10. A COHERENT AGRICULTURE TRADE POLICY FOR MEXICO

10.1 INTRODUCTION

Mexico has a large rural territory and population – the largest population living in predominantly rural areas in the countries of the Organisation for Economic Cooperation and Development (OECD, 2007, p. 14). Farm employment, however, has dropped significantly in recent decades. Agriculture accounts for about 14 per cent of employment in Mexico,[2] down from more than 25 per cent in the early 1990s. Furthermore, agriculture today contributes only about 4 per cent to Mexico's gross domestic product (GDP), which is half the level that it contributed two decades ago. Rural poverty is high; 56 per cent of the people in rural areas live in poverty (OECD, 2007, p. 16).

This development coincides with a trade policy that has led to much more open markets, especially within the North American Free Trade Agreement (NAFTA) region, and significantly increased trade in agricultural products. Although a shrinking agricultural sector is not uncommon during the course of development, the situation of the agricultural sector in Mexico is considered unsatisfactory by many Mexicans and development economists, and it has been argued that Mexico's external trade relations have an adverse impact on the agricultural sector in Mexico. Increasing imports of maize, of which more than 99 per cent come from the United States of America (US), have been discussed extensively in the literature. Corn imports were 670 per cent higher in 2008–2010 than they were in 1991–1993. Although it is clear that NAFTA had an impact on the trade flows, it appears less clear what effects the increasing trade have had on employment and wages in Mexico. This chapter provides an overview of the development of trade and employment in Mexico's agricultural sector and discusses causality. The focus, however, is on analysing the possible effects of some potential policies intended to reinforce the agricultural sector.

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[1] David Vanzetti was employed by UNCTAD when writing the first draft.

[2] World Development Indicators 2011. The Food and Agriculture Organization (FAO) reports that the agricultural population was 19 per cent of the total population in 2008, down from 30 per cent in 1990. OECD statistics report 12.9 per cent employment in agriculture in 2009 as a share of total civilian employment, down from 25.7 per cent in 1993.

What can the Mexican government do to strengthen its agricultural sector so as to increase employment and food security while reducing poverty? The scope for trade measures is limited, as Mexico has committed itself in the World Trade Organization (WTO) and various regional trade agreements to abstain from certain types of measures and as Mexico has a free trade agreement with its largest trading partner, the US. There is limited scope for increasing tariffs on imports or reducing tariffs facing its exports.

If agricultural tariffs were to be raised, trade agreements, especially NAFTA, would have to be revised. Revisions have been advocated – by presidential candidates, among others – and discussed in the literature.[3] Mexico would probably have to offer Canada and the US something in return, and thus any benefits to some agricultural sectors could be offset by additional costs to other sectors in Mexico. For example, because of the links between grains, oilseeds, and livestock, trade policies raising prices for feed grains could have adverse effects on livestock producers and consumers.

An alternative policy is to provide additional domestic support, or to provide the same amount in a different fashion, possibly better targeted to producers in need. As a means of support, input subsidies, on electricity or credit, for example, have the advantage of distorting only one side of the market, production, as opposed to both sides, as do output subsidies. Input subsidies may be preferred for that reason. However, the question remains whether such support can address poverty. McMillan et al. (2006) find, for example, that the poorest corn farmers in Mexico are net consumers of corn, and de Janvry et al. (1995) find that the majority of small- and medium-size corn producers do not produce for the market. To address poverty, the government might consider providing targeted direct income support to those in need, whether or not they are farmers.

The purpose of this study is to assess various policy options. Policies examined include:

1. increasing tariffs on agricultural imports from NAFTA countries to most favoured nation (MFN) levels;
2. removing the payroll tax on agricultural labour;
3. funding research and development to increase agricultural productivity;
4. switching current domestic support to subsidies on output or input.

A global general equilibrium model, the Global Trade Analysis Project (GTAP) model, is used to analyse the production, trade, and welfare effects of such policy changes. The results show that policies that increase distortions may strengthen the agricultural sector in terms of higher output, exports, and employment but are likely to have

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[3] See, for example, DTB Associates and AgRisk Management. *Implications for the U.S. and Mexico of Mexico withdrawing certain agricultural products from NAFTA.* 2006, and McKinley (2008).

adverse effects on the rest of the economy. In contrast, removing payroll taxes and adopting policies that increase agricultural productivity have positive effects for both the agricultural sector and the economy as a whole.

10.2 THE AGRICULTURAL SECTOR

Agriculture plays an important role in Mexico's economy.[4] It accounts for about 14 per cent of employment in Mexico (World Bank, 2011), contributing, however, only about 4 per cent of its GDP. The relative importance of agriculture to Mexico has declined, as in other OECD countries. Between 1993 and 2010 total agricultural employment in Mexico declined by 28 per cent (figure 10.1).[5] In 1993 about 8 million people were employed in agriculture in Mexico, and in 2010, 5.8 million. Agriculture's contribution to GDP in per cent has halved in two decades.

The decline of the agricultural sector in Mexico appears to be greater than in many other countries. The share of employment in agriculture declined between the periods 1990–95 and 2005–10 by 45 per cent, more than in such other middle income countries as Brazil (29 per cent), Chile (30 per cent), Malaysia (37 per cent), and Turkey (43 per cent). On average, the decline in the upper-middle income group of countries was 29 per cent. Furthermore, agriculture's current share of employment in Mexico, at 14 per cent, is at the lower end of the scale compared with many other developing countries in this group, where an average of 33 per cent are employed in agriculture.[6]

Figure 10.1: Employment in agriculture in Mexico, in millions of people, 1993–2010
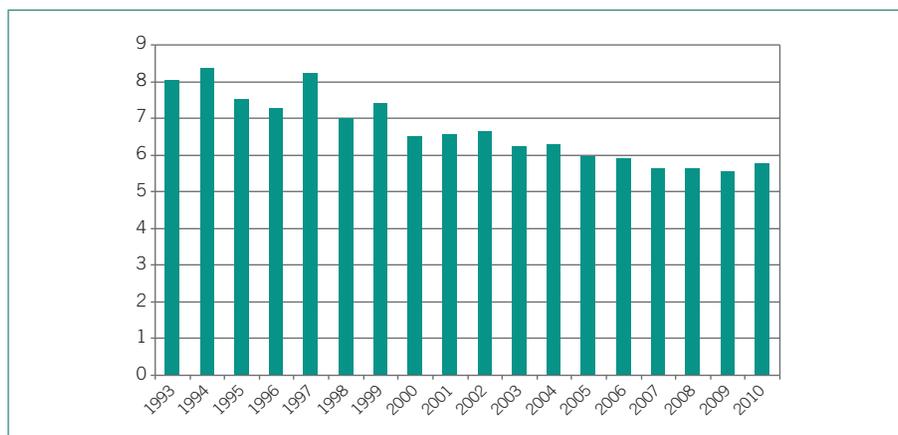
Source: OECD labour force statistics.

[4] Section 10.2, 10.3 and 10.3 partly use material from UNCTAD (2013).

[5] International Labour Office (ILO) data confirm the order of magnitude for the period 1995–2008.

[6] Data are based on World Bank World Development Indicators 2012; latest available year for each country.

The structural adjustment of the rural economy, with a declining contribution of agriculture and an increasing share of non-farm activities, has increased significantly the number of unemployed people in both rural dispersed and rural semi-urban areas. Furthermore, significant migration from rural areas to urban areas or to the US indicates a lack of rural employment opportunities.

Economic disparity and poverty remain challenges in Mexico. Most people living below the poverty line live in rural areas(Agriculture and Agri-Food Canada, 2010). The percentage of the rural population living in poverty is 56 per cent. Wages in the primary sector are about one-fifth to one-quarter of wages in other sectors (Scott, 2010). This is one consequence of the low labour productivity of agriculture in Mexico.

Mexico's agricultural sector is diverse. In some areas, predominantly in north-western parts of the country, larger commercialized farms operate. In central and southern states, farms are often smaller and often produce for subsistence. The relative importance of products for big and small farms varies as well. According to Prina (2011), fruits and vegetables are relatively more important for smaller farms than for larger farms, for which maize is more important. The average farm size is 8 hectares. Both small and large farms have become more common, while the number of middle-sized farms has decreased. Small farms represented approximately 73 per cent of total production units in 2007. Small- and medium-size farms employ a majority of the agricultural workforce. Many constraints, such as the land tenure system, limit the productivity of these smaller operations.

Table 10.1: Mexican agricultural products with highest production value in 1990 and 2010, US$ million

Commodity	1990	2010
Indigenous cattle meat	3 735	5 279
Indigenous chicken meat	1 065	3 811
Cow milk, whole, fresh	1 917	3 332
Hen eggs, in shell	838	1 975
Indigenous pig meat	1 160	1 804
Sugar cane	1 311	1 656
Maize	1 510	1 433
Tomatoes	797	1 108
Chillies and peppers, green	298	1 099
Mangoes, mangosteens, guavas	644	978
Oranges	429	783
Avocados	476	767
Lemons and limes	276	750
Beans, dry	735	665
Bananas	559	592
Wheat	547	554

Source: FAOstat.

Production in terms of value and quantity has increased from 1990 to 2010 for most major agricultural products. Meat products have the highest value of production, followed by the crops sugar and maize, and fruits and vegetables (table 10.1). Wheat and rice production values are relatively low, about US$600 million and $200 million, respectively.[7]

10.3 AGRICULTURAL TRADE

In 2010 agriculture accounted for about 6 per cent of Mexico's merchandise exports (about US$17 billion) and less than 7 per cent of its imports (US$21 billion) (figure 10.2).[8] These shares have continuously decreased from an average of 11.9 per cent for exports and 16.8 per cent for imports in 1980–1993 (Kose et al., 2004), while manufacturing trade has increased its shares. In absolute terms both exports and imports have increased.

Mexico's agricultural exports and imports both are highly concentrated on the US, which accounted for 78 per cent of total agricultural exports and 74 per cent of imports in 2010. The share of agricultural imports sourced from the US increased before the start of the implementation of NAFTA in 1994 to a level of around three-quarters (74 per cent in 1993), and since then has fluctuated around that level (figure 10.3). The share of agricultural exports going to the US decreased from 89 per cent in 1993 to the current level of 78 per cent. Thus, the share of aggregated agricultural trade with the US has not significantly increased since the implementation of NAFTA began.[9] The composition of trade, however, has changed; for certain staple food and meat products, the share of US imports has increased significantly (table 10.2).

More staple crops and meats are flowing south and more beverages, seasonal fruits, and vegetables are flowing north. In that sense, NAFTA's liberalization of agricultural trade appears to have produced the "expected" results (Wise, 2009). The major imports from the US are stock feed – soya beans, maize, and sorghum. Wheat and beef are the major food imports (table 10.3). Total agricultural imports from the US have increased from US$4.3 billion in 1993 to $15.6 billion in 2010.

Notwithstanding the growth of aggregate agricultural imports, which is basically in line with growth for other developing countries,[10] imports of some particularly sen-

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[7] Rice production value was not available from FAO. The value has been calculated from the amount of production and a price of US$500 per ton.

[8] UN Comtrade; WTO definition of agricultural trade.

[9] Trade with Canada has been growing disproportionately but remains at a low level. The share of imports from Canada grew from 5 per cent to 8 per cent from 1993 to 2010 and the share of exports to Canada from 1 per cent to 3 per cent.

[10] From 1995–1997 to 2008–2010, Mexico's agricultural imports increased by 201 per cent. During that same period world agricultural imports increased by 130 per cent in US$ nominal value terms, and total low- and middle-income countries' imports increased by 238 per cent (e.g. Brazil26 per cent, Chile 207 per cent, Colombia 124 per cent, Guatemala 278 per cent, Peru 146 per cent, and Turkey 147 per cent).

Figure 10.2: Mexican agricultural imports and exports, 1990–2010, in US$ billion
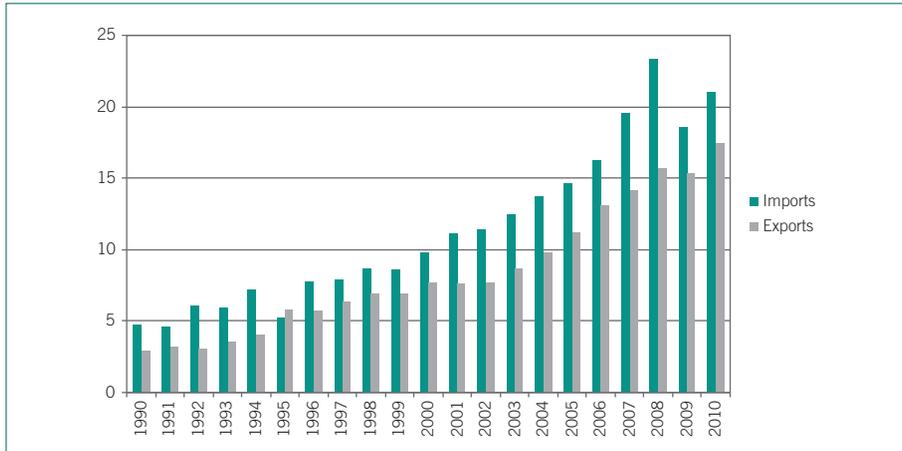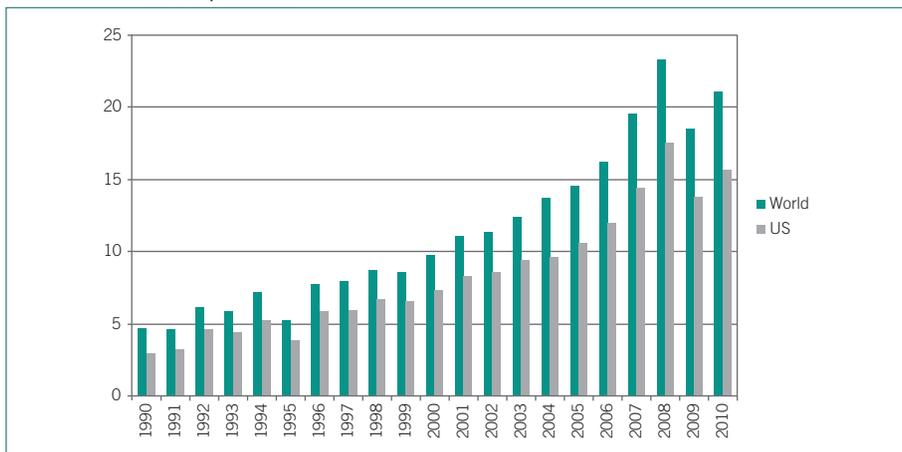

Source: UN Comtrade, current US$.

Figure 10.3: Mexican agricultural imports from the world and the US, 1990–2010,
             in US$ billion

Source: UN Comtrade, current US$.

sitive products, such as corn, rice, beef, poultry, and beans, are dramatically high.
Moreover, for all these imports, the US market share is very high, and, for many of
these products, the US share has been increasing since 1993. Imports of maize were
670 per cent higher in 2008–2010 than they were in 1991–1993. Almost all of the
imported maize comes from the US (table 10.3). Similarly, beans imports have in-
creased by 853 per cent. Imports of wheat from the world have increased less, by
192 per cent, but the share of imports coming from the US increased from 58.9 to
76.1 per cent. Growth in pork and poultry meat imports was also high, at 664 per
cent and 390 per cent, respectively.

Table 10.2: Main Mexican agricultural imports from US as a percentage of total agriculture imports from US

HS 2 digit	Product	1993	2010
10	Cereals	15.4	19.0
02	Meat and edible meat offal	13.5	17.7
12	Oilseed, oleaginous fruits; miscellaneous grains	14.4	12.8
52	Cotton	8.0	6.8
23	Residues and waste from the food industry	4.9	6.0

Source: UN Comtrade.

Table 10.3: Imports to Mexico of selected agricultural products

	Imports from the world				US share of total imports (%)	
	Volume (average 2008-10 in 1000 tons)	% change in volume 1991-93 to 2008-10	Value (average 2008-10 in US$ millions)	% change in value, 1991-93 to 2008-10	Value 1991-93	Value 2008-10
Beans	129.1	852.6	126.1	1 330.0	92.4	90.8
Beef	318.9	70.2	1 152.7	198.6	81.1	84.6
Maize	8 179.6	670.3	1 854.6	947.7	99.0	99.3
Pork	478.4	664.1	843.3	791.5	78.3	90.5
Poultry	642.6	390.2	757.9	506.4	98.5	90.7
Rice	820.7	173.7	345.5	390.8	72.3	99.5
Sorghum	2 101.0	–44.4	411.3	–3.9	99.4	100.0
Sugar	4 556.5	1 031.5	649.7	413.1	43.5	73.9
Wheat	3 323.2	191.7	1 006.8	484.0	58.9	76.1

Source: UN Comtrade, SITC classification of products; see annex.

Mexico's agricultural exports to the US increased from an estimated $3.2 billion in 1993 to $13.6 billion in 2010, and account for about 17 per cent of the total value of agricultural imports of the US. Horticulture products such as tomatoes and fruits are the main exports (table 10.4). Beer exports have increased significantly, while the importance of live cattle has decreased.

Regional trade agreements (RTAs) usually cause trade creation and diversion effects, resulting in a higher share of intra-RTA trade. Mexico's imports from Canada and the US increased slightly between 1993 and 2010, from 79 per cent to 82 per cent (table 10.5). On the other side, US imports from Mexico increased from an import market share of 11 per cent to 17 per cent between 1993 and 2010, and for Canada Mexico's share of imports has increased from 2 per cent to 4 per cent. This confirms the trade creation effect. The decreasing share of Mexico's exports to the

Table 10.4: Main Mexican agricultural exports to US as a percentage of total agriculture exports to US

HS 2 digit	Product	1993	2010
07	Edible vegetables and certain roots	38.1	30.3
22	Beverages, spirits, and vinegar	7.8	17.0
08	Edible fruit and nuts; peel of citrus	12.3	14.9
17	Sugars and sugar confectionery	1.3	8.7
19	Preparations of cereal, flour, starch/milk	1.9	5.3

Source: UN Comtrade.

NAFTA markets (from 89 per cent to 78 per cent) is explained by lower import growth rates in Canada and the US and does not reflect loosing market shares. However, the Mexican market share in Canada is still very low.[11]

Increasing specialization, with more staple crops and meat flowing south and more seasonal fruits and vegetables flowing north, has resulted from the NAFTA-induced tariff cuts, which reduced the real Mexican border price of corn, an imported commodity, and increased the real Mexican border price of fruits and vegetables, which are exported commodities (McMillan et al., 2006; Prina, 2011). This confirms the finding by Dimaranan et al. (2003), cited in Stiglitz and Carlton (2005), that, on one hand, Mexico has become more dependent on imports in programme crops and meat/livestock. On the other hand, Mexico has been successful in the export of vegetables and fruits. Vegetable exports to the US increased at 0.8 per cent annually during the 1989–1993 period and then jumped to increases of 6.2 per cent annually in the post-NAFTA period (1994–2004)(Prina, 2012). More than 85 per cent of the tomatoes imported into the US come from Mexico. Mexican fruit exports to the US rose at 2.8 per cent per year between 1989 and 1993 and at 4.8 per cent per year after that.

Table 10.5: Market shares of exports and imports in NAFTA

Reporter	Partner	Imports (%)		Exports (%)	
		1993	2010	1993	2010
Mexico	US	74	74	89	78
	Canada	5	8	1	3
	NAFTA	79	82	90	81
US	Mexico	11	17	8	12
Canada	Mexico	2	4	2	4

Source: UN Comtrade.

[11] The average MFN rate in Mexico has not decreased since the implementation of NAFTA. It remains relatively stable at around 20 per cent for the simple average. It is possible, however, that non-NAFTA trade, which accounts for about 20 per cent of agricultural trade, is not MFN trade but is instead under other preferential schemes.

10.4   TRADE POLICY

Mexico has undertaken significant agricultural market reforms. Since the early 1990s it has decreased its trade barriers, shifted away from commodity support to more decoupled forms of support, and encouraged market liberalization (OECD, 2007).

10.4.1 Market access

Mexico is a founding member of the WTO, with an average bound rate of 44 per cent and a relatively high and stable average MFN applied rate of 21 per cent (simple averages for agricultural products, 2010) (table 10.6). Sugars and confectionary, animal and dairy products, and coffee and tea attract the highest tariffs.

Most of Mexico's imports are under preferential agreements. The NAFTA among Mexico, the US, and Canada was ratified in 1994. Many tariffs were eliminated immediately, and others were phased out over several years. Because of the sensitivity of agriculture, the agreement featured an extended implementation period for sensitive products over periods of 5 to 14 years. In Mexico maize is particularly sensitive; the NAFTA agreement had a 14-year phase-in period to protect the Mexican market from imports of US maize. The phase-in was completed in 2008.

It has been shown that the comprehensive liberalization schedule with the US has had the impact of increasing certain agricultural imports from the US (see, e.g. McMillan et al., 2006 and Prina, 2011). The free market access to the US has most likely also helped Mexican exporters, but the US does not in general have very high tariffs on agricultural goods. On fruits and vegetables, the major export products to the US, the average applied MFN rate is low, at 4.9 per cent. In many sectors where

Table 10.6: Mexican tariffs by product group

	Bound	**MFN applied 2010**	**NAFTA**
Animal products	64	41	0
Dairy products	63	35	0
Fruit, vegetables, plants	37	18	0
Coffee, tea	64	37	0
Cereals and preparations	45	20	0
Oilseeds, fats, and oils	44	17	0
Sugars and confectionary	119	66	0
Beverages and tobacco	44	28	0
Cotton	39	5	0
Other agricultural products	28	7	0
All agriculture	**44**	**21**	**0**
Fish and fish products	35	17	0

Source: WTO, ITC, UNCTAD world tariff profiles 2010.

Table 10.7: Average applied tariffs in agriculture between the US, Canada, and Mexico

Import country	Export country	Preferential tariff (%)	MFN rate for export basket (%)
Mexico	US	0.0	31.1
	Canada	0.0	16.7
US	Mexico	0.0	5.4
Canada	Mexico	0.0	5.8

Note: MFN rate is the trade-weighted average MFN tariff for the actual export basket from the indicated export country. Preferential tariff is the theoretical rate since some products may face the MFN level if they do not meet, for example, rules of origin requirements.
Source: UNCTAD TRAINS Database, 2009 and 2010.

the US has high tariffs, such as in dairy (16.2 per cent), Mexico is not a major exporter.[12] Thus, the tariff preferences through NAFTA appear to have relatively lower value for Mexico's agricultural producers than for US farmers (table 10.7).
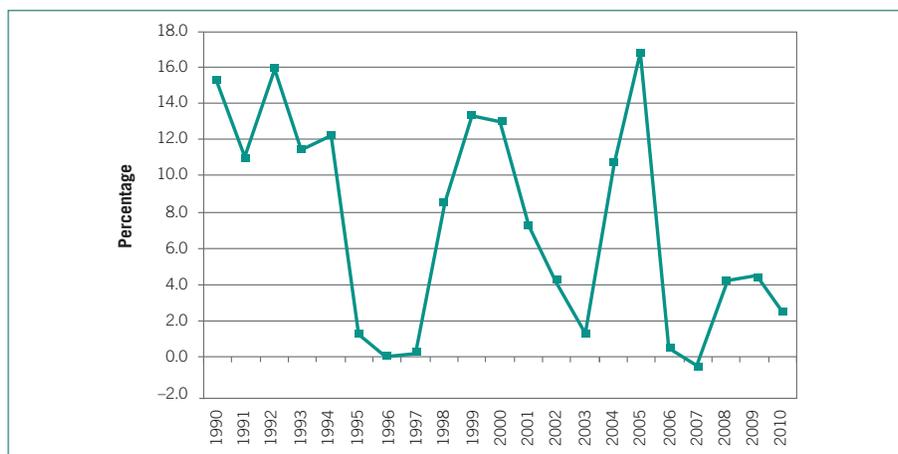
10.4.2 Domestic support

There are no limitations in the NAFTA agreement concerning the use of domestic support. Still, US subsidies on agriculture are a major concern for Mexican farmers. Total support for US agricultural producers has risen and fallen since NAFTA was implemented in 1994. The latest figure for producer support is $26 billion (2010), according to OECD estimates. This is currently about 7 per cent of the total value of production. After a peak of more than $55 billion in 1999 (about 26 per cent of the total value of production), the decline is attributable in part to an increase in commodity prices; since some of the payments are countercyclical, payments are reduced in times of high prices.

Total domestic support (for example, including general services such as research and food stamps for low income families) for US agriculture in 2010 was still significant, totalling $133 billion. However, little of this was paid to producers according to output use ($1.9 billion) or input use ($9.6 billion). These are the categories that are considered most production-distorting. Therefore, it is difficult to assess how distorting the US domestic support is for Mexico.

Of particular interest is maize, as both Mexico and the US grow this crop, and at the signing of NAFTA Mexican producers were concerned about being flooded with cheap imports of maize following the removal of tariffs. US and Mexican maize are not completely substitutable. The US produces mainly yellow maize, which is used as a stock feed. Mexico produces white maize, which is also used as a food for human consumption. However, there is some substitutability between yellow and white maize, and the US also exports some white maize.

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[12] There are some exceptions. US imports of processed tobacco and processed ground-nuts, for example, were protected by tariffs of 77 per cent and 164 per cent of the product price, respectively. Relative to the rest of the world, Mexico benefits from preferential access to the US market for these agricultural products.

Figure 10.4: Producer support for maize in the US as a percentage of production value, 1990–2010

Source: OECD.

Domestic support in the US for maize as a percentage of production, according to OECD estimates, is shown in figure 10.4. Product-specific support was very high in certain years, reaching 16 per cent in 2005. Since then it has been decreasing, reaching a level close to 2 per cent in 2010.

Mexican maize producer prices were double US prices in 1994, when the NAFTA agreement was ratified. Some convergence appears to have occurred in the first year, but a gap remains, and prices in the two countries have generally moved in the same direction since then. McMillan et al. (2006) found that, while the Mexican producer price has always moved in tandem with the world price, NAFTA squeezed the differential between Mexican producer prices and border prices.

There is, however, no consensus concerning the impact of the US subsidies on the border price. McMillan et al. (2006) conclude from an overview of the literature that "though the estimates are all over the place … the bottom line seems to be that the magnitude of the price difference would actually be quite small." Wise (2009) disagrees. He analysed the impact of US agricultural policy on Mexican producers and assessed the extent to which subsidized products were exported to Mexico at prices below production costs between 1997 and 2005. His calculation is based on dumping margins that are supposed to capture not only the effect of direct subsidies but also other subsidies that allow exports below production costs. Maize producers were by far the most heavily affected, with a dumping margin of 19 per cent, resulting in a loss of $6.6 billion for Mexican maize farmers during that 9-year period.

Maize is not the only US product competing with Mexican production that benefits from subsidies. According to OECD's Producer Single Commodity Transfers estimate, the US subsidizes mainly crops and milk. For the eight products – maize, soybeans, wheat, cotton, rice, beef, pork, and poultry – for which Wise (2009) estimates

the dumping margin, he calculates that subsidies in the US caused losses of $12.8 billion for Mexican producers over the period from 1997 to 2005.

Since 2005 product-specific domestic support in the US has dwindled to very low levels due to the countercyclical nature of much of that support, as noted. For instance, US maize prices have risen from a little over US$2 per bushel in 2001 to $8 per bushel in 2011. Some observers have attributed part of this rise to the influence of US- and EU-mandated biofuels policies. Some 40 per cent of the US maize crop is diverted for this purpose, according to the United States Department of Agriculture (USDA).[13] Babcock (2011) suggests that, as a result, US maize prices were 17 per cent higher in 2011 than they would have been otherwise. This policy not only raises the price of maize but also the prices of other crops, such as vegetable oils and sugar, that are used in ethanol production, and wheat and coarse grains, which are substitute animal feeds.

While previous US policies may have had a detrimental effect on Mexican maize producers, the data suggest this effect is now small or, indeed, may have reversed. If the US policy that supports the production of maize for ethanol production leads to higher prices, the Mexican maize sector could benefit from that policy. While beneficial for maize producers, higher maize prices are likely to be detrimental for Mexican livestock producers and for consumers' access to food. Wise (2012) estimates that, from 2006 to 2011, expansion of US ethanol production cost Mexico about $1.5 billion due to ethanol-related corn price increases.

For its part, Mexico supported its agricultural producers with MXN79 billion in 2010 (US$6.2 billion),[14]12 per cent of the value of agricultural production, which is about MXN592 billion. The total support estimate, which includes transfers from consumers, was MXN94 billion. The largest items are support based on commodity outputs and input use. Market price support goes primarily to poultry meat, sugar, and milk. Subsidies on input use include electricity, price hedging (mainly on maize, sorghum, and wheat), and fixed capital formation. Expenditure on research and development is relatively low, at MXN1.3 billion.

Mexico's domestic support is significant but lower than the average OECD farm support. The OECD calculated an average producer support of 18.3 per cent for 2010, partly driven by highly subsidizing countries such as Japan, Republic of Korea, Norway, and Switzerland. Although in 2010 the Mexican producer support estimate was 12 per cent compared with the US level of 7 per cent, during many years in recent decades product-specific subsidies on crops in Mexico were lower than in the US. For instance, maize support was 8.8 per cent in 2005, roughly half of the support that US farmers received.

Scott (2010) notes that market price support and output-linked payments in Mexico have targeted mostly traditional crops, particularly maize and other grains, as well as raw sugar and some animal products such as milk and poultry meat.

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[13] http://www.usda.gov/oce/commodity/wasde/
[14] Exchange rate from USDA ERS 12.64.

However, fruits and vegetables have not received significant support but have benefited from the liberalization of agricultural markets.

10.4.3 Non-tariff measures

Mexico's trade policy has led to much more open markets, especially within the NAFTA region. While tariffs on agricultural products between the US and Mexico have been eliminated, standards and other non-tariff measures regulating cross-border trade prevent full integration of the two markets. Non-tariff measures are the dominant obstacle to exports for Mexican agricultural producers. The most important non-tariff measures are technical measures, mainly sanitary and phytosanitary (SPS) measures and labelling requirements, as well as rules of origin requirements. NAFTA has allowed differing levels of standards to develop (as opposed to effective equivalence). Vollrath (2004) notes that SPS-related issues and standards remain contentious in the context of NAFTA in areas such as dairy, beef, sugar, wheat, rice, corn, and livestock. This is due to a lack of harmonized product, health, safety, and environmental standards, which, in turn, stem from differences in national laws and regulations, divergent farm programmes, and incompatible macroeconomic policies. Products legally produced in one country in NAFTA cannot automatically be sold in other NAFTA countries but may require additional certification.

10.4.4 Effect of trade policy on Mexican producers

NAFTA has been accused of damaging farmers in Mexico and jeopardizing Mexico's food self-sufficiency (Polaski, 2006). Fanjul and Fraser (2003) argue that NAFTA has been responsible for a surge in US maize exports to Mexico and the associated decline in the Mexican producer price of maize. Moreover, Mexican farmers would be at a disadvantage vis-à-vis US farmers because of the US subsidies. The result, it is argued, was an increase in poverty. Similarly, Polaski (2004) contends that US exports of sub-sidized crops such as corn have depressed agricultural prices in Mexico, and the rural poor have borne the brunt of the adjustment to NAFTA. Khor (2007) also is critical of NAFTA, arguing that the increase in Mexican exports of some agricultural products has not been enough to compensate for the substitution of imports of other products for domestic agricultural products.

In contrast, the World Bank (2004) argues that the reduction in producer prices reflected a long-term trend and cannot be blamed on NAFTA. Barron and Rello (2000) analyse the growing tomato agro-industry and argue that vegetable exports have proved to be an alternative to rural unemployment and are crucial to the survival of entire villages. The authors are, however, also critical of poor working conditions. Hufbauer and Schott (2005) acknowledge that expanded agricultural trade under NAFTA imposed adjustment costs in Mexico, but they argue that static and dynamic gains probably exceed adjustment costs within Mexico by a factor of five or more. Others find small effects of US subsidies on Mexican prices (see discussion in McMillan et al.(2006)).

Some analyses of the impact of NAFTA on Mexico's agricultural sector distinguishes between regions close to the US border and remote areas in the south of Mexico as well as among farms of different sizes. Nicita (2004) finds that trade liberalization has affected domestic prices and labour income differently both across income groups and geographically across the country. The effects on prices were found to be higher in regions more exposed to global markets, close to the US border. The findings indicate that trade liberalization has lowered relative prices of most non-animal agricultural products, reducing households' agricultural income. While reducing the cost of food, thus benefiting consumers, the policy also contributed to widening the income gap between urban and rural areas.

Using household survey data, de Janvry et al. (1995) found that the majority of small- and medium-size corn producers do not produce for the market. Therefore, they predicted that most corn farmers' income will not be directly affected by the decline in the price of corn associated with NAFTA, while a significant share will benefit as consumers. Using a general equilibrium model, Levy and Van Wijnbergen (1995) quantify the impact on household income, labour, and land markets of liberalizing the Mexican corn sector. They emphasize that even subsistence farmers who do not sell corn are likely to sell labour. Thus, if dropping corn prices reduce wages, subsistence farmers are likely to be hurt by the liberalization of the corn sector. Prina (2012) finds, however, that NAFTA-triggered changes in the border prices of crops imported from the US and exported to the US had no impact on the wages of agricultural workers in Mexico. She argues that the mobility and flexibility of workers, inter alia resulting from little likelihood of sector-specific skills, insulated workers from any adverse impact.

McMillan et al. (2006) confirm that the majority of the poorest corn farmers did not sell corn in the market prior to NAFTA, and so their income will not have been directly affected by the forces of globalization associated with NAFTA. A majority of the medium- and large-size corn farmers, however, sell corn in the market, and the medium-size corn farmers experienced a sharp decline in real income as a result of NAFTA. The income of the largest corn farmers has increased.

Thus, the studies have shown that the impact of globalization, and more specifically NAFTA, appear to depend on farm size, proximity to the US border, types of agricultural products produced, income levels, and share of agricultural income in total household income. It appears that a majority of small farms were not much affected, and that middle-income corn farmers were adversely affected, while the highest-income farmers were able to profit.

In her econometric study Prina (2012) also assesses the impact of NAFTA-induced changes in the border price of crops on agricultural employment in Mexico.[15]

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[15] Prina (2011) finds that NAFTA-induced tariff cuts caused a reduction in the real Mexican border price of corn and an increase in the border price of tomatoes and melons. Nicita (2009) finds that tariff liberalization in Mexico decreased the price of a basket of agricultural goods.

She finds that increases in the real price of vegetables are associated with an increase in employment in the cultivation of vegetables, and the drop in the real price of corn reduces employment in the corn sector. Furthermore, she confirms that the effects vary with the distance to the US border, emphasizing the importance of accounting for regional differences.

Prina (2012) does not assess the overall effect on employment in agriculture. Furthermore, it has been argued that agriculture cannot be looked at separately in the context of NAFTA. Nicita (2004), for example, shows that, despite the likely negative effect on certain farm households, tariff changes during the 1990s appear to have raised disposable income for all households, with richer households enjoying a 6 percent increase and poorer households enjoying a 2 percent increase.

To summarize, it appears that NAFTA has reduced domestic prices for many agricultural products in Mexico, including corn, while tariff reductions increased prices for certain vegetables and fruits. Most analysts find an adverse effect of US subsidies on Mexican farmers, but the degree to which prices are reduced is controversial and in any case varies from year to year. These price changes have brought hardship for many Mexican farmers, such as those with medium-size corn farms, whose incomes have declined, while benefiting some larger farms as well as vegetable producers. Smaller farms appear to be less affected, as they produce little for the markets. Wages seem to have been little affected, while employment has shifted between sectors.

10.4.5 The way ahead

The need to strengthen the rural sector in Mexico, with its high unemployment and poverty rates, is evident. The United Nations Conference on Trade and Development (UNCTAD) (2011) argues that, along with structural change in developing countries, agricultural development can facilitate economic development, can promote higher value addition, and can provide export-led growth opportunities while generating positive externalities for society, such as poverty reduction, employment, and food security. The World Bank (2008) also has emphasised the importance of agriculture as a vital development tool. In recent years agriculture has contributed little to Mexico's growth, however. Between 1996 and 2010 the contribution of agriculture to real GDP growth was 2.6 per cent, considerably lower than the contribution of agriculture in, for instance, Brazil or Turkey. In developing countries the average contribution was much higher, at 5.7 per cent (table 10.8).

What can the Mexican government do to strengthen its agricultural sector so as to increase employment and food security while reducing poverty? The scope for trade measures appears limited, as Mexico has committed itself in the WTO and in various RTAs to abstaining from certain types of measures. There is limited scope for increasing tariffs on imports or reducing tariffs that its exports face. The possibility to use tariff rate quotas in NAFTA has been phased out, and subsidies have not been addressed in existing RTAs. A successful conclusion of the Doha Round, where subsidies could be limited, seems unlikely at this point.

Table 10.8: Contribution of agriculture to growth of real GDP between 1996 and 2010

	Percentage contribution of agriculture to real GDP growth
Brazil	6.6
Mexico	2.6
Turkey	3.9
United States of America	1.4
Developing economies	5.7
World	3.2

Source: Authors' calculation based on UNCTADStat.

It is important to increase the competitiveness of the agricultural sector. In Mexico agriculture is the least productive sector, in contrast to the case in many other Latin American countries, where agriculture is often more productive than, for example, wholesale and retail trade, construction, or even business services (McMillan and Rodrik, 2011). Poverty in rural areas is correlated with low productivity. Increasing total factor productivity could help strengthen the agricultural sector, although the impact on employment is unclear. Mexico spends relatively little on research and development in agriculture. Studies, such as Alston et al. (2010) and Alston (2010), have shown that increasing research and development can increase the productivity of the agricultural sector and that this policy can have a high rate of return on investment.

If agricultural tariffs were to be raised, trade agreements would have to be changed. Such revisions have been advocated and discussed in the literature (e.g. DTB Associates and AgRisk Management, 2006). Mexico would probably have to offer Canada and the US something in return, and any benefits to the agricultural sector could be offset by additional costs to others sectors in Mexico. Because of the links between grains, oilseeds, and livestock, trade policies raising prices for feed grains could have adverse effects on livestock producers and consumers.

An alternative policy is to provide additional domestic support, or to provide the same amount in a different fashion, possibly better targeted to the producers in need. The WTO rules on domestic support provide considerable flexibility for countries to design their own support mechanisms, and the domestic support pillar is not covered in Mexico's bilateral treaties.

Another possible policy is to reduce payroll taxes on agricultural labour. Agriculture is a labour-intensive sector and such sectors can contribute to creating – or keeping – jobs. A higher labour productivity, however, would allow higher wages in agriculture, a sector where salaries are typically low, especially in developing countries. Sustainable agriculture could be an alternative to conventional agriculture for some Mexican small-scale farmers as a means to increase their profitability and to create jobs. Sustainable agriculture relies on such techniques as crop rotation,

composting, and biological pest control to increase soil productivity. Yields increase, they need less expensive inputs, and the production is more labour-intensive than conventional agriculture, thus having a positive impact on employment and poverty reduction. In Mexico organic production is dominated by small-scale producers. A study by UNCTAD and the United Nations Environment Programme (UNEP) confirmed that this can be an economically advantageous way for small farmers in developing countries to escape the rising prices of inputs, with corollary benefits for the environment, climate, and employment (UNCTAD, 2008). A lower payroll tax is only one – admittedly weak – instrument that could contribute to moving agriculture in a direction that uses fewer non-labour inputs (that often are based on fossil fuels) towards a more labour-intensive production (see discussion in Hoffmann, 2011).

The possible effects of these policy options are analysed in the next section.

10.5   MODEL, DATA, AND SCENARIOS

The well-known global general equilibrium trade model, GTAP, is designed for trade policy analysis of this nature (Hertel, 1997, and chapter 3 of this book). Specifically, it contains the bilateral trade and tariff data that are necessary to model the impacts of trade and domestic policy changes in the context of preferential agreements. The GTAP database, version 8, refers to the base year 2007. The model divides labour into two types, skilled and unskilled. Input–output tables link the sectors in each economy.

The base data specifies the use of each primary factor (land, labour, capital, etc.) and intermediate input into the production of each good. Changes in output affect the use of labour according to the labour–output ratios shown in table 10.9. For example, assuming no changes in response to relative prices, a US$1 increase in the output of rice requires an additional 39 US cents in labour costs, whereas the production of more wheat requires less than half as much additional labour. It can be seen that crops are more labour-intensive than livestock products. This suggests that policies to increase the output of crops are likely to be of greater assistance to labour than those addressing livestock production. Cereals, including maize, and vegetables and fruit are similarly labour-intensive, according to the GTAP database.

The GTAP database has Mexican tariffs of 16 per cent on coarse grains and 5 per cent on milk products.[16] The US has tariffs of 27 per cent on sugar imports from Mexico.

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[16] World Integrated Trade Solution (WITS) data show that for 2010 Mexico imported maize worth US$1,423 million from the US at a trade-weighted tariff of 5.9 per cent. However, for the previous two years the tariff was zero. Positive tariffs can occur despite a free trade agreement if, for example, some imports do not meet the rules of origin requirements.

Table 10.9: Labour–output and capital–output ratios in Mexican agriculture

Product	Code	Labour–output ratio	Capital–output ratio
Primary agriculture			
Paddy rice	pdr	0.39	0.24
Wheat	wht	0.18	0.12
Cereal grains nec	gro	0.36	0.23
Vegetables, fruit, nuts	v_f	0.34	0.21
Oilseeds	osd	0.09	0.07
Sugar cane, sugar beet	c_b	0.35	0.22
Plant-based fibres	pfb	0.13	0.09
Crops nec	ocr	0.30	0.19
Cattle, sheep, goats, horses	ctl	0.17	0.13
Animal products nec	oap	0.27	0.18
Raw milk	rmk	0.10	0.08
Wool, silk-worm cocoons	wol	0.15	0.09
Forestry	frs	0.47	0.08
Fishing	fsh	0.03	0.46
Processed agriculture			
Meat: cattle, sheep, goats, horse	cmt	0.07	0.01
Poultry and other meats	omt	0.23	0.34
Vegetable oils and fats	vol	0.16	0.40
Dairy products	mil	0.03	0.06
Processed rice	pcr	0.69	0.17
Sugar	sgr	0.31	0.35
Food products nec	ofd	0.23	0.04

nec=not elsewhere classified.
Source: GTAP version 8 database.

Four hypothetical scenarios are simulated to assist in analysing the likely impacts of policy options aimed at assisting agriculture (table 10.10).

Trade between Mexico and the US is now duty free. One possible approach to support Mexican producers that has been proposed and discussed would be for Mexico to request a revision of NAFTA. One option, albeit somewhat speculative, would be for Mexico to raise agricultural tariffs to their MFN levels. This is analysed in the first scenario, MFN.

The second scenario, Labour, involves removing taxes on the employment of agricultural labour. Payroll taxes for unskilled and skilled labour amount to 4 and 5 per cent, respectively, of the cost of employing labour. Lowering the cost of hiring

Table 10.10: Scenarios

Scenario	Description
MFN	Increasing Mexico's tariffs on agricultural imports from NAFTA countries to MFN levels
Labour	Removing payroll tax on agricultural labour
R&D	Funding research and development (R&D) to increase agricultural productivity
Domestic Support	Increasing support on output to 5 per cent or switching support to inputs

labour would lead to a substitution of labour for capital and make the sector more competitive domestically and internationally.[17]

In the third scenario, R&D, we assume that R&D expenditure is increased, with a resulting increase in productivity of 1 per cent. Currently, Mexico spends only 2 per cent (MXN1.3 billion) of its support to agriculture on R&D. A survey of meta-studies suggests that R&D expenditure has an internal rate of return of between 20 and 80 per cent per annum (Alston, 2010), indicating a likely underinvestment in R&D in Mexico. Estimates of returns will depend on specific circumstances, such as location and crops, but are likely to be greater in developing countries, where productivity is low. To finance the increase in R&D expenditures, taxes would have to be increased or expenditures in other areas reduced. We do not assess these effects here and focus on sectoral rather than macro effects.

Finally, the fourth scenario, Domestic Support, involves increasing domestic support on all agricultural outputs to 5 per cent. Other subsidies in agriculture, such as general services, remain intact. Subsidies on output tend to benefit non-target groups, that is, those farms that are larger than average. Therefore, a second Domestic Support scenario involves switching the same amount (about US$8 billion) to an input subsidy on all primary factors (see chapter 3 of this book).

In this application of GTAP, the standard closure is modified to reflect a semi-variable labour market for unskilled labour, implying that a change in the demand for labour leads to some increase in both wages and employment. Skilled labour is assumed to be mobile in each country but in fixed supply, with no surplus labour. This is the standard GTAP assumption.

GTAP is used here to compare the trade and welfare effects of changes in trade and other domestic policies once the impacts have worked through. There is no attempt either to phase-in the policy changes or to trace the time profile of the impacts. Thus, we ignore changes such as growth in trade that may have occurred over the implementation period.

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[17] Technically, changing the payroll tax requires running an uncondensed version of the GTAP model. In the standard model the payroll tax is not an exogenous variable that can be shocked.

10.6 RESULTS

10.6.1 MFN scenario

Under this scenario tariffs in Mexico on all agricultural imports from the US are increased from the preferential tariffs to Mexico's MFN rates (table 10.11).

The increase in the tariffs leads to a reduction of imports into Mexico of 0.8 per cent. Total imports from the US fall by 3.6 per cent. The main imports from the US that are reduced the most are rice, vegetable oils and fats, dairy products, and meat products (table 10.12).

Table 10.11: Initial and new tariffs in Mexico on imports of agricultural products from the US, MFN scenario

Product	Initial (%)	MFN (%)
Paddy rice and processed rice	0	49.99
Other cereals	16.1	20
Sugar	0	10
Oilseeds	0	5
Vegetable oils and fats	0	18
Vegetables and fruit	1.53	19
Other crops	0	13
Milk	0	0
Dairy products	4.66	29
Cattle and sheep	0	7
Pigs and poultry	0	9
Ruminant meat	0	31
Non-ruminant meat	0	57.33
Other processed agriculture	0	20

Source: GTAP and WITS.

Table 10.12: Change in value of imports of agricultural products to Mexico from the US, MFN scenario

Product	Initial (US$ million)	Under MFN (US$ million)	% change
Paddy rice and processed rice	884.29	142.98	−83.8
Other cereals	1 917.38	1 895.42	−1.1
Sugar	141.68	110.54	−22.0
Oilseeds	1 449.05	1 399.80	−3.4
Vegetable oils and fats	747.18	386.44	−48.3
Vegetables and fruit	824.69	681.62	−17.3
Other crops	190.46	104.40	−45.2
Milk	0.50	0.54	8.0
Dairy products	894.83	269.09	−69.9
Cattle and sheep	57.97	44.23	−23.7
Pigs and poultry	648.09	597.78	−7.8
Ruminant meat	1 352.44	569.65	−57.9
Non-ruminant meat	939.41	57.56	−93.9
Other processed agriculture	3 179.58	2 069.92	−34.9

Source: GTAP and WITS.

Table 10.13: Change in agricultural imports to Mexico from the world, MFN scenario

Product	Initial (US$ million)	Under MFN (US$ million)	% change
Paddy rice and processed rice	1 128.96	1 022.40	−9.4
Other cereals	2 014.96	1 999.88	−0.7
Sugar	156.60	129.90	−17.0
Oilseeds	2 046.85	2 118.18	3.5
Vegetable oils and fats	1 150.97	1001.30	−13.0
Vegetables and fruit	1 077.75	1 054.39	−2.2
Other crops	587.48	576.03	−1.9
Milk	2.73	2.95	8.1
Dairy products	1 747.01	1 432.84	−18.0
Cattle and sheep	126.67	122.98	−2.9
Pigs and poultry	709.83	668.68	−5.8
Ruminant meat	1 661.84	1 592.61	−4.2
Non-ruminant meat	1 097.12	608.52	−44.5
Other processed agriculture	5 033.18	4 342.96	−13.7

Source: GTAP simulation.

As products from other countries become relatively less expensive, imports of these products would partly compensate for the sharp reduction of imports from the US. Despite the trade diversion and creation effect, the scenario still leads to significantly reduced imports of agricultural products, indicating the importance of the NAFTA agreement for imports to Mexico (table 10.13). Meat and sugar imports would be about 20 per cent smaller if tariffs vis-à-vis the US were at MFN levels.

As a result of decreasing imports of most agricultural products, domestic output increases by 2.5 per cent. For example, the value of domestic production of rice would increase by 22 per cent, and the value of certain meat products would increase by 9 per cent (table 10.14).

Table 10.14: Change in value of agricultural production in Mexico, MFN scenario

Product	Initial (US$ million)	Under MFN (US$ million)	% change
Paddy rice and processed rice	1 504.36	1 828.09	21.5
Other cereals	7 270.61	7 462.83	2.6
Sugar	6 967.28	7 038.59	1.0
Oilseeds	370.70	394.24	6.4
Vegetable oils and fats	3 308.05	3 514.40	6.2
Vegetables and fruit	15 414.69	15 513.99	0.6
Other crops	1 029.50	1 030.10	0.1
Milk	5 345.48	5 559.76	4.0
Dairy products	14 627.55	15 084.68	3.1
Cattle and sheep	4 128.76	4 152.97	0.6
Pigs and poultry	11 260.29	11 806.32	4.8
Ruminant meat	5 043.36	5 316.62	5.4
Non-ruminant meat	7 622.01	8 285.39	8.7
Other processed agriculture	83 037.75	84 087.45	1.3

Source: GTAP simulation.

Table 10.15: Percentage change in demand for unskilled labour in Mexican agriculture, MFN scenario

Sector	Assumption	
	Fixed wages	Wages and employment adjust 50/50
Paddy rice and processed rice	20.50	20.48
Other cereals	2.02	1.98
Sugar	1.02	1.01
Oilseeds	4.99	4.97
Vegetable oils and fats	3.97	3.99
Vegetables and fruit	0.15	0.11
Other crops	−0.39	−0.41
Milk	2.88	2.85
Dairy products	2.26	2.29
Cattle and sheep	−0.48	−0.50
Pigs and poultry	3.73	3.70
Ruminant meat	0.52	0.54
Non-ruminant meat	7.36	7.39
Other processed agriculture	0.54	0.56

Source: GTAP simulation.

While the output of agricultural products increases, the output of non-agricultural products and services decreases even though tariffs for those products have not changed. Agricultural output becomes more expensive, and this raises the cost of production of downstream processed agricultural products. Since the share of agricultural inputs in non-agricultural production is low, the main reasons for the decrease in production of non-agricultural products are general equilibrium effects. In addition, demand for primary resources such as land and labour in agriculture is increasing, which raises the costs for these factors. Total value of output increases only slightly, by 0.2 per cent.

The impact of the change in trade policy on imports, exports and output is fairly robust across labour market assumptions. This is also the case for changes in employment of unskilled labour at the sectoral level, under two different assumptions (table 10.15). Under the first assumption wages are fixed, and all adjustment is absorbed by a change in the level of employment. This is the standard assumption in this analysis. Total employment of unskilled labour would decrease by 0.4 per cent. Behind this nationwide change is an increase of employment in the agricultural sector and a decrease in the non-agricultural sector. The value of employment, i.e. wages multiplied by employment, increases by 1.4 per cent in agriculture, while in the non-agricultural sector it decreases by 0.02 per cent. Under the second assumption the adjustment for changes in labour demand is shared equally by employment changes and wage changes. The results are similar, however. In this case total employment of unskilled labour would decrease by only 0.2 per cent, and wages for unskilled labour would decrease slightly, by about 0.06 per cent. Sectoral changes in the value of unskilled labour are

similar. Table 10.15 shows the changes in the value of employment for unskilled labour in agriculture under these two assumptions.

Real land rents would increase by almost 5 per cent under both assumptions. Thus, if farmers own their land, the de facto impact on incomes would be a mixture of increased revenue from land rents and slightly decreasing wages.

An increase of tariffs to the MFN level in Mexico vis-à-vis imports from the US would have a strong redistribution effect. Similar but much smaller effects would result from a similar exercise regarding trade with Canada. The agricultural sector would benefit, while the other sectors would be worse off. Total welfare in Mexico is estimated to be reduced by about US$1.0 billion.

Since the free trade agreement is a reciprocal preferential agreement, a scenario in which Mexican tariffs are raised to MFN levels could imply higher rates on Mexican exports to the US as well. This would result in lower agricultural exports from Mexico to the US. Raising tariffs in the US to its MFN levels would reduce agricultural exports by Mexico to the US by 13 per cent and reduce Mexico's *increase* in output by 60 per cent compared with the scenario in which only Mexican tariffs are raised. Opposite employment effects in agriculture would almost neutralize each other, resulting in only a small positive effect in agriculture of 0.2 per cent but also a small negative total employment effect of -0.01 per cent. Output in agriculture would still increase, however, since US MFN rates are considerably lower than Mexico's. Thus, excluding the agricultural sector in both Mexico and the US from preferential access would have larger effects on Mexico's imports than on its exports.

The effect of raising tariffs to MFN levels is likely to be different from the effect of having left trade barriers at that level in the first place, i.e. excluding sensitive sectors from tariff reductions, as is frequently done with agricultural products, as shown in chapter 2 of this book. Years of economic integration have increased inter-dependency, e.g. in terms of inputs being imported, and have led to a structural adjustment in which some sectors have declined and others have expanded.

A scenario with a long-term closure, in which capital is mobile and adjusts to the new trade policy, does not lead to very different results. The assumption can have a significant impact, but in the MFN scenario the impact on the agricultural sector is not dramatic. The decline in employment in Mexico would be slightly greater, at about 0.6 per cent, than in the standard MFN scenario, at 0.4 per cent. Sectoral changes in trade and output are roughly similar to the changes discussed above.

10.6.2 Labour scenario

GTAP records information about payroll taxes, which drive a wedge between what the employer pays and what the employee receives.[18] A payroll tax is often an important source of revenue for governments and social security systems, but it has negative

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[18] The data are not represented explicitly. They are implicit as the difference between valuations of primary factor flows. Payroll taxes are the difference between market value and agents' value (where agents are employers of factors). Negative values indicate a subsidy.

Table 10.16: Payroll tax on unskilled and skilled labour in Mexican agriculture

Product	Unskilled (% of wage)	Skilled (% of wage)
Paddy rice and processed rice	2.85	3.57
Other cereals	−0.88	−1.01
Sugar	2.78	4.87
Oilseeds	3.48	3.46
Vegetable oils and fats	5.59	5.59
Vegetables and fruit	2.53	2.49
Other crops	2.97	2.94
Milk	2.95	2.94
Dairy products	5.59	5.59
Cattle and sheep	2.48	2.46
Pigs and poultry	−0.72	−0.78
Ruminant meat	5.59	5.59
Non-ruminant meat	5.59	5.59
Other processed agriculture	5.59	5.59

Source: GTAP.

economic effects on both the demand side and the supply side. It reduces workers' income and increases the costs of employers to hire workers. In theory payroll taxes reduce the incentive to work and increase the incentive to substitute other production factors for labour. Reduction of payroll taxes can be an instrument to increase employment. This is frequently discussed as a policy instrument. In the Labour scenario the payroll tax on both unskilled and skilled labour is eliminated in the agricultural sector. Table 10.16 shows the initial payroll tax in the agricultural sector in Mexico in GTAP. The payroll tax is on average only 4 per cent for unskilled and 5 per cent for skilled labour.

Eliminating payroll taxes has only a small impact on trade and output value. Total agricultural exports increase by 1 per cent, and total agricultural imports decrease by 0.3 per cent. Total overall and total agricultural production values remain almost the same, although with some small variation among sectors. The total value of output increases by 0.1 per cent, while the value of agricultural output decreases slightly, by 0.03 per cent. This reflects the change in domestic prices, which fall due to the reduction in production costs. Output in real terms increases for all agricultural sectors and all non-agricultural sectors (table 10.17).

The impact on employment in agriculture is clearly positive. The total value of unskilled employment in agriculture increases by 2.5 per cent. Employment in the sectors vegetable oils and fats, dairy products, ruminant meat, non-ruminant meat, and other processed agriculture increases by more than 5 per cent (table 10.18). These are sectors in which the payroll tax was relatively high, and thus its removal has a significant impact. Total employment of unskilled labour in Mexico increases by 0.5 per cent.

Table 10.17: Percentage changes in Mexican agricultural imports from and exports to the world and output (real) of Mexico, Labour scenario

Product	Exports	Imports	Output
Paddy rice and processed rice	2.9	–0.1	1.4
Other cereals	–0.4	0.6	0.2
Sugar	2.4	–1.0	0.4
Oilseeds	2.8	0.3	2.0
Vegetable oils and fats	1.5	–0.5	0.6
Vegetables and fruit	0.6	0.1	0.6
Other crops	2.7	–0.3	2.2
Milk	0.0	—1.5	0.5
Dairy products	3.2	–1.4	0.5
Cattle and sheep	1.4	–0.5	0.5
Pigs and poultry	0.0	0.1	0.2
Ruminant meat	3.1	0.0	0.5
Non-ruminant meat	1.7	–0.7	0.4
Other processed agriculture	1.4	–0.7	0.5

Source: GTAP simulation.

Table 10.18: Changes in agricultural employment of unskilled labour in Mexico, Labour scenario

Product	% change in employment
Paddy rice and processed rice	2.15
Other cereals	0.25
Sugar	1.80
Oilseeds	2.52
Vegetable oils and fats	5.24
Vegetables and fruit	0.97
Other crops	2.73
Milk	0.91
Dairy products	5.60
Cattle and sheep	0.87
Pigs and poultry	0.20
Ruminant meat	5.10
Non-ruminant meat	5.42
Other processed agriculture	5.27

Source: GTAP simulation.

Table 10.19: Changes in factor prices, Mexico, Labour scenario

Product	% change in factor price
Rent for land	1.55
Wage of unskilled labour	0
Wage of skilled labour	0.23
Capital	0.12
Natural resources	0.12

Source: GTAP simulation.

For skilled employment it is assumed that changes in demand for labour lead to changes in wages instead of changes in total employment, as it is assumed for unskilled labour. Under the Labour scenario wages for skilled labour in Mexico rise modestly, by 0.23 per cent (table 10.19). Given that skilled labour is mobile between sectors and agriculture employs only a small fraction of Mexico's skilled labour (skilled labour accounts for only 8.4 per cent of the wage bill), this small increase is remarkable.

Eliminating the payroll tax in agriculture is an opportunity to increase employment in the sector. Although the payroll tax is on average not very high, removing it leads to an estimated increase in agricultural employment of about 2.5 per cent. Government revenue may fall as a consequence of the tax cut. At the same time, however, a tax cut can stimulate the economy and lead to more activity, which in turn leads to higher revenues from other taxes. The general equilibrium model takes the effect on government revenue into account. Removing the payroll tax in agriculture indeed does lead to a very small increase in government revenue and spending and to a small increase in the GDP. The total welfare effect in Mexico is positive but not large, an increase of $940 million.

10.6.3 R&D scenario

The approximately 13 per cent of Mexico's total labour force that works in agriculture is producing 4 per cent of the national output (World Bank, 2011). Thus, as in most developing countries, labour productivity in Mexican agriculture is low compared with other sectors in the economy. While a partial measure of productivity, such as the productivity of labour, measures output per unit of a particular input, total factor productivity (TFP) measures output in relation to an index of inputs, usually the value-weighted sum of all production components. TFP can be taken as a measure of technological progress, which can be attributed to changes in agricultural research and development, human capital, infrastructure, extension services, and government policies. High productivity implies high competitiveness for given factor prices. In an open economy, where domestic goods compete with goods from abroad, productivity is very important.

Table 10.20: Percentage changes in agricultural imports, exports, and real domestic output of Mexico, R&D scenario

Product	Exports	Imports	Output
Paddy rice and processed rice	6.4	−1.3	1.3
Other cereals	1.5	−1.0	0.2
Sugar	4.8	−3.1	0.4
Oilseeds	3.0	0.0	1.9
Vegetable oils and fats	5.4	−1.6	0.5
Vegetables and fruit	0.9	−0.5	0.6
Other crops	3.5	−1.0	2.2
Milk	8.7	−4.5	0.5
Dairy products	8.9	−3.9	0.5
Cattle and sheep	5.1	−2.3	0.5
Pigs and poultry	2.0	−0.8	0.2
Ruminant meat	8.5	−0.8	0.4
Non-ruminant meat	13.5	−5.2	0.3
Other processed agriculture	2.0	−1.0	0.4

Source: GTAP simulation.

Productivity in agriculture is low because labour is relatively unskilled and the amount of capital used with labour is small. Productivity could be enhanced by improving the quality of labour through more education and skills-building for farmers and by investments in physical capital such as infrastructure. Other factors also affect productivity. Public investments in institutions, extension services, training, and technology research are important levers of productivity in agriculture (Zepeda, 2001). Investment in developing and extending agricultural technology yields high rates of return.

The R&D scenario assumes a hypothetical 1 per cent increase in the productivity (TFP) of the Mexican agricultural sector. Increasing productivity is generally desirable for an economy, but there are two negative effects. The increase in domestic supply may lead to a decrease in domestic prices of agricultural goods. In addition, if the technology change is labour-saving, the productivity change may lead to a decrease in employment. A general equilibrium model can capture these effects.

In this scenario exports from Mexico increase significantly, by 3.4 per cent. Exports of meat and dairy products increase by more than 8 per cent. Rice exports increase by 6.4 per cent. Products where initial exports are high, such as vegetables and fruits, increase by a smaller percentage, e.g. 0.9 per cent (table 10.20). In contrast, imports decrease for all agricultural products except oilseeds. The impact on non-agricultural products is small. Exports decrease and imports increase slightly, both by less than 1 per cent.

The impact on employment is positive in most agricultural sectors and overall, but the increase is small (table 10.21). Total employment of unskilled labour in agri-

Table 10.21: Changes in Mexican agricultural employment, R&D scenario

Product	% change in employment
Paddy rice and processed rice	1.1
Other cereals	–0.8
Sugar	–0.6
Oilseeds	0.7
Vegetable oils and fats	0.6
Vegetables and fruit	–0.2
Other crops	1.6
Milk	–0.7
Dairy products	0.8
Cattle and sheep	0.2
Pigs and poultry	0.1
Ruminant meat	0.7
Non-ruminant meat	1.8
Other processed agriculture	0.3

Source: GTAP simulation.

culture increases by 1 per cent. The total employment effect for Mexico also is positive but very small, with an increase in the use of unskilled labour of 0.4 per cent.

The reason for the more significant change in exports and imports and yet small positive employment effects is that an increase of productivity leads to reduced factor demand for a given output. Thus, if real output increases only slightly more than productivity, the effect on employment is small. As Table 10.20 shows, the output effects are mostly below 1 per cent.

R&D programs that increase productivity yield beneficial effects, but the benefits do not accrue solely to the workers. Much of the benefit may go to owners of capital and land and to domestic and foreign consumers. In fact, if the labour mobility between sectors is in reality not perfect, as assumed here, but instead is sluggish, workers in some sectors may be worse off as a result. Also, wages can come under pressure. A program of increasing productivity by 1 per cent in the agricultural sector generally increases output in each agricultural sector and real GDP as a result. However, increased output drives down the output price, and the fall in prices more than offsets the increase in output. This implies that the value of agricultural production falls, and, with it, employment in the agricultural sector. If real wages are fixed, some agricultural workers will seek jobs in the industrial and service sectors.

Despite these caveats, the productivity increase would have many positive implications for many of Mexico's stated objectives. It leads to greater self-sufficiency ratios in agriculture and higher employment in the some agricultural sectors as well as higher total employment in Mexico; it produces significant welfare gains of some $4.3 billion. Costs for the R&D programmes, however, would need to be deducted from those benefits.

10.6.4 Domestic support scenario

Mexico's domestic support for agriculture is well below the OECD average. According to its WTO commitments, it can provide product-specific trade-distorting support under de minimis of up to 10 per cent. Official data notified by Mexico to the WTO on domestic support are not available for recent years.[19] In 2004, the latest available notification, Mexico reported a total of 1.4 billion, in constant 1991 pesos, of product-specific support. Most of this, 954.5 million pesos, falls under de minimis support, i.e. its value is relatively low compared with the value of production.

The GTAP data, based on the year 2007, show subsidies approaching 5 per cent only for oilseeds output (table 10.22). Subsidies for rice are 1.7 per cent. For vegetables and fruits and other crops, subsidies are around 1 per cent, and for other agricultural products output subsidies are zero or slightly negative.

The scenario Domestic Support assesses the effect of raising domestic support on agricultural output to the level of 5 per cent and in a separate scenario switching the same amount to an input subsidy. Data in GTAP do not necessarily match exactly with the OECD estimates or WTO notifications. One reason is that definitions of product-specific support vary. Also, GTAP taxes do not fully correspond to the various complex and country-specific support programmes. Furthermore, the producer support estimate aggregates output and input subsidies, while in GTAP these are separated. Table 10.22 shows the initial and new output subsidies on agricultural products in Mexico.

Table 10.22: Support to agricultural outputs, Mexico, Domestic Support scenario

Product	Initial (%)	New (%)
Paddy rice and processed rice	1.7	5.0
Other cereals	0.1	5.0
Sugar	−0.1	5.0
Oilseeds	4.8	5.0
Vegetable oils and fats	−0.1	5.0
Vegetables and fruit	0.8	5.0
Other crops	0.8	5.0
Milk	0.0	5.0
Dairy products	−0.1	5.0
Cattle and sheep	0.0	5.0
Pigs and poultry	0.0	5.0
Ruminant meat	−0.1	5.0
Non-ruminant meat	−0.1	5.0
Other processed agriculture	−0.2	5.0

Source: GTAP.

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[19] Domestic support under the WTO agreement on agriculture differs from the OECD definition.

Table 10.23: Percentage changes in agricultural imports, exports, and real domestic output of Mexico, Domestic Support scenario

Product	Exports	Imports	Output
Paddy rice and processed rice	7.5	2.9	5.8
Other cereals	1.5	2.5	4.2
Sugar	21.7	−8.4	3.4
Oilseeds	−10.5	8.1	−0.1
Vegetable oils and fats	28.0	−8.6	7.4
Vegetables and fruit	0.4	4.9	1.3
Other crops	0.9	4.3	2.6
Milk	16.7	−8.8	5.6
Dairy products	47.9	−17.4	5.8
Cattle and sheep	13.7	−4.5	5.3
Pigs and poultry	6.2	−2.9	5.4
Ruminant meat	45.3	0.2	5.8
Non-ruminant meat	71.6	−21.4	10.1
Other processed agriculture	11.8	2.9	4.3

Source: GTAP simulation.

Increasing domestic support to 5 per cent of the value of output in agriculture leads to increasing exports and output for all agricultural products except oilseeds, where the initial support value was already 4.8 per cent (table 10.23). Imports increase for some products and decrease for others. Some imports increase due to their links in the value chain. For example, if output of meat products increases, demand for imported feed increases.

The impact of the Domestic Support scenario on employment in the agricultural sector is positive. Employment increases significantly in all agricultural sectors, and total unskilled employment in Mexico increases by 1.8 per cent. If the same amount of domestic support spent on output is spent instead on input subsidies, the total employment effects are very similar. Employment of unskilled labour in Mexico would increase by 1.7 per cent. The effects in various agricultural sectors would be very different from the sectoral effects of the output subsidy, however (table 10.24).

Subsidizing output or inputs supports the corresponding sector, but it is a costly policy for the rest of the economy. In trade theory it has been shown that under certain circumstances subsidies can be welfare-improving, e.g. when the subsidy has an impact on a country's terms of trade. This is unlikely for most agricultural products in Mexico. In general, output subsidies are distorting and move resources into sectors where they are not used most efficiently. External effects, however, may economically justify subsidies. For example, when rural-to-urban migration incurs costs to society that are not reflected in prices and when subsidies can discourage such migration, certain subsidies may be economically justifiable. However, although unskilled labour employment increases, and this is likely to reduce poverty, the policy may be poorly targeted, and large industrial farms might benefit disproportionately.

Table 10.24: Percentage change in employment of unskilled labour, with fixed wages, Mexico, Domestic Support scenario

Product	Output subsidy scenario	Input subsidy scenario
Paddy rice and processed rice	7.7	12.2
Other cereals	5.6	5.7
Sugar	5.5	5.7
Oilseeds	1.0	10.9
Vegetable oils and fats	8.7	4.8
Vegetables and fruit	2.5	5.5
Other crops	3.9	13.5
Milk	7.2	5.6
Dairy products	7.1	5.1
Cattle and sheep	6.8	5.6
Pigs and poultry	6.9	5.0
Ruminant meat	7.1	4.5
Non-ruminant meat	11.5	7.0
Other processed agriculture	5.6	5.0

Source: GTAP.

Despite the positive effects of subsidizing the agricultural sector on output and, thus, on self-sufficiency, employment, and trade, input and output subsidies are distorting and should be provided only in the case of substantial external effects or if the positive effects are politically deemed more important than the costs for the rest of the economy.

10.7 CONCLUSION

Agriculture remains a very important sector for Mexico. Mexico's agricultural trade reform has been associated with increasing agricultural imports and decreasing employment in agriculture, and poverty rates remain high in rural areas. Some have accused NAFTA of harming Mexican farmers and jeopardizing Mexico's food self-sufficiency. Others acknowledge the effects of expanded agricultural trade but argue that static and dynamic gains far exceed the related adjustment costs.

Imports have increased from all major trading partners and particularly from NAFTA members, who supply more than 80 per cent of Mexico's agricultural imports. In recent decades more staple crops and meat products have been imported and more fruits and vegetables and certain processed agricultural products have been exported. Most analysts acknowledge an adverse effect of US subsidies on Mexican farmers, but how much the subsidies depress prices is controversial and in any case varies from year to year.

It has been shown that the impact of globalization and more specifically NAFTA depends on farm size, proximity to the US border, types of agricultural goods produced, income levels, and share of agricultural income in total income. It appears that a majority of small farms were not much affected, while middle-income corn farmers were adversely affected. Greater market opportunities for vegetables have increased employment in the cultivation of vegetables, whereas the drop in the real price of corn has reduced employment in the corn sector. It is difficult to assess the overall effect on employment in agriculture, and it has been argued that agriculture cannot be looked at separately in the context of NAFTA.

Despite these mixed effects, the need to strengthen the rural sector in Mexico is evident, given its high unemployment and poverty rates. UNCTAD (2011) argues that, along with important structural change in developing countries, agricultural development can facilitate economic development, can promote higher value addition and provide export-led growth opportunities while generating positive externalities for society, such as poverty reduction and increases in employment and food security.

What policy measures are appropriate to strengthen the agricultural sector depends on the specific objectives. Policies to reduce poverty and rural-to-urban migration differ from those that increase export revenue or maximize agricultural output. Mexico's trade policy options are limited due its commitments in trade agreements. A stated objective is to use the existing policy space with a view to enhancing Mexico's benefits from its agricultural sector, including increasing jobs in the sector, reducing dependency on imports, and promoting exports.

We have analysed four different policy scenarios for strengthening the agricultural sector that have been publicly discussed. The well-known CGE model GTAP has been used to assess the potential impact on the agricultural sector as well as on the economy as a whole.

1. **Revising RTAs to enable Mexico to impose tariffs on agriculture** has been discussed in Mexico. Imposing MFN tariffs on agricultural imports from its largest trading partner, the US, would benefit the agricultural sector if no tariffs were imposed on Mexico's exports. Imports would decrease and output would increase. Employment would increase in the agricultural sector, but it would decrease in the non-agricultural sector. If tariffs were applied in the US on Mexico's agricultural exports, exports would decrease and opposite employment effects in agriculture would almost neutralize each other and leave only a small positive effect on agricultural employment of 0.2 per cent along with a small negative effect on total employment of 0.01 per cent.

2. **Removing the payroll tax in agriculture** would have only a small effect on trade and output, but it is an opportunity to increase employment in the sector. Removing the payroll tax leads to a small increase of the GDP. The total welfare effect in Mexico is estimated at US$940 million – small but positive.

3.   Mexico's agricultural sector has low productivity, but the country spends relatively little on **research and development in agriculture**. Supporting activities that would lead to a higher productivity would increase output and exports. Imports would decrease, and thus the self-sufficiency rate would increase. The impact on employment would be positive but very small.

4.   **Subsidizing output in agriculture or providing input subsidies** would increase production, exports, and employment in the agricultural sector but in the larger economy could shift resources to less efficient activities. Such subsidies would involve costs for the rest of the economy.

Several limitations ought to be kept in mind when interpreting these results. For instance, the R&D scenario does not take into account the cost of such a programme. The analysis addresses the distribution effects and does not focus on national welfare effects.

The analysis also assumes that the scenarios would be implemented as specified. The MFN scenario is purely hypothetical and is unlikely to be politically feasible. However, since it has been proposed by leading politicians, it is important to analyse it.

A further limitation is the data. No specific data are available on para-tariffs and non-tariff measures. As tariffs are changed, these other impediments to trade are likely to play a role. Finally, the model used here is static, with no account taken of dynamic gains relating to growth in technology, competition, and productivity. Nor has account been taken of the one-off costs of structural adjustment, such as temporary unemployment.

Nevertheless, the results have important implications for policy-makers. Policies that increase distortions may strengthen the agricultural sector in terms of higher output, exports, and employment, but they are likely to have adverse effects on the rest of the economy. In contrast, removing payroll taxes and adopting policies that increase agricultural productivity have positive effects for both the agricultural sector and the economy as a whole.

ANNEX

Table A10.1: Product definition

Name	SITC Rev.3
Barley	043
Beans	05423
Beef	011, 01251, 01252, 01681, 0176
Coffee	071
Eggs	025
Maize	044, 04721, 05677, 08124, 4216, 59212
Milk	0221, 0222, 02241
Pork	0122, 0161
Poultry	0123
Rice	042
Shrimp	03611
Sorghum	0453
Sugar cane	06111, 06151
Sugar	061
Tuna	03414, 03423, 03713
Wheat	041, 046, 08126, 59217

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