufacture	0	0	0	0	0	0	-38.5	-37.5	-38.5
Service	0	0	0	0	0	0	0	0	0
Scenario II									
Agriculture	0	0	0	-36	-24	-36	-15	-5	-15
Manufacture	0	0	0	0	0	0	-38.5	-37.5	-38.5
Service	0	0	0	0	0	0	0	0	0
NAFTA/ MERCOSUL					YES			YES	
Scenario III									
Agriculture	-20	-13.3	-20	-36	-24	-36	-36	-24	-36
Manufacture	0	0	0	0	0	0	-38.5	-37.5	-38.5
Service	0	0	0	0	0	0	0	0	0
Scenario IV									
Agriculture	-20	-13.3	-20	-36	-24	-36	-36	-24	-36
Manufacture	0	0	0	0	0	0	-38.5	-37.5	-38.5
Service	0	0	0	0	0	0	0	0	0
NAFTA/ MERCOSUL					YES			YES	

The third scenario takes trade liberalization to the full extent of the Uruguay Round. Agricultural production subsidies, export subsidies and tariff reductions are at the maximum required by the Round. Production subsidy is reduced by 20 percent in the developed countries (DVC) (i.e., Canada, USA), by 16.8 percent in the European Union, and by 13.3 percent in the less developed countries (LDC) (i.e., Argentina, Brazil, and Mexico). Because some major developed countries are in the rest of the world (ROW) category, and because they are, in some case, very protective, it is assumed a 20 percent reduction in ROW agricultural production subsidy. The agricultural export subsidy in DVC and ROW are reduced by 36 percent and by 24 percent in LDC. The agricultural import tariff is reduced by 36 percent in DVC and ROW, and by 24 percent in developing countries. Only import tariff reduction is



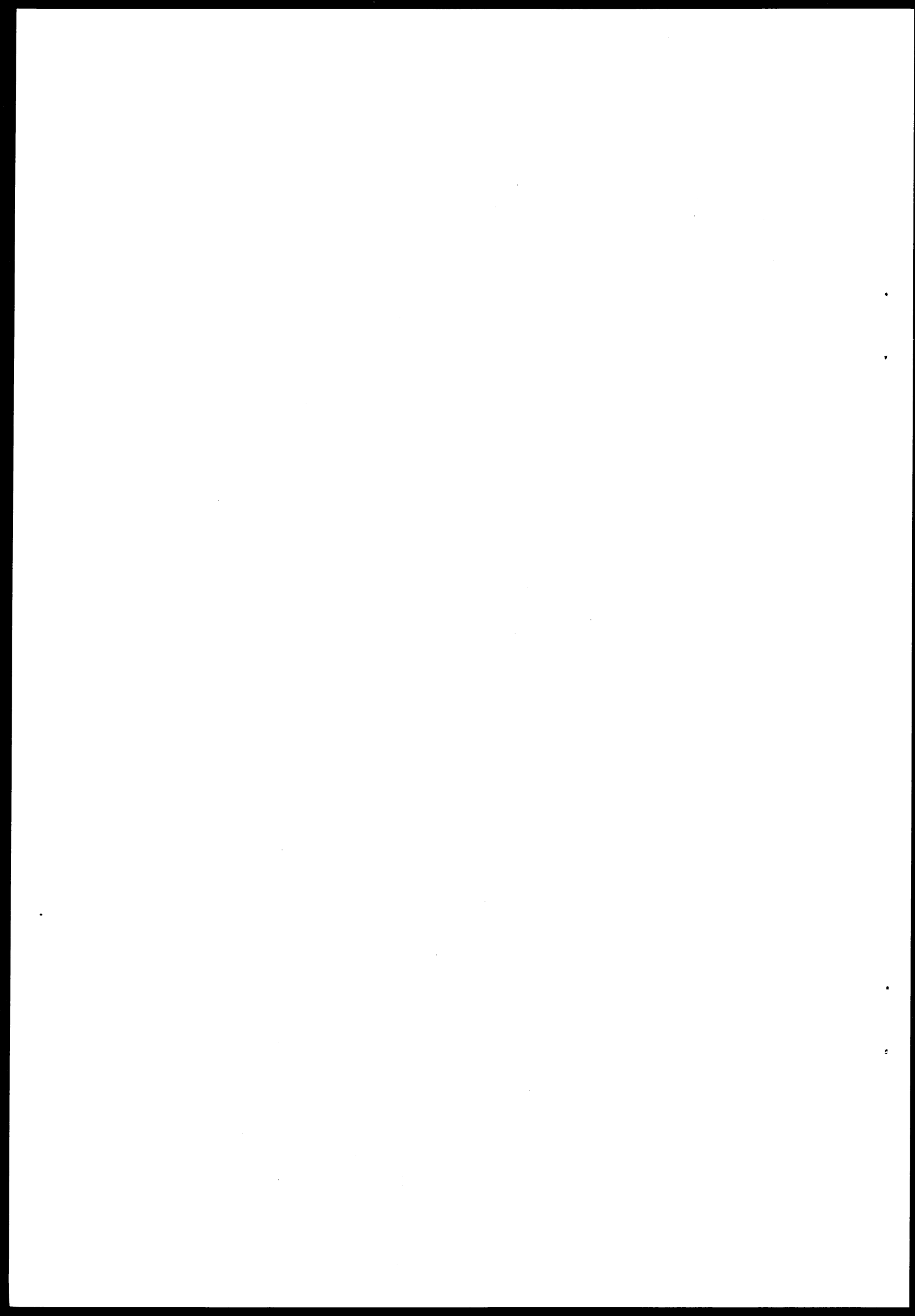
required for the manufactures sector in the order of 38.5 percent for DVC and 37.5 percent for developing countries. There is no shock required for the service sector.

The last scenario adds the more trade liberalizing commitments of the economic blocks MERCOSUL and NAFTA to the third situation. Trade among the member countries of the regional economic blocks, NAFTA and MERCOSUL, is free of export subsidies and import tariffs on agricultural products. Also, import tariffs on manufactured goods are eliminated (Carriquiry, 1994).

The GTAP model is implemented using the GEMPACK software (Codsí & Pearson, 1988; Harrison & Pearson, 1994). This software allows, by changing some closures, to run GTAP as a multi-region general equilibrium model and other variation like single or multi-region partial equilibrium. Although GTAP is implemented in a linearized setting, GEMPACK may obtain arbitrarily accurate solutions to the underlying nonlinear model (Pearson, 1991; Hertel, Horridge & Pearson, 1992).

### 3. RESULTS

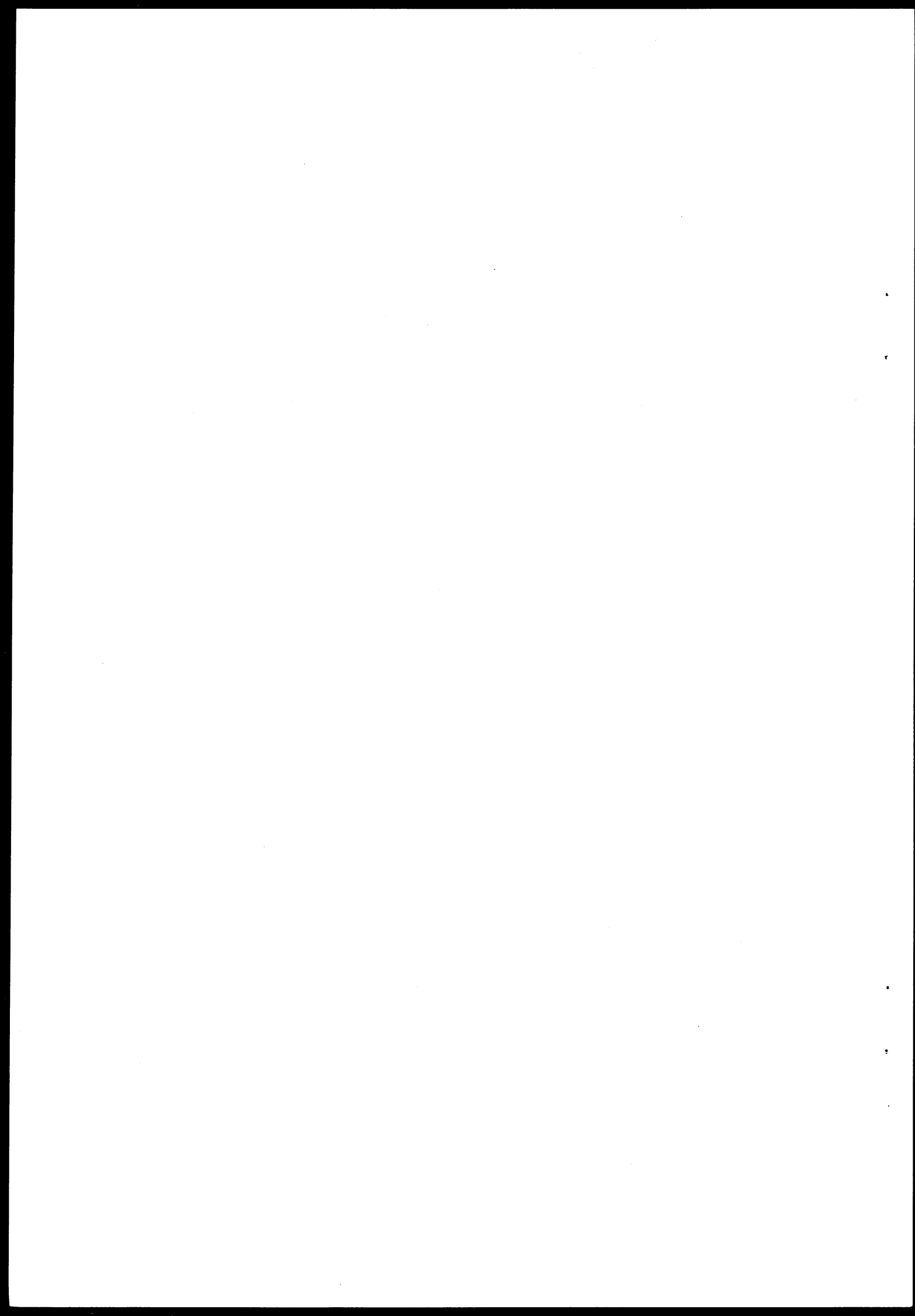
This section presents the findings which reflect the impact of the Uruguay Round Agreement on the Brazilian economy, considering the necessary period required for its full implementation (i.e., 10 years). Four scenarios are examined, starting from a less trade liberalizing situation where only the minimum agreed in the Round is considered and finishing with the simulation of the agreement at its full extent, including the NAFTA and MERCOSUL economic blocks, where all trade barriers are eliminated (Table 2). Processed meat and milk, and beverages/tobacco are treated as agricultural goods and face the same reduction in import tariffs and export subsidies. However, they were not subject to shocks on domestic agricultural output subsidies, and thus treated as manufactured products for which there is no agreement on output subsidy in the Round. Also, manufacture output subsidy is very rare and low, when they are not irrelevant. Quantity restrictions established by the Agreement, such as the reduction in the volume of subsidized exports by 21 percent and 14 percent in developed and developing countries, respectively; and the "minimum access opportunity" requiring that 3 to 5 percent of the domestic consumption should be imported in case of tariffication, were not simulated. These quantity restrictions were included in the Uruguay Round Agreement to make sure the agreed reductions on



export subsidies and import tariffs would take place and impact trade. However, in the empirical analysis, the subsidy and tariff reductions are binding, making it unnecessary to impose quantity restrictions. On the other hand, in the case of tariffication, some countries set their tariff for the base period at a very high level, such that the Uruguay Round requirement for tariff reduction is not binding. In this case, quantity restrictions in the form of "minimum access opportunities", if imposed, would avoid overestimation of the impacts of the Uruguay Round. Also, it is possible a smaller reduction on export subsidies than the 36 percent for developed countries or 24 percent for developing countries. If trade liberalization increases world price as it is expected, export subsidy expenditure will be reduced relative to the base period, requiring a smaller reduction in export subsidy expenditure by each country.

The results start with commodity output, progresses to trade, price variables, and finish with a discussion of the impact of the Agreement on economic welfare.

**Commodity Output.** Percentage changes in commodity output under four Uruguay Round Agreement scenarios are presented in Table 3. Under the first scenario (Scenario I), agricultural output subsidy is still in place; and the import tariff on agricultural goods is reduced by 15 percent in developed countries and 5 percent in developing countries. The manufactured goods import tariff is reduced by 38.5 percent and 37.5 percent in developed and developing countries, respectively. The Agricultural Export subsidies fall by 36 percent and 24 percent in developed and developing countries, respectively. Thus, this is a very limited trade liberalizing scenario, the minimum agreed in the Uruguay Round. Under this scenario, rice and grains output in Brazil decreases by less than 1.0 percent due to the 5 percent reduction in its import tariff and the 24 percent reduction in its export subsidy that would increase the price of intermediate inputs by more than the commodity price. Production of wheat, non-grain, livestock, processed meat and milk, and beverages/tobacco increase by less than 1.5 percent. This increase in production is due to the impact of the differentiated reduction on import tariffs and export subsidies, which generates a small increase in the domestic market price for those products. Reductions of import tariffs is the main factor determining the small decrease in the production of other manufactured goods. In this case, although Brazil is a net



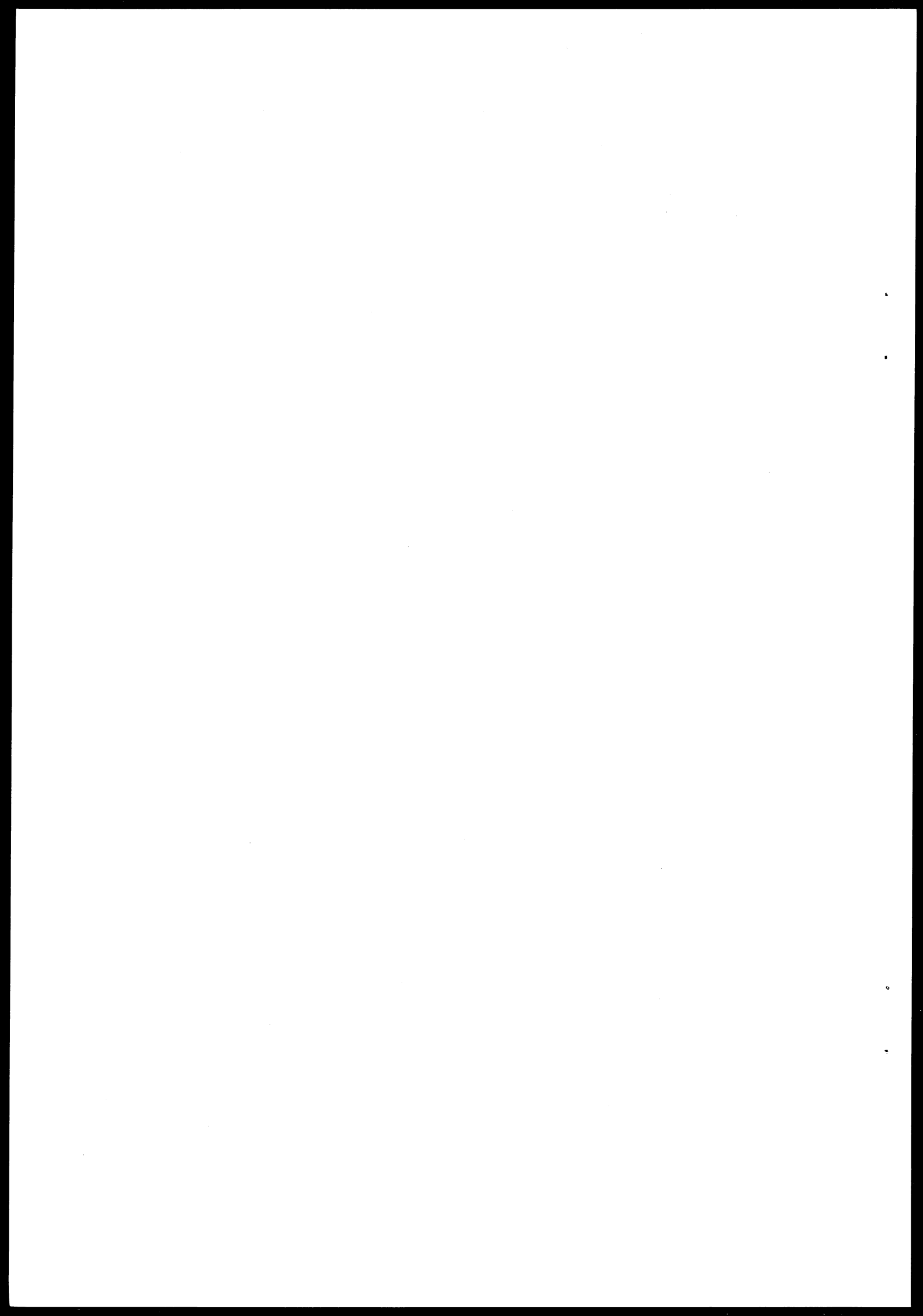
exporter, the export subsidy for manufactured goods is non-existent or irrelevant, and there is not a large differential on the required tariff reduction between developed and developing countries, such that tariffs reductions reduce domestic market price (Table 9).

Table 3. Percentage change in commodity output (qo) under four Uruguay Round Agreement scenarios; Brazil, 1992.

Commodity	Scenario I	Scenario II	Scenario III	Scenario IV
Rice	-0.41	-0.64	-1.26	-1.46
Wheat	0.13	1.59	-1.54	-0.11
Grains	-0.65	-1.48	-1.43	-2.09
Non-Grains	0.60	0.01	3.19	2.61
Livestock	1.00	0.93	1.31	1.23
Meat	1.36	1.29	1.97	1.89
Milk	0.87	0.13	0.02	-0.55
Beverage- Tobacco	0.81	0.57	1.02	0.75
Manufactures	-0.84	-0.70	-1.19	-1.06
Services	0.35	0.33	0.40	0.39

In the second scenario (Scenario II), trade liberalization is increased, relative to the first scenario, via a 100 percent reduction of import tariffs and export subsidies on trade among the member countries of NAFTA and MERCOSUL. Although the additional change in production is very small, most of it comes from the more liberalized trade environment with MERCOSUL. In this scenario, production of rice and grain in Brazil decreases by 0.64 percent and by 1.48 percent respectively. This fall in production is greater than that of the first scenario possibly due to increased competition from lower cost producers in Argentina. The increase in the production of wheat, non-grain, livestock, meat, milk, and beverages/tobacco is smaller than that of the previous simulation, ranging from 0.01 percent for non-grain to 1.59 percent for wheat. Thus, the impact of MERCOSUL is to further reduces the production of rice and grains and increases the production of other agricultural commodities by less than in the previous scenario. Production of manufactured goods decreases 0.7 percent, a smaller fall than that observed in Scenario I. This is due to the increased demand for the Brazilian manufactured products in Argentina which holds their prices at a higher level than in the first scenario.

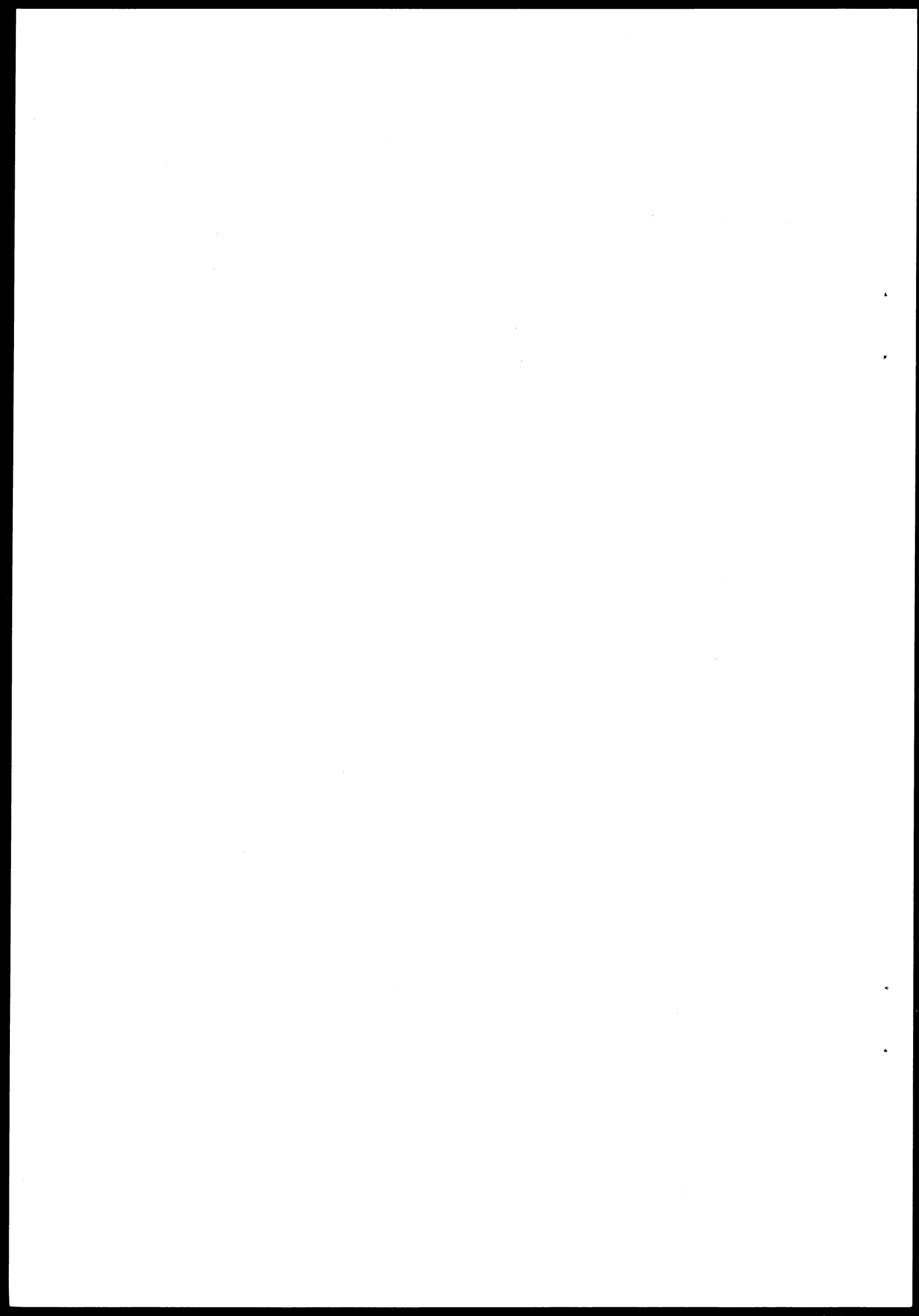




The third scenario (Scenario III) implies a much more trade liberalized environment. Domestic agricultural subsidies are reduced by 20 percent in the US, Canada, and ROW; by 16.8% in the EU; and by 13.3 percent in Brazil, Argentina and Mexico. Agricultural Import tariffs and export subsidies are reduced by 36 percent and 24 percent in developed and developing countries, respectively. The reduction of import tariffs on manufactured good is the same as in the first and second scenarios. The reduction of the production subsidies generates a larger fall in the production of rice (-1.26 percent) and in the production of wheat (-1.54 percent). No change is observed in the production of grains relative to the second scenario, which means that this more liberalized situation has the same impact as the presence of MERCOSUL in the production of grains. The production of the other agricultural commodities increases more than with earlier scenarios from 0.02 percent for milk up to 3.19 percent for non-grains. Production of manufactured products decreases by 1.19 percent.

In the fourth scenario (Scenario IV), trade is liberalized to a greater extent than in the third scenario through the elimination of import tariffs and export subsidies in trade among countries belonging to the NAFTA and MERCOSUL economic blocks. The further reduction of import tariffs and export subsidies lowers the profitability of rice and grains in the Brazilian market thereby reducing production of these two commodities: rice production falls by 1.46 percent and the production of grains decreases by 2.09 percent. The reduction in wheat production is now much smaller, -0.11 percent relative to -1.54 percent in the third scenario. Milk production, which increases in the other simulations, decreases by 0.55 percent in the fourth scenario. Production of other agricultural commodities increases by a lower rate in the presence of MERCOSUL. The production of manufactured goods is reduced by a smaller rate (-1.06 percent).

Summarizing these results, one can say that trade liberalization at the extent of that in the Uruguay Round Agreement has a very small impact in production of agricultural goods, non-agricultural commodities and services in Brazil. Further liberalization, following Uruguay Round criteria, would have a production reducing impact on rice, wheat, grain, milk and manufactured products while increasing production of non-grain, livestock, meat, beverage/tobacco, and services. The impact



of NAFTA and MERCOSUL on production in Brazil is even smaller than the effect of the Uruguay Round. The presence of MERCOSUL, since most of the effect on the II and IV Scenarios comes from this block, has a positive influence only in the production of wheat, and manufactured goods.

**Trade.** The percentage changes of aggregate exports are presented in Table 4. The value of exports valued at f.o.b. prices is in the first column under the header "Basic Value". The export value for each commodity: rice, wheat, grains and milk is lower than 11 million dollars, implying that Brazil is a residual exporter of those commodities. The most economically significant exports are: non-grains, meat, beverage and tobacco, services and above all, industrial products.

In the first scenario, where trade liberalization is restricted to the minimum commitment agreed to in the Uruguay Round, the exports of all commodities, except grains, increases. Increasing trade liberalization, as simulated in the second, third, and fourth scenarios, expands the quantity of exports for all significantly exported commodities, except services. In the second scenario (Scenario II), adding the more trade liberalizing conditions of NAFTA and MERCOSUL to the first scenario, has a small effect on the most exported agricultural commodities, however, it almost doubles the change in the exports of manufactured products. After trade liberalization is complete in the fourth scenario, change in exports of the main agricultural products, which are non-grain, meat, and beverage and tobacco, is more than twice what it is in the first scenario. This is due to the strong trade liberalization impact of the Uruguay Round Agreement on agriculture exports (Scenario III). On the other hand, MERCOSUL has again a small negative impact in the most significantly exported agricultural products (Scenario IV). However, through participation in the MERCOSUL economic block (Scenario IV), Brazil's export of manufactured products increases by 26.19 percent, almost twice the 13.39 percent increase in the third scenario.

Total exports, weighted by fob prices, increases by 12.54 percent in the first scenario and by 22.51 percent in the fourth. The greater impact of MERCOSUL on exports reflects the large manufactured products share in the Brazilian export sector.

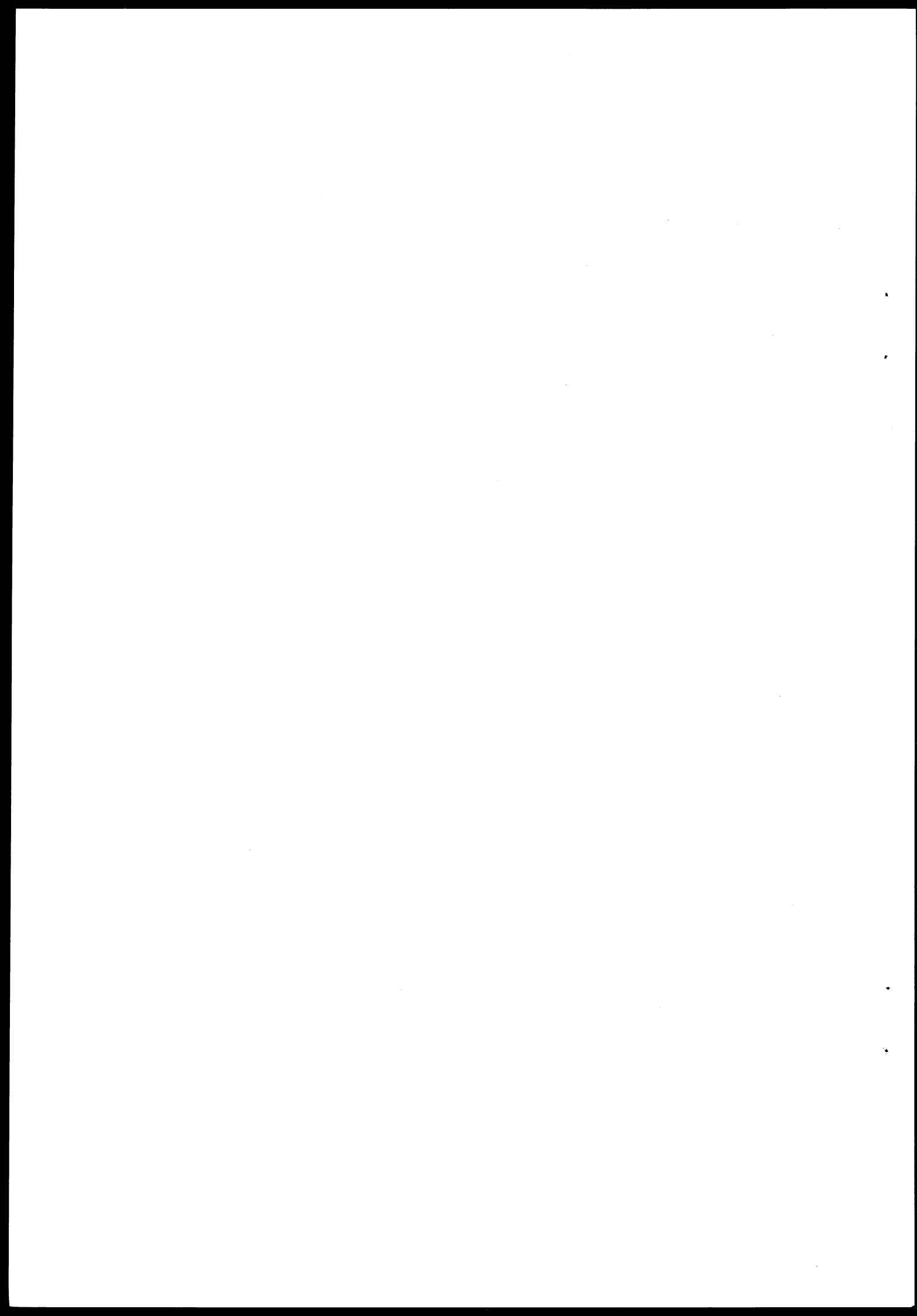


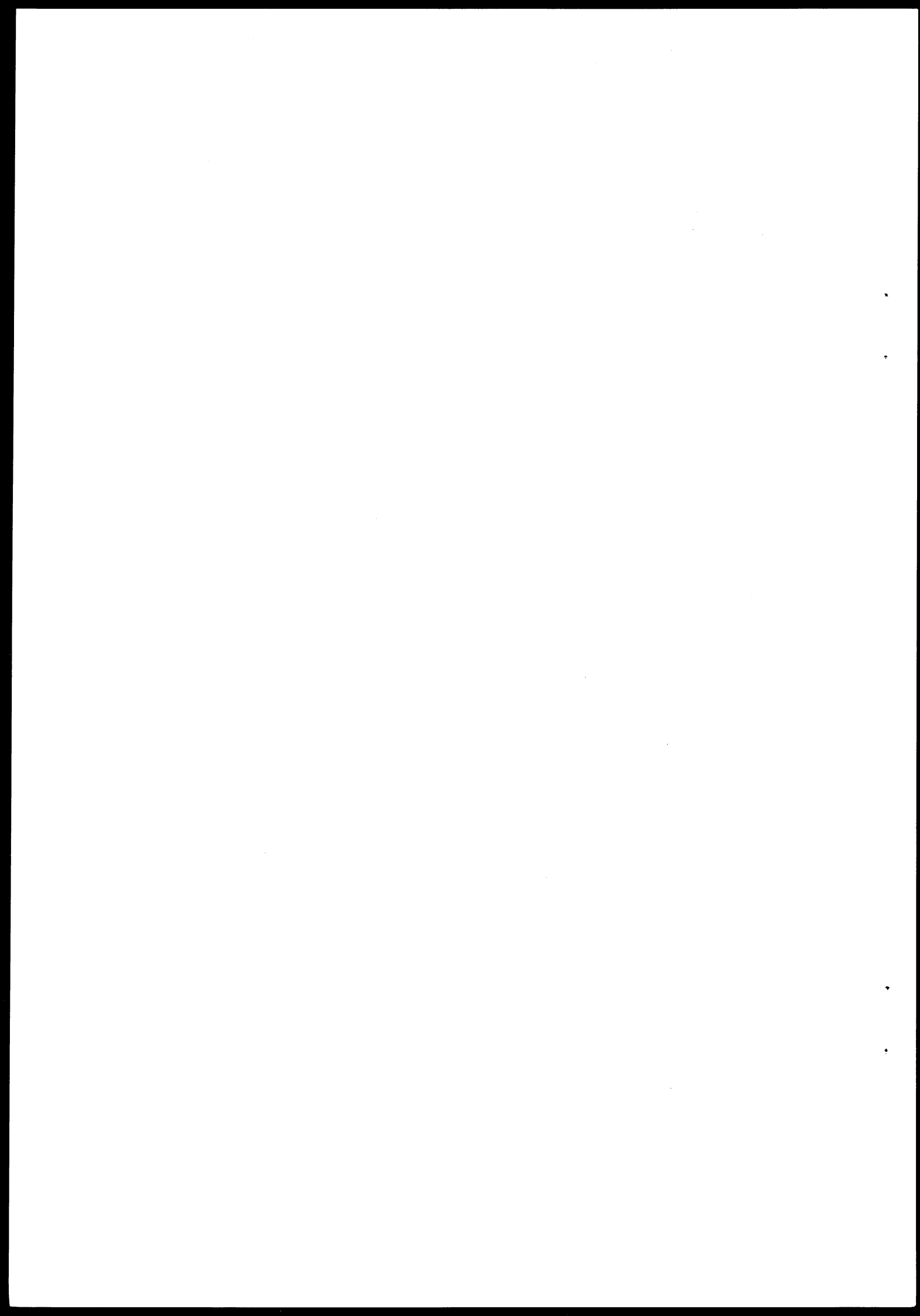
Table 4. Percentage change in aggregate exports (qxw) under four Uruguay Round Agreement scenarios, Brazil, 1992.

Commodity	Basic Value(\$)	Scenario I	Scenario II	Scenario III	Scenario IV
Rice	0.73	5.10	12.27	-13.34	-8.67
Wheat	0.43	1.37	-1.43	-19.49	-21.86
Grain	2.06	-7.56	-4.04	-17.80	-15.22
Non-Grain	2,677.82	3.74	1.37	21.92	19.39
Livestock	161.20	13.66	21.14	37.14	41.97
Meat	1,376.88	9.24	9.59	18.65	18.49
Milk	10.96	21.08	95.96	19.51	77.10
Beverage- Tobacco	1,036.76	3.87	2.08	7.66	5.42
Manufacturing	32,303.15	14.95	28.04	13.29	26.19
Services	3,178.43	3.28	2.03	3.35	2.03
Total Exports	40,748.41	12.54	22.31	12.93	22.51

The changes in export quantities are explained, in part, by the increase in the market price of aggregate exports (Table 5). Export prices for all agricultural commodities increase with trade liberalization, reducing domestic consumption and increasing exports. Although the export price increase is small, in the range of 1.03 percent to 3.38 percent (Table 5, Scenario IV), for the agricultural commodities showing positive changes in export, its impact on export is strong (Table 4, Scenario IV). The much higher increase in the market export price of rice, wheat and grain, around 5 and 6 percent, has no impact on the exports of those commodities, since their export is negligible. Changes in the aggregate exports of other manufacturing goods is better explained by the differential between the world price, which increases with trade liberalization and the domestic price, which is reduced by 0.27 percent (Table 5, Scenario IV).

Table 5. Percentage change in aggregate export price index (pxw) under four Uruguay Round Agreement scenarios, Brazil, 1992.

Commodity	Scenario I	Scenario II	Scenario III	Scenario IV
Rice	0.44	1.08	5.42	6.13
Wheat	0.55	1.53	3.92	4.97
Grain	1.32	2.04	5.44	6.27
Non-Grain	1.23	1.86	2.41	3.07
Livestock	0.72	1.40	2.22	2.94
Meat	0.78	1.50	1.68	2.44
Milk	0.88	2.44	1.79	3.38
Beverages/ Tobacco	0.13	0.74	0.38	1.03
Other Manufacture	-0.78	-0.56	-0.52	-0.27
Services	0.12	0.89	0.27	1.06



The percentage change in aggregate imports (qim) under four Uruguay Round Agreement scenarios is shown in Table 6. The second column has the value of imports valued at c.i.f. prices. Imports of each commodity: rice, grain, livestock, meat, milk, and beverage and tobacco are small, under 210 million dollars. Imports of wheat and non-grain are each below 1,000 million dollars, while imports of industrial products and services are above 5,000 million dollars for each commodity.

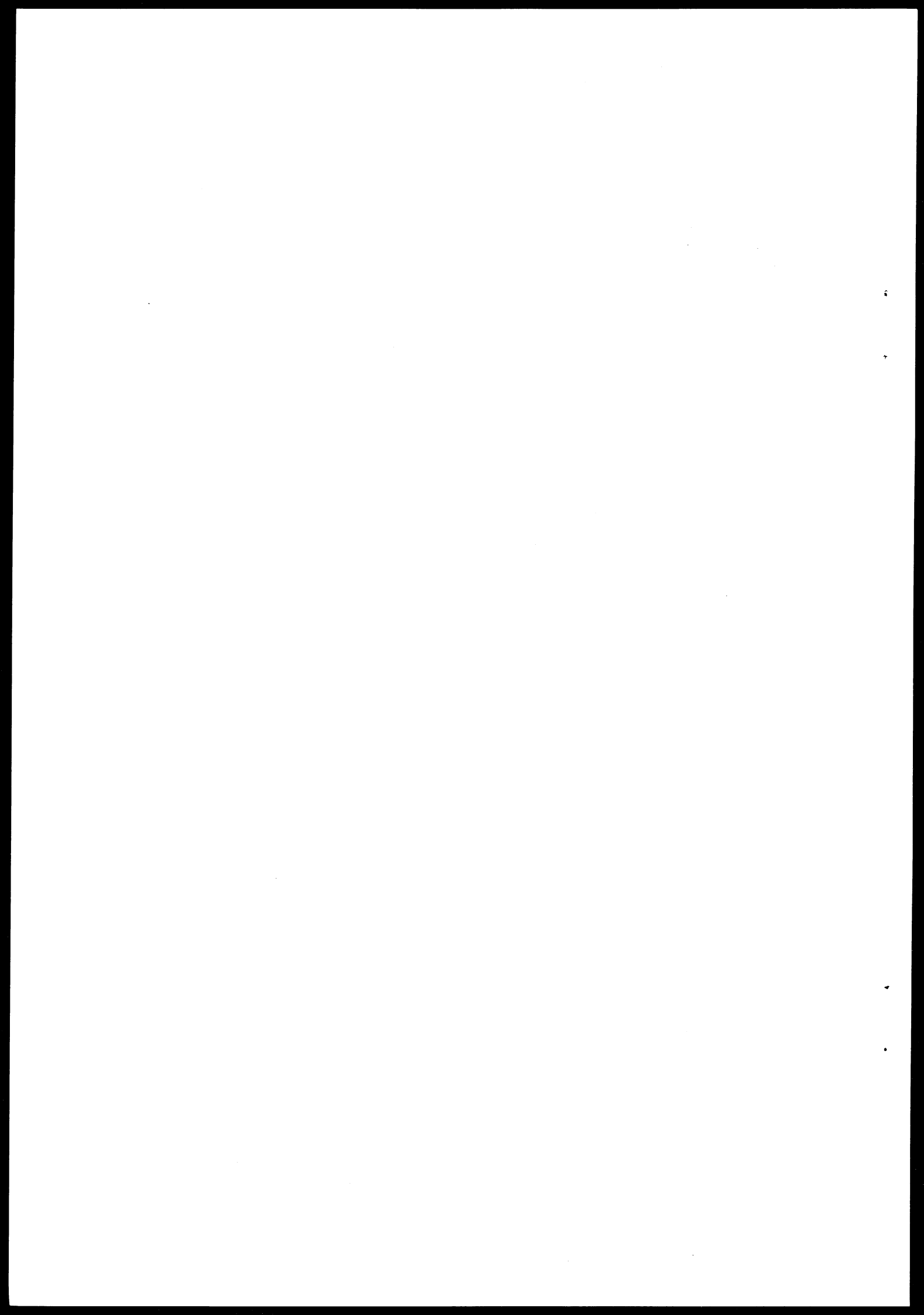
In the first scenario, where trade liberalization is very limited, and because of the tariff reduction differential, imports of agricultural goods decrease, except for livestock, and beverage/tobacco. Imports of agricultural goods is reduced in the range of 10.45 percent for meat to 0.18 percent for non-grain. This reduction in imports is explained by the increase in the market price of composite imports (pim) of agricultural goods, other than livestock and beverage/tobacco (Table 7). The increase in the market prices of imports (pim) is caused by an increase in international prices, due to trade liberalization which more than offsets the decrease that should occur in the domestic market due to tariff reduction.

Table 6. Percentage change in aggregate imports (qiw) under four Uruguay Round Agreement scenarios; Brazil, 1992.

Commodity	Basic Value	Scenario I	Scenario II	Scenario III	Scenario IV
Rice	111.05	-1.07	4.39	5.09	10.14
Wheat	687.32	-2.05	-3.69	-0.59	-2.22
Grain	144.62	-2.90	26.65	9.18	34.34
Non-Grain	782.49	-0.18	4.43	4.90	8.51
Livestock	96.03	3.14	6.00	9.83	12.53
Meat	194.66	-10.45	2.98	-1.03	9.67
Milk	207.37	-7.66	14.99	4.37	22.63
Beverage- Tobacco	96.10	2.93	13.20	17.10	25.19
Other	24,934.61	19.07	33.05	19.52	33.36
Manufacturing					
Services	5,660.42	-0.13	0.53	0.03	0.74
Total Imports	32,917.28	14.24	25.42	15.03	26.01

The second scenario increases trade liberalization by eliminating import tariff among countries member of NAFTA and MERCOSUL. In this scenario, 100 percent reduction in import tariff between Brazil and Argentina (MERCOSUL) has a strong impact on imports (Table 6). Imports of all agricultural goods except wheat increases,





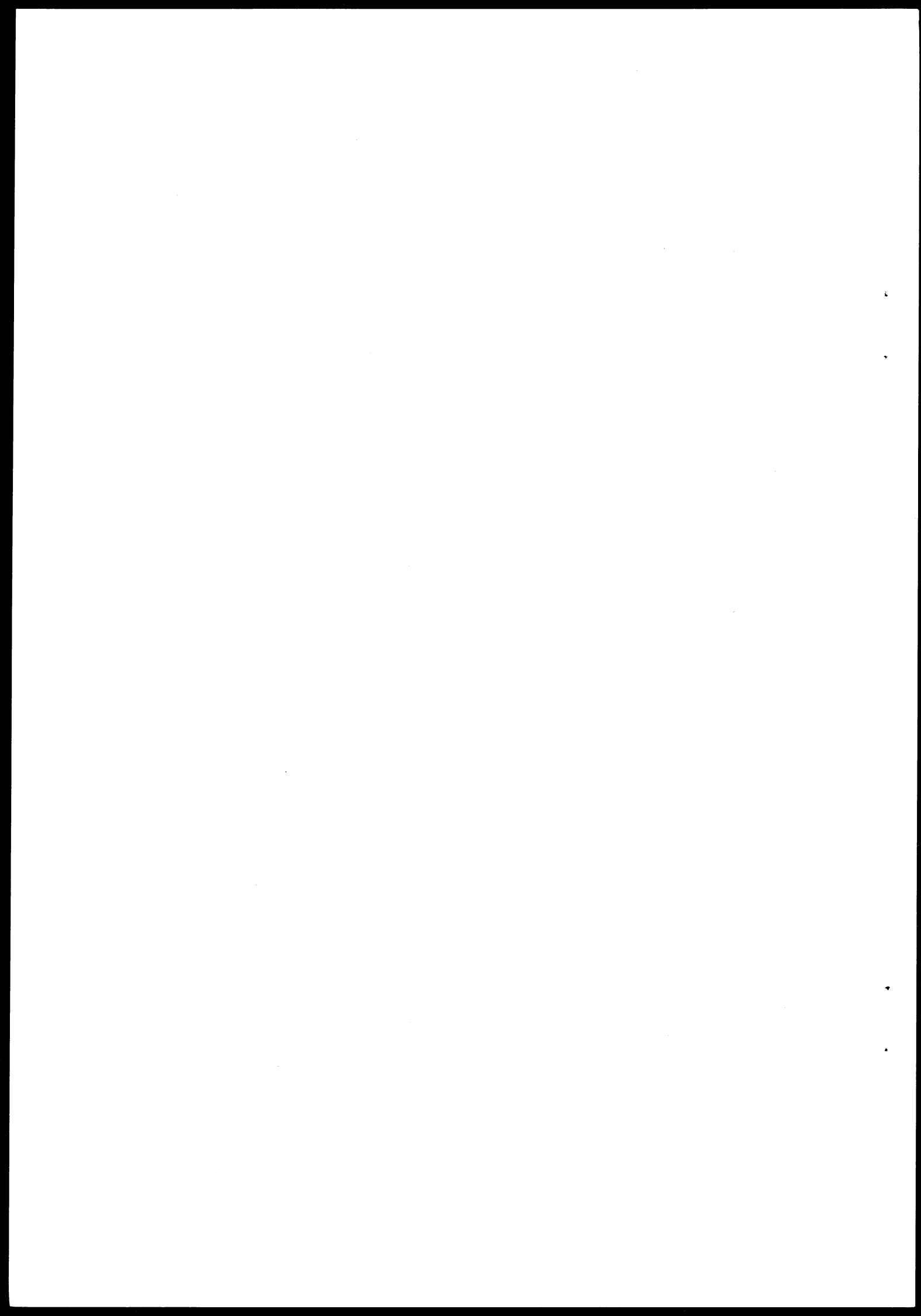
varying from an increase of 2.98 percent for meat to 26.65 percent for grain. Also, tariff reduction has a strong impact in the market price of imports (Table 7). The percentage change in the market price of imports is negative for all agricultural commodities other than wheat and meat (Table 7, column 3).

The third and fourth scenarios increase trade liberalization to the full extent of the Uruguay Round Agreement and then add further liberalization through NAFTA and MERCOSUL. Imports of agricultural goods increase in both scenarios, except for wheat and meat (Table 6). This increase in imports is explained by the decrease in prices of all commodities, except rice and wheat (Table 7). Imports of manufactures also increase from 19.07 percent in the first scenario to 33.36 percent in the fourth scenario (Table 6). The increase in imports of services is very small, less than 0.75 percent. Total imports increase the most, and by 26.01 percent in the fourth scenario when trade liberalization includes MERCOSUL, and by only 15.03 percent when free trade between Brazil and Argentina is not taking into account (Scenario III).

Table 7. Percentage change in the market price of composite import (pim) under four Uruguay Round Agreement scenarios, Brazil, 1992.

Commodity	Scenario I	Scenario II	Scenario III	Scenario IV
Rice	0.67	-0.98	2.36	1.02
Wheat	1.56	4.03	3.47	6.00
Grain	1.41	-9.53	-0.36	-8.76
Non-Grain	0.81	-0.44	-0.65	-1.46
Livestock	-0.22	-0.55	-1.23	-1.43
Meat	6.87	1.63	2.59	-1.09
Milk	4.55	-3.23	-0.59	-6.08
Beverage-Tobacco	-0.80	-2.96	-5.41	-6.78
Other Manufacture	-8.83	-12.66	-8.82	-12.60
Services	0.32	0.75	0.40	0.82
Price Index (piwreg)	0.16	1.01	0.30	1.15

Percentage change in prices received (psw) and prices paid (pdw) for tradable, and in terms of trade (tot) are shown in Table 8. Prices received for tradable decrease less with increasing trade liberalization. That is, in the first scenario with restricted trade liberalization, prices received decrease by 0.71 percent while their decrease is 0.16 percent in the fourth scenario with more trade liberalization. However, prices paid for tradable increase with liberalization. Percentage changes in prices received and paid for tradable generates a decreasing terms of trade effect, around 1.0 percent, in every scenario.

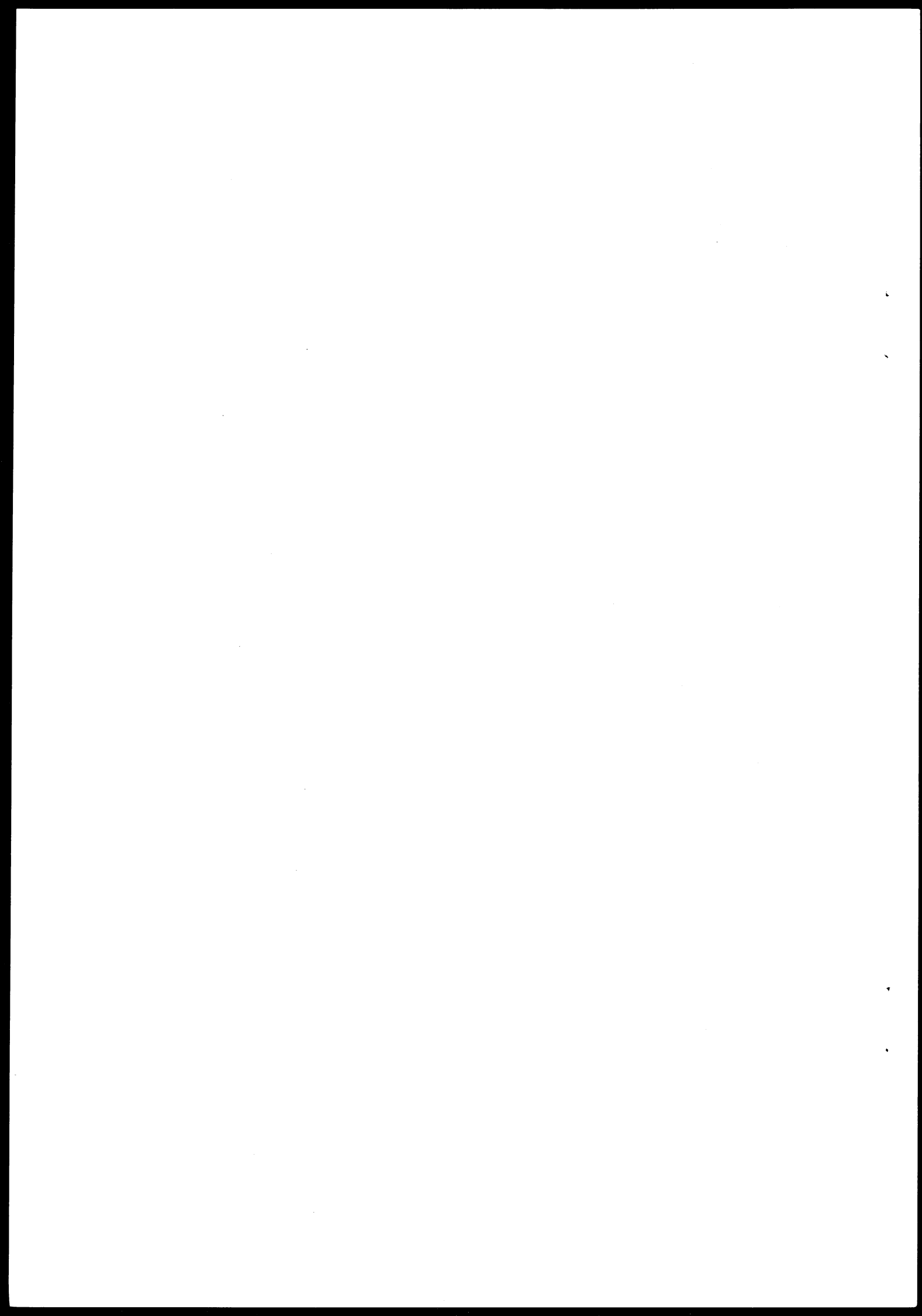


In summary, trade liberalization under the Uruguay Round and MERCOSUL Agreement expands exports of non-grains, meat, and manufactures, the most important Brazilian exported commodities, by more than 18 percent (Table 4, Scenario IV). MERCOSUL has a very small negative impact on export of agricultural commodities, but a strong positive effect on the exports of manufactured products. Imports of agricultural product, except wheat, increase with trade liberalization. Elimination of import tariffs between Brazil and Argentina almost double the change in imports of agricultural and industrial commodities. Total imports increases by 14.24 percent in the first scenario and by 26.01 percent in the fourth scenario. The decrease in terms-of-trade is very small, less than 1.1 percent in any scenario.

Table 8. Percentage change in prices received (psw) and prices paid (pdw) for tradable, and in terms of trade (tot=psw-pdw), Brazil, 1992.

Price	I Scenario	II Scenario	III Scenario	IV Scenario
psw	-0.71	-0.49	-0.40	-0.16
pdw	0.09	0.58	0.17	0.66
tot	-0.80	-1.07	-0.56	-0.81

**Prices.** Table 9 presents percentage change in market price (pm) of endowments, tradable commodities and capital goods. Market price increases for all commodities, except for manufacturing and capital goods, in every scenario. The endowment with the highest increase in price is land. Its price increases with trade liberalization, changing from 2.03 percent in the first scenario to 4.83 percent in the fourth scenario. Because land is not mobile across sectors, increasing the market price of agricultural commodities, bids up most the price of this factor of production. The impact of NAFTA and MERCOSUL on land price is very small relative to the effect of the Uruguay Round Agreement. Although the increase in the prices of capital and labor are smaller than that of land, most of their price change can be accounted to the MERCOSUL accord. The agricultural commodities with higher price increases are rice, grains and wheat. Yet, production of rice and grains decreases (Table 3), possibly due to a higher increase in the price of intermediate inputs. Uruguay Round Agreement trade liberalization accounts for most of the change in these prices, though MERCOSUL provides an important contribution. The percentage change in the



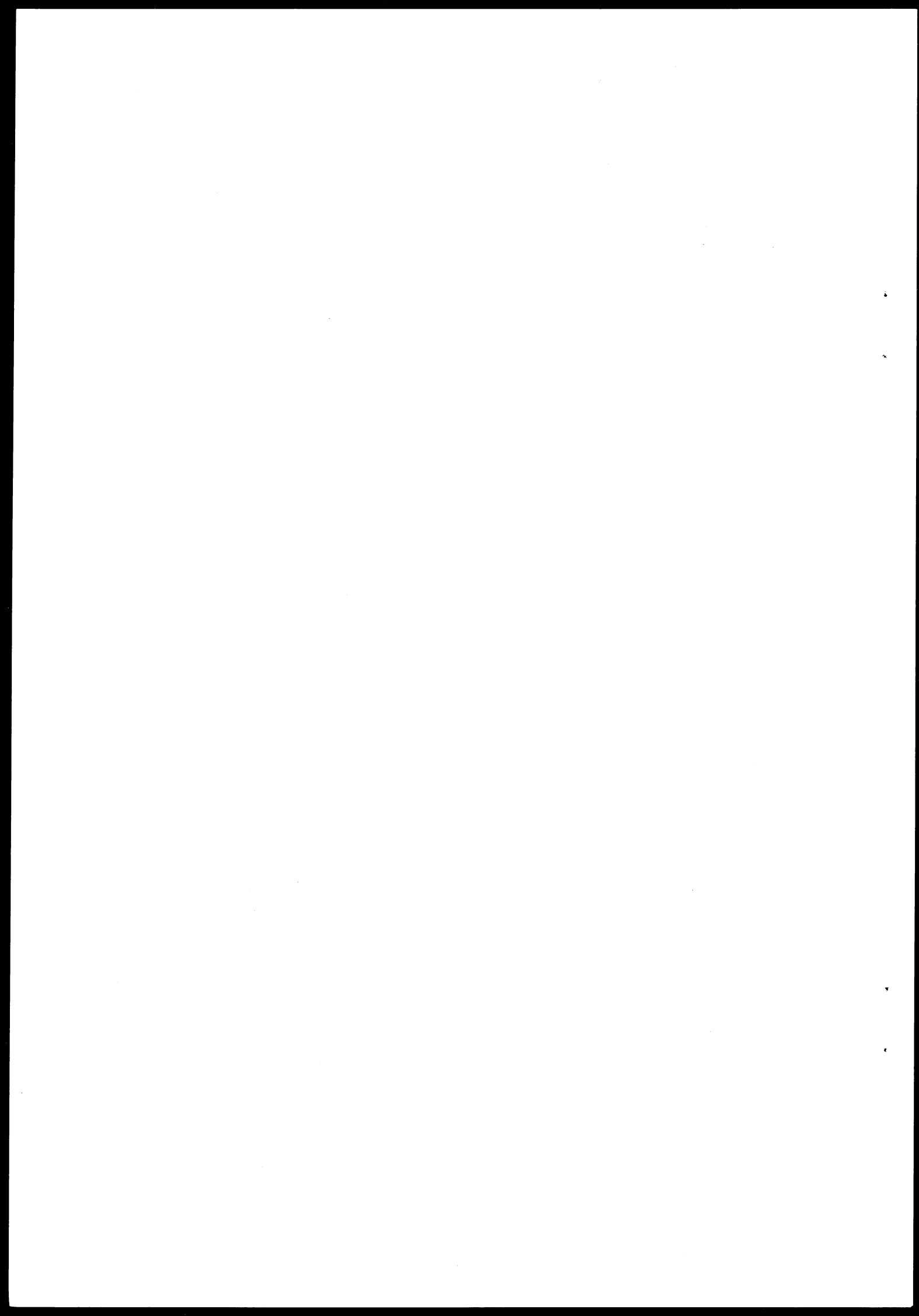
market price of rice increases from 0.44 in I Scenario to 5.42 in III Scenario. By adding the influence of NAFTA and MERCOSUL, rice price increases by 6.13 percent (IV Scenario). The percentage change in the market price of other agricultural commodities like non-grain, livestock, meat, milk, and beverages/tobacco vary from 1.03 to 2.94 (Table 9, column 5). Market prices of other manufacturing and capital goods decrease by 0.27 percent and 1.01 percent respectively in the fourth scenario.

Inflation, measured by the change in the price index for private household expenditures (Table 9), decreases by 0.28 percent in the first scenario with restricted trade liberalization, and by 0.01 percent when full Uruguay Round Agreement is taken into account. However, it increases by 0.18 percent and by 1.05 percent in the second and fourth scenarios respectively, where NAFTA and MERCOSUL are included. Thus, trade liberalization has overall a small impact on price variation in the Brazilian economy.

Table 9. Percentage change in market price (pm) under four Uruguay Round Agreement scenarios, Brazil, 1992.

Commodity	Scenario I	Scenario II	Scenario III	Scenario IV
Land	2.03	2.22	4.54	4.83
Labor	0.65	1.76	0.76	1.88
Capital	0.57	1.68	0.68	1.80
Rice	0.44	1.08	5.42	6.13
Wheat	0.55	1.53	3.92	4.97
Grain	0.39	0.90	4.47	5.08
Non-Grain	0.63	1.20	1.80	2.41
Livestock	0.72	1.40	2.22	2.94
Meat	0.57	1.23	1.47	2.18
Milk	0.46	1.14	1.36	2.08
Beverage-Tobacco	0.12	0.73	0.38	1.03
Other Manufacturing	-0.78	-0.56	-0.52	-0.27
Services	0.12	0.89	0.27	1.06
Capital Goods	-1.23	-1.26	-1.01	-1.01
CPI (ppriv)	-0.28	0.18	-0.01	1.05

**Welfare.** Percentage change in GDP value, percentage change in per capita utility, and equivalent variation of per capita utility in millions of US dollars are presented in Table 10. GDP growth is strongly affected by trade liberalization caused by NAFTA and MERCOSUL. Brazilian GDP increases 0.31 percent in the first scenario with



limited trade liberalization. However, when MERCOSUL trade agreement is considered, GDP increases by 0.91 percent. At full Uruguay Round Agreement, Brazilian GDP increases by 0.61 percent in Scenario III, and by 1.24 percent when trade liberalization includes the economic blocks (fourth scenario). Thus, trade liberalization and participation in economic blocks can have some influence on Brazilian economic growth.

Trade liberalization produces a very small percentage change in per capita utility. In Scenario IV, the most broad trade liberalized situation, welfare increases only 1.03 percent. However, the equivalent-variation measure shows that this small increase in utility is equivalent to a national welfare gain of more than 3.5 billion dollars (Table 10, Scenario IV).

Table 10. Percentage change in value of GDP, and in per capita utility from aggregate household expenditure; Brazil, 1992.

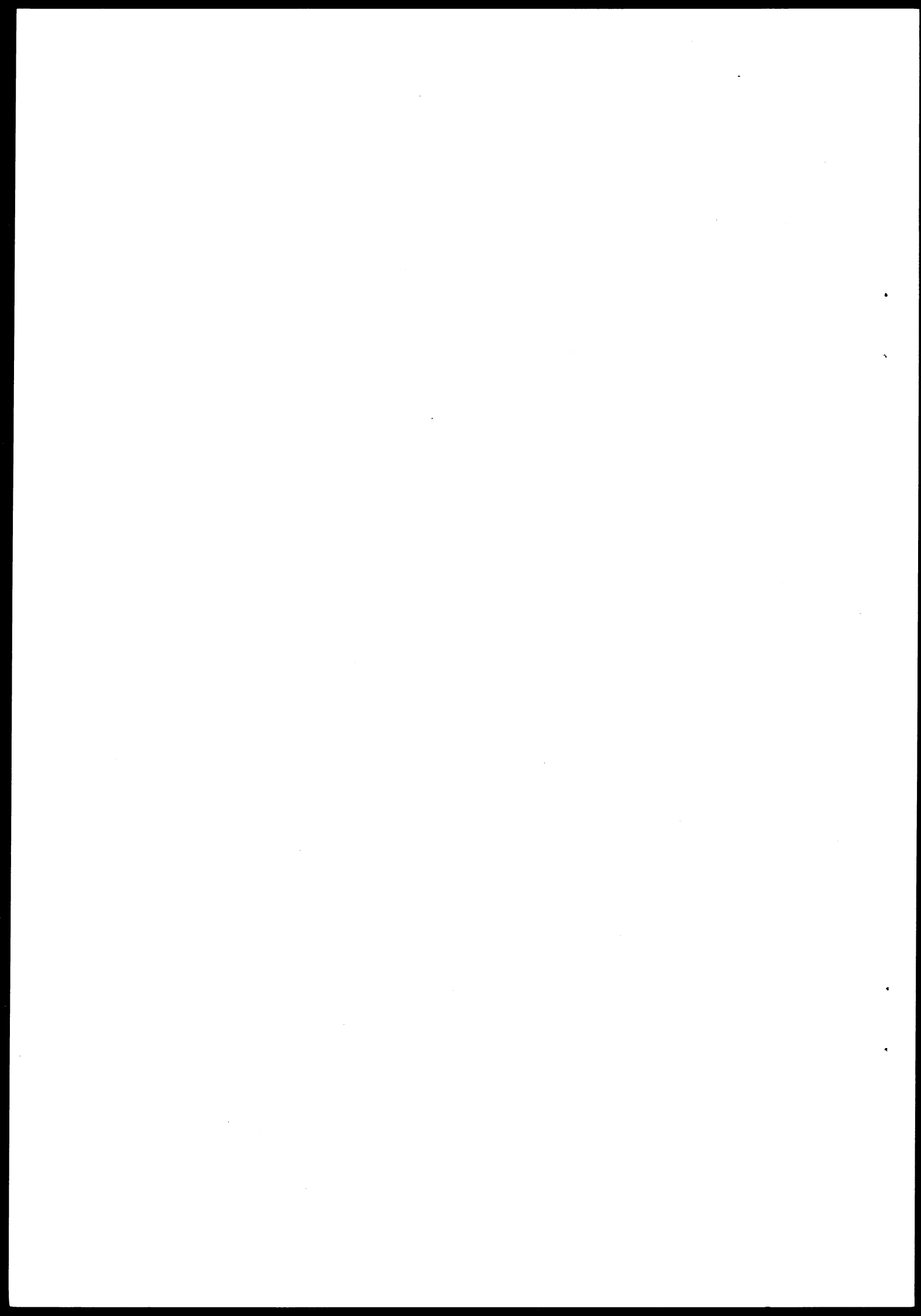
Variable	Scenario I	Scenario II	Scenario III	Scenario IV
GDP Value	0.31	0.91	0.61	1.24
Utility	0.73	0.95	0.81	1.03
Equivalent Variation <sup>1</sup>	2,474.90	3,223.88	2,747.60	3,503.84

#### 4. CONCLUSION

Trade liberalization, under the Uruguay Round Agreement, even considering the more liberalized conditions of NAFTA and MERCOSUL, has a very small impact on the production of agricultural and non-agricultural commodities. The production of grains, the commodity whose production decreases most, is reduced by 2.09 percent, while production of non-grains, the commodity with the highest increase in production, increases<sup>1</sup> by 3.19 percent. Trade liberalization has a production decreasing impact on rice, grain, wheat, and manufactures; and an increasing effect in the production of non-grains, livestock, meat, beverage/tobacco, and services. The MERCOSUL agreement has a smaller effect on production than the Uruguay Round Agreement. It reduces production of all commodities, with only two exceptions, namely wheat and manufacturing.

<sup>1</sup> Equivalent variation is computed as  $Ev_r = u_r * INC_r / 100$ , where  $INC_r$  represents total expenditure (i.e., income) in initial equilibrium, measured in 1992 US dollars.





The Uruguay Round Agreement, MERCOSUL included, expands exports of non-grains, meat, and manufacture goods, all products with export value above one billion dollars, by more than 18 percent. The impact of MERCOSUL alone on Brazilian exports of agricultural products is, in general, very small and negative. However, its impact on manufactured goods, commodities with export value above 32 billion dollars, is very large.

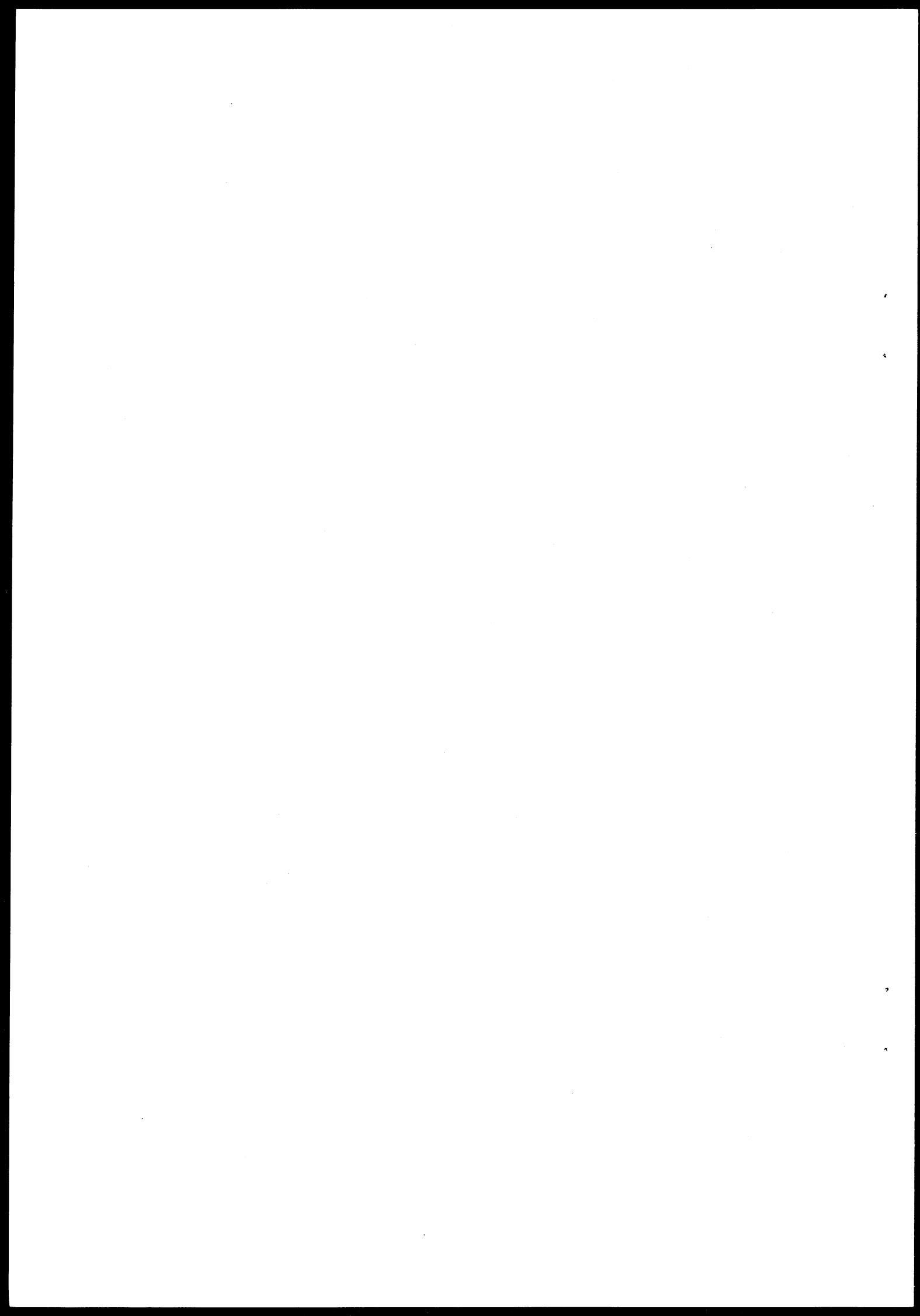
Imports of agricultural product, except wheat, increase with trade liberalization. Elimination of import tariff between Brazil and Argentina (i.e., MERCOSUL) has a strong positive impact on imports of agricultural and industrial products. The decrease in terms of trade, approximately -1.0 percent in every scenario, is the least (i.e., -0.56 percent) when the Uruguay Round Agreement's trade liberalization is at its extreme (Scenario III).

The impact of the Uruguay Round Agreement on the variation of the consumer price index, measured by the change in the price index for private household expenditures, is very small, less than 1.1 percent. However, it increases with trade liberalization, from -0.28 percent in Scenario I to 1.05 percent in Scenario IV.

The value of Brazilian GDP increases by 1.24 percent in the most liberalized trade scenario. Without MERCOSUL the increase in GDP value would be only 0.61 percent. Percentage changes in per capita utility are very small. Even in the scenario with the most broad trade liberalization, welfare increases by only 1.03 percent. However, the equivalent variation estimates shows that this small increase in utility is equivalent to a national welfare gain of 3.5 billion dollars.

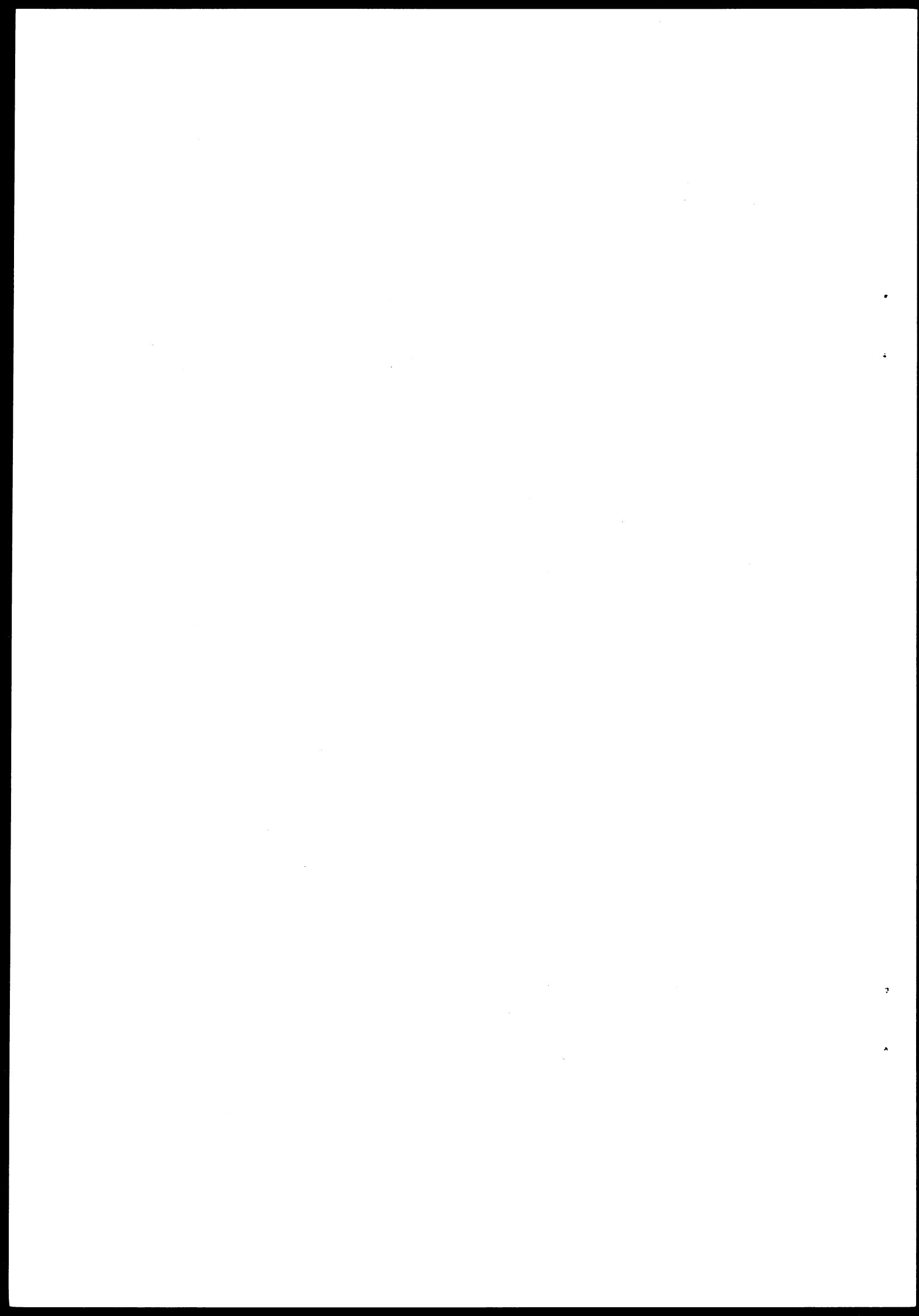
## **ACKNOWLEDGMENTS**

The author gratefully acknowledge Garth Holloway, Colin Carter and Daniel Sumner for insightful discussion on policy reform and trade issues. I am very grateful to Chris Fields for his friendly help with my written English. The Department of Agricultural Economics of the University of California, Davis deserves a special thanks for granting me the necessary research environment. Many thanks I owe to Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and to Universidade Federal de Viçosa (UFV) for financing this research.

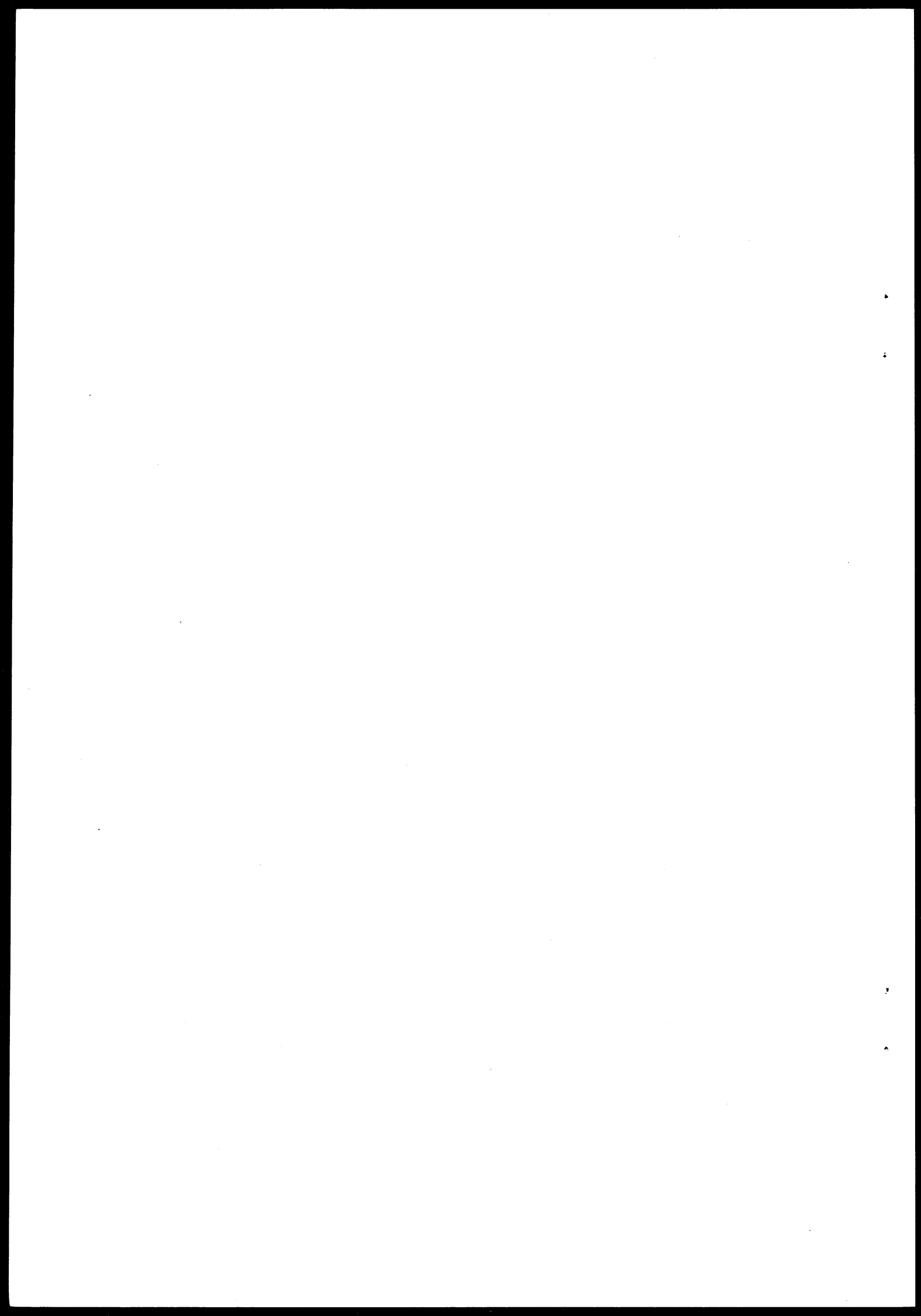


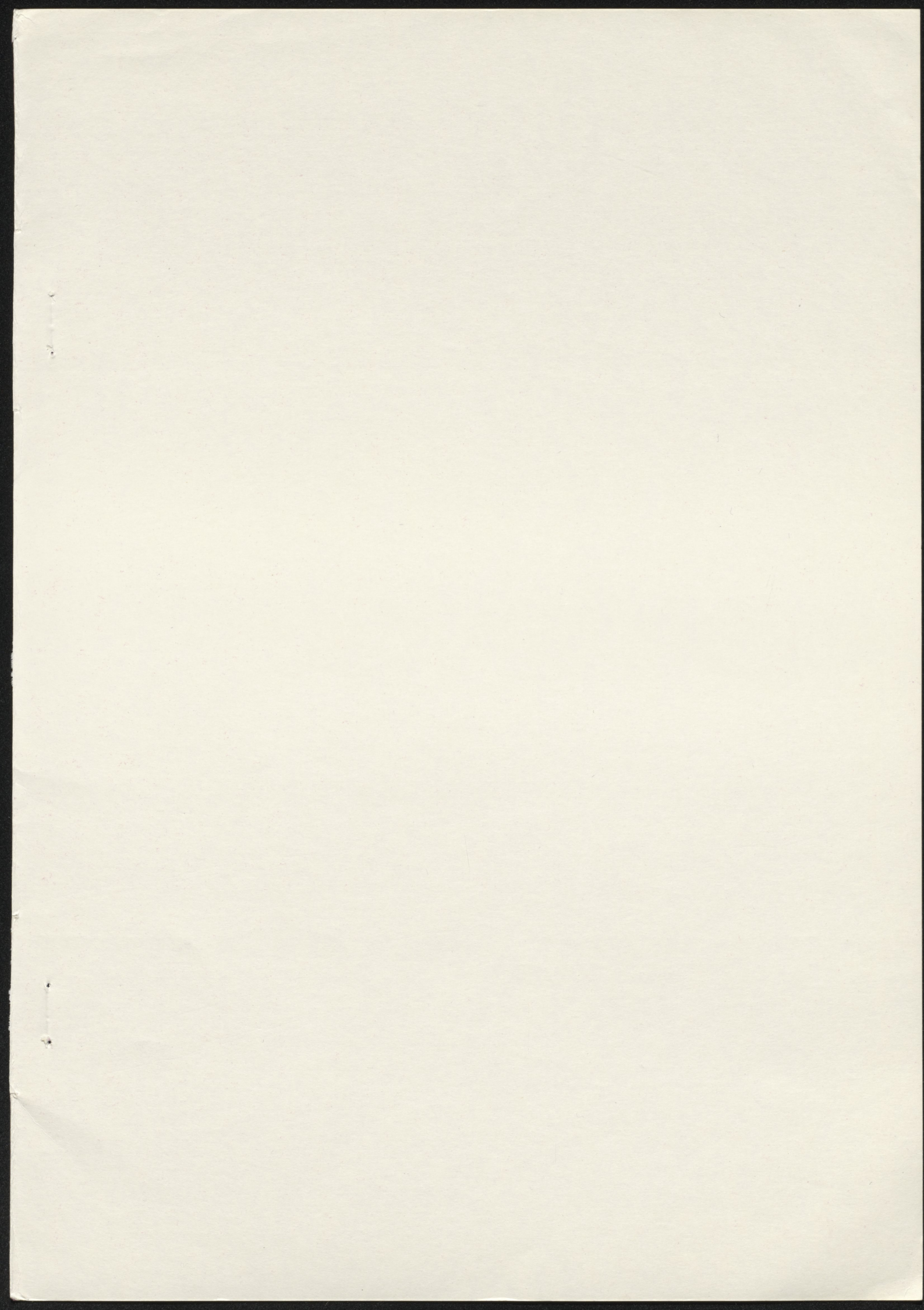
## REFERENCES

- Carriquiry, M.R., 1994. Políticas Agrícolas e Integração Econômica: o Caso do MERCOSUL. In: Maria Helena Fagundes (Organizadora), Políticas Agrícolas e o Comércio Mundial. Brasília: IPEA, 466 p.
- Codsi, G., and Pearson, K.R., 1988. GEMPACK: General-Purpose Software for Applied General Equilibrium and Other Economic Modellers. *Computer Science in Economics and Management*, 1:189-207.
- Fagundes, M. H., 1994. Introdução. In: Maria Helena Fagundes (Organizadora), Políticas Agrícolas e o Comércio Mundial. Brasília: IPEA, 466 p.
- GATT (General Agreement on Tariffs and Trade), 1994. The results of the Uruguay Round of Multilateral Trade Negotiations. Geneva, GATT Secretariat.
- Gehlhar, M. et al., 1996. Overview of the GTAP Data Base. In T.W. Hertel (ed.), *Global Trade Analysis: Modeling and Applications*. New York, Cambridge University Press, forthcoming.
- Hanoch, G., 1975. Production and Demand Models with Direct or Indirect Implicit additivity. *Econometrica* 43(3):395-419, May.
- Harrison, G. W.; T. F. Rutherford; D. G. Tarr, 1995. Quantifying the Uruguay Round. Unpublished Manuscript, The World Bank, 55 p.
- Harrison, J., and Pearson, K.R., 1994. GEMPACK User Documentation, Release 5.1, Volumes 1 and 2, Monash University IMPACT Project, Clayton, Australia.
- Helpman, E. & Krugman, P. R., 1989. *Trade Policy and Market Structure*. Cambridge, The MIT Press, 191 p.
- Henz, R., 1994. Situação das Negociações Agrícolas no Mercosul. *Revista de Política Agrícola*, 3(3):29-34, July-September
- Hertel, T. W. (ed.), 1996. *Global Trade Analysis: Modeling and Applications*. New York, Cambridge University Press, forthcoming.
- Hertel, T. W. & M. E. Tsigas, 1996. Structure of GTAP. In T.W.Hertel (ed.), *Global Trade Analysis: Modeling and Applications*. New York, Cambridge University Press, forthcoming.



- Hertel, T.W.; Horridge, J.M.; Pearson, K.R., 1992. Mending the family tree: a reconciliation of the linearization and levels schools of AGE modeling. *Economic Modeling*, October: 385-407.
- Hertel, T.W. et al, 1991. Implicit Additivity as a Strategy for Restricting the Parameter Space in Computable General Equilibrium Models. *Economic and Financial Computing* , 1(1):265-289.
- Josling, T. et al., 1994. The Uruguay Round Agreement on Agriculture: An Evaluation IATRC Commissioned Paper No. 9. Davis, 91 p.
- Pearson, K.R., 1991. Solving Nonlinear Economic Models Accurately Via a Linear Representation. Preliminary Working Paper No. IP-55, The Impact Project, July.
- Vousden, N., 1990. The economics of trade protection. New York, Cambridge University Press, 305 p.







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