Transition Policy and the Structure of the Agriculture of Mexico

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INTRODUCTION

Beginning in the early 1980s, Mexico witnessed a radical change in the economic orientation of its development policies, from a strategy of import substitution to a model of outward orientation with diminishing direct state intervention. A phase-out of government intervention in agriculture started at the end of the 1980s and deepened during the second quarter of the Salinas Administration, culminating with the implementation of the North American Free Trade Agreement or NAFTA in 1994.

The inclusion of agriculture in NAFTA has, since the beginning of negotiations with the US, provoked a deep controversy in Mexico. At one extreme is the official view arguing that trade liberalization helps to promote the structural transformation of the agricultural and rural economy of Mexico; at the other extreme are some academics and journalists maintaining that agricultural trade liberalization between Mexico and the US adversely affects Mexican farmers and jeopardizes the country's food self-sufficiency. Recently, farmers, peasants, and other groups of Mexican civil society have criticized NAFTA in an organized fashion, arguing that agricultural trade liberalization with the US has negatively affected the agriculture of Mexico. The pressures have intensified to such an extent that, in 2003, the Fox administration agreed with farmers and peasant organizations to evaluate the effects of the accord on Mexico's countryside.

The overall purpose of this chapter is to contribute towards understanding the impacts of NAFTA and other policy reforms in the agricultural and rural economy of Mexico, with special reference to the field crops sub-sector, to small farmers, and to trade between Mexico

and the US. Our starting point is the effect of liberalization policies on relative prices, which according to received economic wisdom leads to predictable changes in resource allocations on farms. Profound liberalization is expected to result in major changes in prices, provoking a structural transformation of trade and domestic supply.

Recent literature on the effects of agricultural reforms on Mexico's rural economy seeks insights from trends or descriptive statistics of relevant variables during the periods before and after major policy changes.[1] We propose that analysis of policy impacts be based on econometric methods to test whether or not a shock (such as NAFTA) has caused structural change and on micro economy-wide analysis to explore the effects of shocks on rural economies. We have carried out econometric analyses of prices, planted area and yields, and trade of major commodities imported and exported by Mexico to the US.[2] We also have developed new methods to uncover rural economy-wide impacts of policy reforms, by embedding "micro" models of agricultural households within larger, regional, economy-wide models.

This chapter has three main objectives. The first is to review major changes in Mexico's agricultural policies in the context of trade liberalization. The second is to explore econometrically the impact of these policy changes on key variables of interest, including prices, trade, production, and rural out-migration. The third is to illustrate the use of disaggregated policy modeling techniques to explore the sometimes paradoxical impacts of recent policy changes on Mexico's rural economies. After reviewing trends in the evolution of the rural economy of Mexico, including employment, land property rights, and poverty, we suggest hypotheses to explain why some of the expected effects of NAFTA and agricultural reforms have not occurred. The chapter ends with a reflection on the current political/economic situation in Mexico.

MAJOR REFORMS AND NEW INSTITUTIONS

The National Company of Popular Subsistence (CONASUPO) was a major player in government intervention in agriculture. Before the reforms of the 1980s, the Company's programs involved eleven agricultural field crops (termed basic crops): barley, beans, copra, maize, cotton, rice, sesame, sorghum, soybeans, sunflower, and wheat. By supporting prices for the producers of these crops by processing, storing,

[1] This has been specially the case of studies on NAFTA impacts on the Mexican agricultural sector (Schwentesius et al.; Puyana and Romero).

[2] Details are in Yunez-Naude and Barceinas (2002 and 2004). Other important traded commodities such as sugar and livestock are not covered due to data and time limitations.

and distributing the crops, and by regulating trade through direct imports, CONASUPO exacted control over an important component of Mexico's food chain.

By 1995/96, most of CONASUPO's subsidiaries and financial activities were dismantled, privatized, or transferred to farmers, and by 1999, the liquidation of CONASUPO was practically complete (Table 5.1, details are in Yunez-Naude).

In 1991, an agricultural marketing agency, ASERCA (Support Services for Agricultural Marketing), was created as a substitute for some of CONASUPO's functions. The operations of ASERCA are directed towards marketing of basic crops, but the agency does not buy or store commodities, as CONASUPO did. Another important function of ASERCA is the program of direct income transfers to farmers (PROCAMPO is discussed below).

A major reform in Mexican state intervention in staple production was implemented parallel to the creation of ASERCA: the elimination of guaranteed prices that CONASUPO had traditionally awarded to the producers of basic crops (the exceptions were beans and maize, whose guaranteed prices were eliminated in the mid-1990s). Starting in 1995, the Administration of President Zedillo (1995-2000) took further steps towards a more liberalized food chain that lead to the final decision to liquidate CONASUPO before the end of his mandate in 2000.

Some months before NAFTA was signed, PROCAMPO began to be implemented. The program is a "decoupled" income support for all farmers producing basic crops with the purpose of facilitating producers' transition from price supports to freer and more open international markets. PROCAMPO is planned to last until 2008, when full liberalization under NAFTA will be reached.

In addition to ASERCA and PROCAMPO, in 1995, the Zedillo Administration created "Alliance for the Countryside." Alliance's main objective is to increase agricultural productivity and to provide funds for farmers to make investments to better integrate their operations in the food chain and improve sanitary conditions. A major purpose of Alliance is to promote farming efficiency by exploiting potential comparative advantage by growing fruits and vegetables rather than basic crops. Alliance includes a phytosanitary program and has a decentralized character, with state-level control of its programs and contributions to the funding by participating farmers (SAGARPA).

Table 5.1: Agricultural policy reforms, 1985-2003.

POLICY/YEARS	DESCRIPTION
Mexico joins GATT/1986-1994	By 1990/91, most licenses to import agricultural products abolished. In 1991-1994 most agricultural commodities subjected to tariffs fluctuating between 0 and 20%.
Institutional reforms and the government's new role/1988-1999	Privatization of State companies: seed and production of fertilizer, grain storage and marketing of coffee, sugar and tobacco. ASERCA (1991) was created to give marketing support and services to producers.
Reform of the Agrarian Law/ 1992	Land redistribution ends. Recognizes the individual rights of each ejido.
NAFTA with two separate agricultural agreements: Mexico-Canada and Mexico-US/1994	Defines the obligatory conditions for market access and export subsidies. Each country has the right to choose its own internal subsidies, phytosanitary measures, rules of origin and regulations for packing and tagging products. Consistency with the WTO and the Uruguay Round. Import and export licenses are abolished and substituted by tariffication. In Jan. 2008 NAFTA members will eliminate all tariffs.
PROCAMPO, part of ASERCA/ Winter 1993-1994	Direct payments to the producers of basic crops that compensate producers for the loss of input subsidies, price supports, and import protection. Grants annual direct payments per hectare to those producers who continue to produce, based on historical acreage for nine crops.
Elimination of producer price supports, abolition of CONASUPO/1991-1999	In 1991 guaranteed prices for wheat, sorghum, soybeans, rice, barley, safflower, sesame seed, and sunflower were eliminated, and in 1999 support prices for beans and maize producers were abolished.
Creation of the Ministry for Social Development/1991	PROGRESA: monetary transfers to poor rural female household heads for nutrition, school, and health services (from 2001 the program is extended and called OPORTUNIDADES)
Alliance for the Countryside (Alianza para el Campo)/1995	Set of programs designed to support farmers with productive potential in an open economy. Federalized. Each state is responsible for the application of Alliance's programs. Farmers in the programs have to contribute to its financing.
Agri-food Armour/2002	To protect Mexican farmers from impacts of US Farm Bill of 2002
Privatization of rural credit/ 1990-2003	Reduction of official credit and credit subsidies. Creation of Financiera Rural and abolishion of BARURAL
National Accord for the Countryside/2003	An agreement between the Fox Administration and farmer and peasant organizations to define policies for rural development

Source: Yunez-Naude and Barceinas (2004).

In relation to credit, the Salinas Administration decided to reduce its credit subsidies, with the expectation that private credit institutions would satisfy the credit requirements of Mexican farmers.

With the *ejidal* reform of 1992, the Mexican State also enacted a major change in land property rights. Up to 1991, farms in Mexico were either private or *ejidal*, and *ejidal* lands could not be sold or leased out by *ejidatarios*.[3] The *ejidal* reform marks the end of land redistribution, seeks to give security to those who own land, and to enhance well defined property rights in land, and through this, to develop the land market (Saldivar).

The first step the Mexican government took towards trade liberalization was to join the GATT in 1986. By 1990:1, most licenses to import agricultural products were abolished, and in the period 1991-1994 most agricultural commodities were under a tariff regime. The second step was NAFTA.

Under NAFTA, some agricultural commodities were liberalized in January 1994; others – ones considered sensitive by the signing governments – were subject to a process of year-to-year liberalization, so that full free trade was either reached in January 2003 or will be attained in January 2008. For the latter group of commodities, tariff rate quotas (TRQs) and/or seasonal tariffs were used: Mexico imposed TRQs on the imports of barley, dry edible beans, maize, and powdered milk. The US imposed seasonal tariffs as well as TRQs for several fresh vegetables and fruits imported from Mexico.

Quota levels were established based on average 1989-1991 trade flows between Mexico and its two North American partners. In 1994, the TRQs were set at 2.5 million metric tons (t) for US maize and 1,000 t for Canadian maize, and the above-quota base or consolidated tariff on maize from both countries was fixed at 215 percent (or 206.4 US$/t). In January 1994, the quota for dry edible beans was 50,000 t for the US and 1,500 t for Canada, and the above-quota tariff was 139 percent (480 US$/t). For both grain and malt barley, the 1994 quota was set at 120,000 t for imports from the US and 30,000 t for imports from Canada, and the above-quota *ad valorem* tariffs were 128 percent for grain barley and 175 percent for malt barley. Beginning in 1995, the quotas for these three crops and for milk powder have been growing each year, and the above quota tariffs have been progressively reduced as protection is gradually phased out (Yunez-Naude and Barceinas 2002).

[3] However, renting *ejidal* land was done before the reform. Since this practice was illegal, there is not reliable data about its extent.

NAFTA does not imply specific commitments with regard to domestic marketing support reductions or export subsidies. It allows its members to use safeguards and includes dispute settlement mechanisms in Chapters 19 and 20.[4]

SOCIAL PROGRAMS

Parallel to economic liberalization, specific policies to attend to the rural poor were created. The first one was the Program of National Solidarity or PRONASOL founded in 1988, followed by the creation of the Ministry for Social Development or SEDESOL. One of the most important programs of SEDESOL was PROGRESA (Program for Rural Education, Health and Nutrition), created in 1997.

PROGRESA's objective was to contribute to human capital formation, focusing on the poorest rural families, providing monetary and in kind transfers to poor rural female household heads conditional upon sending their children to school, caring about their nutrition, and bringing them to health centers on a regular basis.

In the National Program for Social Development (2001-2006), the current Administration has adopted the notion of human development and calls its social strategy, CONTIGO. The purpose of CONTIGO is to bring together governmental efforts to enhance human development by promoting the capacities of the people (education, health, and nutrition); by generating income opportunities (infrastructure, credit, and employment); by helping the poor in acquiring assets (housing, savings, and property titles); and by providing them social protection (insurance, social provision, and attention to collective risks). CONTIGO extends the objectives of the previous administrations by expanding the activities of PROGRESA (now called OPORTUNIDADES) to the urban sector (Programa de las Naciones Unidas para el Desarrollo).

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[4] In this latter respect, and given the strong US opposition to exempt NAFTA countries from each other's antidumping and countervailing duty actions (AD/CVD), a compromise was reached in the Canadian-US Free Trade Agreement or CUSTA – and followed in NAFTA – to establish binational panels to review AD/CVD actions between two countries when requested by an involved party. The role of these binational panels is limited to determine whether a country appropriately follows its own national AD/CVD laws in making a particular determination. National AD/CVD laws of the US were not changed, and Mexico adapted them to be in accordance to its trade liberalization policies. Although national AD/CVD laws cannot be questioned by the review panels, the process provides an alternative to having national courts handle appeals of AD/CVD decisions. This provides the possibility of greater impartiality of the review. (Leycegui and Cornejo; Lederman, Maloney, and Serven [Chap. 3]).

PREDICTED IMPACTS OF POLICY REFORMS

Predictions of the effects of internal liberalization and NAFTA on Mexico's agriculture are based on price movements caused by these policy changes. In particular, with the elimination of producer price supports for basic crops in Mexico and with trade liberalization in North America, prices of imported crops by Mexico were expected to decrease. With this change, Mexican producers of importables would be forced to compete with Canadian and US farmers. Greater competition would increase productivity and/or reduce Mexico's supply of importables. Farmers were expected to substitute the production of exportables for importables. Under this scenario, NAFTA and internal policy reforms would provoke considerable growth in agricultural trade in North America (for Mexico, particularly with the US).

It was also predicted that employment created by increasing production of exportables would be insufficient to absorb the displaced workers from the importables sector, leading to a rise in rural out-migration.

The above expectations implicitly assume macroeconomic stability, a condition that the Mexican economy did not enjoy from the end of 1994 to 1996 (Audley et al.). So, in reviewing the evolution of Mexico during NAFTA one has to keep in mind the macroeconomic crisis that this country suffered during the above mentioned period.

TENDENCIES AND ECONOMETRIC ANALYSES OF STRUCTURAL CHANGE[5]

Here we review trends in agricultural prices, trade and production and summarize findings from our econometric analyses.

Prices

There has been a general tendency for Mexico's prices of major exported and imported crops to follow US prices more closely in the wake of reforms (Yunez-Naude and Barceinas 2002). Of particular interest here are domestic prices of major crops imported by Mexico. The data show

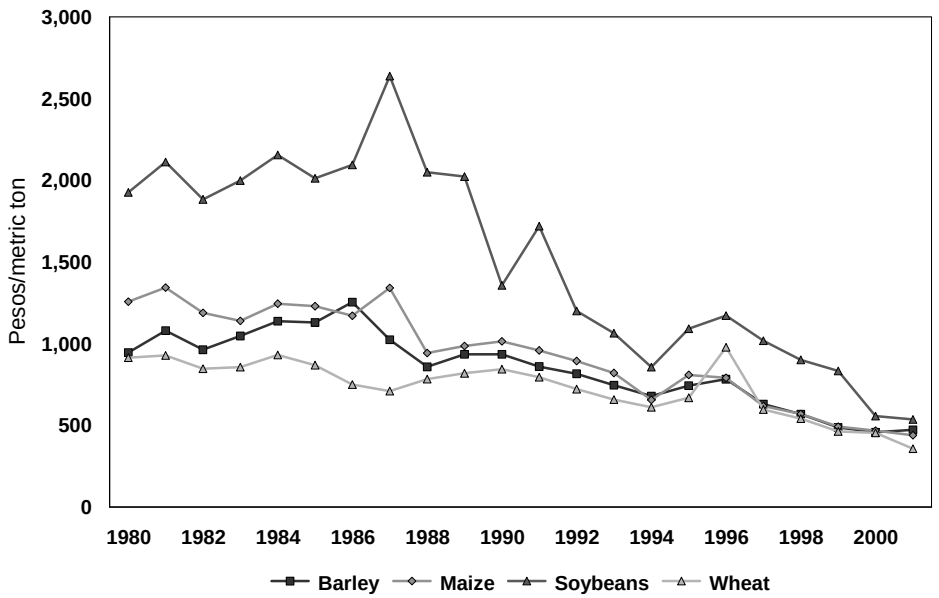
[5] The notion of structural change used in this section is statistical. It is based on time series data and tells us if a change of model parameters between two periods is permanent or not. From the statistical tests existing in the literature, we use the Error Correction Model to test structural change in prices; for trade we applied tests of "unknown break point" (Zivot and Andrews; Ben-David and Papell); and for structural change in production and productivity we used the more conventional Chow test (the latter was used due to the low amount of available observations).

that these have been diminishing (Figure 5.1). However, with the exception of an increase during the macroeconomic crisis of 1994-1996, this trend appears to have been present since 1987. Hence, econometric analysis is required to study the nature of price changes for major imported crops.

We used the theory of "Purchasing Power Parity" (PPP) and, in particular, the "Error Correction Model" (ECM) to test whether or not the "law of one price" has ruled the market of Mexico's major traded crops during NAFTA; that is, if the internal price of each of these commodities has followed closely the foreign (US) price. The methodology also allows for empirical study of whether there have been changes in the speed of adjustment of these two prices before and after NAFTA (Baffes and Ajwad). The results reported here are for major crops imported by Mexico from the US (barley, maize, sorghum, soybeans, and wheat) and the study covers the period from January 1981 to March 2003.[6]

[6] The econometric estimates of the ECM were done for the whole period, as well as separately for the pre-NAFTA and NAFTA periods (the exception is soy, because the available data series begins in January 1994). We also studied the evolution of relative prices of major exported vegetables and fruits. The results show that since NAFTA, there has been a tendency for domestic and US prices of these crops to converge, i.e., that the two price series are cointegrated. These findings and details of the ECM are in Yunez-Naude and Barceinas (2003).

Figure 5.1: Average producer prices of selected basic crops in Mexico (1994=1).



Source: Mexico Ministry of Agriculture (SAGARPA) data base (SIACON) deflated by the National Consumer Price Index from Bank of Mexico.

Our findings indicate that during the last 22 years there is a tendency for the internal price of barley, maize, sorghum and wheat to follow the US price, and that this price convergence was present before and during NAFTA. However, the adjustment of Mexican prices to changes in the US price takes a long time (at least 20 months), and the periods of adjustment did not decrease during NAFTA.

These results contrast with accepted wisdom in two ways. First, they are inconsistent with the view that, before the elimination of producer price supports for basic crops, prices of grains in Mexico moved independently of international prices. Second, they do not support the contention that price convergence of these crops began with NAFTA. As we will discuss below, these tendencies could be one of the reasons explaining why production of basic crops in Mexico has not collapsed during NAFTA's implementation.

Trade

The share of agricultural trade in Mexico's total agricultural supply has almost doubled during the last 13 years, from an average of 18.7 percent during the four years prior to NAFTA to an average of 35 percent from 1994-2002. This share was even higher during the macroeconomic crisis of 1994-1996 (39 percent), and has remained high since then (35 percent during 1997-2002).[7]

Agricultural trade between Mexico and the US has also increased during NAFTA. The value of exports in constant US dollars increased by an average of 49 percent from 1994-2003 compared with 1989-1993, and imports rose 53 percent during the same period. As a consequence, Mexico's agricultural trade deficit with the US has widened.

The volume of Mexican exports of major fresh vegetables and fruits has grown considerably under NAFTA: by 75 and 100 percent, respectively, in the period 1995-2002 compared with 1983-1994. This jump is also shown by the share of exports in the domestic production

[7] The shares include forestry and are calculated with trade (Secretaría de Economía) and production data (Instituto Nacional de Estadística Geografía e Informática). The data were deflated using the US consumer price index (US Department of Labor Bureau of Labor Statistics).

[8] The model we applied is convenient for our purposes, because if structural change is detected, the date when this happens is determined endogenously. The variable for estimating the equation of structural change in agricultural trade was the value of agricultural monthly exports and imports (totals and per crop) in constant pesos using the real exchange rate index for 1990. For the case of total agricultural exports and imports, the period we considered was from January 1980 to August 2002. Due to data restrictions, the period considered for specific crops or groups of crops was from January 1991 to August 2002 (Yunez-Naude and Barceinas 2004).

of these crops, which rose from 14.1 to 20.8 percent during the same period. Imports of the six major basic crops also grew, by 88 percent in physical terms.

The latter trend has meant that the ratio of imports to total national production of these crops has increased continuously during the reforms and NAFTA. The combined volume of imports of barley, beans, maize, sorghum, soybeans, and wheat accounted for 27.5 percent of domestic production during the period 1983-1990, 29.8 percent in the following four year period, 34.7 percent during 1995-1996 and almost 50 percent from 1997-2003 (Yunez-Naude and Barceinas 2004).

The evolution of Mexico agricultural trade indicates that, as expected, it has increased during NAFTA. However, this trend could have been present before NAFTA. We conducted an econometric study to test if the Agreement caused structural change in agricultural trade.[8]

Our results show that there is a contrast between agricultural exports and imports. As expected, agricultural exports have experienced structural change, but imports have not. Total agricultural and tomato exports experienced structural change in the last month of 1994. Fresh vegetables, melons, watermelons, and "other fresh fruits" also experienced structural change, but in different periods (November 1994, September 1994, and June 1995, respectively). In contrast, we find no evidence of structural change in total agricultural imports or in any of the major imported crops considered in the analysis (maize, sorghum, other oilseeds and seeds, and wheat).

The dates of structural change for exports make us suspect that this could have been due to the sharp devaluation of the peso at the end of December 1994 and beginning of 1995 (our findings on trends in Mexico's agricultural trade are similar to those reported by the US Department of Agriculture Economic Research Service [1999 and 2000]).

Production and Productivity

As expected, the volume of production of major exported vegetables and fruits has grown continuously since the early 1990s and during NAFTA. This is explained by an increase in both total area planted and yields for each of the major exported crops (Tables 5.2 and 5.3).[9]

What is striking is that, in contrast with expectations, national production of the most imported and important basic crops grown in Mexico (barley, beans, maize, sorghum, soybeans, and wheat) also

[9] The exceptions are garlic in the period 2001-2003 compared with 1997-2000 and in the area cultivated in tomatoes during the same periods. However, tomato yields rose.

Table 5.2: Volume of production, cultivated area, and yields for major exported vegetables (simple averages).

Period	Commodity	Production (t)	Cultivated Area (Ha)	Yields (t/Cropped Ha)	Commodity	Production (t)	Cultivated Area (Ha)	Yields (t/Cropped Ha)
1983-90	**Cauliflower**	40,007	2,763	14.3	**Garlic**	52,813	6,943	7.7
1991-94		52,835	3,717	14.6		54,168	7,399	7.4
1995-96		43,048	2,920	15.3		54,509	7,120	7.7
1997-00		58,068	3,539	16.8		64,079	8,580	7.6
2001-03		57,670	3,047	19.4		47,019	5,619	8.4
1983-90	**Broccoli**	79,909	7,755	10.7	**Onions**	593,361	37,011	16.9
1991-94		149,755	14,552	10.4		703,540	38,513	18.7
1995-96		143,524	13,476	10.7		682,326	34,356	20.1
1997-00		215,883	18,470	12.1		957,957	43,719	22.6
2001-03		236,983	19,019	12.7		1,106,462	45,709	25.3
1983-90	**Carrots**	157,398	6,820	23.6	**Tomatoes**	1,759,108	76,287	24.56
1991-94		227,360	9,098	25.8		1,583,647	80,282	21.34
1995-96		209,544	8,988	23.4		1,941,775	74,159	27.09
1997-00		341,724	14,936	23.4		1,940,435	71,955	27.89
2001-03		355,655	14,596	25.1		1,963,828	68,579	29.74
1983-90	**Cucumbers**	251,236	15,637	17.0	***Totals***	*2,933,829*	*153,216*	*19.1*
1991-94		258,556	15,436	17.7		*3,029,861*	*168,997*	*17.9*
1995-96		322,034	15,910	20.6		*3,396,760*	*156,928*	*21.6*
1997-00		428,194	18,088	24.1		*4,006,340*	*179,288*	*22.3*
2001-03		441,938	17,741	25.4		*4,209,555*	*174,311*	*24.1*

Sources: Mexico Ministry of Agriculture Data Bases (SIACON) and Anuario Estadistico de la Produccion Agricola 1999-2000 (preliminary data for 2003).

Table 5.3: Volume of production, cultivated area, and yields for major exported fruits (simple averages).

Period	Commodity	Production (t)	Cultivated Area (Ha)	Yields (t/Cropped Ha)	Commodity	Production (t)	Cultivated Area (Ha)	Yields (t/Cropped Ha)
1983-90	**Avocados**	552,952	83,699	8.4	**Oranges**	2,014,141	211,316	12.6
1991-94		753,538	92,464	8.8		2,753,953	281,757	12.3
1995-96		813,942	92,199	9.1		3,778,075	335,409	12.9
1997-00		856,370	93,705	9.5		3,651,931	328,361	11.7
2001-03		934,400	97,064	9.8		4,053,263	342,578	12.2
1983-90	**Lemons**	762,074	80,973	10.7	**Papaws**	510,149	22,335	28.3
1991-94		758,177	88,784	9.6		394,615	19,157	24.7
1995-96		1,021,073	102,038	11.1		489,909	21,007	31.6
1997-00		1,313,145	119,366	12.1		602,825	20,979	32.7
2001-03		1,719,266	137,035	13.1		817,312	21,353	40.5
1983-90	**Mangoes**	1,023,273	114,866	10.6	**Strawberries**	70,557	4,600	16.7
1991-94		1,115,717	139,492	9.2		80,233	6,086	16.6
1995-96		1,266,043	151,364	9.3		95,055	4,635	20.5
1997-00		1,510,776	159,736	9.9		91,840	4,160	22.6
2001-03		1,565,827	170,418	9.5		113,901	4,318	26.9
1983-90	**Guavas**	150,257	14,915	12.4	**Watermelons**	441,759	39,381	13.0
1991-94		190,540	15,764	13.1		426,815	37,953	13.1
1995-96		205,963	17,237	12.3		509,271	35,172	16.3
1997-00		198,101	20,614	11.7		842,324	42,858	21.2
2001-03		285,368	22,093	13.2		923,732	44,050	22.2
1983-90	**Cantaloupes**	394,566	36,546	12.5	***Totals***	*5,919,728*	*608,631*	*9.7*
1991-94		495,472	42,996	12.9		*6,969,059*	*724,453*	*9.6*
1995-96		448,011	30,152	16.0		*8,627,342*	*789,212*	*10.9*
1997-00		598,010	30,277	20.6		*9,665,322*	*820,057*	*11.8*
2001-03		512,701	23,236	22.7		*10,925,770*	*862,145*	*12.7*

Sources: Mexico Ministry of Agriculture Data Bases (SIACON) and Anuario Estadistico de la Produccion Agricola 1999-2000 (preliminary data for 2003).

increased during the 1990s and the first years of the new millennium – that is, during the deepening of internal reforms and NAFTA (Table 5. 4). This is explained by a continued increase in crop yields. For example, during 2001-2003, the production of these six basic crops was 36 percent higher than in 1983-1990, yields increased 21 percent, and cultivated area remained practically the same.

There are different trends when we distinguish production of major basic crops under irrigated conditions from production on rain-fed lands. Supply from irrigated lands increased sharply during 1991-1994 with respect to the previous eight year period (19.5 percent), but it remained practically the same from 1995-2003 (around 14 million t). Parallel to this, cultivated area decreased (by more than 20 percent), meaning that yields increased for crops under irrigation. Production under rain-fed conditions followed a different trend, expanding over the whole period under study (for example, average production during 2001-2003 was 40 percent higher than in 1983-1990). This trend is based on an increase in planted area and, to a lesser extent, in yields. Whereas production and cultivated area under irrigation declined during the macroeconomic crisis of 1994-1996 compared to the previous four year period (5.7 and 15 percent, respectively), supply and cultivated area under rain-fed conditions increased during the same period (by 21.8 and 15.7 percent). The expansion of rain-fed production suggests a different reaction by farmers producing basic crops depending on their access to water (a question that is discussed in the next section, with special reference to maize).

Yields from irrigated lands are much higher than yields under rain-fed conditions, and the disparity has deepened since the second half of the 1990s. For the six basic crops we studied, in 1983-1990 and 1991-1994 the average yield (t/ha) under irrigation were 2.9 times higher than yields obtained under rain-fed conditions. The difference increased to more than 3.4 times after 1997.

The same result obtains when we consider basic crops separately. Of particular interest is maize. This grain has been the major crop produced in Mexico, overall, and in terms of Mexico's supply of staples. During 1983-1990 it accounted for almost 48 percent of total supply of the six major basic crops and 57 percent of total cultivated area in these crops. Surprisingly, these percentages have increased during the period of reforms and NAFTA: during 2001-2003 the contributions of maize production and cultivated area to the respective totals for the six basic crops were around 56 and 60 percent, respectively. After a sharp rise in maize production and cultivated area under irrigated lands during 1991-1994 (121 and 56 percent, respectively, compared with 1983-1990), these contributions remained practically the same in 1995 to 1996 and

2001 to 2003. For rain-fed maize, the situation during the period of reforms and NAFTA has remained similar to that prevailing during 1983 to 1990 (we propose hypotheses below that are intended to explain these unpredicted trends).

Whether or not the evolution of the Mexican supply of major basic crops during the last 13 years signifies a structural change is an empirical question. Crop production is the result of cultivated area and yields. We tested econometrically whether structural changes in the effects of prices and trade on Mexico's supply of the most important imported and exported crops took place beginning with NAFTA's implementation (Table 5.5).[10]

Our results show that out of the seven major exported vegetables for which we applied the test, tomatoes experienced (negative) structural change in cultivated area and broccoli a significant (positive) rise in yields. These structural changes are due to trends in supply under irrigation.[11] For the case of exported fruits, data availability limited us to study only melons and watermelons, and our findings indicate that both goods show significant positive changes in yields but not in cultivated area.

The only basic crop that experienced structural change in cultivated area beginning with NAFTA is sorghum produced on rain-fed lands. The direction of the change is towards increasing planted area and is significant enough to produce positive structural change in total (including irrigated) area in this grain.[12] With respect to yields, barley produced under irrigation is the only basic crop that experiences positive structural change, and yields for soybeans show structural change in the opposite direction.

These econometric results do not contradict previous observations regarding trends in the production of major exported and imported crops. Furthermore, they indicate that, overall, no structural change is

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[10] The period covered is from 1980-2002. We used planted area instead of cropped area since the latter depends heavily on climate and can hence be taken as exogenous to farmers' decisions.

[11] Notwithstanding that most exported vegetables are produced on irrigated lands, our analysis shows that the area cultivated in broccoli and cucumbers had a positive increase under rain-fed conditions. This result could be the basis to study whether farmers producing these two crops under good rain-fed conditions may have reacted to liberalization policies.

[12] The result is interesting if we take into account that sorghum production is a close substitute for maize production. An analysis of this issue is lacking but fundamental to study the effects of NAFTA and policy reforms on Mexico's supply of staples.

Table 5.4: Volume of production, cultivated area, and yields for major basic crops (simple averages).

Product	Period	Production ('000 t)			Cultivated Area ('000 of Ha)			Yields (t/Cultivated Ha.)		
		a. Total	b. Irrigated	c. Rainfed	a. Total	b. Irrigated	c. Rainfed	a. Total	b. Irrigated	c. Rainfed
Barley	1983-90	690	317	373	325	64	260	2.1	4.9	1.4
	1991-94	651	305	346	282	59	223	2.3	5.1	1.5
	1995-96	713	281	433	318	48	270	2.2	5.8	1.6
	1997-00	699	229	470	342	41	301	2.0	5.6	1.6
	2001-03	973	383	529	372	63	301	2.6	6.1	1.8
Beans	1983-90	998	270	728	2,164	227	1,937	0.5	1.2	0.4
	1991-94	1,187	399	788	2,149	302	1,847	0.6	1.3	0.4
	1995-96	1,310	399	911	2,275	277	1,998	0.6	1.4	0.5
	1997-00	1,043	407	637	2,306	302	2,003	0.5	1.3	0.3
	2001-03*	1,341	403	903	2,073	258	1,832	0.6	1.6	0.5
Maize	1983-90	12,472	2,932	9,540	8,076	994	7,082	1.5	2.9	1.3
	1991-94	16,885	6,488	10,397	8,294	1,553	6,741	2.0	4.2	1.5
	1995-96	18,189	5,997	12,192	8,859	1,343	7,516	2.1	4.5	1.6
	1997-00	17,844	5,957	11,886	8,649	1,175	7,474	2.1	5.1	1.6
	2001-03*	19,846	6,661	13,055	8,285	1,121	7,213	2.4	5.9	1.8
Sorghum	1983-90	6,890	3,607	3,283	2,009	618	1,391	3.4	5.8	2.4
	1991-94	5,612	2,895	2,717	1,423	395	1,028	3.9	7.3	2.6
	1995-96	7,419	3,548	3,871	2,059	468	1,591	3.6	7.6	2.4
	1997-00	9,292	4,455	4,837	2,320	479	1,841	4.0	9.3	2.6
	2001-03*	10,052	4,304	5,215	2,329	459	1,877	4.3	9.4	2.8

Sources: FAO and Mexican Ministry of Agriculture: Data Bases (SAGAR SIACON) and Anuario Estadistico de la Produccion Agricola 1999-2000

* The data for irrigated and rain-fed lands are for the period of 2001-02.

Table 5.4 continued: Volume of production, cultivated area, and yields for major basic crops (simple averages).

Product	Period	Production ('000 t)			Cultivated Area ('000 of Ha)			Yields (t/Cultivated Ha.)		
		a. Total	b. Irrigated	c. Rainfed	a. Total	b. Irrigated	c. Rainfed	a. Total	b. Irrigated	c. Rainfed
Soybeans	1983-90	704	605	99	401	317	84	1.8	1.9	1.2
	1991-94	585	504	81	304	250	54	1.9	2.0	1.5
	1995-96	123	70	53	103	50	53	1.2	1.4	1.0
	1997-00	142	62	80	108	38	70	1.3	1.7	1.1
	2001-03*	111	37	67	69	21	47	1.6	1.8	1.4
Wheat	1983-90	4,292	4,036	256	1,087	887	200	4.0	4.6	1.3
	1991-94	3,854	3,474	379	970	730	240	4.0	4.8	1.6
	1995-96	3,422	2,966	455	911	611	300	3.8	4.9	1.5
	1997-00	3,351	3,072	279	765	565	200	4.4	5.4	1.4
	2001-03*	3,151	3,012	244	664	531	146	4.7	5.7	1.7
Totals	1983-90	*26,046*	*11,767*	*14,280*	*14,061*	*3,107*	*10,954*	*1.9*	*3.8*	*1.3*
	1991-94	*28,774*	*14,066*	*14,708*	*13,422*	*3,290*	*10,133*	*2.1*	*4.3*	*1.5*
	1995-96	*31,177*	*13,260*	*17,916*	*14,525*	*2,797*	*11,728*	*2.1*	*4.7*	*1.5*
	1997-00	*32,371*	*14,182*	*18,189*	*14,489*	*2,599*	*11,890*	*2.2*	*5.5*	*1.5*
	2001-03*	*35,474*	*14,799*	*20,013*	*13,793*	*2,453*	*11,416*	*2.6*	*6.0*	*1.8*

Sources: FAO and Mexican Ministry of Agriculture: Data Bases (SAGAR SIACON) and Anuario Estadistico de la Produccion Agricola 1999-2000

* The data for irrigated and rain-fed lands are for the period of 2001-02.

Table 5.5: Structural change in cultivated area and yields of major traded crops, 1980-2002.

	Cultivated Area			Yields		
	Total	Under Irrigation	Rainfed	Total	Under Irrigation	Rainfed
Exportables						
Broccoli	NO	NO	*YES*	*YES*	*YES*	NO
Carrots	NO	NO	NO	NO	NO	NO
Cauliflower	NO	NO	NO	NO	NO	NO
Cucumbers	NO	NO	*YES*	NO*	NO*	NO
Garlic	NO	NO	*YES*	NO	NO	NO
Onions	NO	NO	NO	NO*	NO	NO
Tomatoes	*YES*	*YES*	NO	NO	NO	*YES*
Melons	NO	NO	NO	*YES*	*YES*	NO
Watermelon	NO	NO	NO	*YES*	*YES*	NO*
Importables						
Beans	NO	NO*	NO	NO	NO	NO
Barley	NO	NO	NO	NO	*YES*	NO
Maize	NO	NO	NO*	NO	NO	NO
Wheat	NO*	NO	NO	NO	NO	NO
Soybeans	NO	NO	NO	*YES*	*YES*	NO
Sorghum	*YES*	NO	*YES*	NO	NO	NO

Source: Own estimations.
*Significant at 10% level.

apparent in Mexican agriculture after more than ten years of reforms and NAFTA.

Trends in Other Relevant Variables Related to the Rural Economy

Econometric tests of structural change in relevant rural and agricultural variables for Mexico other than prices, trade, and production are lacking (as we will see below, the exception is migration). Notwithstanding this, for the purposes of this chapter, we now discuss the evolution of labor productivity and wages, rural out-migration, credit, land property rights, and poverty).

Labor Productivity Concurrent with the trends in yields, labor productivity in crop production – measured as value added divided by employment – increased continuously, from the late 1980s to 2001. Agricultural real wages have experienced a different evolution: they decreased from 1980-1997 (especially during the macroeconomic crisis of 1994-1996) and rose slightly from 1997-2001 (Puyana and Romero).

Rural Employment and Out-migration Employment in the agricultural sector of Mexico has decreased, and this is reflected in a drop of almost two percent in total employment in the primary sector (agriculture and mining) during 1993-2002 versus 1984-1993, according to estimates by Audley et al., based on Mexico National Employment Surveys. Although this is in accordance with expectations, a critical question is where these displaced workers from the "primary sector" have found alternative jobs. Answering this question is complicated by the nature of official data; for example, employment figures are based on a sectoralization of the Mexican economy by major production activities, ignoring the complexity of rural households' economic life. That is, the data abstract from the fact that a typical rural household in Mexico is a diversified production unit whose members are engaged in crop, cattle, and other household production activities, as well as in local, domestic-migrant, and international labor markets (see next section).

Preliminary results from the Mexico National Rural Household Survey of 2003 offer some insight into where the displaced workers from the primary sector may be located.[13] These results show statistical evidence that rural out-migration (both internal and to the US) rose significantly during the 1990s compared to the previous decade. The increase has been most pronounced for migration to the US during the second half of the 1990s through 2002. The number of migrants from Mexican villages in the rest of the country was 182 percent higher in 1994 than in 1980, but it was 352 percent higher in 2002. The number of migrants from rural Mexico in the US rose more slowly during the first period (it grew 92 percent between 1980 and 1994). However, it was 452 percent higher in 2002 than in 1980.

If we consider that most rural migrants in the rest of Mexico go to cities, we can link the above finding with the official data on agricultural employment and propose that increasing numbers of people born in rural Mexico are working in nonagricultural activities. We can add to this the argument of Audley et al. that insufficient growth in manufacturing employment during the 1990s meant that many of these rural migrants work in urban informal services, and many others with networks in the US decided to migrate to the north.

Credit Credit subsidies and official credit coverage for working capital given to farmers by public financial institutions for rural development declined sharply during the 1990s. During and prior to the deepening of reforms in the 1980s, the government granted credit subsidies to

[13] Encuesta Nacional a Hogares Rurales de Mexico (ENHRUM) is a statistically representative survey of households living in towns and villages with 500 to 2,500 people all over Mexico. It gathered data on migration from 1980 to 2002 (Taylor and Dyer; PRECESAMa).

farmers and provided 55 percent of total credit given to the agricultural sector. Since 1990, official credit has been sharply reduced, and the private credit percentage increased to more than 73 percent. The amount of credit channeled to agriculture grew during the first four years of the 1990s (11 percent in constant pesos), but it has decreased sharply since the financial crisis of 1995 (total credit granted to agriculture was 21 percent higher in 1983-1990 than in 1996-2000 [Yunez-Naude and Barceinas 2002]). In addition, the proportion of agricultural credit in total credit granted in Mexico has been declining; it fell from 5.9 percent in 1994 to 2.8 percent in 2002 (Puyana and Romero).

The above trends suggest that the banking crisis of 1994/95 was a major factor impeding the flow of private credit to agriculture that was expected to occur after economic and *ejido* reforms.

Lower credit access may have forced commercial farmers to use decoupled supports (PROCAMPO and Alliance for the Countryside) as a substitute for credit in order to continue production. Credit constraints may have reduced the options that liberalization provided to farmers to switch production to competitive crops after policy reforms and NAFTA (see below). The credit crisis limited domestic investment in agriculture, and US investment in Mexico's field crops has remained low (Bolding, Calderon, and Handy; Casco and Rosenzweig).

The Ejidal Reform Certification of *ejido* lands to individual *ejidatarios* is a prerequisite for the development of land markets in Mexico. The Salinas Administration expected that the process of issuing individual certificates of title to *ejido* land parcels, conducted by the Program for Certification of *Ejidal* Rights (PROCEDE) would conclude in a couple of years. This did not happen, and the process of certification is still under way.

One reason for the slow pace of certification is that, in order to assess ownership rights, PROCEDE has to confirm the boundaries of *ejidos* and individual parcels, resolve internal disputes, and distribute titles. PROCEDE has given new life to boundary disputes, particularly conflicts with absentee *ejidatario*s, over the inheritance right of non-*ejidatario* women or children, and over the rightful ownership of land that has been illegally used for loan collateral (Saldivar).

Once land is certificated, it can be transferred to someone else within the family or within the *ejido* by way of sale. Then the certificate can be converted to a private property title; a request to this effect has to be submitted to the entire *ejido* assembly and majority approval (50 percent plus one vote) obtained. If permission is granted and a title issued, the proprietor of the land has a "complete right" to the land (*derecho pleno*)

and can then sell it to anyone, inside or outside the *ejido*, as private property.

The process of certification of *ejidal* lands is now almost complete: in 2002, 76 percent of the *ejidal* lands were certified. However, in the same year, only 3.86 percent of the ejidal lands had a "complete right" (Ministry of Agrarian Reform).

Leasing-out *ejidal* lands has increased since the reform. According to the 1997 National *Ejido* Survey, from 1994-1997 there was a 19 percent increase in rental transactions by *ejidatario*s (Saldivar). By 1999, 51.4 percent of the rural territory was still under *ejido* regime and just five percent of *ejidatario*s had sold their land (Appendini 2001). Jones and Ward argue that changes in ownership patterns have been much more modest than expected under the *ejidal* reform, partly because of the slow pace of individual land titling under the PROCEDE program and the limited productive value of the land except in urban and suburban *ejidos*, where land is coveted by private real estate developers, and irrigated land where productivity is assured.

Rural Poverty Poverty incidence has been greater in rural than in urban Mexico, and the difference has not changed appreciably during the last ten years. The incidence of extreme rural poverty has been around 30 points higher in rural than urban areas, whereas the rural-urban difference in moderate rural poverty has decreased from around 30 points in 1992 to 25 points in 2002. Rural (and urban) poverty – moderate and extreme – increased during the macroeconomic crisis that Mexico suffered in 1994-1996 and has been decreasing since then, returning in 2002 to the levels of 1992 (Caballero).

THE STRUCTURE OF MEXICO'S RURAL ECONOMY

Overall, our studies of the evolution of the rural and agricultural economy of Mexico indicate that, rather than experiencing a sudden structural transformation during policy reforms and NAFTA, this sector has experienced year-to-year cumulative changes since the 1980s (the exception being the effects on agricultural exports and rural out-migration in the context of the macroeconomic crisis of 1994-1996). The structure of crop production in Mexico has not radically changed, and in particular, production of basic crops other than soybeans has not collapsed. Government policies and the dual character of agricultural production in Mexico may explain this surprising outcome.

The heterogeneity of the Mexican agricultural sector is reflected in the coexistence of entrepreneurial farmers with peasant or family producers. The latter are rural households engaged jointly in production and consumption of staples, agriculture representing only a part of

their "portfolio" of income earning activities. In general, peasant producers have limited land (typically with plots no larger than two to two and one half hectares) and do not have access to irrigation and credit. Most are subsistence producers who do not participate in maize markets; their production and consumption decisions are shaped by unobserved "shadow prices" instead of market prices. The traditional view is that subsistence farms, isolated from outside markets by high transaction costs, have a supply response that is perfectly inelastic: output on these farms does not change when the market price of maize falls.

By contrast, the entrepreneurial or commercial farmer's decision making process is the same as that of any farmer in the developed world: their production is specialized, for profit, and for the market in a context of low transaction costs. These characteristics enable commercial farmers to react to price changes by altering their supply of agricultural goods.

Both commercial and peasant farmers producing basic staples have benefited from PROCAMPO, and there is evidence that direct income transfers may have promoted domestic production of major crops imported by Mexico, particularly on small farms. Garcia and Taylor, Yunez-Naude, and Hampton look at the case of maize.

We propose that – together with productivity increases and direct income transfers (i.e., PROCAMPO) – new governmental programs and policies directed towards commercial or entrepreneurial farmers can explain why the production of some basic crops has not collapsed during the reforms, and also why the prices of staples have not followed US prices more closely during the same period. These policies include the marketing subsidies granted through ASERCA and other supports related to Alliance for the Countryside.

ASERCA offers marketing supports to commercial producers of basic crops in surplus regions.[14] Until the spring/summer season of 2000 the government and surplus producers negotiated a certain price. Then, in a public bid, interested buyers asked for a subsidy in order to commit themselves to buy a certain amount of the crop in question at the negotiated price. Hence, marketing supports of ASERCA are not decoupled and they could have helped maintain or even promote the commercial production of these crops, notwithstanding competition from the US under NAFTA.

[14] This is the case of the northern Mexico surplus producing States, where most of the marketing assistance budget has been directed (for example, 89 percent during 2002). This has been especially so for maize in the State of Sinaloa; sorghum in the State of Tamaulipas and wheat in the State of Sonora. The case of maize in Sinaloa is discussed in de Ita.

Subsidies granted to commercial farmers by Alliance for the Countryside have to be added to the PROCAMPO and ASERCA supports as explanations for why the production of staples by entrepreneurial agriculture has not collapsed and/or why the structure of commercial farmers' supply has not changed more significantly under market reforms and NAFTA. As reported by the United Nations Food and Agricultural Organization (FAO), there is evidence that, instead of substituting staples for competitive crops, commercial farmers have used Alliance supports to respond to the credit crisis from which they have suffered since the macroeconomic crisis of 1994-1996.

In relation to peasant agriculture, the relevant crop is maize, the major basic staple for human consumption in Mexico. A considerable portion of the production of maize by family farmers is used for own consumption. Due to the lack of disaggregated time series data, an approximation is required to distinguish peasant from commercial production of maize. This can be done by using maize output on irrigated land to approximate commercial production and output on non-irrigated lands as peasant production.

Table 5.4 shows that maize production and cultivated area on rain-fed lands has increased since 1995/96 (note, in contrast with irrigated maize, yields on rain-fed lands have remained practically unchanged).

There are two alternative hypotheses which have been proposed in the literature to explain why peasant production of maize has not collapsed in the wake of policy reforms and NAFTA. The first one is that, due to high transaction costs, peasant agriculture is relatively isolated from maize markets. In addition to cultivating the grain for home consumption, this means that, as producers of maize, the peasantry is not directly affected by price changes (de Janvry, Fafchamps, and Sadoulet). The alternative hypothesis, by Dyer and Taylor, is that economic linkages among commercial and subsistence households have shaped the outcomes of policy and market shocks in surprising ways (see next section).

The agrarian structure of Mexico can also provide an explanation for why the *ejidal* reform has not led to the expected radical increase in the size of agricultural units. Although research on this theme is needed, we propose that the development of the market for *ejidal* lands has taken place only in areas located near urban and tourism centers and in zones with high quality lands for agricultural production, as well as developed transportation, communications, and marketing infrastructure.

A RURAL, MICRO ECONOMY-WIDE PERSPECTIVE

Throughout modern history, marked heterogeneity among producers has characterized agriculture in Mexico, where a majority of land-poor, subsistence households coexists in more or less isolated markets with a small number of land-rich, commercial (i.e., surplus) growers (Hewitt; Appendini 1994). The extent of their interaction is such that social scientists often explain each group's actions in relation to those of the other group (Bartra; Fox). This has not been the case in the economics literature. Mexican maize agriculture is also marked by a panoply of transaction costs. These costs have been described in relation to maize markets (de Janvry, Sadoulet, and de Anda; Key, Sadoulet, and de Janvry), and a diversity of crops and services associated with maize are typically non-tradable (Clawson; Hernández; Martínez et al.).[15] However, enormous geographical heterogeneity suggests that the particular combination of market failures affecting this sector varies widely.

The ability to predict supply response (or lack of response) in less developed rural economies is limited by the lack of an integrated macro/microeconomic analysis that accounts for interactions among heterogeneous rural households, particularly between commercial and subsistence farms. Countrywide models capture aggregate general equilibrium effects, but, as pointed out by de Janvry, Sadoulet, and de Anda, they necessarily neglect heterogeneity across rural households revealed in microeconomic analysis. Microeconomic models have their own limitations. In order to predict aggregate responses, it is not sufficient to add up responses estimated from representative micro-household models. One must also account for interactions among heterogeneous households in local markets.

Drawing from Dyer and Taylor, we use a disaggregated economy-wide model to demonstrate how interactions between commercial and subsistence farms in local markets shape the outcomes of a nationwide change in the price of maize. Disaggregated models highlight heterogeneous household responses to market signals by incorporating household specific shadow prices for subsistence maize farmers. A series of individual household farm models is embedded within a village model. This makes it possible to link micro responses with aggregate outcomes in a manner not possible using conventional computable general equilibrium approaches.

We use a disaggregated model to simulate the village-wide and household specific impacts of a ten percent decrease in maize price,

[15] Non-market benefits of maize include economic, social, and ritual services (e.g., food security); income diversification; and social standing.

reflecting recent policy reforms. We estimated the model with data from a survey of households in Zoatecpan, a village located in the Sierra Norte de Puebla.[16] This is an isolated village in which 94 percent of households are subsistence maize producers. Textbook models of subsistence farmers, guided by idiosyncratic shadow prices, would not predict a major impact of changes in the market price of maize in this village.

Wages, like land rents, are assumed to be locally endogenous.[17] We believe that this assumption is realistic. Although the Mexican rural labor force is relatively mobile, significant variation in the agricultural wage across the country suggests the existence of market imperfections generating local wages or at least some rigidities in rural labor markets. At the time of the survey, households in this village did not have access to migrant labor markets that might connect the village with outside wages. Nevertheless, we also explore the impacts of maize prices in a hypothetical scenario of access to outside labor markets (i.e., a fixed wage).

In each of the endogenous and exogenous wage scenarios, the model yields estimated impacts of the simulated changes on every household in the sample. This distinguishes the present model from previous village-wide models and is critical for estimating differential impacts of staple price shocks across households. Table 5.6 reports village-wide aggregate impacts of the price change. Table 5.7 reports distributional effects, as measured by Gini coefficients estimated from individual household outcomes.[18]

The initial impact of the decrease in the market price of maize is felt only by commercial households. The price decrease creates a direct incentive for surplus growers to scale back their maize production. Maize output on commercial farms decreases by more than 28 percent in the endogenous wage scenario [column (a)]. In the fixed wage scenario, commercial farm output drops more sharply, by 48 percent, as commercial farms actually withdraw from the market and labor leaves the village.

As commercial production contracts, the demand for land and labor on commercial farms decreases substantially, forcing local rental rates and (in the endogenous wage scenario) wages downward by 14 and ten

[16] A ten percent decrease is chosen for convenience. Maize prices actually dropped 13 percent between 1994 – the start of NAFTA – and 1999 – the year of our survey (Banco de Mexico).

[17] Despite legal restrictions on ejido land, rental was already common throughout rural Mexico prior to the recent reform of land tenure laws (Dewalt and Rees).

[18] These are not obtainable from previous village or aggregate CGE models.

Table 5.6: Effects of a 10% decrease in the market price of maize, Zoatecpan, Mexico (percentage change).

Variable	(a) Closed Labor Market (endogenous wage)	(b) Open Labor Market (fixed wage)
Production activities*		
Maize (aggregate)	-4.89	-14.22
Commercial Households	-28.52	-47.65
Subsistence Households	4.77	-0.56
Other agriculture	4.45	0.00
Livestock	-0.64	0.64
Non-Ag. Activities	-18.98	-9.49
Commerce	-36.19	-18.45
Labor wage	-9.60	0.00
Rental rate	-14.05	-14.25
Village GDP	-7.26	-3.77
Household income*	-1.69	-0.87
Commercial Households	-3.97	-3.04
Subsistence Households	-1.57	-0.75
Maize household surplus*	-57.20	-100.00
Demand*		
Homegrown maize	5.30	-0.45
Commercial Households	5.37	0.40
Subsistence Households	5.29	-0.62
Market maize	4.52	6.72
Commercial Households	-4.31	0.94
Subsistence Households	4.54	6.73
Animal products	-4.10	-1.85
Non-Ag. Goods	-4.57	-2.29
Other food	-10.33	-5.27
Manufactured goods	-9.53	-5.20
Village maize imports	15.50	23.69

* Village aggregate.

percent, respectively. Land rents and wages represent costs of production for both commercial and subsistence households. A decrease in these input prices partially compensates commercial households for the lower output price; this is why the negative output shock is smaller (i.e., the elasticity is closer to zero) in column (a) than in column (b). When both rental and wage rates are endogenous, all subsistence growers increase their scale of production. Although commercial maize production falls, subsistence maize production increases in the

Table 5.7: Effects of a change in the market price of maize, Zoatecpan, Mexico

Variable	Original	After Maize Price Change	
		13% Increase	13% Decrease
Gini coefficient for real income	0.356	0.362	0.353
Gini coefficient for land use	0.562	0.606	0.502
Average number of plots per household	1.64	1.48	1.83
% Households giving-up plots	-	14.58	4.17
% Households taking-up plots	-	2.08	23.00
% Households leaving agriculture	-	4.17	0.00

endogenous wage scenario (by just under five percent). When wages are fixed, subsistence production is almost unchanged.

In both scenarios, household incomes fall. The income drop is larger in commercial than in subsistence households, and it is larger in the endogenous wage than in the fixed wage scenario, due to the negative effect on wage income. With lower maize prices, despite lower incomes, the demand for market maize increases and the demand for homegrown maize rises in most cases. Due to the rental of land to subsistence households, consumption of homegrown maize rises by 5.3 percent in scenario (a). A contraction in commercial output and a higher local demand for maize result in a 57 percent decrease in total household marketed surplus of maize (from a small base) in the endogenous wage case, and a complete disappearance of marketed surplus in the exogenous wage case. As a result, village maize "imports" or purchases from outside markets rise by 15 to 24 percent, reflecting a higher village maize deficit.

Lower household incomes decrease the demand for non-maize goods and services. Since the price of village non-tradables falls, the demand for fixed priced imports decreases the most, leading to a contraction of the formal commerce sector. Nonetheless, demand for non-tradables also adversely affects local activities that do not use land or male labor, such as nonagricultural activities and, in some households, livestock. As a result, the village's GDP decreases by four to seven percent. Although every household experiences a nominal decrease in income, changes in real income are positive for some households; three out of ten households experience a real income increase. Households engaged in formal commerce experience the greatest decreases, even greater than those of commercial maize growers.[19] Households whose chief income source is migrant remittances, as well as those dependent on public welfare, experience increases in real income as they consume cheaper local goods, but do not lose from the decrease in local wages.

The maize price decrease results in a more egalitarian distribution of land, as land previously used by a few commercial growers is distributed among a large number of subsistence households; the

[19] This is true in absolute terms, but not as a percentage.

Gini coefficient for land decreases from 0.562 to 0.502. A sensitivity analysis suggests that most of these changes are gradual. As price changes go from five to ten to 13 percent, household responses intensify with a cumulative effect on village aggregates.

It should be noted that the simulations presented above do not take into account other policy changes that were concurrent with the decrease in the market price of maize such as PROGRESA and PROCAMPO, nor production subsidies to commercial farms, which were not observed in this village as in many other villages in Mexico (PRECESAMb). They also ignore technological changes that appear to have accompanied trade liberalization, increasing productivity, and buffering commercial farmers from the negative effects of lower staple prices.

Nevertheless, the simulation results suggest a local explanation for the unexpected supply response to maize price liberalization seen across Mexico. In Zoatecpan's largely subsistence economy, the decline in the price of maize induced commercial maize growers to scale back production, reducing their demand for land and labor. Subsistence growers who must buy maize to satisfy part of their consumption needs benefited directly from the price drop but suffered from lower wages and fewer jobs. Although some of these households experienced increases in real income, most experienced declines. As incomes dropped, so did expenditures, which resulted in a contraction of demand for local goods and village imports. On balance, the village became more self-reliant, as households substituted local goods for imports they could no longer afford and homegrown goods for purchased goods. In the end, a lower maize price was deleterious for seven out of ten households in a mostly subsistence community that purchases three quarters of its maize. Thus, the decline in maize price did not trigger a shift away from subsistence maize cultivation – as experts predicted (Levy and van Wijnbergen) – but rather, stimulated subsistence activities, including maize as well as other goods and services.

SUMMARY AND FINAL REFLECTIONS

The results of our analyses of the evolution of Mexico's agricultural sector during the last two decades indicate that, instead of structural change, this sector has experienced a process of gradual change characterized by: lower prices for Mexican producers of basic crops; a growth in agricultural trade and trade deficits; and productivity increases in some traded crops produced under irrigated lands. The exceptions are structural changes in rural out-migration to the US

and in cultivated area and yields of some agricultural exportables that occurred during the peso devaluation of the mid 1990s.

Increases in agricultural labor productivity and the development of private property rights appear to have experienced a relatively gradual process of change, whereas the problems of rural credit, employment, and poverty remain. In addition, it is plausible that a process of "retrogression" has been present in the production of maize by small farmers (i.e., from producing the staple for market to producing it for subsistence).

Despite the macroeconomic stability Mexico has experienced since the last quarter of the 1990s and the steadiness of the process of change in some basic components of agriculture and in the rural economy, the country witnessed political unrest during late 2002 and the beginning of 2003, spearheaded by farmers and peasant organizations. The farmer and peasant movement (called *El Campo no Aguanta Más*) ushered in a new political context that could be dated to 2000, with the election of President Fox. The main motivation for this movement was the perception that the state of affairs in the countryside had worsened under policy reforms and NAFTA (Dyer and Dyer).

In relation to NAFTA and agriculture, the following three events were signaled by farmers as the basis for their political actions: 1) the increase in imports of basic foods and maize in particular; 2) the US Farm Security and Rural Investment Act of 2002 or US Farm Bill; and 3) the deepening of the process of agricultural trade liberalization with the US beginning in January 2003. Negotiations between these organizations and the Fox Administration led to policy changes, crystallized first in what is called the "Agro-Food Armour" (AFA) and later in the National Accord for the Countryside (*Acuerdo Nacional para el Campo*).

The AFA was designed to mirror the US Farm Bill; it includes: an income safety net scheme for the producers of basic grains and oilseeds on a multi-year basis; energy subsidies to equalize the costs of electricity and diesel that Mexican farmers pay with the costs paid by their Canadian and US counterparts; and a commitment to increase access to credit at lower interest rates for Mexican farmers. The AFA also meant changes in Mexico Trade Law to create an effective framework to face unfair competition from dumped imports (Knuston and Ochoa; Rosenzweig).

The National Accord for the Countryside (NAC) was signed in April, 2003 by the government and farmer and peasant organizations. The NAC expands the coverage of the AFA to the rural economy and includes several principles, ranging from acknowledgment that rural sustainable development is a fundamental component of national development, to food self-sufficiency, food security, and the implementation of differentiated support policies by type of rural producer.[20]

The NAC's treatment of maize is particularly noteworthy. There is a controversy over whether imports of US corn have competed with Mexican maize production under NAFTA.[21] The disagreement stems from the fact that most maize imports are of the yellow variety, whereas most of the production in Mexico is of white maize. Farmers and some authors argue that the two types of maize are substitutes for processing (Puyana and Romero), whereas the Mexican government and other analysts argue that they are not (Zahniser and Coyle).

Settling this question is fundamental because, if the second interpretation is valid, imported yellow maize does not pose serious competition for Mexican farmers, and hence the government decision to allow maize over-quota imports without charging the established tariff under NAFTA could be justified on the grounds that these over-quota imports promote Mexico's agro-industry and livestock production without harming maize producers. However, if this is the case, the following question emerges: why did the Salinas Administration negotiate a transitional TRQ regime for maize with the US?

Keeping in mind the question about uses of national and imported maize, the NAC could provoke other uncertainties, since its goal of attaining food self-sufficiency does not consider the implications on trade policy of the prospect that both maize and livestock demand in Mexico will increase with income growth.

It is likely that the commitments of the Fox Administration under the NAC will, at most, be put into practice only partially. However, as Aceves argues, the relevance of the accord is that it reflects a

[20] In practice, the NAC meant 1,580 million pesos of fresh resources over and above the 116,100 million pesos of the budget approved by Congress for 2003, an additional 100 pesos per hectare of PROCAMPO to producers with less than five hectares, the extension of PROCAMPO transfers to farmers with less than one hectare of land, and the expansion of several programs benefiting the poorest sections of rural society (Aceves; Dyer and Dyer).

[21] Among other reasons, the debate is rooted in the lack of detailed studies on the characteristics and evolution of maize demand in Mexico.

serious effort to reconsider some former public policies towards the rural sector of Mexico. The design of new policies requires a clear understanding of the functioning of Mexico's rural economy and the likely impacts of policy changes on a disaggregated level.

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