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**THE EFFECTS OF AGRICULTURAL DOMESTIC AND TRADE
LIBERALIZATION ON FOOD SECURITY: LESSONS FROM MEXICO**

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Summary

The paper is dedicated to examine the implications of agricultural trade liberalization within the North American Free Trade Agreement (NAFTA) for food security in Mexico. Since NAFTA implementation has almost 20 years of existence, the Mexican experience is relevant to draw lessons for other emerging economies in South East Asia involved in regional free trade agreements. Taking into consideration agricultural heterogeneity in Mexico at both production and regional levels, the main objective of the paper is to evaluate empirically the effect of NAFTA and domestic reforms on Mexico's agricultural prices, production, trade and food security with special attention to Mexico's non-competitive crops under NAFTA: grains and oilseeds and maize (the major food staple of Mexico). The study shows that some of the official expectations about the effects of NAFTA have not been realized: e.g. domestic production of maize has increased. In order to explain unexpected trends, I propose that particular reactions of subsistence household farmers to market-price changes and subsidies to commercial farmers producing staples explain unforeseen trends. With respect to food security during NAFTA, I find that per capita food consumption in Mexico has increased, partially at the expense of "import dependency" and "self-sufficiency". However, what causes concern is that income inequality and poverty prevails, meaning that food security has not been granted for all Mexicans. I conclude that food production and security can increase in Mexico by "reforming the reforms" in a market oriented and globalized context by a long run effective policy design that favors the provision of public goods and that integrates social policies with productive policies for rural households with a competitive potential.

Key words: Agriculture, Trade, Food Security, Maize.

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1. Introduction

Mexico is a notable laboratory in which to study agricultural development policies and outcomes under trade and domestic liberalization. In the 1980s, the Mexican government began to apply market oriented policies. In agriculture and the rural sector, the reforms ranged from Constitutional changes to enhance private property rights in rural communal lands to the elimination of price supports granted to farmers producing staple crops. Policy changes included agricultural trade liberalization: in 1985 Mexico joined the General Agreement on Trade and Tariffs (GATT, now the World Trade Organization or WTO), and in January 1994 the North American Free Trade Agreement (NAFTA) was implemented. NAFTA included the liberalization of agriculture, and in conjunction with its implementation the Mexican state applied a series of transitional policies intended to prepare farmers for the new economic conditions.

As in other developing and emerging countries, a feature of the Mexican agricultural sector that has to be considered in any effort to study agricultural transformation in a globalized economy is its heterogeneity. In Mexico's farm sector there is a juxtaposition of entrepreneurial farmers and rural households producing food in small plots for both self-consumption and the market, while also being involved in other economic activities. Rural households make production and consumption decisions jointly for staples, with agriculture being just part of their income-earning activities. In general, family producers have limited land, do not have access to formal credit, and—due to poor communications and transport limitations—face high transaction costs in some markets. In contrast, entrepreneurial or commercial farmers live outside the rural sector and operate in a context that

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enables them to make decisions in the same way as farmers in the developed world. Their production is specialized and for profit and is oriented towards the market in a context of low transaction costs. Hence, the heterogeneity of farm production implies that the effects of external shocks such as agricultural free trade agreements depend on the conditions of production, market linkages and access to markets of farmers.

In addition to productive heterogeneity, Mexico is characterized by sharp regional agro-ecological and welfare differences: the arid North requires irrigation for agricultural production and has the lowest food poverty index; the South-South-East is humid and has the poorest population, and Central Mexico lies in between North and South in both aspects.

Taking into consideration agricultural heterogeneity, the main objective of this paper is to evaluate the effect of NAFTA and domestic reforms on Mexico's agricultural prices, production, trade and food security with special attention to grains and oilseeds and maize. Maize warrants particular attention, as it is the major staple for Mexicans, produced by both commercial farmers and small-subsistence farmers or rural households, and considered to be non-competitive under NAFTA negotiations. I update the trends in major components of the agricultural and rural sectors of Mexico over the last 20 to 30 years, and I present empirical evidence to inquire whether official expectations about the effects of NAFTA have been realized. In order to draw lessons from this experience, I propose hypotheses explaining the dynamics of the agricultural and rural sector of Mexico, and its implications on food security.

Including this introduction, the paper is divided into six sections. In the next section I present a summary of the domestic agricultural reforms and characteristics of NAFTA, together with a description of the government policies aimed to prepare agricultural producers to face trade liberalization, and a discussion of what were the main governmental expectations about the effects of these policy changes. In section 3 I document the salient features of the agriculture and rural sectors of Mexico during the last 30 years; I include the evolution of food import dependency, self-sufficiency and security, the changes in farm size and property rights on farm lands, as well as the trends in rural out-migration. In section 4 I synthesize results of existing empirical research on the effects of NAFTA. I include tests to inquire if domestic prices have converged with international/ U.S. prices of major agricultural imported crops. I also examine the results of econometric studies on the presence of structural change in Mexico's agricultural production, trade and rural out-migration, and on changes in welfare of the population of Mexico. In section 5 I discuss the contemporary policy environment and propose hypotheses to explain the changes in agricultural

production, as well as recent programs in the light of the evolution of food security. In Section 6 I conclude with a reflection on the lessons the Mexican experience can bring to other countries.

2. Reforms and Expected Effects

As in other Latin American countries, market oriented policy reforms to the Mexican economy began in the 1980s as a form of structural adjustment to solve its debt crisis. The liberalization of the agricultural sector began in the late 1980s and deepened during the first half of the 1990s. In the mid-1980s, government support prices to farmers producing what we call basic crops (grains, beans and oilseeds) began to be abolished, as well as most subsidies for agricultural inputs and for credit. In addition the banking system was re-privatized, public infrastructure to support the marketing of basic crops began to be sold or abolished and in 1992 the Constitutional Article regarding land property rights was reformed (Table 1, details in A. Yunez-Naude, 2003).

The land or *ejidal* reform granted individual property rights to *ejidatarios*, those peasants who benefited from the process of rural land distribution and re-distribution implemented after the Mexican Revolution of 1910 during the application of the Agrarian Reform from the 1930s to 1991. Before the 1992 reform, *ejidatarios* had to use *ejidal* land for production purposes, but were not allowed to sell or rent it, nor even to conduct business in association with the private sector. The individual beneficiaries of land distribution could and did pass their land to their children, who became *ejidatarios* themselves.² With the land reform of 1992 the above restrictions could disappear if the *Ejido* Assembly –formed by all the *ejidatarios* of the *Ejido*—approves it. One expected consequence of the *ejidal* reform was to drastically reduce the number of small farmers engaged in agricultural production and to promote access to credit via the possibility of using former *ejidal* land as collateral. In addition to hoping to deepen the rural land rental market, the federal government has created policies to promote the use of agricultural lands more efficiently and in association with other economic actors, e.g., via what are called *Fundaciones Produce*, and to facilitate subcontracting and the enhancement of value added chains.

Agricultural credit was another target of policy reforms. In the early 1990s the government decided to sharply reduce official credit subsidization, with the expectation that private banks would fill the credit requirements of Mexican farmers. In spite of this, the two main official rural credit

² In addition to land distribution to *ejidatarios*, the application of the Agrarian Reform emanated from the Revolution of 2010 included the distribution of land to rural communities. In some cases, the *Ejidal* Reform of 1992 allows community land exploited collectively to be distributed to individual owners.

institutions—BANRURAL (Rural Bank) and FIRA (*Fideicomiso Relacionado con la Agricultura*)—were not abolished, and in 2003 the government replaced BANRURAL with *Financiera Rural* (Rural Financing, a government bank) in an effort to increase rural credit and avoid persistent high rates of default on loans by BANRURAL, whose assets and liabilities were taken over by *Financiera Rural*.

Table 1. Liberalization Process of Mexico's Agriculture

POLICY	MAIN POLICY CHANGES	YEARS
Mexico joins GATT and food imports restrictions began to be reduced	Substitution of import licensing for tariffication of agricultural goods (tariffs ranging from 0% to 20%)	1986-1994
Sale of Food State Enterprises	Privatization of State Food Storage Facilities and State enterprises selling seeds and fertilizers at subsidized prices	1988/89
	Abolition of State enterprises selling coffee, sugar and tobacco	
"Ejidal" Reform (land property rights reform)	Ending of agricultural land distribution to peasants	1992
	Liberalization of agricultural land property rights	
Elimination of price supports to farmers producing food staples (in 1999 the State Trading Enterprise providing this subsidy was abolished)	Domestic prices of staples determined taking into account international prices	1989 to date
	Creation of ASERCA in 1991, a marketing support agency granting subsidies to commercial staple crops' producers and buyers	
	Creation of PROCAMPO in 1994, a direct income transfers program to all producers of staples	
North American Free Trade Agreement (NAFTA)	Prohibits the use of import licenses and applies tariffication principles	Jan. 1994- Jan. 2008
	"Free" trade in 15 years. Sensitive agricultural products were subject to Tariff Rate Quotas for a transitional period of up to 15 years	
	Interventions are allowed in the 3 countries for Agricultural subsidies, import restrictions on phytosanitary grounds and rules of origin and for packing.	
Alliance for the Countryside	Group of programs to promote agricultural and rural productivity, including small farmers	1995-2007

Source: own.

A third major agricultural reform of the past twenty years was the abolition of producer price supports granted by the State-owned National Company of Popular Subsistence (CONASUPO is the acronym in Spanish). Since its creation in the mid-1960s, CONASUPO was fundamental in Mexican agricultural policies, shaping food production, storage, consumption, and rural incomes. Before the reforms, the Company's programs involved eleven agricultural field crops (termed basic

crops): barley, beans, copra, maize, cotton, rice, sesame, sorghum, soybeans, sunflower seeds and wheat. By supporting prices for the commercial producers of these crops, by processing, storing, and distributing these crops and by regulating their trade through direct imports and import permits, CONASUPO exerted control over an important component of Mexico's food chain.

CONASUPO began to be eliminated in the mid-eighties. By 1995-96, most of CONASUPO subsidiaries and financial activities had been dismantled, privatized or transferred to farmers. By 1999, the liquidation of CONASUPO was practically complete (Yunez-Naude, 2003). A major reform of Mexican state intervention in staple production consisted of the elimination of guaranteed prices that CONASUPO had traditionally awarded to the producers of basic crops, so that up to 1999 price interventions were limited to beans and maize producers, and in 2001 consumption subsidies for *tortillas* (flat maize bread) were eliminated.

A fourth group of policy changes in Mexico are related to trade. The first step the Mexican government took towards trade liberalization was to join the General Agreement on Tariffs and Trade or GATT in 1986. By 1990-1991, most licenses to import agricultural products were abolished, and in 1991-1994 most agricultural commodities were under a tariff regime.

After Mexico joined GATT, the Mexican and U.S. governments initiated bilateral trade liberalization negotiations. An accord was reached, and NAFTA began to be implemented in January 1994. In the agricultural sector, two separate agreements were negotiated: one between Mexico and Canada and the other between Mexico and the U.S.

The level of concessions Mexico has given to U.S. and Canada vis-à-vis the rest of the world is shown in Table 2. Mexico has signed trade agreements with several Latin American countries, with Israel, the European Union and with other European countries.³ The only Asian Pacific country included in Mexico's trade agreements is Japan, in 2005. However, as will be seen below, the U.S. both before and after NAFTA has been the main agricultural trade partner of Mexico.

³ Mexico signed a Partial Scope Agreement (PSA) with Chile in 1992 and a Free Trade Agreement (FTA) in 1999, an FTA with Colombia and Venezuela in 1995 (Venezuela dropped out in 2006), an FTA with Costa Rica in 1995 and with Bolivia in the same year. Mexico also has participated in FTAs with Nicaragua since 1998, with Israel since 2000 and in a Regional FTA with the European Union since 2000. In 2001 Mexico signed an FTA with the Central American North Triangle countries (Guatemala, El Salvador and Honduras), with Iceland, Liechtenstein, Norway and Switzerland in 2001, and with Uruguay in 2004. Mexico has also a PSA with Argentina since 1987, which was extended to a FTA in 2006, a PSA with Brazil beginning in 2003, and a PSA with Peru since 1987 with current negotiations to extend it as an FTA. These agreements include different degrees of liberalization in agricultural and food products, as well as limitations on domestic supports to exported goods (source; Mexico Ministry for the Economy: www.economia.gob.mx).

Under NAFTA, trade in some agricultural commodities was liberalized in January 1994. Other commodities—considered sensitive by the signing governments—were subject to a process of year to year liberalization, so that full free trade was reached in January 2003 for barley and in January 2008 for beans, maize and powdered milk. Mexico imposed tariff rate quotas for the imports of barley, dry edible beans, maize and powdered milk, whereas the U.S. included seasonal tariffs as well as tariff rate quotas for several fresh vegetables and fruits imported from Mexico (Table 3). Beginning in 1995, quota levels grew and above quota tariffs were reduced until free trade was reached in January 2003 for barley, and in January 2008 for the other sensitive commodities (Table 4).⁴

Table 2. Structure of protection: major crops: 1985-1995

TARIFF FRACTION No.	DESCRIPTION	Status between 1985 and 1989/90		Status: NAFTA and Uruguay Round				
		Tariff (%)	Import Licence	NAFTA (January, 1994)*	Quota (US) (Canada)		MFN (January, 1995)**	
10051001	Corn for cropping	0	X	Nil			Nil	
10059001	Corn for popcorn	20	X	10.0			20	
10059002	Corn Kernels	0	X	5.0			10	
10059099	Corn, other	0	X	215.0	2,500	1.0	198	10.0
07133301	Beans for cropping (Phaseolus vulgaris)	0	X	Nil			Nil	
07133399	Beans, other	0	X	139.0	50	1.5	128	5.0
10030001	Barley for cropping	0	X	Nil			10	
10030002	Barley	5	X	128.0			118	
11071001	Malt	10	X	175.0	120	30.0	161	1.2
10011001	Hard Wheat (durum)	10		7.5			67	98.0
10019099	Wheat (other)	0	X	7.5			67	
10061001	Rice (paddy with husk)	10		5.0			10	
10062001	Rice peeled	20		10.0			20	
1063001	Rice, whitened	20		10.0			20	
10064001	Rice, broken	10		5.0			10	
10070001	Sorghum (Dec. 16th to May 15th)	0	X	Nil			Nil	
10070002	Sorghum (May 16th to Dec. 15th)	15	X	Nil			15	
12010001	Soy bean for cropping	0	X	Nil			Nil	
12010002	Soy bean (Feb. 1st to July 31st)	0	X	Nil			Nil	
12010003	Soy bean (August 1st to January 31st)	15		5.0			15	
12030001	Copra	10	X	10.0			45	
12060001	Sunflower seed (for cropping)	0	X	Nil			Nil	
12060099	Sunflower other	0	X	Nil			Nil	
12072001	Cotton seed for cropping	0	X	Nil			Nil	
12074001	Sesame seed	0	X	Nil			Nil	
12076001	Suflower seed for cropping	0	X	Nil			Nil	
12076002	Suflower seed (Jan. 1st to Sept. 30th)	0	X	Nil			Nil	
12076003	Suflower seed (Oct. 1st to Dec. 31th)	10	X	5.0			10	
	Milk Powder		X	139.0	40		128	80.0

* When TRQs apply, the figures are for above-quota tariffs (in quota- tariffs are nil). Quotas are in thousands of metric tons.

** When TRQs apply, the figures are for above-quota tariffs (consolidated in-quota tariffs are 50%).

Sources: Mexico Ministry of Trade (SECOFI),1994 and Economic Commission for Latin America web-site , <http://www.eclac.cl>

⁴ Yunez-Naude and Barceinas 2002. Notwithstanding the above, the Mexican government never charged tariffs for maize imports when imports were over the NAFTA quotas (Yunez, Orrantia and Guzman, 2010). Thus, in what follows I consider that Mexico's maize imports from the U.S. were practically free of tariffs.

NAFTA does not imply specific commitments with regard to domestic marketing support reductions or export subsidies, and it includes mechanisms for dispute settlement. NAFTA was signed with the following official expectations. Based on the facts that the U.S. is a major player in setting world prices of the most important crops in which Mexico is non-competitive (basic) crops and that the U.S. is the single most important agricultural trade partner of Mexico, NAFTA, coupled with domestic reforms, was expected to lead to price convergence in agricultural products. So, under NAFTA Mexico was expected to follow U.S. prices closely. Since U.S. prices were lower, Mexico's imports of basic crops from its northern partner would rise. With respect to agricultural products in which Mexico is competitive (fruits and vegetables), U.S. liberalization of imports restrictions under NAFTA would increase Mexico's exports of these goods.

Table 3. Liberalization by the U.S.A. of Mexican major exported agricultural commodities

Fraction	Commodity	Tariff reductions	Tariff Rate Quotas
	<i>Vegetables</i>		
0709.20.10	Asparagus	Some seasonal tariffs eliminated in Jan. 1994, others in 1998 and the 25% tariff from Feb. 1 to April 30 will be reduced gradually until its elimination in Dec. 2008	
0706.10.05	Carrots and turnips	A seasonal tariff eliminated in Dec. 1998 and from Oct to April tariff will be eliminated in Dec. 2003	120,800 mt. from Oct to April
0704.10	Cauliflower and broccoli	Tariff reduced to 15% in 1994 and will be eliminated in Dec. 2003	
0707.00.50	Cucumbers	Seasonal tariffs to be eliminated in Dec. 2008	
0703.20.00	Garlic	Tariffs eliminated in 1994	
0703.10	Onions	Seasonal tariffs to be eliminated in Dec. 2003	130,700 mt from I-1 to VI-30
0709.60.00	Peppers	A seasonal tariff to be eliminated at the end of 2003 and other seasonal tariff in Dec. 2008	
0702.00.60	Tomatoes (fresh and frozen)	A seasonal tariff eliminated in Dec. 1998 and other seasonal tariff in Dec. 2003	165,000 mt from III-1 to VII-14 and 172,300 from XI-15 to II-28(9)
	<i>Fruits</i>		
0804.40	Avocados	Annual tariff reductions until eliminated in XII-30-2003. Phytosanitary restrictions	
0806	Grapes	Free beginning in Jan. 1994	
0805.30	Limes and lemons	Annual tariff reductions until eliminated in XII-30-2003	
0804.50	Mangoes	Tariffs eliminated in 1994	
0807.10	Cantaloupe	The tariff for XII-1 to V-15 eliminated in 94; the tariff for VIII-1 to IX-15 to be eliminated in 2003, and free trade until Dec. 2008 for the rest of year	
0805.10.00	Oranges	Trade restrictions will be gradually reduced until eliminated in XII-30-2008	40 million SSE gallons of FCOJ and 4 million SSE, plus a snapback provision
0807.20.00	Papaws	Tariff will be gradually eliminated until Dec. 2003	
0804.30	Pineapples	Tariffs eliminated in 1994	
0810.10	Strawberries	Tariffs eliminated in 1994	
0807.10	Watermelon	Tariff from V-1 to IX-30 will be eliminated in Dec. 2003	54,400 mt, increasing 3% per year until 2008

Sources: Ministry of Trade (SECOFI), 1994 and Economic Research Service (ERS), U.S. Department of Agriculture website.

An additional expectation was that the elimination of industrial protection in Mexico would lead to a reduction of agricultural physical capital and input prices of tractors, irrigation equipment, fertilizers, improved seeds, etc. Trade liberalization would hence improve resource allocation, efficiency and agricultural productivity in Mexico. Non-competitive farmers producing basic crops

would have to sell or lease-out their lands or use them differently; e.g. to produce competitive foodstuffs such as fruits and vegetables. Thus, during the nineties, the Mexican governments were not concerned about the implications of freer agricultural trade in North America on Mexico's self-sufficiency. Food security was implicitly taken for granted according to the above mentioned expectations, together with the expected increase in income and poverty reduction in Mexico.

Table 4. Process of Liberalization of Agricultural Products Subject to TRQs under NAFTA (thousands of mts. and percentages)

PRODUCT	1998		2000		2003		2008	
	QUOTA	Over Quota Tariff (%)	QUOTA	Over Quota Tariff (%)	QUOTA	Over Quota Tariff (%)	QUOTA	Over Quota Tarriff(%)
Maize	2,814.90	172.00	2,986.32	145.20	3,263.24	98.80	0.00	0.00
Beans	57.96	111.20	61.49	93.90	67.20	58.70	0.00	0.00
Barley (grain and malt)	182.33	102.40	201.01	72.90	0.00	0.00	0.00	0.00
Powdered Milk *	45.02	111.20	47.76	93.90	52.19	58.70	0.00	0.00

* Excluded from negotiations with Canada, but with a quota of 80 thousand Mts for the rest of the world.
Sources: same as Table 2

Specific public policies and institutions aimed at reducing rural poverty were created in parallel with the above reforms. The first of these was the National Solidarity Program (*Programa de Solidaridad Nacional*, PRONASOL) founded in 1988, followed by the creation of the Ministry for Social Development (SEDESOL) in the early 1990s and, in 1997, by *Progresa* (later called *Oportunidades*, Program for (rural) Education, Health and Nutrition), a conditional cash-transfer program aimed at reducing poverty in the short run while promoting human capital formation in the medium to long run. *Progresa/Oportunidades* has become a model for similar cash transfer programs in Latin America and elsewhere.

Domestic policy reforms and NAFTA would imply the transformation of Mexican agriculture, leading in the short to medium term to increasing rural migration to Mexico's cities or to the U.S. However, in the longer run international rural out-migration would tend to disappear with the expected rapid growth of the Mexican economy (in the early 1990s the above expectations were validated by results of general equilibrium models applied to the agriculture and rural sector of Mexico, see for example, Robinson, *et. al.* 1993, and Levy and Wijnbergen, 1994)

Economic liberalization was accompanied by transitional measures implemented by SAGARPA (the acronym in Spanish for the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food). As well as the period of transition under NAFTA discussed above, domestic measures were implemented with the creation in 1991 of ASERCA (Support Services for Agricultural Marketing or *Apoyos y Servicios a la Comercialización Agropecuaria*), a SAGARPA's institution that has provided subsidies to commercial producers and buyers of basic

crops, and, through PROCAMPO, direct income transfers to all farmers producing these crops just before NAFTA began to be implemented (PROCAMPO is the acronym in Spanish for *Programa de Apoyos Directos al Campo* or Program for Direct Supports to the Countryside). “Alliance for the Countryside” was the third major program of SAGARPA that the Mexican government implemented from 1995 to 2007. It consisted of government supports to enhance rural productivity (Table 1).

ASERCA was created to substitute the traditional direct interventions in major grains and oilseeds produced in Mexico that the government did through CONASUPO. Since its creation, ASERCA has followed a scheme of "indifference prices" for these crops, with the purpose of making buyers indifferent between buying domestically produced basic crops or importing them. The scheme is similar to U.S. “deficiency payments”: it consists in fixing a "concentrated price" for the crop in question before the cropping season, taking as a reference the international prices, together with transport costs. The scheme is regional-specific by which the government subsidizes surplus commercial producers that sell their crop to big intermediaries and/or processors. Up to 2001 the government transferred to the buyers and, from this year, to the farmers, the difference between the international and the concentrated price.⁵ The scheme is basically a governmental income transfer. ASERCA is also in charge of PROCAMPO. In contrast with *Procampo*, ASERCA marketing supports are not decoupled from production.⁶

Alliance for the Countryside, which includes agriculture and other rural activities, was restructured beginning in 2009, but its main objective is still to increase agricultural productivity and capitalize farmers by providing funds for investment and phytosanitary projects to integrate farmers into commercial food markets. A goal of Alliance has been to promote farming efficiency by facilitating a switch from basic crops to fruits and vegetables, where farmers are deemed to have a potential comparative advantage in the context of an open economy. Alliance has a decentralized character, with state-level control of programs, evaluation, and implementation and is funded by contributions from participating farmers. One Alliance program (*Desarrollo Rural*, or Rural Development) focuses on agricultural and non-agricultural production in marginal rural regions

⁵ To the scheme of indifference prices, a program of price coverage in the international markets has been added and increased in 2007, when international staple prices increased.

⁶ PROCAMPO has been basically, an unconditional income transfers program: the only condition for a farmer to be a beneficiary of PROCAMPO is to have produced basic crops during the three years before the program began and to use the benefited land for any legal purpose.

with high poverty rates. Rural Development is the only SAGARPA program that in principle has a focus on small farmers (www.sagarpa.gob).

Politically, the process of agricultural reform and liberalization went smoothly until the beginning of the present century, when the Political Party that ruled Mexico for 70 years lost power, and when massive protests against the agricultural components of NAFTA emerged. The basic concern of these protests was the increasing imports of maize from the U.S. and the argument that with them, Mexico was losing food security and sovereignty. The way to resolve the conflict was the signing of an agreement between the federal government and the political forces involved, and later the approval by the Federal Congress of the Law for Sustainable Rural Development. Amongst other purposes, this Law includes the promotion of food security in Mexico, translated in practice by increasing public expenditure in the rural sector and stopping, until 2008, imports of white maize (white maize is the maize produced in Mexico and used for human consumption; most yellow maize is imported from the U.S. and used for animal feed). In 2007 the food security purposes began to be implemented in a more concrete manner by the strategy called Special Program for Food Security or PESA, inspired and backed by FAO office in Mexico.

3. Salient features of the agriculture and rural sector of Mexico and changes during the last 30 years

Since the 1980s the performance of agriculture has been poor, especially up to 2004. Processed food and beverage production has performed better, mainly due to the rise of beer production during the period (Table 5). The above has meant a continuous decrease in the share in Gross Domestic Product (GDP) of agriculture and food and beverage (Table 6).

Table 5. GDP Average Rates of Growth: 1980-2008 (2002 pesos)

	GDP	Agriculture, Fisheries and Hunting	Field Crops and Pastures	Livestock	Processed Foods and Beverages
1980-1988	-0.41%	-0.10%	0.92%	-2.77%	1.97%
1989-1993	4.06%	1.27%	2.28%	-1.40%	5.41%
1994-1998	1.60%	-1.67%	-2.48%	0.53%	1.59%
1999-2004	4.60%	0.39%	-0.66%	2.86%	4.02%
2005-2008	4.38%	5.08%	8.11%	0.78%	3.21%

Source: Banco de Información Económica (BIE)

In absolute terms, rural population and employment has practically remained the same. According to FAO data, rural population increased from 23 million to 24.9 million from 1985 to 2001, and

rural employment from 8.4 to 8.7 million during the same years (<http://www.rlc.fao.org/prior/desrural/gasto>, from Sept. 2011). Data on rural population from official Mexican sources show a larger rural population: 29.3 million in 1980 and around 29.8 million in 2006, 2007, 2008 and 2009.⁷ According to Mexico's National Institute of Statistics, Geography and Informatics (Spanish acronym, INEGI), rural employment decreased from 6.7 million in 2000 to 5.8 in 2010.⁸ Notwithstanding the above differences, both FAO and official Mexican figures indicate that rural population and employment has not changed during the past thirty years. This, together with urban population and employment growth, has meant a decline in the share of rural population and employment in the total figures: rural population participation declined from 43.5% in 1980 to 27.7% in 2009, and rural employment from 17.7% in 2000 to 13.3% in 2009 according to INEGI's data (30.2% in 1988 and 21.6% in 2001 according to FAO's figures).

Table 6. Agriculture and Processed Foods Participation in GDP: 1980-2008

	Agriculture, Fisheries and Hunting	Field Crops and Pastures	Livestock	Processed Foods and Beverages
1980-1988	6.28%	3.70%	2.10%	4.35%
1989-1993	6.27%	n.a.	n.a.	4.66%
1994-1998	5.26%	3.46%	1.43%	4.80%
1999-2004	3.74%	2.42%	1.02%	4.85%
2005-2008	3.59%	2.23%	1.08%	4.66%

Source: Banco de Información Económica (BIE)

Compared to industrial wages, agricultural wages have decreased continuously since the beginning of NAFTA (Table 7), and rural out migration to urban Mexico and to the U.S. has increased (Taylor, J. E. and G. Dyer: 2003)

⁷ The dissimilarities may be because of differences in the definitions of rural localities. What we know is that Mexico's official rural population data is for localities with up to 15,000 inhabitants, whereas FAO may be using data of localities with smaller populations, say 10,000 inhabitants.

⁸ INEGI does not provide data for previous years. INEGI's rural employment figures may be restricted to agricultural and fisheries employment.

Table 7. Differences between agricultural wages with respect to total and industrial wages *

	With total	With Construction	With Industry
1994-1998	-41.20%	-18.07%	-34.71%
1999-2004	-40.77%	-20.52%	-36.87%
2005-2008	-43.85%	-29.34%	-45.26%
2009-2010	-44.83%	-27.96%	-50.27%

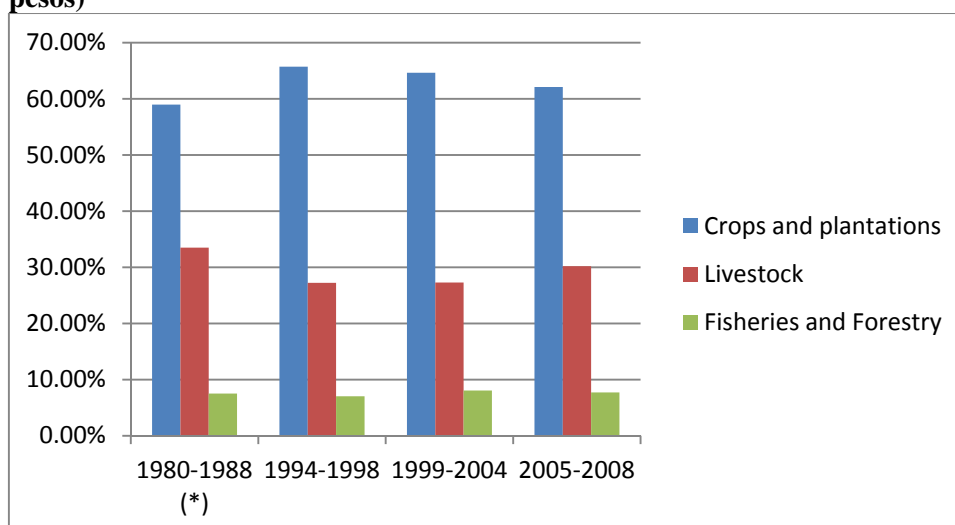
* Based on average daily wages in pesos of workers with Social Security (Mexican Institute of Social Security)

Source: Ministry of Labor website.

Main Agricultural Products

Field crop production has remained the major component of agricultural GDP since the 1980s, followed by livestock and fisheries and forestry (Figure 1).

Figure 1. Participation of Components of Primary sector GDP: 1980-2008 (constant 2002 pesos)



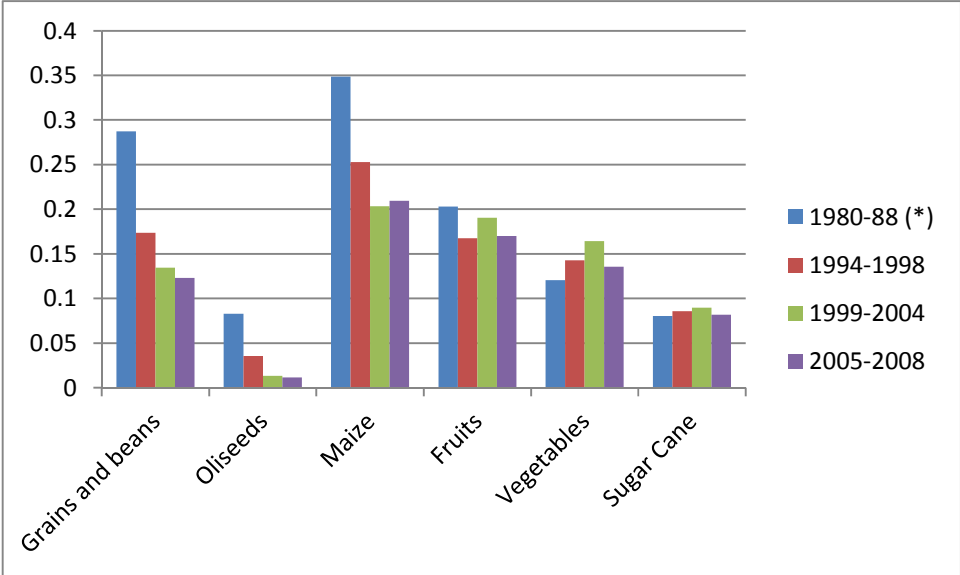
(*) Data for agriculture GDP is not available for 1989, 1991, 1992 and 1993.

Sources: Ministry of Agriculture and Fisheries (SAGARPA), Food Information Consulting System (SIACON) and Services of Food Information (SIAP) websites.

Maize has continued to be the major single crop produced in Mexico, despite the fact that its share of total crop production declined during the first five years of NAFTA implementation: from 35% during the 1980s and 25% during 1994-1998. A similar tendency has been experienced by other major grains, whereas oilseed share of field crop value of production has decreased sharply (Figure 2). Fresh fruits and vegetables participations have experienced ups and downs during the studied periods; however their share of field crop production has remained: between 20% and 17% for

fruits and between 12% and 14% for vegetables. Finally, the share of sugar cane has experienced virtually no change since its share of total production has remained around 8% and 9%.

Figure 2. Participation of main crops and plantations in field-crop production GDP (constant 2002 pesos)*



* Grains include barley, sorghum and wheat, oilseeds are composed of safflower and soy beans; fruits include avocado, peach, strawberry, guaba, citrus, mango, apples, melon, papaya, pineapple, banana, water melon; vegetables include tomatoes, carrots, garlic, broccoli, pumpkin, onion, chayote, peas, chili, coriander, sprouts, cauliflower, asparagus, cucumber and peppers.

(*) Data for agriculture GDP is not available from 1989, 1991, 1992 and 1993.

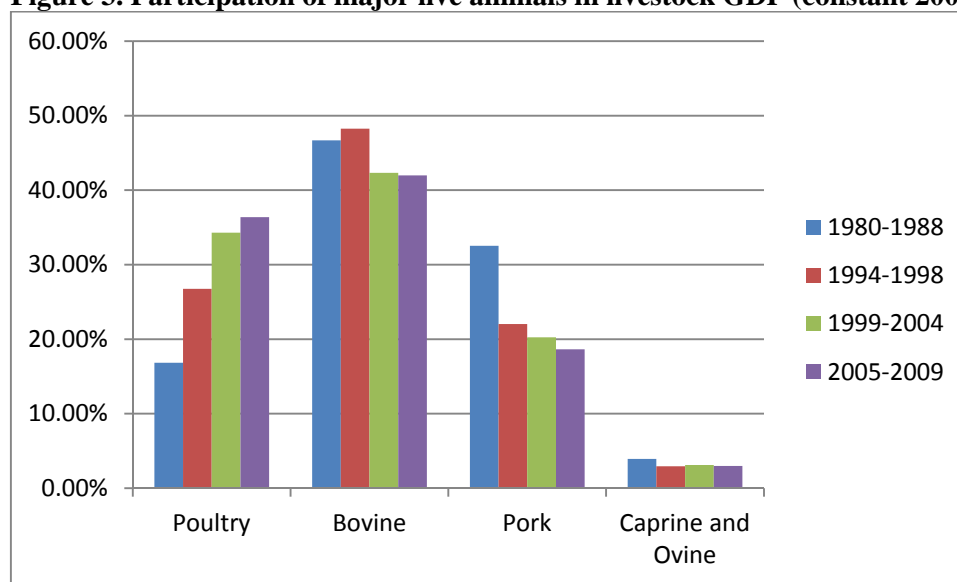
Sources: Ministry of Agriculture and Fisheries (SAGARPA), Food Information Consulting System (SIACON) and Services of Food Information (SIAP), at SAGARPA website.

With respect to livestock, the share of major live animals in livestock GDP varies according to the type of animals. The value of chickens has increased continuously since the beginning of NAFTA (from 17% during 1980-1988 to 36% during 2005-2009), whereas that of cattle increased slightly during 1999-2004 (from 47% in the previous period to 48%) and declined to 42% and 41% during the last two periods under study (Figure 3). Finally, the share of pork has declined since the beginning of NAFTA (from 33% to 19%) and the share, or value of other live animals (sheep and goats) has decreased and remained negligible.

Table 8 shows that volume of domestic production of rice, wheat and major oilseeds have had a tendency to decline, and that of sugar cane has remained practically unchanged. Taking into account

the expected impacts of reforms and NAFTA, it is surprising that the production of maize has continuously increased.⁹

Figure 3. Participation of major live animals in livestock GDP (constant 2002 pesos)



Sources: Ministry of Agriculture and Fisheries (SAGARPA), Food Information Consulting System (SIACON) and Services of Food Information (SIAP), at SAGARPA website.

Table 8. Volume of production of basic crops: annual average rates of growth 1980-2009 (Mt. Tons.)

	Rice	Beans	Barley	Maize	Sorghum	Grain Wheat
1980-1988	0.31%	-1.01%	-4.37%	-1.93%	2.90%	3.49%
1989-1993	-14.09%	21.37%	5.58%	13.42%	-15.25%	-4.87%
1994-1998	5.23%	-1.95%	7.53%	0.30%	15.01%	-6.04%
1999-2004	-3.13%	1.90%	15.45%	4.14%	4.13%	-5.13%
2005-2009	-2.51%	5.93%	-9.12%	1.02%	2.54%	8.09%
	Soy	Safflower	Sesame Seed	Cotton seed	Sugar Cane	
1980-1988	-4.32%	-7.93%	-15.66%	-10.89%	2.48%	
1989-1993	-15.85%	-18.12%	-16.24%	-36.48%	-0.58%	
1994-1998	-26.77%	27.93%	37.47%	20.01%	3.84%	
1999-2004	0.08%	-2.55%	1.01%	-2.20%	1.53%	
2005-2009	-10.32%	-5.05%	9.22%	-8.71%	-1.42%	

Sources: Ministry of Agriculture and Fisheries (SAGARPA), Food Information Consulting System (SIACON) and Services of Food Information (SIAP), at SAGARPA website.

Table 9 shows that the rate of change of the value of production of major basic crops (in constant 2002 pesos), has experienced a similar trend with respect to the volume of production; it also indicates that the value of production of these crops declined until the end of the 1990s, but at much lower rates than before the beginning of NAFTA implementation: -3.9% during 1980-88, -0.5%

⁹ Barley production has been sustained by the boom of beer production in Mexico.

during 1999-1993 and -0.2% during 1994-98 (this trend is mainly explained by the evolution of maize production). As expected, the value of production of vegetables has increased during NAFTA, but its average rates of growth have been declining during 1999-2004 and turned slightly negative during 2005-2009. However, production of fruits declined from 1994 to 2004. Part of these trends may be explained by the rise of fruits and vegetables exports to the U.S. of the members of the Central American and Dominican Republic Free Trade Agreement or CAFTA (see for example, Taylor, J. E., Yunez-Naude A. and N. Jesurum-Clemets, 2010).

Table 9. Value of production of major field crops: annual average rates of growth 1980-2009 (constant 2002 pesos)

	Rice	Beans	Barley	Maize	Sorghum	Grain Wheat
1980-1988	-3.31%	-7.77%	-4.48%	-4.30%	0.47%	2.66%
1989-1993	-25.95%	24.94%	-0.19%	8.39%	-21.51%	-9.91%
1994-1998	3.62%	3.73%	2.88%	-3.17%	14.62%	-8.81%
1999-2004	-8.20%	-2.21%	13.76%	1.09%	4.42%	-7.00%
2005-2009	8.18%	16.50%	0.63%	11.59%	13.74%	19.50%
	Soy	Safflower	Sesame Seed	Cotton seed	Subtotal	
1980-1988	-2.47%	-10.59%	-15.89%	-8.86%	-3.91%	
1989-1993	-28.30%	-26.80%	-21.77%	-41.34%	-0.51%	
1994-1998	-25.85%	30.71%	34.07%	19.87%	-0.19%	
1999-2004	-3.72%	-4.58%	1.04%	-5.93%	0.31%	
2005-2009	3.87%	6.12%	15.96%	-1.02%	12.58%	
	Fruits *	Vegetables *	Sugar Cane	Coffee		
1980-1988	0.07%	6.50%	1.49%	-0.33%		
1989-1993	0.93%	8.51%	-3.07%	-21.16%		
1994-1998	-1.71%	10.51%	-1.28%	15.69%		
1999-2004	-4.62%	2.93%	1.45%	-20.83%		
2005-2009	5.88%	-0.41%	-4.12%	5.53%		

* List of included fruits and vegetables in Figure 2.

Sources: Ministry of Agriculture and Fisheries (SAGARPA), Food Information Consulting System (SIACON) and Services of Food Information (SIAP), at SAGARPA website.

Regarding sugar cane and coffee (two additional Mexico exportables), the figures in Table 9 show that the value of production of sugar cane has not experienced considerable changes during the studied period, whereas the value of coffee production suffered huge variations leading to a sharp decline during the 21st Century with respect to the 1980s: from 10.6 billion (constant 2002) pesos in 1980-1989 to 3.6 billion during 2000-2009. The trend is explained by the impacts of the reduction of international coffee prices.

Figures in Table 9 for 2005-2009 indicate that the value of production of basic crops increased during the period, due to the increase in their international prices coupled with the rise in the volume of production of beans, maize, sorghum and wheat (Table 8, see discussion below).

Despite the fact that in general, volume of production of major meats and live animals have experienced positive rates of growth during NAFTA, poultry is the only component that experienced positive and high rates of growth during the period (Table 10). The value of egg production (in constant pesos) has also increased continuously during the last thirty years (from 14 billion pesos in 1980 to 23 in 2009), whereas cow milk production has declined (from 51 thousand millions of pesos in 1980 to 37 in 2009, <http://www.siap.gob.mx/>).

Table 10. Livestock Value of production: annual average rates of growth 1980-2009 (constant 2002 pesos)

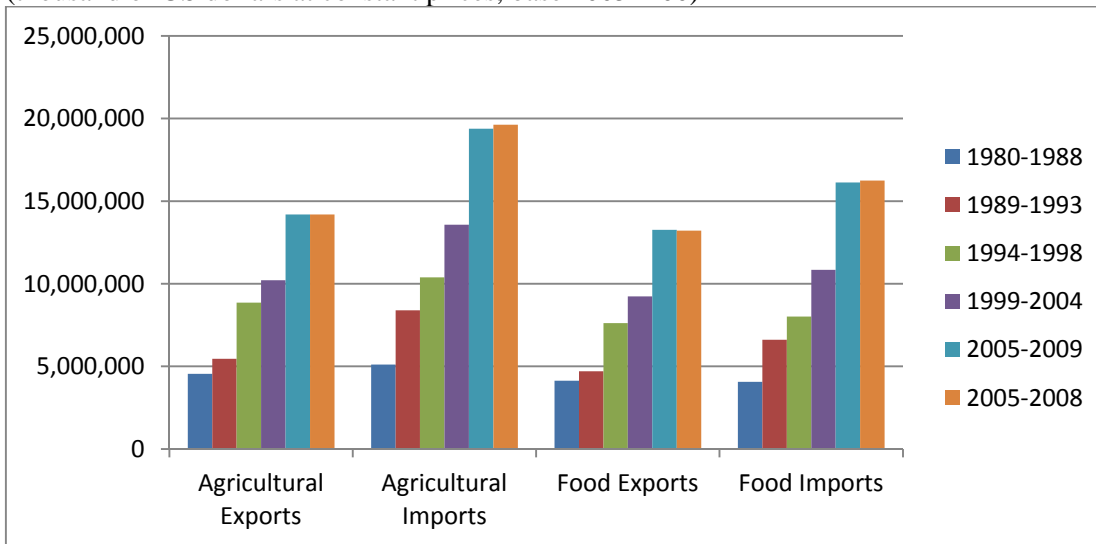
	Poultry	Beef	Pork	Caprine	Ovine
Live animals					
1980-1988	2.50%	-0.14%	0.78%	-2.08%	0.72%
1989-1993	-1.82%	-8.68%	-11.38%	-8.63%	-8.12%
1994-1998	11.29%	-0.12%	0.33%	-4.76%	-1.59%
1999-2004	5.57%	-0.78%	1.05%	0.71%	5.27%
2005-2009	2.61%	-0.48%	-0.72%	-1.19%	1.39%
Meats					
1980-1988	5.40%	2.30%	-0.94%	2.02%	2.59%
1989-1993	-1.16%	-10.59%	-9.07%	-7.91%	-8.29%
1994-1998	5.35%	-1.79%	0.71%	-1.53%	-0.72%
1999-2004	6.61%	0.65%	2.58%	0.29%	7.75%
2005-2009	3.71%	-0.45%	-1.11%	-1.41%	1.80%

Sources: Ministry of Agriculture and Fisheries (SAGARPA), Food Information Consulting System (SIACON) and Services of Food Information (SIAP), at SAGARPA website.

Trade

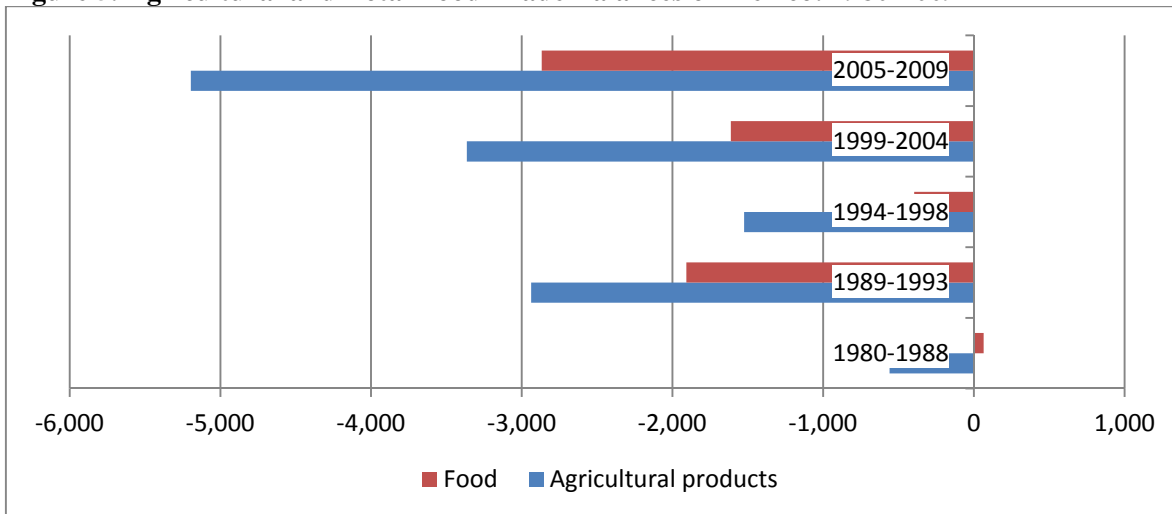
Agricultural and food trade in Mexico have doubled after signing NAFTA (Figure 4). However, the value of imports has increased much more than exports, resulting in increasing agriculture and food trade deficits (Figure 5). Despite these trends, the share in constant U.S. dollars of basic crops in total agricultural imports has decreased from 30% during 1980-1993 to 20% during 2005-2008, whereas that of livestock increased from 6% to 12% during the same period (<http://comtrade.un.org/>) With the exception of sorghum, imports of major basic crops have increased (Table 11).

Figure 4. Agricultural and Food Trade: 1980-2009
 (thousand of US dollars at constant prices, base 2005=100)



Source: World Trade Organization website. Conversion to constant 2005 U.S. prices using the International Monetary Fund (IMF) website data on U.S. consumer prices.

Figure 5. Agricultural and Total Food Trade Balances of Mexico: 1980-2009



Source: World Trade Organization website. Conversion to constant 2005 U.S. prices using the IMF website data on U.S. consumer prices.

Before and after NAFTA, the U.S. share in Mexico's total and agricultural trade has been greater than 80%. During NAFTA, both food exports to and imports from the U.S. increased.¹⁰ Of particular interest for this paper are imports of field crops, and of maize in particular, because maize

¹⁰ For example, in 1990 Mexico was the 6th importer of U.S. agricultural products, while in 2008 Mexico reached the 2nd place, just behind but very close to Canada.

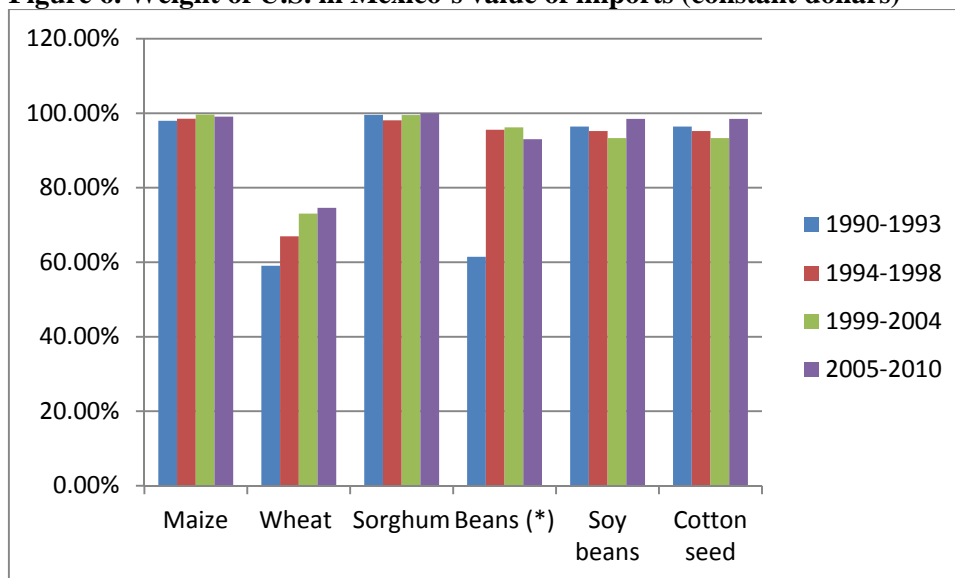
has been the major crop and food staple of Mexico produced by commercial and family farmers (Figure 6).

Table 11. Imports of major basic crops. Average simple rates of growth in constant 2005 U.S. dollars *

	Maize	Wheat	Sorghum	Dry Beans	Soy Beans	Cotton Seed
1980-1988	-8.22%	-5.21%	-12.87%	-31.36%	7.03%	-14.60%
1989-1993	-40.54%	27.36%	-1.37%	-51.75%	6.45%	27.16%
1994-1998	11.32%	13.01%	-5.32%	32.40%	5.16%	-3.85%
1999-2004	0.27%	8.64%	-3.93%	-12.67%	3.35%	12.37%
2005-2008	44.83%	22.67%	-0.98%	14.48%	19.81%	5.73%
2005-2010	14.71%	4.37%	2.40%	12.25%	8.45%	-2.36%

* Estimated using U.S. Consumer Price Index data from IMF website
Sources: 1980-2008, FAO website; 2009-2010 United Nations website on trade.

Figure 6. Weight of U.S. in Mexico's value of imports (constant dollars)



(*) Includes kidney beans and white pea beans

Source: United Nations website on trade, using U.S. Consumer Price Index data from IMF website.

Most of Mexico's exports of major competitive fresh fruits and vegetables experienced high average rates of growth before NAFTA, and continued to grow during the first years of the trade accord (Tables 12 and 13). However, export trends show a tendency of diminishing rates of growth, especially during the last five years of the 2000s. These trends suggest that once greater market access to the U.S. was reached, and due to competing exports from Central American and other countries of the Americas, Mexico's competitive edge in fruits and vegetables has been eroded. Refined sugar exports have increased during NAFTA and also those of coffee despite the fact that

the value of exports sharply decreased during 1999-2004 (Table 14) Mexican beef and pork meat exports have increased considerably during NAFTA. However, the deficit Mexico has had in meats trade balance has sharply increased (Figure 7)

Table 12. Exports of competitive vegetables. Average simple rates of growth in constant 2005 U.S. Dls.

	Avocado	Strawberry	Lemon and Lime	Mangoe and guaba	Orange	Papaya	Watermelon
1980-1988	25.9%	18.6%	18.1%	3.3%	-6.4%	57.4%	2.5%
1989-1993	9.7%	6.7%	47.2%	65.4%	29.0%	69.0%	-9.4%
1994-1998	13.5%	17.8%	6.2%	5.8%	28.3%	62.1%	4.5%
1999-2004	26.0%	-3.7%	15.9%	-4.9%	-31.2%	25.2%	14.9%
2005-2010	6.6%	7.9%	4.4%	11.1%	13.9%	-0.6%	10.0%

Sources: 1980-2008, FAO website; 2009-2010 United Nations website on trade , using U.S. Consumer Price Index data from the IMF website.

Table 13. Exports of competitive fruits. Average simple rates of growth in constant 2005 U.S. Dls.

	Garlic	Hot pepper *	Cauliflower and Broccoli *	Asparagus	Cucumber	Pepper *	Tomatoes(peeled)	Tomatoes
1980-1988	-1.1%	31.0%	30.7%	20.4%	-6.9%	1.4%	0.0%	-1.1%
1989-1993	11.6%	73.6%	12.9%	43.5%	9.8%	0.4%	-0.9%	14.3%
1994-1998	40.5%	14.0%	22.2%	35.0%	-0.6%	7.0%	23.0%	10.1%
1999-2004	-25.6%	13.3%	-2.6%	-22.5%	16.7%	5.4%	20.3%	8.4%
2005-2010	-4.6%	-0.7%	8.7%	11.8%	-3.5%	1.7%	-7.2%	7.8%

*Covers 2005 to 2008

Sources: 1980-2008, FAO website; 2009-2010 United Nations website on trade , using U.S. Consumer Price Index data from the IMF website.

Table 14. Refined Sugar and Coffee trade *

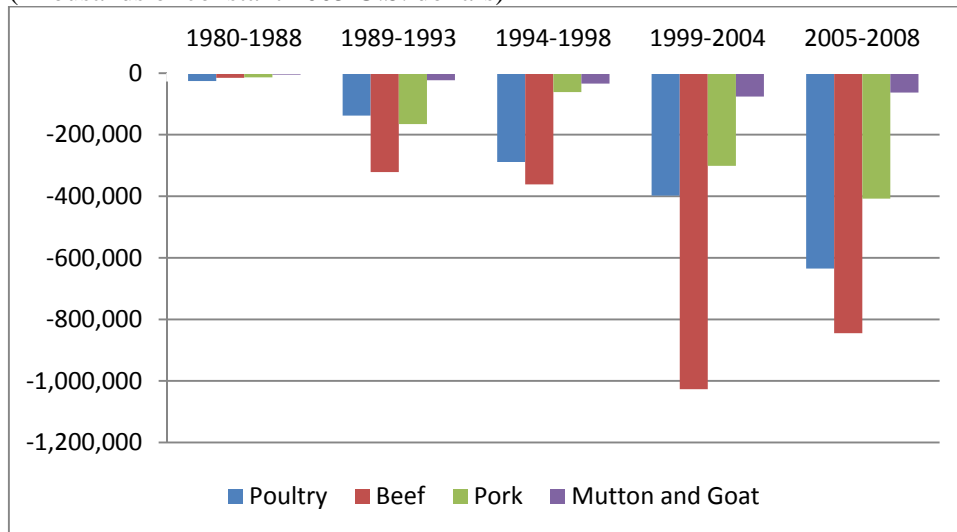
(Thousands of constant 2005 U.S. dollars)

	Sugar		Coffee	
	Exports	Imports	Exports	Imports
1990-1993	176	254,554	470,408	2,461
1994-1998	70,771	13,963	809,799	19,167
1999-2004	41,038	34,748	362,349	14,206
2005-2009	95,885	13,102	808,323	17,059

* Coffee includes raw and toasted coffee

Sources: 1980-2008, FAO website; 2009-2010 United Nations website on trade , using U.S. Consumer Price Index data from the IMF website.

Figure 7. Meats Trade Balances
(Thousands of constant 2005 U.S. dollars)



Source: FAO website, constant 2005 US dollars, calculated using U.S. Consumer Price Index data from the IMF website.

Food import dependency and self-sufficiency

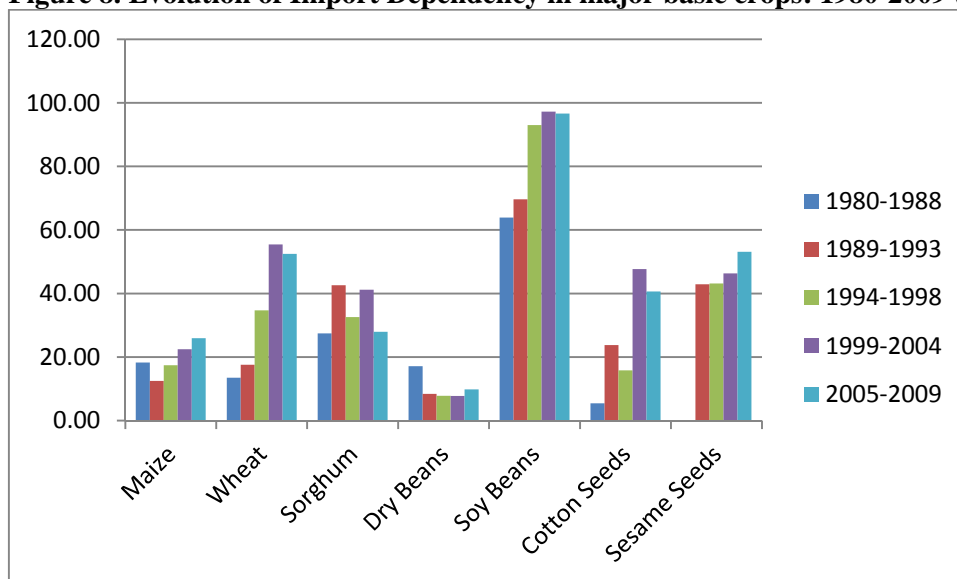
The evolution of import dependency and self-sufficiency ratios (IDR and SSR, respectively) serves to synthesize the agricultural changes in Mexico during agricultural trade liberalization. Overall and in volume terms import dependency in major basic crops and in meats has increased since the beginning of NAFTA, and self-sufficiency in these crops and animal meats has decreased (Figures 8 to 11, respectively).

However, import dependency in maize has remained relatively low after NAFTA (e.g. from 18% during 1980-1988 to 26% during 2005-2009), the same has happened to import dependency in sorghum and dependency of beans has also remained low (less than 10% since 1989-93). In contrast import dependency in major oilseeds has sharply increased during NAFTA (Figure 8).

Mexico has experienced similar tendencies in food self-sufficiency for most major crops; for example, the SSR in maize has decreased at a low rate, and for beans has increased considerably during the period under study, whereas it has sharply decreased for soy beans. (Figure 9).

Since 1989, import dependency in major meats has increased and self-sufficiency in these goods has decreased (Figures 10 and 11).

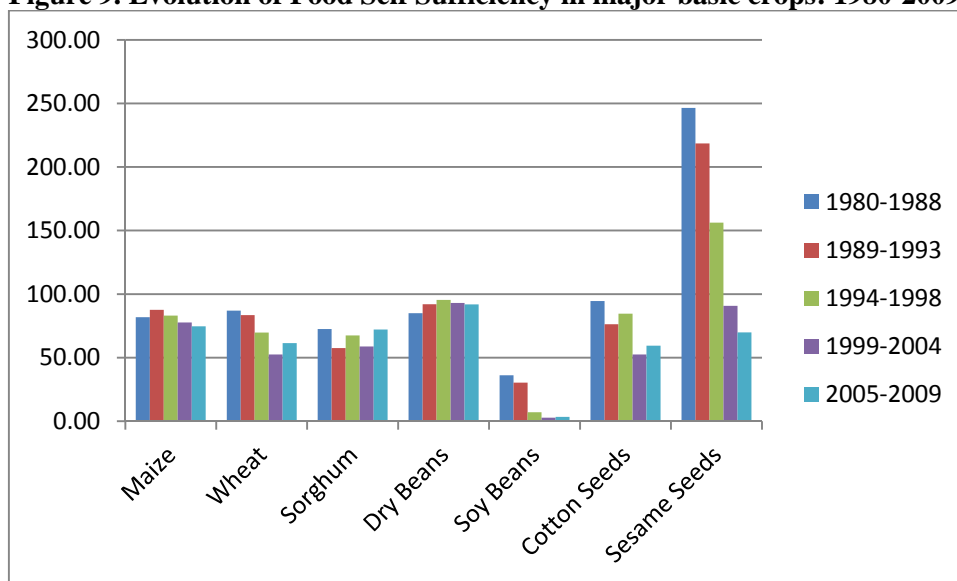
Figure 8. Evolution of Import Dependency in major basic crops: 1980-2009 (%)*



* Import dependency ratio in volume (IDR) = ((Imports)/(Production+Imports-exports))*100

Sources: Production SAGARPA website; Imports and Exports for 1980-2008, FAO website and for 2009 President Calderon annual address 2010.

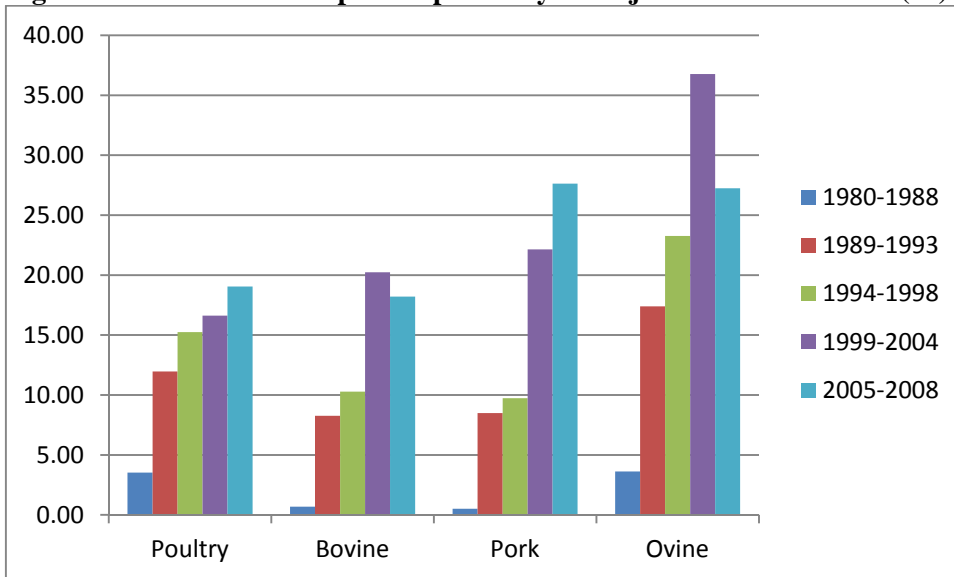
Figure 9. Evolution of Food Self Sufficiency in major basic crops: 1980-2009 (%) *



* Self-sufficiency ratio in volume (SSR): ((Production)/(Production+Imports-exports))*100.

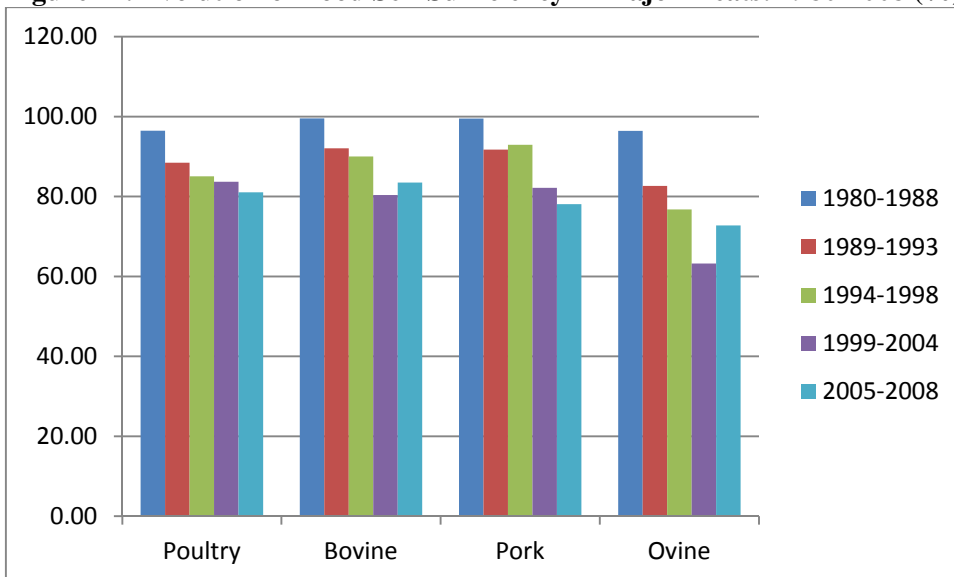
Sources: Production SAGARPA website; Imports and Exports for 1980-2008, FAO website and for 2009 President Calderon annual address 2010.

Figure 10. Evolution of Import Dependency in major meats: 1980-2008 (%)



Sources: Production SAGARPA website; Imports and Exports for 1980-2008, FAO website and for 2009 President Calderon annual address 2010.

Figure 11. Evolution of Food Self Sufficiency in major meats: 1980-2008 (%)



Sources: Production SAGARPA website; Imports and Exports for 1980-2008, FAO website and for 2009 President Calderon annual address 2010.

Food security, poverty and inequality

Based on estimations of the trends in per capita consumption of food, it can be said that food security in Mexico improved during NAFTA. In particular, available official data indicate that per capita consumption of maize and soy beans and of all major meats has increased during NAFTA,

whereas per capita consumption of the remaining major basic crops has decreased (Table 15 and Figure 12, respectively). These figures suggest that, despite increasing imports of wheat, per capita consumption has not increased, and that the contrary has happened with respect to soy beans.

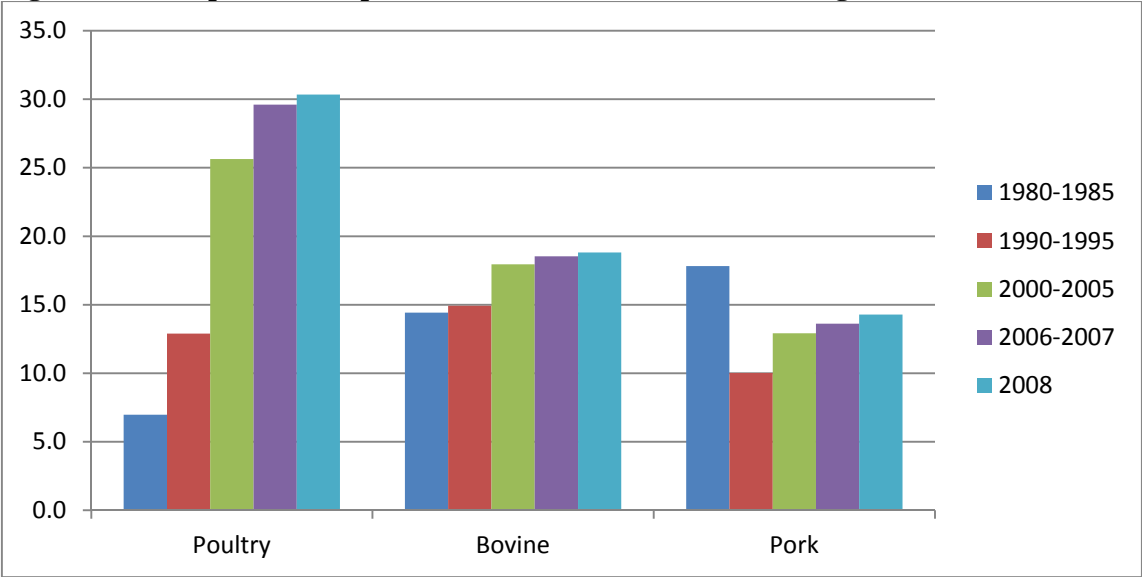
Table 15. Per capita consumption of Selected Basic Crops: 1980-2009 (Kg.)

	Maize	Wheat	Sorghum	Beans	Soy Beans	Cotton Seeds
1980-1985	224.2	64.7	109.9	17.4	22.2	24.1
1990-1995	225.8	48.6	86.7	16.3	22.0	7.3
2000-2005	236.7	59.6	96.9	9.2	39.5	5.9
2006-2007	287.3	59.3	77.0	12.2	35.8	7.1
2008-2009	283.7	50.7	78.3	11.1	33.6	4.4

Sources: Population,1985-2009 Banco de México and 2010 INEGI 2010 Poulation Census; production SAGARPA website; Imports and Exports FAO website.

It is worth noticing that during the last years covered by available data, per capita consumption did not change much or drop. Per capita consumption of maize slightly declined during 2008-9 compared to 2006-7, while that of wheat, beans and soy beans and cotton seed declined during the same period and per capita consumption of sorghum remained practically the same. Per capita consumption of poultry and beef did not experience major changes in 2008 compared to the previous two years, whereas that of pork slightly increased.

Figure 12 Per capita consumption of Selected Meats: 1980-2008 (Kg.)

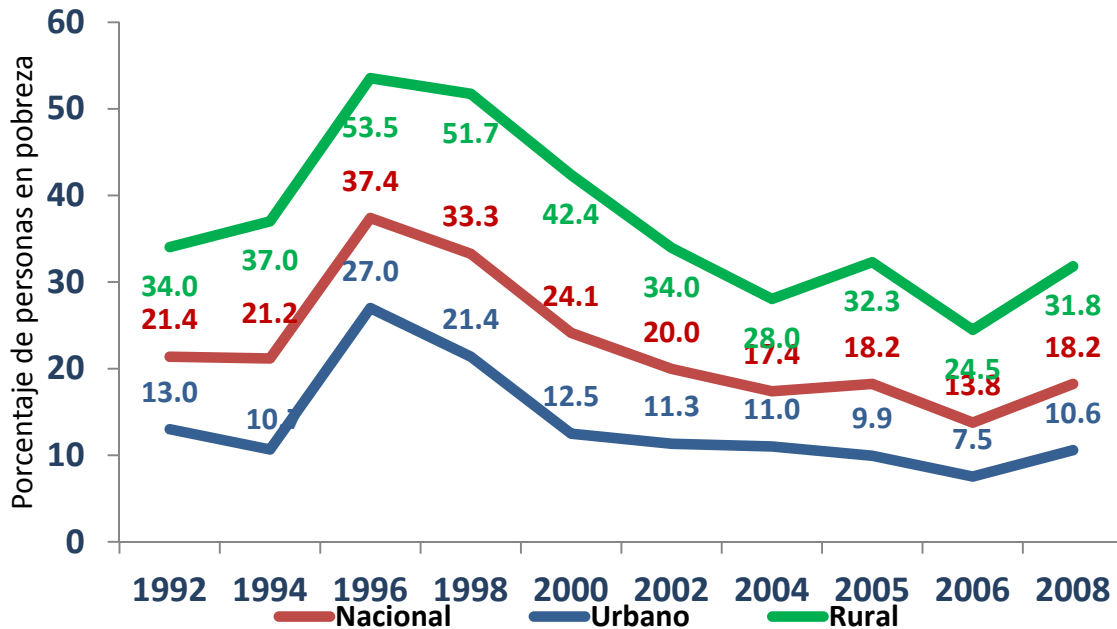


Sources: Population,1985-2009 Banco de México and 2010 INEGI 2010 Poulation Census; production SAGARPA website; Imports and Exports FAO website.

These figures suggest that the increase in food prices that began in 2006/7 has negatively affected food consumption and food security in Mexico. This coincides with the official figures of a rise in

food poverty in 2008 compared to 2006 (in Figure 13, note that poverty also increased, and more sharply during the macro economic crisis that Mexico suffered in the mid-1990s).

Figure 13. Evolution of Rural Poverty in Mexico: 1992-2008



Source: CONEVAL website.

Regarding per capita expenditure on foods, the tendency of households to reduce the proportion of expenditure in food on total expenditure beginning in 1998 (i.e. after de mid-1990s macroeconomic crisis) reverted in 2008 and 2010. The increase in per capita expenditure on foods during 2008 and 2010 compared with the previous 10 years is explained in part by a rise in expenditure on grains and beans (Table 16). However, in absolute and constant 2002 peso terms, food expenditures of the poorest three income deciles of Mexican households decreased in 2010 --compared with 2008, and expenditure on maize by the poorest households (first income decile) decreased in 2008 compared with 2006 and in 2010 compared with 2008 (see Annex). If we consider that maize and maize products are the single most important food in the consumption basket of the poor, the later tendency may explain in part the increase in food poverty during 2008 and 2010 according to the estimations of the National Council for the Evaluation of Social Development Policies (<http://www.coneval.gob.mx/>, CONEVAL is the institution's Spanish acronym).

As shown in Figure 13 rural poverty has been and remains much higher than urban poverty. In addition rural poverty varies considerably between Mexico's rural regions (Table 17).

Table 16. Per capita expenditure on foods

Year	Participation of Food in Total Expenditure	Participations on total food expenditure *					
		Maize	Wheat	Other Grains	Beans	Fruits and Vegetables	Meats
1992	25.14%	7.20%	5.70%	0.93%	2.94%	12.00%	19.22%
1994	23.98%	6.35%	5.44%	1.06%	2.53%	11.05%	17.65%
1996	25.73%	7.69%	7.01%	1.25%	3.92%	10.35%	16.76%
1998	24.80%	7.38%	6.01%	1.23%	3.14%	10.88%	16.60%
2000	24.38%	7.23%	5.41%	1.05%	1.95%	10.54%	14.90%
2002	23.75%	7.61%	5.49%	1.24%	2.10%	11.67%	14.61%
2004	21.67%	6.13%	5.26%	1.38%	1.40%	9.45%	12.90%
2006	21.66%	6.08%	5.15%	1.41%	1.34%	9.66%	12.20%
2008	24.54%	6.65%	5.84%	1.56%	1.52%	9.50%	12.24%
2010	25.29%	6.69%	5.49%	1.50%	1.49%	9.82%	12.35%

* Includes processed foods.

Sources: INEGI. National Income and Expenditure Household Surveys for the reported years.

Table 17. Households in poverty by Rural Region: % of total

Region	Food Poverty	Poverty in Capacities	Poverty in Assets
South-South East	0.62	0.69	0.81
Center	0.36	0.45	0.63
Center-West	0.30	0.36	0.52
Northwest	0.20	0.25	0.35
Northeast	0.38	0.43	0.58
All Rural Regions	0.38	0.44	0.58

Source: Own estimations base on ENHRUM 2002.

Finally, income inequality prevails and remains high in Mexico; the Gini coefficient was 0.53 in 1992 and 0.51 in 2005 (CONEVAL, <http://www.coneval.gob.mx/>). Inequality in Mexico's rural households is even higher (0.57 in 2002). In addition, inequality in the distribution of assets between rural households is even higher, and this also applies to some of these households income sources (Table 18). In contrast, measured in years of schooling, inequality in human capital is quite low (0.25). If we consider that the Gini coefficient for waged income and government transfers is lower than the Gini coefficient for the full net income of rural households, we can argue that education, government transfers and participation in labor markets of households members contribute to reduce income inequality in rural Mexico (Ceron, H. 2011 evaluates this hypothesis

empirically using data of a representative rural household survey: Nation Survey of Rural Households (or ENHRUM for its acronym in Spanish).

Table 18. Gini Coefficients of Rural Households Net Incomes and Assets: 2002

Income Sources	Gini	Assets	Gini
Basic Crops	0.77	Schooling of Household Members	0.25
Commercial Crops	0.83	U.S. Migrants	0.90
Livestock	0.77	Migrant to rest of Mexico	0.84
Non Agricultural Production	0.68	Land Property (Has)	0.85
domestic Remittances	0.64	Tractors	0.95
U.S. remittances	0.65	Other Agricultural Machinery	0.89
Forestry	0.55		
Agricultural waged labor	0.51		
Non-agricultural waged labor	0.56		
Government Transfers	0.53		
Total Net Income	0.57		

Source: Ceron, H. (2011) based on ENHRUM data.

Farm size and Property Rights

Data from the Agricultural Censuses of 1991 and 2007 (AGC) provide information to describe the structure and evolution of agriculture by “farm” size (“agricultural production units” in INEGI’s terms).¹¹

From 1991 to 2007 the number of agricultural units of production (AUP) decreased by 1.2%. Since the area covered by these AUP experienced a greater reduction (-3.9%), the average size of Mexico’s AUP declined from 8.18 to 7.96 hectares during the period. According to AGC stratification of AUP, from 1991 to 2007 average farm size slightly decreased for plots of less than 2 hectares, remained practically unchanged for plots between 2 and 5 hectares, and increased for the remaining plots (1st two columns of Table 19).

Table 19 also indicates the prevailing high heterogeneity in Mexico’s agrarian structure. For example the number of small AUP (up to 5 hectares of land) accounted for almost 60% of total AUP in 1991 and for 68% in 2007, but have less than 16% of total area in both years. By contrast,

¹¹ Agricultural Units of Production are the set of land holdings with or without agricultural or forestry production in rural areas or with agricultural and forestry production in urban areas, located in the same county or municipality, and under the same administration.

big AUP's (more than 50 hectares), constitute just over 3% of total AUP, but cover around 40% of total hectares.

Table 19. Quantity, area and size of Agricultural Units of Production (AUP): 1990 and 2007

Census Strata	Average size of AUP (has.)		Distribution in total number of AUP		Distribution in total area of AUP	
	1991	2007	1991	2007	1991	2007
Up to 2 Has.	1.12	1.09	34.56%	44.47%	4.71%	6.10%
From 2 to 5 Has.	3.41	3.46	25.35%	24.21%	10.55%	10.51%
From 5 to 20 Has.	8.78	9.23	31.25%	23.16%	33.52%	26.84%
From 20 to 50 Has.	20.51	25.26	5.27%	5.10%	13.22%	16.16%
From 50 to 100 Has.	42.64	51.68	1.77%	1.74%	9.24%	11.32%
From 100 to 1000 Has.	104.11	130.58	1.67%	1.25%	21.22%	20.45%
From 1000 to 2500 Has.	351.45	517.82	0.09%	0.05%	3.70%	3.06%
More than 2500 Has.	710.86	1724.79	0.04%	0.03%	3.84%	5.55%
Total or average	8.18	7.96	100.00%	100.00%	100.00%	100.00%

Sources: Agricultural Censuses: 1990 and 2007

Despite the fact that the total area of individual *ejidal* lands increased by 23.4% from 1991 to 2007 (Table 20), the average size of *ejidal* plots decreased by 1 hectare, from 8.5 to 7.5 (H. Robles V., 2010). The rise in total hectares of individual *ejidal* land may be partly explained by two phenomena suggested by figures in Table 20: After the Land Reform of 1992, public and “other” lands were distributed to *ejidos* whose land distribution was pending (see also Garfias, 2010); and common lands’ division for individual exploitation increased.

Table 20. Land Property rights (Has.): 1991 and 2007

	Type of Propoert Rights				Total *
	Ejidal	Communal	Private	Public	
1991	30,032,644	4,338,099	70,493,493	1,315,198	106,179,434
2007	37,009,820	3,783,889	69,672,269	492,580	110,958,557
Abs. Change	-6,977,177	554,210	821,225	822,618	-4,779,123
Change (%)	23.2	-12.8	-1.2	-62.5	4.5
Weights					
1991	28.28%	4.09%	66.39%	1.24%	100%
2007	33.35%	3.41%	62.79%	0.44%	100%

* Excludes land for housing and public services

Sources: Agricultural Censuses: 1990 and 2007

Thus, contrary to expectations about the effects of economic liberalization and the Land/Ejidal Reform, fragmentation has increased: The number of minifundia has not decreased and private property rights of former *ejidal* lands for agricultural production have not increased. The latter is

partly because most of the 20% of the land that has been privatized has been located in urban areas or in coastal resorts. In short, there are no signs of significant rural land market development (Garfias, 2010).

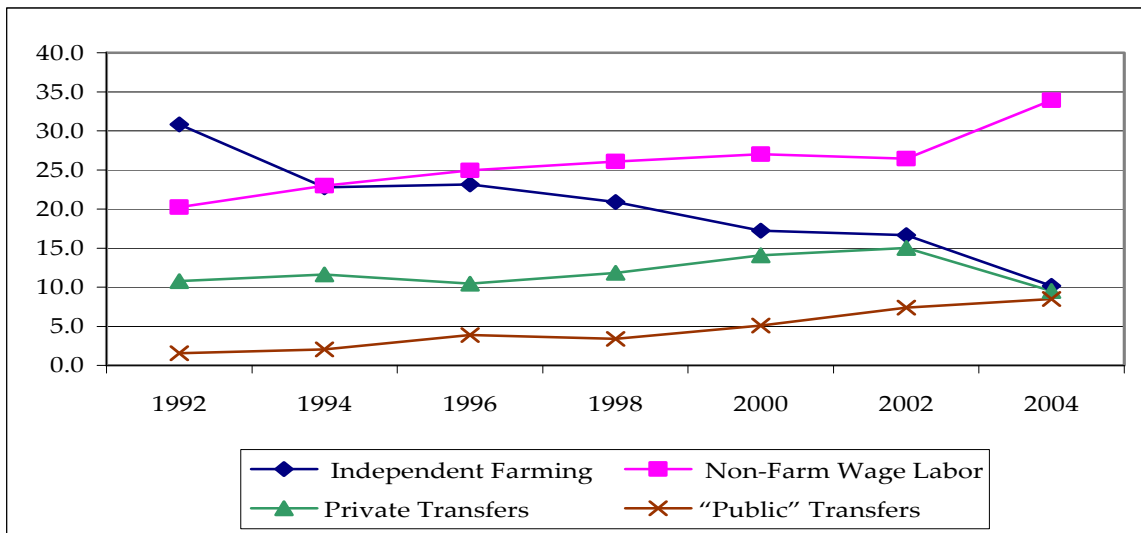
In addition to the prevalence of minifundia, formal access to credit sharply declined from 1991 to 2007 and the use of family labor and animal traction and production for subsistence consumption still prevails in small farms. Notwithstanding the above, AGC data on the evolution of crop production and yields by farm size (by AUP size) indicate that production of maize by small farmers has prevailed in Mexico. The data also indicate that small farms production of competitive cash agricultural goods –such as sugar cane and oranges—has been a viable option for them. Furthermore, tendencies show that medium sized farmers producing the above mentioned crops as well as other basic crops have been able to confront the challenges of reforms and trade liberalization (details in Taylor *et. al.*, Feb. 2011). As I discuss below, the above despite the dismissal of this type of producers as subjects of transitional and agricultural policies during the last two decades.

Rural Migration and Rural Households Income Sources

Labor migration from Mexico's rural sector increased during NAFTA. The destinations of rural migrants are to urban Mexico and to the U.S., and during NAFTA the rate of rural international migration has been higher compared to domestic migration. ENHRUM data show that the number of domestic rural migrants was 183% higher in 1994 and 342% higher in 2002 compared to 1980. Migration to the U.S. increased 92% in 1994 and 452% in 2002 (Taylor and Dyer, 2003).

In addition to the increase in rural migration, the source of income of rural households has changed radically during NAFTA. Figure 14 shows the increasing importance of non-agricultural waged labor in the income structure of Mexican rural households, as well as the increasing importance of public and private (mainly remittances) transfers. These figures are consistent with ENHRUM results for 2002 and 2007. Being more disaggregated, the data of these surveys indicates that in 2002 and 2007 the share of remittances in rural household's net income from rural migrants to the U.S. was similar to the net income produced by their field crop activities.

Figure 14. Changes in the composition of income sources of rural households: 1992-2004



Source: CONEVAL website.

4. Effects of NAFTA on Agricultural prices, Trade, Production, Rural Migration and Welfare: Empirical results

In this section I summarize the main findings on a series of econometric tests we have done using time series data to analyze the effects of NAFTA and domestic reforms on Mexico's agriculture and rural out-migration. I also summarize the results of an econometric analysis of changes in welfare before and after NAFTA.

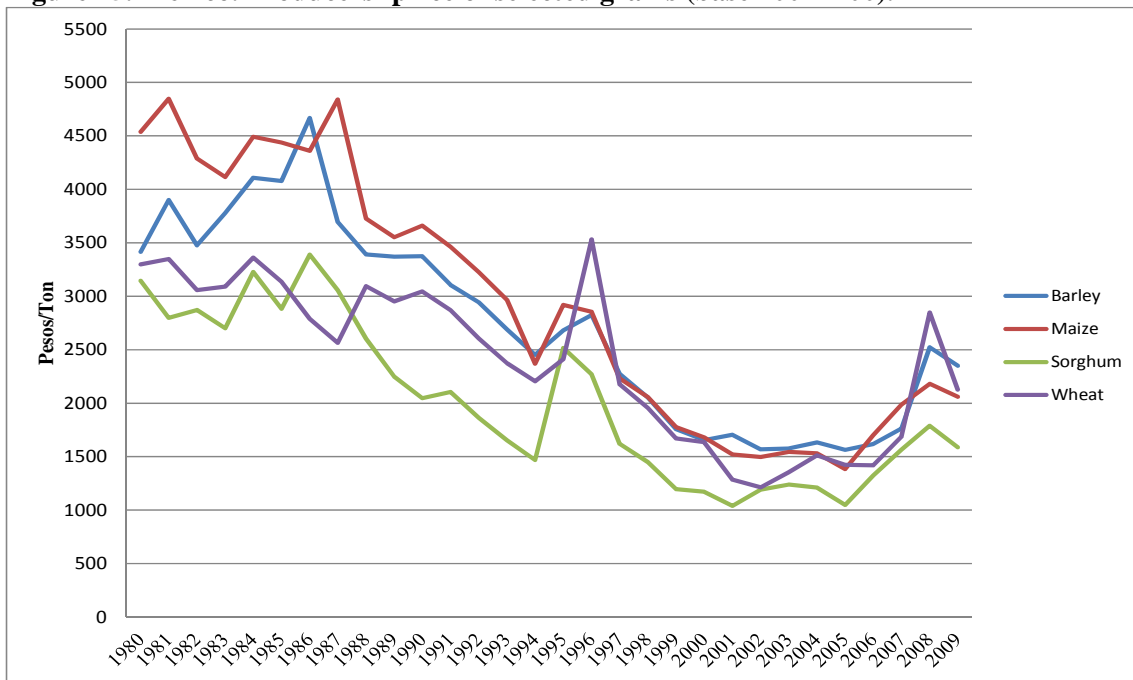
The "Law of One Price" and structural changes in agricultural trade, production and rural out-migration

One of the most fundamental expected impacts of NAFTA relates to price changes of non-competitive crops, previously protected by Mexico, since this could imply changes in the structure of Mexico's agricultural production and trade. Based on the theory of Purchasing Power Parity, we applied the Error Correction Model (ECM) to evaluate whether price convergence between Mexico farm gate and U.S. prices of major basic crops has occurred during domestic reforms and NAFTA. By applying co-integration models we have also studied empirically if structural change has occurred during NAFTA in Mexico's agricultural trade and in its crop imports and exports, as well as in production and yields of non-competitive crops. The main results of these studies are summarized below.

*Price convergence in major non-competitive grains*¹²

As expected, commercial producer prices of basic crops in Mexico declined after the late 1980s; the exceptions were during the macroeconomic crisis of 1995/96 and the price surge during 2006- 2008 (Figure 15). Since the price trends are similar to those in the U.S., we formally tested the price-convergence hypothesis for maize, sorghum and wheat. Our econometric findings suggest that price convergence between Mexico and the United States occurred for these crops during and after the reforms, i.e., from January 1981 to December 2009. For maize, we found evidence of a long run convergence between Mexico and U.S. maize prices and an increase in price convergence from January 1996 to December 2008.¹³ We obtained similar results for wheat and sorghum. For the first crop the long run price convergence began in January 1995 and for sorghum in the same month of 1995.¹⁴

Figure 15. Mexico. Producers' price of selected grains (base 2002=100).



¹² In our estimations on price convergence we used U.S. prices, not only because the U.S. is an important player in setting international prices of crops imported by Mexico, but also because before and after NAFTA, the share of the U.S. in Mexico's total and agricultural trade has been overwhelming (see for example, Figure 6).

¹³ Details in Jaramillo, *et al.* May, 2011. Similar results are obtained by Prakash Adam, 2011. His and our results suggests that yellow maize (imported by Mexico from the U.S.) and white maize (produced in Mexico) are substitutes, which has been demonstrated by Yunez, Orrantia and Guzman, 2010.

¹⁴ Similar price tendencies and price convergence results were obtained for barley, rice and major oilseeds for the period covering 1980 to 2003 (See Yunez and Barceinas, 2003, and World Bank, 2005). Due to their heterogeneity in quality, price, etc., beans were not included.

Source: SAGARPA-SIACON website, deflated using Bank of Mexico consumer price index.

Since Mexico's macroeconomic crisis of early 1995-1996 coincides with the second and third year of the beginning of NAFTA implementation, it is not possible to propose which of the two phenomena explain the increasing price convergence. However, based on our analysis of long run tendencies what can be argued is that after the macroeconomic crisis, agricultural trade liberalization between Mexico and the U.S. led to price convergence in basic crops.

Agricultural Trade

Results of previous econometric research to test the presence of unit root and temporary and structural changes using time series from 1960 to 2007 of major crops imported by Mexico indicate the following: for cotton seed, rice, soy, and wheat there is evidence of structural change; i.e. the volume of time series on imports are stationary and show a "permanent" increase beginning in 2000, 1992, 1989 and 1996, respectively: for beans, barley, maize and sorghum there is no strong evidence of structural change, since the time series on imports of these crops are not stationary. However, our results show temporary shocks for maize in 1993 and beans in 1981, 1982 and 1990 (Yúnez, 2010).

Total agricultural exports of Mexico and exports of some of the major fruit and vegetable exports have experienced structural change beginning with NAFTA (tomatoes, fresh vegetables, melon, watermelon and fresh fruits). The months when structural change appears were at the end of 1994 and beginning of 1995; that is, during the macroeconomic crisis of Mexico. This result leads us to suspect that in addition to NAFTA, structural change is explained by the deep devaluation against the U.S. dollar the Mexican peso experienced in December 1994 and during the first months of 1995.¹⁵

Domestic Production of basic crops

Our study of structural change on production used time series on the volume of domestic production of major non-competitive crops from 1970 to 2007. For oleaginous crops, our results indicate structural change on domestic production of these goods during the reforms and NAFTA. There is strong evidence for soy and sesame (1979 and 1981), and some evidence for cotton seed in 1982. We argue that domestic production of these crops experienced a "permanent" reduction shock before NAFTA. With respect to major grains, our econometric tests show evidence that domestic

¹⁵ Yunez-Naude and Barceinas, 2003. Our findings are similar to those from the U.S. Department of Agriculture's Economic Research Service, ERS: 1999.

production of barley and maize experienced a “permanent positive” shock in 2000 and 1992 respectively (we did not find evidence of structural change in the domestic supply of beans, sorghum and wheat, although time series show that the production of this latter grain has been declining since 1995, Yunez and Baarceinas, 2003).

Rural Out-migration

Based on ENHRUM retrospective data from 1980 to 2002 Taylor and Dyer (2003) present econometric evidence that migration from the rural to the urban sectors of Mexico increased in a statistically significant manner from 1980. The same applies to rural migration to the U.S. during the second half of 1990. However, this latter change cannot be directly linked to NAFTA. The authors propose other phenomena that may explain the observed increase in migration of rural Mexicans to the U.S. One is the devaluation of the Mexican peso against the U.S. dollar during the 1995/1996 macroeconomic crisis. Therefore the devaluation meant an increase in pesos of the value of remittances migrants sent or could send to their family in Mexico, and hence, promoted more emigration. The effects of the reforms in agriculture and the lack of high growth rates of the Mexican urban economy –hence of growth of labor urban demand—could have had an additional effect on rural migration to the U.S., as well as the U.S.’s migrant reform of 1986 and its increased border controls since 1995. By legalizing foreign born laborers the migrant reform amplified migrant networks in the U.S., and stricter border enforcement may have provoked undocumented migrants to stay longer in the U.S. In addition, the *ejidal* reform of 1992 could have reduced the expectations of land ownership of *ejidatarios’* children. These factors, in combination with limited employment opportunities in Mexico, could have pushed rural out-migration to the U.S. Finally, to the above one has to include the cumulative effect of migration; i.e. rural migration to this country during the first half of the 1990s could have provoked more migration afterwards.

Changes in Welfare

Results of an econometric analysis of households’ welfare changes in Mexico at the municipal (county) level (the smallest political unit in Mexico) using the methodology called Small Area Estimates and the software called *Poverty Map* or PovMap (Elbers, C., Lanjouw J.O., Lanjouw P. 2003), show a very poor performance of Mexico in respect to poverty reduction, decrease in inequality and increase in consumption from 1992 to 2005. Only 89 of the 2403 counties of Mexico experienced significant inequality and poverty reductions, as well as increased household

consumption (this welfare improvement covered just 2.6% of the population of Mexico, Table 21). By contrast, in 911 municipalities (containing 45.7% of the population) there was no significant improvement in any of the three welfare indicators. Overall, 53.1 percent of Mexico’s population is found in counties that achieved improvements in at least one of the three welfare indicators (details in Yúnez Naude, A., J. Méndez Navarro y J. Arellano González, 2010).

Table 21. Typology of Municipalities According to Changes in Welfare: 1992 and 2005

Changes in Welfare *	Number of Municipalities	Total Population, 2005	Covered Population, %
Significant improvement in the 3 welfare indicators *	89	2,601,059	2.6%
Significant improvement in consumption and poverty	751	14,821,530	14.9%
Significant improvement in consumption and equality	2	337,995	0.3%
Significant improvement in consumption	122	3,877,783	3.9%
Significant improvement in poverty and equality	122	5,526,366	5.5%
Significant improvement in poverty	147	4,379,188	4.4%
Significant improvement in equality	259	21,412,247	21.5%
No significant change in any of the 3 welfare indicators	911	45,561,331	45.7%
Non available estimations/new municipalities after 1990	51	1,142,003	1.1%
Total	2,454	99,659,502	100%

* Food poverty reduction, inequality reduction and increase in consumption.

Source: Yunez et al. (2010).

These results reflect an uneven and not very dynamic period of the Mexican economy. Because of the macroeconomic crisis that severely affected Mexico’s per-capita income in the second half of the 1990s and the low economic growth of the country during the reporting period, it is easy to understand that roughly half of the population was left at the margins of progress.

5. The policy environment: from economic reforms to current food security programs

In this section I discuss agricultural and rural policy changes during the 21st Century, when several agricultural policy modifications began to be adopted following massive protests in Mexico City against maize imports under NAFTA and in a political context of enhanced democracy. Based on this and policy reforms and the tendencies revealed in previous sections, I present a series of hypotheses to explain why some of the expected effects of NAFTA on this sector have not been realized after more than 25 years of reforms. I finish the section discussing issues related to food security in contemporary Mexico.

Recent Policy Changes and Policy Environment (Antonio: or all lower case, but be consistent throughout)

The year 2000 marked the end of the reign of the political party that ruled Mexico for more than 70 years. Notwithstanding that market-oriented public interventions in the economy of Mexico have prevailed, the change in political power has led to some modifications in agricultural policies by the new governments.

In 2001 the Law for Sustainable Rural Development (LDRS for its Spanish acronym) was approved, leading both to the extension of the coverage of agricultural policies to other components of the rural sector and to an explicit consideration as policy objectives the attainment of food “sovereignty” and food “security” in Mexico. This was especially apparent in 2003 when the Executive signed an agreement with organizations from the agricultural sector that protested mainly against maize liberalization under NAFTA (the agreement was called “*Acuerdo Nacional para el Campo*-National Agreement for the Countryside”). In addition the LDRS included provisions for decentralizing rural policies and the participation of all Ministries with programs related to the rural sector in an effort to coordinate their policies.

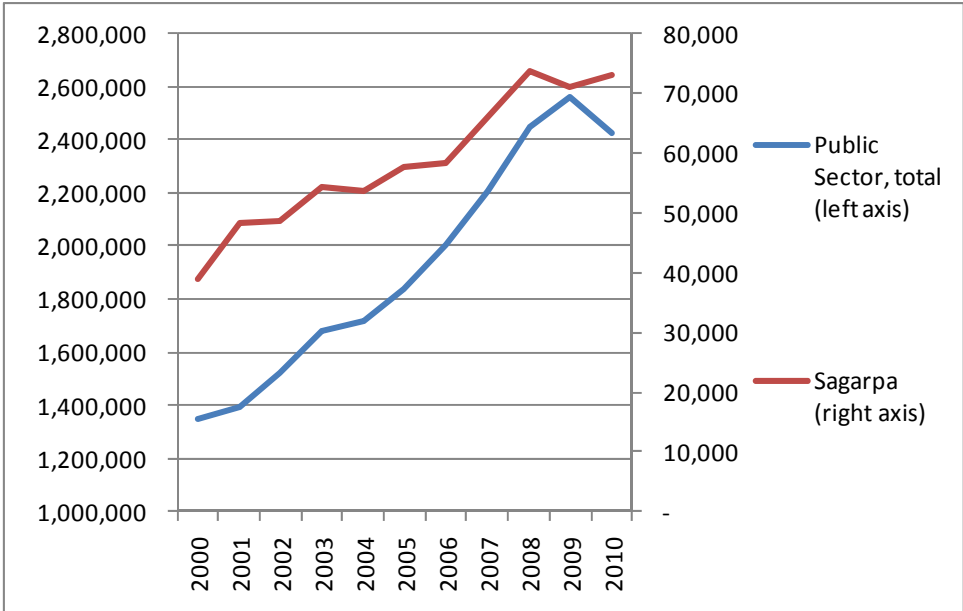
However, in practice, the Ministry of Agriculture continues to be the major recipient of public funding to the rural sector, significant decentralization has not occurred, ministerial coordination is still lacking, and agricultural policies have experienced no profound changes (see Caballero, J. M, 2006, Yunez and Dyer, 2006 Scott, 2010 and Yúnez 2010).¹⁶

In practice, what has been happening is that public funds channeled to agriculture have increased during the present century, a tendency that is summarized in Figure 16 and in OECD and World Bank estimations on agricultural subsidies from 1979 to 2004. According to the Organization for Economic Cooperation and Development estimates (OECD, 2006), producer support equivalent (PSE) of major agricultural goods increased considerably during 2000-2004 compared to 1995-1999 (from 7.2 to 21.4). Other economists’ estimates are lower, from 0.1 to 9.2 during the same periods, because, amongst other differences in his estimation, he excludes PROCAMPO transfers by considering them non-product specific payments (Soloaga and Lara, 2007). In any case, both estimations show considerable increase of supports to Mexican farmers beginning in 2000

¹⁶ A relevant example is that the current President of Mexico –in office until 2012—decided to continue PROCAMPO income transfers, despite that originally it was intended to be a temporary program to be ended when NAFTA period of transition was completed in January 2008.

compared to 1995-1999. The same holds for all major imported basic crops and animal products according to OECD figures (*Ibid.* Table 5).¹⁷

Figure 16. Annual Expenditures: Total Public Sector and SAGARPA. In millions of Mexican pesos of 2010



Source: Soloaga 2011

Notwithstanding the increase in agricultural subsidies since 2000, the composition of the agricultural budget and basic objectives of the Ministry of Agriculture have not changed during this time, and thus the regressive character of public spending in agriculture and the rural sector has prevailed. In fact, according to recent estimations, supports to Mexican farmers remain extremely regressive. The richest 10% of producers (in terms of farm size) received in 2005 the following shares of the main Ministry of Agricultural programs’ transfers: 45% of PROCAMPO; 80% of *Ingreso Objetivo*(deficit payments) and 55% of the Program for Rural Development of *Alliance for the Countryside* (supposedly intended to support rural producers in poor regions). In addition, the richest 10% landowners received 60% of energy and hydrological subsidies (OECD, 2006 and Scott, 2009). Scott also points out that a large part of the rural population (at least the poorest 50%) is excluded from non-targeted, input- or output-linked support programs, simply because they are landless or have plots which are too small to be reached by such programs (the exception is

¹⁷ It is convenient to mention that, as Soloaga and Lara and OECD point out, total and agricultural-specific commodity PSEs decreased during 1995-1999 compared to the previous five-year period, partly due to the macroeconomic crisis and peso devaluation of 1995-1996. However, the fact that public expenditure in agriculture increased from 2000 remains (Figure 16, see also CEDRSSA, <http://www.cedrssa.gob.mx>).

PROCAMPO). A more recent study conducted by Scott reveals that extreme concentrations of benefits for all programs prevailed in 2009, since the poorest producer decile received only 2-3% of PROCAMPO, a 10th percentage point of deficit payments, and similarly insignificant fractions of energy/irrigation subsidies. In contrast producers in the top decile received transfer shares in the order of: 42% of PROCAMPO, 85% of deficit payments, 55% of the Program for Rural Development (PDR) and 60% of energy and hydrological subsidies (Scott, 2010).

The regressive character of government agricultural supports to Mexican farmers is explained not only by the political power of big commercial farmers, but also by the fact that these programs are designed for those farmers with high productivity capacity and wealth. To this it must be added that support from the Program for Rural Development to finance productive projects is conditional on the presentation by potential beneficiaries of a viable productive project and requires them to provide funds to partially finance the subsidized project. Consequently, the very low participation of poor farmers and poor rural producers in this program, which intends to target them is no surprise.

The regressive character of public subsidies to agriculture through deficiency payments applies also at the regional level, since most of the Ministry of Agriculture's budget channeled to deficiency payments has been used to support big commercial farmers located in the North of Mexico. For instance, in 2005, almost 50% of the budget for this program was used to support maize commercial producers located mainly in the North-West State of Sinaloa; the rest of this budget was used to support big commercial producers of wheat in Sonora (also in the North-West), of cotton in Chihuahua (North) and of sorghum in Tamaulipas (North-East). Amongst these supports, those directed to maize producers stand out because of maize's relevance to food security in Mexico. Excluding PROCAMPO, around 70% of Support Services for Agricultural Marketing or ASERCA's budget has been used to support the income of surplus farmers of basic crops (between 430 and 600 million USD per year during 2000-2005). 50% of this subsidy goes to this type of maize producer, of which 70% is for farmers in the single northwestern state of Sinaloa (Yunez 2010).

Towards an interpretation of the evolution of the agriculture of Mexico during reforms and under NAFTA

To understand the evolution of agricultural production in Mexico during the last 30 years (and before) one has to take into consideration from the very outset the heterogeneity of agricultural production, and to combine this feature with the structure of markets and policy interventions.

Based on this framework and on the character of agricultural policies and the evolution of the agriculture of Mexico, I propose the following two general hypotheses. 1) Domestic reforms and NAFTA directly affected commercial farmers producing non-competitive crops, but some of them were protected from U.S. competition by governmental supports; and 2) rural subsistence producers have maintained or even increased their production of food staples (maize in particular) because of the particularities of their decision-making process explained by the transaction costs they face.

Commercial farmers producing non-competitive crops have been directly affected by price reductions in basic crops during NAFTA, and have reacted by increasing productivity or by switching land use; others have been protected from foreign competition based on governmental supports (Sumner and Balgatas, 2007 provide evidence for this).

The responses of rural households to external shocks such as the reduction of maize prices are complex, because they are both units of production and units of consumption facing transaction costs in several markets and have a diversity of income sources (Singh, I.L., Squire and J. Strauss, 1986 provided the foundations of these proposals based on agricultural household models).

Extending the household model approach to a microeconomic general equilibrium model applied to rural Mexico, with transaction costs in product and labor markets for subsistence maize farmers, we have shown that a drop in maize market prices are indirectly transmitted to these producers through interactions in factor markets. The market price shock of maize directly affects commercial rural households producing the grain, reducing local wages and land rents, and stimulating maize production by subsistence households. We propose that this type of reaction by subsistence farmers to the observed reduction of maize market prices explains why small-scale maize production in Mexico has not declined (see for example, Dyer, Taylor, and Yunez-Naude (2005), Dyer, Boucher and Taylor (2006)), and below).

Food security: recent trends and policies

During the present Century public policies in Mexico have included explicit objectives to attain food security, first by the promulgation of the LDRS and the signing of the National Agreement for

the Countryside and afterwards through the Special Food Security Program (PESA for its acronym in Spanish, following FAO's experience in other countries). Until 2007 PESA was a strategy included in the Alliance for the Countryside and from 2008 to 2010 was part of the Ministry of Agricultural Program to Acquire Productive Assets (called the Program to Support Investments in Machinery and Infrastructure since 2011, <http://www.sagarpa.gob.mx/sdr/pesa/>). In addition, in January 2007 the government of Mexico responded to the international food-price surge that began in 2006 with measures to protect the purchasing power of the population in poverty and to boost domestic production of foods.

According to Soloaga (2011) it is difficult to complete an overall assessment of policies applied in Mexico to face the food price crisis. The causal effects of the measures taken by the government to protect Mexicans from the international food prices surge are difficult to assess since by September of 2008 new measures were put into place to try to offset the effect of the international financial crisis. Poverty levels increased markedly in Mexico to 18.3% in 2008 (and per capita consumption of basic staples declined during 2008-2009, Figure 13 and Table 15 above), but it is not clear what part of this was caused by the rise in international food prices: Mexico's GDP dropped by almost 7% in 2009, real wages also decreased, while unemployment increased, adding more difficulties for the whole population, but in particular for the poor.

What can be argued is that without policy interventions during the food price surge, poor Mexicans would have been much more affected. Based on a disaggregated general equilibrium model for the rural South and South-East of Mexico (the poorest region of Mexico), we have shown that a major component of the public interventions to protect the purchasing power of the poor did have positive effects in rural households receiving them (I am referring to the monthly cash transfer of 120 Mexican pesos delivered beginning in 2008 to beneficiaries of *Oportunidades*, see Mendoza, Yunez and Jaramillo, 2011).

Overall, and due to the unchanged structure and regressive nature of agricultural policies, the effects of PESA on small farmers and rural households have been inadequate. However, there was a successful story based on a careful application of a version of PESA to one of the poorest rural regions of Mexico in the southern state of Guerrero. The program began in 2006 and added supports for productive and land conservation purposes to the beneficiaries of *Oportunidades*, as well as access to financial services. After three years of implementation an evaluation of the effects of the program based on the methodology known as propensity score matching shows that the program did

reduce poverty, and increased nutrition levels and food production of its beneficiaries from 2007 to 2008, i.e. during the food price surge (see <http://precesam.colmex.mx>).

Before finishing this section it is convenient to summarize the results obtained by a disaggregated general equilibrium model applied to Mexico to study the effects on production and welfare of Mexican households arising from the 2006-2007 surge in world maize prices. The relevance of the study is that it takes into consideration the double character of rural households as producers and consumers, transaction costs in some markets and for some households (e.g. maize for subsistence producers), as well as the linkages between macro shocks and micro outcomes. Therefore the study uses a new, agent-based, general-equilibrium model to explore the impacts of world maize-price increases on households' activities and income in rural Mexico (as well as on land use). In the model, interactions among heterogeneous agents within a local context shape both macro and microeconomic outcomes. The findings suggest that subsistence activities allowed agriculture to absorb the shocks, limiting the benefits of higher prices for rural commercial maize producers. An estimated 5.7% maize-area expansion by 2008 and wide variation across the five rural regions of Mexico corresponds well with ex-post reports. Agricultural growth led to 0.02% and 3.9% increases in real income for rural households and absentee landholders, respectively (Dyer G. and J. E. Taylor, 2011).

6. Lessons from Mexico

Several lessons based on the Mexican experience in food production and security under NAFTA and domestic reforms can be proposed.

It can be said that in a way, the agricultural sector of Mexico was surrendered during NAFTA, because it was known that, compared to U.S. farmers Mexican farmers had no competitive edge in the production of major food crops (grains and oilseeds). The official expectation was that NAFTA, by promoting the growth of other sectors of the Mexican economy, would reduce the negative impacts of the accord on agriculture. In addition, no official concerns were put forth about Mexico's food dependency under NAFTA and radical changes towards market-oriented policies were possible due to the political power exerted by the political party that ruled Mexico until the end of the past Century.

Notwithstanding the step towards a more democratic political regime in Mexico, what has been happening during the period of NAFTA is that agricultural transitional policies, beginning in the first half of the 1990s, which were intended to help farmers transition to an open economy have

become permanent, at least up to now. In addition, the share of the budget channeled to the agricultural ministry has continuously increased during the present century (this rise has been possible in part by taxing the oil rents from PEMEX, the State-owned oil company of Mexico).

Agricultural supports for non-competitive crops have been directed to some commercial farmers in the North of Mexico. However, non-benefited commercial producers of major grains have increased productivity, maintaining production of some of these crops, and small farmers and subsistence households have continued to cultivate maize.

As well as raising equity questions the supports to some big producers of basic crops imply that frictions with agricultural trade liberalization principles remain in public policies in Mexico. In addition to being regressive, these supports are costly.

During the reforms and NAFTA, most government supports to agriculture and the rural sector have been providing private goods, not public goods. I am convinced that food production in Mexico can be enhanced by modifying this structure, by investing in infrastructure and in research, development and application of technologies in accordance with the heterogeneous agro-ecological conditions of Mexico, taking into consideration the increasing volatility of climate conditions. These are the most fundamental challenges faced by less developed economies, and confronting the Mexican State (a diagnosis and a proposal for the required agricultural policy changes are in Taylor, Yunez and Gonzalez 2007).

The goal of attaining food security is complex. Following FAO's notion, it involves domestic production of food and imports as sources of food supply and elements of stability of supply and access to food by the population. In addition, food security requires healthy foods for the population and, politically is often linked to food self-sufficiency, i.e. to domestically-produced food availability at the national level.

Per capita food consumption in Mexico has increased during NAFTA, partially at the expense of import dependency and self-sufficiency. However, what causes concern is that income inequality and poverty prevails, meaning that food security has not been granted for all Mexicans. In addition, food security has decreased during the macroeconomic crisis of the mid 1990s and more recently during the international price surge and financial crisis, implying that social safety nets during critical periods are still absent in Mexico.

Food production and security can increase in Mexico by “reforming the reforms” in a market oriented and globalized context by a long run effective policy design that favors the provision of public goods (investments in research and the application of new appropriate technologies, in infrastructure and communications, and access to financial markets, etc.) and that integrates social policies with productive policies for rural households with a competitive potential. An initial fundamental condition for this type of reform to be viable is the political will of powerful actors in Mexico, a condition that has been lacking in the current stage of a more democratic country.

References

- Caballero, J. M., March 2006, “Mexico: decentralization of rural development programs”, Vol. II of the World Bank Report, *Decentralized Service Delivery for the Poor. Report No. 35692-ME*.
- Ceron, H.m 2011, “Efectos de los activos de los hogares del México rural en la selección de actividades generadoras de ingresos.”, Ph.D. Thesis, Draft of Chapter 1, El Colegio de Mexico.
- Dyer, G., J.E Taylor and S. Boucher, 2006, “Subsistence Response to Market Shocks”, *American Journal of Agricultural Economics* 88(2):279-291.
- Dyer and J. Edward Taylor, 2011, “The Corn Price Surge: Impacts on Rural Mexico”, *World Development*, 39(10): 1878–1887.
- Dyer, Taylor, and Yunez-Naude, 2005, *Disaggregated Rural Economy-wide Models for Policy Analysis*, *World Development* Vol. 33, No. 10: 1671-1688.
- Economic Research Service (U.S. Department of Agriculture), August 1999, “ERS NAFTA Report”, WRS-99-1, www.econ.ag.gov.
- Elbers C., Lanjouw J.O., Lanjouw P., 2003, “*Micro-Level Estimation of Poverty and Inequality*”. *Econometrica*, vol. 71, No. 1: 355-364.
- Garfias, Ek, F., 2010, “Derechos de propiedad y cambio institucional en el campo mexicano”, B.A. Thesis, Instituto Tecnológico Autónomo de Mexico (ITAM).
- Jaramillo, J. L., A.Yunez Naude, E.Taylor, V. Serrano and R. Sarker, May 2011, “Integración Espacial de Mercados Agroalimentarios de Norteamérica; el caso del maíz, sorgo y trigo”, unpublished report.

- Levy, S. and S. van Wijnbergen, 1994, “Labor markets, migration and welfare: Agriculture in the North-American Free Trade Agreement.” *Journal of Development Economics*, 43: 263-278.
- Mendoza E., A Yunez and J. Jaramillo, Sept. 2011, “Impactos de equilibrio general de políticas públicas al sureste rural”, draft.
- Ministry of Trade (SECOFI), 1994, *Fracciones arancelarias y plazos de desgravación*, Ed. Miguel Angel Porrúa, México.
- Organization for Economic Cooperation and Development (OECD), 2006. *Agricultural and Fisheries Policies in Mexico: Recent Achievements, Continuing the Reform Agenda*, Paris.
- Prakash Adam, ed. 2011, “Safeguarding food security in volatile global markets”, Food and Agriculture Organization, Rome, 2011, http://www.fao.org/corp/google_result/en/?cx=018170620143701104933%3Aqq82jsfba7w&q=self-sufficiency+ratio+Mexico&cof=FORID%3A9#971
- Robinson, S., M. E. Burfisher, R. Hinojosa-Ojeda and K. Thierfelder, 1993, “Agricultural policies and migration in a US-Mexico Free Trade Area: A Computable General Equilibrium Analysis”, *Journal of Policy Modeling*, 15: (5 and 6): 673-701.
- Robles, H., 2010, “Una visión de largo plazo: comparativo resultados del VII Y VIII Censo Agrícola Ganadero 1991-2007”, in *Subsidios para la desigualdad: las políticas públicas del maíz en México a partir del libre comercio*. Jonathan Fox and Libby Haight (eds.), Woodrow Wilson International Center for Scholars & Centro de Investigación y Docencia Económica (CIDE), 185-193. www.wilsoncenter.org/MexicanRuralDevelopment.
- Scott, J., 2009, “Redistributive Constraints under High Inequality: The Case of Mexico”, Research for Public Policy, Inclusive Development, ID-07-2009, RBLAC-UNDP, New York
- Scott, J., 2010. Agricultural Subsidies in Mexico: Who Gets What? Chapter 3 in *Subsidizing inequality: Mexican Corn Policy since NAFTA*, eds. Jonathan Fox and Libby Haight, eds. Woodrow Wilson International Center for Scholars & CIDE.
- Soloaga I. and G. Lara, December 2007, “Distortions to Agricultural Incentives in Mexico”, World Bank, Agricultural Distortions Working Paper 17.

- Soloaga, I., 2011, “Policy responses to the 2007-2008 food price swing and the impact on domestic prices. Case study: Mexico”, draft: July 17, El Colegio de Mexico.
- Singh, Inderjit, Lyn Squire and John Strauss (eds.), 1986, *Agricultural Household Models—Extensions, Applications and Policy*. Baltimore: The Johns Hopkins University Press.
- Sumner, D. A. and J. V Balagtas, 2007, “Economic Analysis of the Ingreso Objetivo Program in Mexico.” Final Report for the Project “Políticas y Gasto Público Federal en el Sector Rural en México,” Interamerican Development Bank, Aug. 13th: 1-55.
- Taylor, J. E., Yunez-Naude A. and N. Jesurum-Clemets, 2010, “Does Agricultural Liberalization Reduce Rural Welfare in Less Developed Countries? The Case of CAFTA, in *Applied Economic Perspectives and Policy*: 95-116.
- Taylor, J. E. and G. Dyer, July 10th 2003, “NAFTA, Trade and Migration”, Paper presented at *The Migration Policy Institute Project, NAFTA*.
- Taylor, J. E., A. Yúnez-Naude, Justin Kagin and Michael Castelhana February, 2001, “Drivers of Structural Change and Smallholder Efficiency in Mexican Agriculture”, Report to FAO (<http://precesam.colmex.mx>)
- Taylor, Yúnez y González, 2007, “Estudios sobre Políticas Públicas para el Sector Rural en México” Informe Consolidado de resultados del Proyecto “Políticas y Gasto Público Federal en el Sector Rural en México” Report to the Inter-American Development Bank and to Mexico’s Ministry of Finance.
- World Bank, 2005, *Mexico: A Study of Rural Poverty*, Washington, D.C.
- Yunez-Naude, A., 2003, “The Dismantling of CONASUPO, a Mexican State Trader in Agriculture”, *The World Economy*, Vol. 26: 97-122.
- _____, 2010, “Las políticas públicas dirigidas al sector rural: el carácter de las reformas para el cambio estructural”, in A. Yúnez, ed. *Economía Rural*, El Colegio de México, 23-62. Also in <http://colmex.mx>
- Yunez A., M. Orrantia and A. Guzman, 2010, *Elementos Teórico Económicos para Evaluar los Fundamentos que Tendría una Controversia Comercial en Contra del Maíz Originario de los Estados Unidos de América*, Colección Estudios e Investigaciones, Centro de Estudios para el

Desarrollo Rural Sustentable y Soberanía Alimentara (CEDRSSA, Center for Studies of Rural Sustainable Development and Food Sovereignty, <http://www.cedrssa.gob.mx>, Cámara de Diputados, Mexico, 2010. Also in <http://www.cedrssa.gob.mx/?doc=2093>

Yunez, A., G. Dyer, Ceron, H., J. Mora, P. Winters and M. Gurria, Feb., 2007, “Evaluación del Impacto de PROCAMPO”, Inter_ American Development Bank and Mexican Ministry of Agriculture, Final Report.

Yunez. A. and F. Barceinas, 2003, “El TLCAN (¿) y la agricultura mexicana”, in Sobarzo, H. y E. Cásares, eds. *Diez Años del TLCAN en México. Una perspectiva analítica*, El Trimestre Económico, Lecturas N° 95.

Yunez Naude, A., J. Méndez Navarro and J. Arellano González, 2010, “Cambios en el bienestar de 1990 a 2005: un estudio espacial para México”, *Estudios Económicos*

Zahniser, S., E. Young and J. Wainio (2005), “Recent Agricultural Policy Reforms in North America”, USDA, WRS-05’03, Washington DC.

Consulted Websites

<http://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?accion=consultarCuadro&idCuadro=CP173§or=8&locale=es>
www.comtrade.un.org
<http://www.coneval.gob.mx/>
<http://www.eclac.cl/>
www.econ.ag.gov
<http://www.ers.usda.gov/>
www.economia.gob.mx
www.fao.org
<http://faostat.fao.org>
www.imf.org/
<http://precesam.colmex.mx>
http://www.nass.usda.gov/QuickStats/PullData_US.jsp
<http://sagarpa.gob.mx>
<http://www.siap.gob.mx/>
http://www.stps.gob.mx/bp/secciones/conoce/areas_atencion/areas_atencion/web/menu_infsector.html
www.wto.org

ANNEX

Per Capita Expenditure in Food by first three poorest income groups (constant 2002 pesos) *

<i>Total expenditure in Food</i>										
	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010
Decil I	177,564	177,122	162,831	166,598	167,684	177,609	208,571	215,340	240,426	236,539
Decil II	268,985	240,042	219,320	222,374	243,545	231,402	284,390	298,199	321,578	302,118
Decil III	311,301	294,771	276,848	281,697	295,981	297,351	338,373	349,708	372,632	353,891
<i>Expenditure in Maize</i>										
	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010
Decil I	38,881	33,918	37,382	32,623	30,585	34,295	31,289	33,357	31,120	30,168
Decil II	44,401	38,109	40,162	35,486	36,693	36,815	36,651	37,757	41,122	39,051
Decil III	40,235	38,430	38,876	36,571	38,075	38,511	40,426	39,464	42,972	41,170
<i>Expenditure in Wheat</i>										
	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010
Decil I	9,166	11,124	11,492	9,641	11,245	10,717	14,741	14,091	18,941	17,214
Decil II	19,827	15,061	16,055	14,821	14,992	15,648	19,893	19,635	23,982	20,462
Decil III	20,974	17,647	23,314	18,712	18,864	19,090	21,772	23,353	27,507	24,199
<i>Expenditure in Other Cereals **</i>										
	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010
Decil I	3,502	4,120	3,873	4,300	4,002	3,307	4,484	4,148	5,559	5,315
Decil II	4,051	4,457	4,475	4,299	3,896	3,998	4,697	4,866	6,423	5,824
Decil III	4,081	4,733	4,657	5,022	4,297	4,393	5,073	5,202	6,276	6,468
<i>Expenditure in Beans</i>										
	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010
Decil I	18,196	16,148	18,218	18,853	13,555	15,755	10,492	12,494	11,923	11,969
Decil II	20,513	16,714	19,628	19,252	12,780	13,735	9,199	9,430	11,395	11,755
Decil III	18,864	18,432	21,918	16,804	11,429	12,431	9,874	8,446	9,824	10,240
<i>Expenditure in Fruits and Vegetables</i>										
	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010
Decil I	23,703	20,473	15,002	17,999	20,708	24,929	23,889	27,315	28,925	29,373
Decil II	33,811	31,737	21,247	26,640	30,830	31,666	32,244	33,532	36,576	36,574
Decil III	37,444	37,090	28,319	32,850	37,311	39,862	40,585	40,299	41,326	41,795
<i>Expenditure in Meats ***</i>										
	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010
Decil I	20,768	22,278	17,469	18,424	19,448	24,205	26,234	27,172	30,167	28,650
Decil II	42,335	36,439	26,986	32,654	39,398	35,614	41,972	42,996	45,151	45,072
Decil III	55,270	52,238	40,382	46,808	51,989	50,042	53,189	52,899	53,126	53,137

* Includes processed foods

** Pork, Bovine and Poultry

*** Oats, Rye, Barley frituras and fried maize and wheat

Sources: Own estimations based on INEGI National Survey of Households Income and Expenditure: 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006, 2008, 2010.