Unclassified **AGR/CA/APM(2006)14/ADD1**

Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development **29-Sep-2006**

English - Or. English

DIRECTORATE FOR FOOD, AGRICULTURE AND FISHERIES
COMMITTEE FOR AGRICULTURE

AGR/CA/APM(2006)14/ADD1
Unclassified

Working Party on Agricultural Policies and Markets

TECHNICAL NOTE TO THE OECD STUDY OF AGRICULTURAL POLICIES IN MEXICO

English - Or. English

JT03214721

TECHNICAL NOTE TO THE OECD STUDY OF AGRICULTURAL POLICIES IN MEXICO

This note introduces data and model work that was conducted in preparation for the Mexico study as it relates to agricultural policies and, in particular, the chapters that address welfare and commodity market effects.

MODIFICATION OF POLICY EVALUATION MODEL (PEM)[1]

1. The Policy Evaluation Model (PEM) contains representations of six major agricultural commodity groups: wheat, coarse grains (including maize), oilseeds, rice, beef, and milk. For this study, dry edible beans (*frijol*) were added as a commodity in Mexico only. Other significant modifications involve separating subsistence maize production from the coarse grains aggregate, and elaborating on the use of purchased inputs of crop commodities and the representation of payments based on input use.

2. The addition of dry edible beans (hereafter, beans) into the model required the following information:

- Production, trade, and policy data from the PSE database. This is the same data source for all commodities in the model.

- Information related to the structure of market demand in the form of own- and cross-price demand elasticities. These parameters are taken from the Aglink beans model. Again, this is the usual source for these data.

- Information regarding land use in the production of beans. These data come from the FAO, the standard data source for this item in the model.

- Information regarding the relative factor intensity of owned and purchased inputs. This information comes from earlier studies and recent data from *Servicio de Información y Estadística* (SIAP).

3. Elasticities of demand used in the final demand functions of the model represent demand for the commodities for all uses other than those which are already represented in the model. That is, as demand for crops for production of concentrated feed used by milk and beef is part of the model structure, the demand elasticities for each crop must be determined with this feed demand held exogenous. Elasticities of demand are generated using the OECD Aglink model based on the current (2004) baseline and observing adjustment at the fifth year of the projection that model generates (Table A.1).[2]

1. For a more complete description of the PEM, the reader is directed to the document *The Six-Commodity PEM Model: Preliminary Results* [AGR/CA/APM(2005)30]. This note is primarily concerned with the modifications made to the model in carrying out the scenario analysis for this study.

2 The choice of lag reflects the different natures of the two models. Whereas PEM reflects a medium-term adjustment period, allowing most factors to shift, AGLINK assesses year-to-year responses.

Table A.1. Demand Elasticities for Mexico

		Change in price →							
		Wheat	**Coarse Grains**	**Oilseeds**	**Rice**	**Dry Beans**	**Fluid Milk**	**Mfg. Milk**	**Beef**
Change in quantity ↓	Wheat	**-0.620**	0.388	-0.004	0	0	0	0	0.010
	Coarse Grains	0.078	**-0.163**	0.007	0	0.054	0	0	0.019
	Oilseeds	0.001	0.054	**-0.493**	0	0	0	0	0.055
	Rice	0.029	0	0	**-0.040**	0	0	0	0
	Dry Beans	0	0	0	0	**-0.500**	0	0	0
	Fluid Milk	0	0.099	0	0	0	**-0.095**	0	0
	Mfg. Milk	0.002	0.035	0.016	0	0.000	-0.189	**-0.265**	0.047
	Beef	0.005	0.131	0.030	0	0.000	0	0	**-0.452**

Source : OECD Aglink model.

4. Factor share data were augmented with recent survey information from SIAP that provided information regarding farm costs on the basis of individual activities and purchased input use. These data were converted into standard PEM factor shares and combined with the existing factor share data regarding fixed costs (farm owned labour and land) (Table A.2). This process amounts to a disaggregation of the "other purchased inputs" cost category, which had previously been the largest cost item. Significantly, this resulted in hired labour becoming part of the cost structure of Mexican crop production in the model for the first time. Beans were added using the same INIFAP data for fixed factors as for the other commodities and the SIAP data for variable input use.

Table A.2. Factor Cost Shares for Mexico

	Wheat	**Coarse Grains**	**Oilseeds**	**Rice**	**Dry Beans**	**Milk**	**Beef**
Farm-owned Capital	0.13	0.17	0.09	0.28	0.26	0.18	0.21
Land	0.24	0.27	0.30	0.15	0.23	0.18	0.47
Cows	0	0	0	0	0	0.08	0.13
Hired Labour	0.04	0.04	0.03	0.11	0.03	0.06	0.02
Other Purchased Inputs	0.03	0.12	0.16	0.13	0.08	0.09	0.06
Concentrated Feeds	0	0	0	0	0	0.41	0.08
Chemicals	0.04	0.03	0.03	0.07	0.03	0	0.02
Energy	0.05	0.07	0.03	0.02	0.08	0	0.01
Fertiliser	0.16	0.11	0.08	0.07	0.07	0	0
Insurance	0.05	0.04	0.12	0	0.09	0	0
Irrigation	0.13	0.09	0.06	0.02	0.06	0	0
Interest	0.10	0.04	0.08	0.07	0.05	0	0
Machinery and Equipment	0.04	0.02	0.04	0.08	0.01	0	0

Source : OECD PEM model.

5. Allen elasticities of substitution are used to characterise the production technology and enter the factor demand equations for commodities. Those for milk and beef are all set at 0.15 with the exception of the substitution between land and feed, which is 0.5. (Table A.3). Elasticities of factor supply were reduced from base model values of 2.5 to 2.0 for all purchased inputs in order to have the yield response better match recent estimates.[3] Factor supply elasticities were left unchanged at 0.5 for other farm-owned factors

3. See Roman Keeney and Thomas Hertel (2006) *Analysis of Aggregate Yield Response for Major Grains and Oilseed Crops in Canada, Mexico, and The United States* report prepared for the OECD.

and cows. The elasticity of substitution between energy and irrigation was reduced to 0 under the hypothesis that these inputs are jointly used to provide irrigation water.

Table A.3. Elasticities of factor substitution for Mexico

		Among purchased inputs	Between energy and irrigation	Between land and other farm owned factors	Between land and purchased inputs	Between purchased and other farm owned	Between land and feed
Crops	Base	0.15	0	0.5	0.5	0.5	-
Milk and beef	Base	0.15	0	0.15	0.15	0.15	0.5

Source : OECD PEM model.

6. Land data comes from the FAOSTAT database maintained by the FAO. The most recent year available in that database was 2002, the values of which are maintained through 2004. Land for milk and beef is an aggregation of land for pasture and land for all other fodder crops (Table A.4). Subsistence maize is assumed to occupy a fixed amount of land (1 402 thousand hectares) in each year.

Table A.4. Land area by commodity

Thousand Hectares

	Wheat	Coarse Grains	Subsistence Maize	Oilseeds	Rice	Dry Beans	Milk	Beef	Other Arable	Misc.
1990	933	8 103	1 402	286	105	2 094	13 080	65 410	12 181	1 900
1991	984	7 283	1 402	342	85	1 989	12 956	66 034	13 015	1 900
1992	916	7 520	1 402	323	90	1 296	13 668	65 822	12 958	2 000
1993	878	7 208	1 402	238	59	1 874	13 479	66 511	13 925	2 000
1994	965	8 191	1 402	290	88	2 087	13 636	66 854	13 024	2 050
1995	929	8 259	1 402	135	78	2 040	13 796	67 094	13 406	2 100
1996	809	9 182	1 402	50	87	2 048	14 181	66 709	12 629	2 150
1997	772	8 186	1 402	123	113	1 615	14 107	66 783	13 312	2 400
1998	769	8 761	1 402	96	102	2 146	14 176	66 714	12 780	2 400
1999	652	7 952	1 402	83	83	1 709	14 690	66 200	13 638	2 500
2000	708	7 943	1 402	80	84	1 503	14 756	66 234	13 593	2 500
2001	687	8 693	1 402	83	53	1 699	14 717	66 273	12 891	2 500
2002	635	7 787	1 402	67	50	2 054	14 910	66 080	13 869	2 500
2003	635	7 787	1 402	67	50	1 948	14 910	66 080	13 869	2 500
2004	635	7 787	1 402	67	50	1 948	14 910	66 080	13 869	2 500

Source : OECD PEM model.

7. Subsistence production is taken to be a fixed 17% of maize production.[4] Maize represents the majority, but not all, of the coarse grains aggregate, which also includes barley and sorghum. Specifically, 17% of maize translates to between 11% and 14% of total coarse grains, depending on the year.

8. The approach to payments based on input in the standard version of the model is to take the total value of these payments and apply it to a subset of purchased inputs in such a manner that each input sees the same rate of support. That is, a single level of input support and a single rate of input support applies

4. A discussion of this and the assumption regarding subsistence land appears later in this technical note.

commonly to all commodities for which those inputs are used. All purchased (variable) factors are assumed to receive input support, except fertiliser and hired labour.

9. In this case, the disaggregated input support data from the Mexico PSE data were used, such that the rate of input support varies by both commodity and input. That is, each use of each input has its own level and associated rate of support, including fertiliser and hired labour. This allows the model to capture important changes in the composition of input support over the study period. For example, the replacement of fertiliser subsidies with energy subsidies between the start and end of the study period, or the dramatic decline in feed subsidies, which were themselves a response to high MPS for feed grains in the early years of the study period (Table A.5).

Table A.5. Total support by input

USD millions

	Hired labour	Chemicals	Energy	Fertiliser	Animal feed	Irrigation	Interest	Insurance	Machinery and Equipment	Other Purchased
1990	0	0	0	0	408	159	0	0	2	0
1991	0	1	0	105	61	143	110	134	1	199
1992	0	2	0	111	55	118	88	0	0	76
1993	0	3	0	59	279	89	112	6	0	88
1994	0	4	0	0	274	119	106	6	0	81
1995	0	5	0	0	91	72	119	13	0	96
1996	0	6	0	4	6	170	61	7	0	38
1997	15	7	0	0	3	4	56	7	0	36
1998	17	8	0	0	1	2	27	6	0	35
1999	25	9	0	0	0	5	7	8	0	32
2000	21	10	0	0	0	7	12	6	0	39
2001	23	11	67	0	0	18	13	8	0	31
2002	20	12	87	0	0	10	3	8	0	36
2003	7	13	93	0	0	21	3	7	0	14
2004	0	14	94	0	0	15	5	6	0	23

Source : OECD PSE database.

AGLINK CONTRIBUTION

1. Background information on the AGLINK model

11. AGLINK is a dynamic supply-demand model of world agriculture developed by OECD in close co-operation with member countries. It is a "partial equilibrium" model for the main OECD agricultural commodity markets: wheat, coarse grains, rice, oilseeds, oilseed meals and oils, dairy products, milk, meat and eggs relative to supply, consumption and prices. Non-agricultural markets are not modelled and are treated exogenously to the model. The model focuses on the potential influence of agricultural policy on agricultural markets. All past analysis with this model has been forward-looking, to assess the effects in the medium-term future.

12. The AGLINK model consists of complete modules for most OECD members and for four non-OECD members (Argentina, China, Russia and Brazil). It is completed by the COSIMO model developed by the FAO for non-AGLINK countries. At the global level, AGLINK simulates market determination of equilibrium prices for most of its commodities, and for which it is assumed that a market price must be adjusted to equate exactly total demand to total supply. In countries where policies sever the link to world commodity markets, domestic price-clearing is the norm. Typically, however, domestic price movements follow world prices, taking into account explicitly exchange rates and border measures, and implicitly transportation costs and quality differences.

2. AGLINK contribution to Chapter 3 of the Mexican study

13. For the Mexican module of AGLINK several changes and improvements were made to obtain a better representation of the Mexican agricultural sector for the period 1990-2005. In the analysis, the Mexican agricultural sector is considered specifically, with the rest of the world being exogenous. The rest of the world impacts the Mexican module through historical values of world prices and key macroeconomic variables.

14. The module was calibrated and solved over the period 1992-2005.[5] However, since most policy changes occurred from 1995, it was decided to focus on impacts as they occurred from 1995. Five alternative scenarios were defined and used to estimate the effects of each of the main policy changes on commodity markets. The results presented in chapter 4 focus on two main types of commodities: crops (maize, beans and wheat), animal products (beef and pork), and on the following key market determinants: production, trade, consumption, and prices.[6]

---

5 This backward-looking analysis represents a significant innovation relative to the more limited historical use of this analytical tool for forward-looking assessments. Analysis is usually conducted in a two step process: a baseline is generated, then policy changes are simulated by changing certain assumptions and simulating new market outcomes. Here, historical data show what outcome in commodity markets was realised by the policy changes – and other factors that affect markets – so the scenarios consist of hypothetically continuing the policy regime of the early 1990s. These exercise are theoretically equivalent.

6 The representation of dairy, poultry and egg markets in AGLINK is sufficient to measure their response to external factors, such as feed prices, but are not adequate for the ambitious policy analysis undertaken in this chapter. Thus, they are excluded. The OECD's sugar model was not adapted for this analysis.

3. Improvements to the AGLINK Mexican module

15. Special attention was given to improving the representation of agricultural policies on the different commodity markets. Given that beans are part of the traditional Mexican diet, the beans sector was added to the commodities present in the Mexican module. The barley sector was also added. Finally, as small farms continue to be prevalent in Mexico, subsistence maize production and consumption were also included.

16. A literature review was undertaken to provide new production costs information and new elasticities. The information obtained was used to re-estimate some of the elasticities and to recalibrate the module over the period 1992-2005. The improvements to the module are presented below.

Representation of policies in place for the period 1990-2005

17. The policy coverage of the Mexican module of the AGLINK model has also been substantially improved. The main payments modelled in the Mexican module are PROCAMPO payments, payments provided by ASERCA under the Marketing Support Program and output support schemes, namely Target Price and Target Income, and CONASUPO consumer subsidies. Details on these programs can be found in Chapter 2 of the main text of the report. The trade policies and the market price support system in place in Mexico are presented in Table A.6.

Table A.6. Trade policies and the system of Guaranteed and Concerted prices in Mexico

		which product
BEFORE 1994	Import licences	Wheat, Maize, Bean, Barley, Cheese, Beef (until 1988), Poultry, Eggs, Soybean (until 1988), Milk powder
	tariffs for some products	Sorghum (seasonal), Rice, Soybean (seasonal), Beef, Pigmeat, Poultry, Eggs, Butter
AFTER 1994	Import licences replaced	
	-by Non-quota tariffs	Wheat, Soybean, Soybean meal, Cheese, Butter, Beef
	-by TRQ and tariffs:	Maize, Bean, Barley, Milk powder, Pigmeat, Poultry, Eggs
	In-quota tariffs are generally equal to zero or very low	
	Tariffs and TRQs are gradually phased out by 2003	Wheat, Barley, Rice, Soybean, Soybean meal, Butter, Cheese, Pigmeat, Poultry, Eggs, Beef (0)
	or 2008	Maize, Bean, Milk Powder

		which product
UP TO 1989	Guaranteed prices	maize, beans, wheat, barley, sorghum, rice, soybeans and other oilseeds
1989	Guaranteed prices removed	wheat, malt barley, sorghum, rice, soybeans and other oilseeds
	replaced by Concerted prices	wheat, sorghum (only for Tamaulipas State), rice, soybeans and other oilseeds

18. The PROCAMPO payment, first allocated in 1994, is classified as a payment based on historical entitlement according to the current PSE classification. In the model – as in fact – these payments are associated with wheat, barley, maize, sorghum, rice, sunflower, soybean and beans, although other eligible uses exist such as pasture area and approved environmental use. For each crop, a share of the total PROCAMPO payment per hectare is allocated according to the decoupling parameter given in "the transfer efficiency and trade effects of direct payments" (Dewbre *et al*., 2001).[7] It enters the model as a net gain through the area planted equations for each commodity. Choices in terms of area planted, and thus production, are directly related to past returns per hectare plus the marginal effect of PROCAMPO payment per hectare expressed in real terms.

$$\ln(AH_t^i) = a^i$$
$$+ b^i * \ln(RH_{t-1}^i / CPCI_{t-1} + 0.15 * AP..HA_t^i / CPCI_t)$$
$$+ c^{ij} * \ln(RH_{t-1}^j / CPCI_{t-1})$$
$$+ d^i * \ln(AH_{t-1}^i + AH_{t-2}^i + AH_{t-3}^i / 3)$$

with:

AH^i_t	Commodity i area harvested
$AP..HA^i$	PROCAMPO payment per hectare
RH^i	Commodity i return per hectare
CPCI	Crop-commodity product cost index
a^i , b^i , d^i	Constant and slope parameters in the functional relationship between commodity i area harvested and commodity i return per hectare, area payment or lagged area harvested
c^{ij}	Slope parameter in the functional relationship between commodity i area harvested and other commodities j return per hectare
t	Time index
i, j	Commodity index

19. For the period 1990-2005, consumer subsidies concern maize, beans and milk powder, including CONASUPO subsidies. Payments were stopped in 1999 for beans and in 2003 for maize. Consumer subsidies are modelled as an amount per ton of the payment which is subtracted from the producer price used in consumption equations for coarse grains, wheat and beans.[8] Concerning milk powder, the consumer subsidy enters the equations as a determinant for milk powder imports and for fluid milk consumption. It is modelled as followed for beans:

7. As stated in Chapter 3, it is important to note the problem of allocating payments based on historical entitlement to specific commodities.

8 Consumer demand is represented as a function of the farm-level price in AGLINK, so elasticities reflect actual consumer responsiveness and also the transmission of those prices to retail prices.

$$QC^i = a^i + b^i * \ln((PP^i - CS..TN^i)/CPI) + c^{ij} \ln((PP^j - CS..TN^j)/CPI) + d^i \ln(GDPI/POP) + \ln(POP)$$

with:

QC^i	Consumption of commodity i
PP^i	Producer price for commodity i
$CS..TN^i$	Consumer subsidy per ton for commodity i With $CS..TN^i = CS^i * 1000/QC^i$
CPI	Consumer price index
GDPI	Gross domestic product, volume index
POP	Population
a^i , b^i , d^i	Constant and slope parameters in the functional relationship between commodity i consumption and commodity i producer price, consumer subsidy per ton and real income (GDPI)
c^{ij}	Slope parameter in the functional relationship between commodity i consumption and other commodities j producer price and consumer subsidy per ton
i, j	Commodity index

20. Payments under the Marketing Support Program have been provided by ASERCA until 2000 to the first buyers of many crops contingent on their paying a price to producers of at least a certain level. In the model, these payments are associated with wheat, sorghum and maize. Marketing support payments for these commodities are modelled as an amount per ton of the payment which is subtracted from the producer price used in food and feed consumption equations for maize, wheat and sorghum.[9]

21. The Target Price and Target Income payments provided by ASERCA are also represented in the model. Of the commodities in the model, the payments are directed towards maize, wheat, barley, sorghum, soybean, sunflower and rapeseeds. It is modelled for each crop through an effective producer price that equals the producer price plus the equivalent payment per ton. This effective price is used to calculate the return per hectare.

$$EPP^i = PP^i + DP^i / QP^i * 1000$$

[9] In modelling terms, the representation of Marketing Support payments is equivalent to the representation of consumer subsidies presented before.

with:

EPP^i	Effective producer price for commodity i
PP^i	Producer price for commodity i
DP^i	Target Price or Target Income program payment for commodity i
QP^i	Production of commodity i
i	Commodity index

Inclusion of beans

22. Beans are an important staple of the Mexican diet. It became apparent that AGLINK commodity coverage was incomplete as the bean sector was not represented. Beans were thus included in the Mexican module. Equations were constructed using the same modelling approach as for maize.

Subsistence agriculture

23. Maize equations were reviewed to reflect the fact that a substantial proportion of maize production is not entering the market.[10]

Technical implementation of the scenarios

24. Choices had to be made concerning how to implement the "No Reform" scenario, especially for policies that have been gradually reduced or suppressed. This is the case for the continuation of the system of market price support with tariffs, import quotas, and guaranteed or concerted prices used to maintain domestic prices above world prices and for the continuation of CONASUPO consumer subsidies.

25. The technical choices made are presented below.

Continuation of the system of market price support with tariffs, import quotas and guaranteed or concerted prices used to maintain domestic prices above world prices

26. In 1990-1994, the market price support, either through tariff and import quotas or through guaranteed and concerted prices, was at its highest level. It was decided to maintain the prices at their average 1990-1994 level in real terms for the rest of the period.

Continuation of the system of CONASUPO consumer subsidies

27. Consumer subsidies have been in place for a long time in Mexico, with a transition period beginning in 1996: for some commodities consumer subsidies were kept at high levels for a few years, for others they were gradually removed.

28. The assumption behind the continuation of CONASUPO consumer subsidies has been to keep consumer subsidies for all commodities at their average levels in real terms for the rest of the period.

[10] Data on subsistence agriculture in Mexico are discussed in the next section.

SUBSISTENCE AGRICULTURE DATA

General Outline

29. The objective of this exercise is to calculate a share of area planted to maize and maize production that is considered as subsistence for the models. For this purpose, subsistence is not equivalent to the amount of their own output that farm families consume. For the economic models used here, the distinction is one of responsiveness to prices or, defined carefully, participation in the market. If the producer is likely to value the opportunity cost of any of their own output that the family uses at the market price, then the operation is not best characterised as subsistence in these economic models. Taking an extreme example, a commercial livestock operation that raises some of the maize that the animals consume is not a subsistence farm, even though it may consume all the maize it produces. Turning to a less extreme example, a small operation that consumes a moderate portion of its own maize but sells most of its production is very likely to be responsive to market prices. The question, then, is whether past research or official data provide a clear indication of the number of subsistence farms by this definition.

Literature

30. The GAO report on International Trade (2005) defines subsistence agriculture as agricultural production that provides for the basic needs of the farmer without surpluses for marketing. The study finds subsistence farmers producing corn in small parcels of less than 5 hectares of mostly rain-fed land. Medium size farmers are more commercial-oriented. The GAO report states that around 75% of all Mexican agricultural producers have farms of less than 5 hectares. According to Mexican government data (no source specified), around 85% of corn producers have farms of fewer than 5 hectares.

31. Romero and Puyana (2004) find that subsistence farmers represented around 72% of the total agriculture producers in Mexico (for the 1970s, but this figure might have changed over the years). When considering the effects on the rural population, they find a detrimental effect, even for subsistence farmers.

32. Henriques and Patel (2003) state that subsistence farmers account for 45% of all corn growing units in Mexico, and production for household consumption represents 38% of all corn growing in Mexico.[11] They operate under inferior conditions with poor quality rain-fed soil, slopping terrain, irregular rainfall, and little if any access to technology, credit, storage facilities and marketing channels. *Ejidiarios* may be part of this group, and 41% of them are believed to sell part of their production (INEGI, 1994), whereas the rest is destined to household consumption.

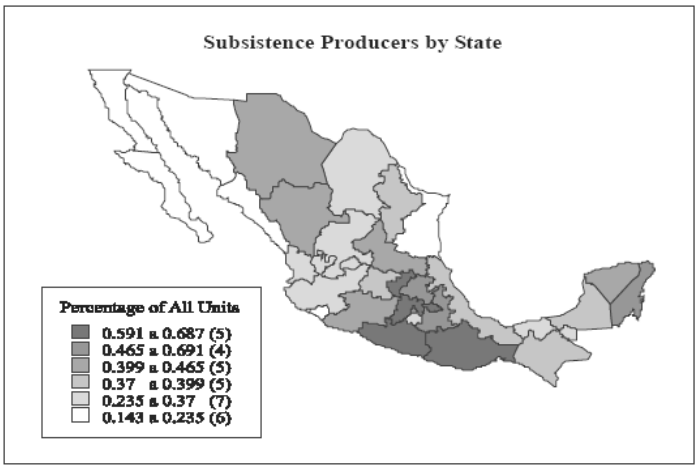
33. According to Nadal (2000) 40% of corn producers are subsistence producers, operating under difficult conditions (soil, sloping terrain, rainfall, small landholding, etc.). This study asserts that the response of subsistence farmers to price reductions has been to maintain and even expand the area of corn cultivation. For subsistence producers, it is still less costly to grow corn for consumption, than to buy it at the local market. Imperfections in the market (concretely, monopolistic behavior) have prevented consumers from a 50% cut in corn prices. Nadal stresses the income needs of subsistence farmers, such that income has to be derived from off-farm activities or petty corn sales between harvests. Petty corn sales

11. Information quoted from the National Institute of Statistics INEGI (1994).

is not optimal for subsistence farmers, since they are forced to sell right after harvest, when supply is greatest and prices are low. In contrast, when acquiring corn to meet family needs, prices tend to be higher in the periods between harvests. The practice is detrimental to farmers, but needed to meet short term financial constraints. Subsistence farmers are one of the most vulnerable economic agents in the Mexican economy, as confirmed in a recent survey of social indicators (*Instituto Nacional de Nutricion* 1997). The report suggests that corn price reduction (40% drop between 1996 and 2000) has driven farmers to produce mainly for household consumption and to increase production levels. In general, they do not have the capacity to convert to other crop types or alternative land uses, given the poorness of land and shallow soils. Nadal stresses that subsistence production does not translate into self-sufficient household economies. Growing corn is a strategy to avoid high costs involved in local markets. Although it is not the primary purpose of production, a small surplus output may be generated for market sales.

34. According to Nadal (2000), subsistence producers are concentrated in the southern and central states, and approximately 68% of all growing units belong to subsistence producers (Figure A.1). Units smaller than 5 hectares – the author's chosen definition – are common in these states. The number of hectares per household needed to meet subsistence needs in corn has been calculated in the report, by up to 1.33 hectares per household in the lowland zone and up to 4 hectares per household in the upland zone).

Figure A.1. Subsistence producers by state



Source: Author's calculations based on National Agricultural and Livestock Census, 1991.

35. De Grammont (2003) finds that firms controlling more than 1 000 hectares represent 0.3% of the total production units but account for 45.6% of Mexico's total agricultural and managed-forest land. Farms in the commercial sector that operate on 5–20 hectares comprise 31% of the total number of production units and 13.8% of the farm area, and the average size of such operations is 10.6 hectares. In other words, the non-commercial, semi-commercial and small-commercial (farms 5–20 hectares) account for 90% of the total production units but control 19.2% of the production area in the agricultural Mexican sector. Brush and Chauvet (2004) distinguish between non-commercial, semi-commercial and commercial producers, in order to better assess the impact of agriculture policies. These categories would be then equivalent to "traditional", "subsistence" and "entrepreneurial". They use the following classification for farms, according to farm size.

Official data

Table A.8. Farm Types In Mexico

Category	Non-commercial	Semi-commercial	Small commercial	Large commercial
<2 hectares	<2 hectares	2–5 hectares	5-20 hectares	>20 hectares
Number of farms[a]	1,305,345	958,338	1,193,865	365,515
Percent of total farms (1991)[a]	34	25	31	10
Percent of total farm area[a]	1.6	3.8	13.8	79.2
Average farm size[a] (ha)	1.1	3.6	10.6	202.1
Production Objective	Home consumption and limited market	Home/Market consumption and market	Market	Market
Seed Supply system	Local and informal	Local and informal	Informal and formal	Informal and formal
Purchased input use	Limited	Limited	Moderated to high	Moderate to high
Irrigation access	Limited	Limited	Moderate to high	Moderate to high

36. According to an agriculture survey from INEGI (1991)[12] maize producers divide in two large groups, depending on farm size.

Table A9. Farm Size and Production (De Ita 2000)

Group	Small farms	Non small farms
Farm Size	<5 ha	> 5 ha
% of all producers	92	
% of the maize area	67	
% of total production	56.4	43.5
% Production destined to consumption	52	13.6
Yields t/ha	1.3 to 1.8	1.8 to 3.2

Source: SARH-DGE 1991 *Encuesta Nacional de Costos, Coeficientes Técnicos y Rendimientos de la Producción Agrícola. Mexico* (Fristcher, M. 1999).

12. SARH-DGE 1991 *Encuesta Nacional de Costos, Coeficientes Técnicos y Rendimientos de la Producción Agrícola. México*, cited by Fritscher 1999; de Ita 2000.

Conclusion

37. There is no clear indication of the amount of subsistence area and production. Past literature tends to define subsistence farms based either on size or on own-consumption share. Official data are not only old, reflecting the absence of any agricultural census since 1991, but also do not provide enough information to give a clear count of subsistence area and production. Of course, one other reason for the difficulty of finding these data is that they move from easily observed facts, such as the share of own-consumption, to the less accessible concept of response to prices and ability to participate in markets.

38. An estimate is required, notwithstanding the limited relevance of most literature surveyed and the age of official data. The production for consumption and for sales is calculated. Having the units of production and the quantities intended for sale, the percentage of production for sales and for consumption is calculated.

Table A10. Production and Sale of Maize by Farm Size

Name	Farm size	Producers (%)	Production		Sales		Consumption	
			Tons ('000)	%	Tons ('000)	%	Tons ('000)	%
a	0–1	39. 7	1161	10.4	209	18	952	82.0
b	1–2	26.9	1520	13.6	574.6	37.8	945.4	62.2
c	2–5	25.5	3630	32.5	2276	62.7	1354	37.3
d	5–10	6.2	2511	22.5	2089	83.2	422	16.8
e	10–20	1.3	1341	12	1174.7	87.6	166.3	12.4
f	> 20	0.4	1011	9	963.5	95.3	47.5	4.7
	TOTAL	100	11174	100	7287	65.2	3887	34.8
	Farms from 0 to 2 ha (a+b+c)		2681	24.0	783.6	10.8	1897.4	48.8

Source: SARH-DGE 1991 Encuesta Nacional de Costos, Coeficientes Técnicos y Rendimientos de la Producción Agrícola. México (Fristcher, M. 1999)

39. An approximate for subsistence (in 1991) can be calculated as follows. Considering subsistence concerns only the share of own-consumption among farms with less than 2 hectares, we find the subsistence percentage as the ratio between consumption (for these farms) and total production. This is:

Per cent subsistence for the model 1897/11174 = 17%

Farms with more than 2-5 hectares have a share of own-consumption of 37%, and the shares are much lower for larger farms. These quantities of own-consumption are ignored: the assumption is that these operations respond to price signals and likely participate in the market.

40. 17% of the Mexican maize production in 1991 was not marketed and thus not directly available to consumers. This quantity of production is used to estimate the area on which subsistence production of maize is grown, based on an estimate of yields per small farm. It is assumed that this subsistence area remains constant over the period 1990-2005. Using the historical national rate of growth of maize yield from 1990 to 2005, it was possible to infer the evolution of maize subsistence production and consumption in Mexico (production is the product of fixed area and changing yield). This information was used to provide estimates of area used for subsistence maize farming and a corresponding production volume over the simulation periods of both PEM and AGLINK models.

Preliminary References

Nadal, A. The Environmental and Social Impacts of Economic Liberalization on Corn Production in Mexico, study commissioned by Oxfam Great Britain and the World Wildlife Fund International, September 2000.

GAO. Report to the Chairman, Committee on Finance, U.S. Senate on International Trade.

Lederman, D. ,Maloney, W. and Luis Serven. Lessons from NAFTA for Latin American and Caribbean (LAC) Countries: A Summary of Research Findings, Office of the Chief Economist for Latin American and Caribbean, the World Bank, December 2003, advance edition.

Evaluación integral de los impactos e instrumentación del capítulo agropecuario del

TLCAN (Comprehensive Evaluation of the Impact and Implementation of NAFTA's

Agricultural Chapter), El Colegio de México, Universidad Autónoma de Chapingo, and

Facultad Latinoamericana de Ciencias Sociales, April 2004.

Romero, J. and Puyana, A. Evaluacion Integral de los Impactos e instrumentación del capitulo Agropecuario del Tratado de Libre Comercio. 2004.

D. Ingco, and Nash, J.D., Edt. (2004), *Agriculture and the WTO. Creating a Trading System for Development,*World Bank, Washington.

Collier, George A. "Búsqueda de alimentos y búsqueda de dinero: cambios en las relaciones de producción en Zinacantán, Chiapas" in Reestructuración económica y subsistencia rural. El maís y la crisis de los ochenta (Cynthia Hewitt de Alcántara, editor). México: El Colegio de México y Centro Tepoztlán. pp. 183-221. 1992.

García Barrios, R., L. García Barrios. "Subsistencia maicera y dependencia monetaria en el agro semiproletarizado: una comunidad rural mixteca", in Hewitt de Alcántara pp. 223-270. 1992

Alcantara, H. 1992.Reestructuración económica y subsistencia rural. El maíz y la crisis de los ochenta. México: El Colegio de México.

Brush, S. and Chauvet, M. Assessment of Social and Cultural Effects Associated with Transgenic Maize Production. Article 13 Initative on Maize and Biodiversity. Secretariat of the Commission for Environmental Cooperation of North America. 2004.

Appendini, K. 1994.Transforming food policy for over a decade: The balance for Mexican corn farmers in 1993. In Corn and the Crisis of the 1980s: Economic Restructuring and Rural Subsistence in Mexico, Transformation of Rural Mexico, No. 2, C. Hewitt de Alcántara, ed., 145-160. San Diego: Center for U.S.-Mexican Studies, UCSD

De Grammont, H. 2003. The agricultural sector and rural development in Mexico: consequences of economic globalization. In Confronting Development: Assessing Mexico's Economic and Social Policy Challenges, K. J. Middlebrook and E. Zepeda, eds., 350-381. Stanford, CA: Stanford University Press.

De Ita, A. 2000. Atrás de la cortina de Nopal: una visión desde el lado de los perdedores In Impacto del TLCAN en el sector agroalimentario Cámara de Diputados LVII Legislatura, Comisión de Agricultura, 3-93. Ed. UACH, CECAM y CIESTAAM.