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ECONOMICS OF MARGINALIZED PEASANTRY OF MEXICO

Economics of the Marginalized Peasantry of Mexico

1. Introduction.

Questions related to the economic behavior of marginalized subsistence peasant corn producers in Mexico although raised, have only been partially answered by recent research. In fact, no explanation of why peasants continue growing corn when, according to official data, its market price is lower than their production costs. Why haven't they all migrated to urban areas leaving the countryside abandoned? Do they behave irrationally? If not, what are the economic relations that determine their behavioral patterns? Will the North American Free Trade Agreement (NAFTA) push them to migrate, or will they not be affected? If they are forced out, how many, and in what year? For all of these questions, how is the marginalized peasant to be economically characterized both for production and consumption using the household as the unit of analysis?

A good deal of recent research on Mexican agriculture has focused on measuring NAFTA's derived effects on these questions, using two basic approaches and aggregation levels: i) a partial equilibrium model directed toward specific questions or specific agricultural goods or commodities, as for example in estimations of producer and consumer subsidy equivalents;[1] ii) as a sector within computable general equilibrium models (CGEM), having more or less emphasis on the agricultural sector. [2] Within this group two works, among others, are closely related to this paper addressing some questions raised above.

The work by Levy and Wijnberger that, under NAFTA and within a CGEM environment, analyzes the whole corn subsector dividing the plantings in two areas: irrigated, and rainfed. They assume that subsistence producers are located on rainfed soils, grow only corn and with farms not bigger than 5 hectares. These are strong assumptions, for as will be shown, marginalized peasants own at most two hectares, corn has byproducts, and corn and beans in common practice tend to be jointly produced.

Levy and Wijnberger's main conclusion is that an immediate liberalization of corn from product and input subsidies and import controls would produce the highest gain (0.6% per year) in gross domestic product (GDP), and biggest rural out-migration (700,000 workers). If liberalization were to be gradual, gains would be 0.4% in GDP, and out-migration would be distributed over a period of 5 years. In this analysis, gainers are consumers, taxpayers and government, while losers are those corn growers who are not net corn buyers.

At the other extreme, there is the work by Taylor that used a village's CGEM with the following assumptions: production is composed of staples, livestock, and non-agricultural products; subsistence farm households own less than two hectares of land, a middle group owns two to eight hectares of land, and larger households have more than eight hectares of land. Within this analysis the guaranteed price of corn is reduced by 40 %, while at the same time transferring an equivalent income payment to corn producing households, if direct subsidies to both producers and consumers of the maize are set at zero, and if transaction costs are included, a number of his findings are relevant to this study. Taylor shows that under these conditions household production is reduced by no more than 1.6 percent, while income is increased by 2.8 percent for the subsistence households. Migration is reduced by 2.5 percent in contrast to Levy's estimations, and leisure time for the peasant family increases by 3.6 percent.

The differences in conclusions of these two studies in part derive from their differences in basic assumptions -- the nature of the product-mix, the use of direct income transfers, and the size of land resource base. In the analysis here being reported, when the marginalized peasant produces only corn, and with the kinds of markets specified under the NAFTA, the results, as will be shown later, indicate that the peasantry will cease to produce more or less in the period 1997 - 2000; this corresponds approximately with the conclusion of Levy when he provided for a gradual opening-up of Mexican domestic corn markets. However, when I allowed for the more commonly observed conditions with the subsistence peasant farmers jointly producing corn and beans, the results show them continuing to stay in agriculture through the last year modeled in the analysis (2003). This result contradicts that of Levy and approximates that of Taylor: the greater the variety of products being produced, the lesser the effect of corn price on the viability of the marginalized peasant as a participant in the farmer economy. There are two further differences which can be noted here. My results indicate that when only corn is being produced, the smallest peasant producers cease cultivation in the same year with or without a program of direct income transfers; this suggests an efficient resource allocation, and contrasts with Levy's interpretation. The results also show that the peasant farmers, when they grow both corn and beans, continue to maintain about the same allocation to these commodities, which is a result apparently in contrast to Taylor's with his showing a drop in corn production. However, his results are for all producers as a group and where there is opportunity to produce a variety of agricultural and non-agricultural products. A significant limitation to this assumption is that it cannot really apply to the marginalized peasantry; if they had these alternatives, they would not be marginalized.

Not related to NAFTA, but relevant to understanding the economic behavior of the marginalized peasantry is a case study on a small village. The question of why these farmers cultivate corn even at high costs relative to market prices, and why their production is more or less stable are answered on cultural and anthropological bases, which makes it rather difficult to compare with the present paper. [3]

Other studies are in progress such as the one which applies the Policy Analysis Matrix. This is a partial equilibrium approach, rather different to those cited earlier. In addition since the work is not yet completed, their results remain to be seen.[4]

2. Tasks and objectives.

The main purposes of this paper are to characterize the nature of production of corn and beans for the marginalized producers both from the economic and technological points of view, as well as to rationalize family consumption patterns from the nutrient properties of their foods. In section 3, I analyze the relationship between technological packages, both actual and potential, with derived corn yields as a function of the marginalized producer's land acreage. In order to dimension the size of the targeted population group, there is an estimation of the number of farmers with their households that should be considered as marginalized. The production side is rounded out by reporting the most common inputs and factors used in production and why these are selected. The analysis specifies the peasantry's production mode.

Section 3 also includes the characterization of household consumption in terms of calorie, vitamin, protein and mineral intakes and how these compare to those recommended by the National Institute of Nutrition of Mexico. The analysis offers a priori answers of why these peasant household food baskets are composed of corn, beans, and chili and other vegetables.

A second task is the building of a behavioral model (in section 4) of the marginalized peasant household economy developed from the discussion in section 3. It is a Neo-Malthusian one, combined with activity analysis of consumption of Lancaster's type. Assumptions and properties of the model are specified. It is appropriate to note that the household is the unit of analysis, both as producer and consumer.

A third element of this study is the calibration of the model using relevant data, and generating simulations for several scenarios, including those of NAFTA. Here, most of the questions introduced at the beginning are addressed. In fact, the answers generated from the model constitute the basic objective of this work. They are presented under the heading of results in section 5. Section 6 specifies the conclusions and gives the policy interpretation of the main findings.

3. Economic and technological patterns of corn production.

3.1 Technology and potential yields.

The National Forestry, Agricultural and Livestock Research Institute (INIFAP) has classified cultivable land according to humidity regimes into five classes: (1) gravity irrigated, (2) pump irrigated; and rainfed in three categories, (3) good natural rainfall, (4) inadequate rainfall, and (5) relatively poor rainfall. Marginalized peasant lands fall into the fourth and fifth classes.[5]

Using 31 explanatory variables and a statistical model, the Secretariat of Agriculture and Water Resources of Mexico (SARH), INIFAP and the Colegio de Postgraduados (CP, Postgraduate School) have shown that the fourth and fifth land class areas: i) have low potentiality to produce other agricultural products different from corn, because either there is no disposable technology, or yields are too low including those of maize and beans, making production unfeasible. Among the variables considered, one can mention: humidity, transevaporation, soil types, rainfall, irrigation, temperatures, and land slope; ii) demonstrate no significant differences in corn yields derived from the alternative technological packages utilized, even those especially designed according for the agro-ecologic regional and soil conditions. It follows that changes in seed quality, input mix, use of machinery, etc. do not statistically modify corn and bean yields, but they do affect production costs. [6] Under these circumstances traditional technology is the one with the relatively lowest mean cost among the relevant technologies, and it is hardly challenged by any of the alternative technological packages. One can expect corn to continue to be produced utilizing the traditional technology as long as the mean cost imputed to produce grain -- net of byproduct costs, considering them as recuperations utilized to feed farm animals -- does not exceed its market price, recognizing that production costs move according to the market prices of inputs.

3.2 Land acreage and observed yields

According to an updated sample survey of corn farmers by the SARH, 67 percent of corn producers (1.6 million peasants) own less than two hectares. [7] Of these, 70 percent (1.12 million) producers, are located in inadequate and poor natural rainfall areas, according to SARH, INIFAP and CP's work . The other 500 thousand could improve their yields, and lower their mean production costs by applying known technological packages. Observed yields for those 1.12 million lesser advantaged peasants are in the ranged of from 0.48 tons/hectare to 1.2 tons/hectare, with a mean of .8 tons/hectare. This compares to the former better-off group's mean yield of 1.4 tons/hectare, and to the national yield of 2 tons/hectare. Cumulative land and production distribution for maize are presented in Table 1. The 67% of the two lowest subgroups is the segment of population targeted in this essay, those that I refer to as the marginalized peasantry. Other characteristics of this group will be specified.

3.3 Productive inputs and factors

Data developed by SARH, INIFAP, and CP spatially disaggregated by Rural Development Districts (DDR), which are sub-zones within states, show for the marginalized producers that the dominant actual and/or potential technologies combine the two traditional factors, land and labor, with minimal capital goods, and two direct inputs, seeds and fertilizer. Physical technological coefficients per hectare and per ton are shown in tables 2 and 3.

These tables define the technological possibilities, yields, productive inputs and factor mixes and allow estimating these producers' production function over time using a classical formulation with constant land yield (0.8 tons/hectare), a la Malthus, as explored earlier by Baumol . [8]

3.4 Income and consumption patterns.

A recent household income expenditure survey by the National Institute of Statistics, Geography and Information (INEGI) shows that the relative expenditures on corn to the total food ones by the lowest first and second rural income deciles are twice as much as the one representing the entire rural households.[9] Of course, as income rises the expenditure share on corn decreases. Data also shows the importance of corn relative expenditures by most of rural households -- from ith to vith decil -- (Table 4).

According to the Mexico's National Institute of Nutrition: i) actual consumption of rural low-income classes is far from the standardized nutritional requirements of calories and vitamins (Table 5), 30 percent and 80 percent below the minimum requirements, respectively, on average for the peasant family; ii) this segment of the population's current diet is based principally on four products: corn and its derivatives, beans, chili, and sugar. Their nutritional contents are shown in Table 6. [10]

This basket composition and corn consumption concentration share patterns leads one to suspect that feasible substitutes within the goods basket are of small relevance. Reasons for this may be that:

i) Marginal rates of substitution utility derived from the substitutes and goods actually consumed are quite small. It implies that a rather considerable decrease (increase) of substitutes' (traditional goods) prices would have to occur for the group to reduce traditional consumption goods. Or,

ii) This segment of peasantry has little knowledge of how to cook and prepare substitutes, such as bread from wheat, or that changes would require equipment whose costs of acquisition require cumulated savings, which is rarely available to them. Both possibilities mean that even if substitute prices are lower than that of corn (assuming that in the utility function tastes are equal for corn and noncorn), peasant's costs of cooking substitutes, --or of buying them in the market-- might more than compensate for price differences between traditional goods and substitutes. It also implies that the relevant prices for the peasant families are those of the whole meal and not just of the grain component. Or,

iii) These marginalized families are actually aware of the substitutes' nutritional properties, which happen to be lower in calories, calcium, and vitamins, and equivalent only in proteins (see table 5). One can hypothesize, using an activity analysis of consumption along the lines used by Lancaster and Deaton and Muellbauer , that family consumption is a) objectively efficient in satisfying nutritional requirements if relative prices in terms of corn were higher for the wheat meals; and b) that they are subjectively efficient in choosing their traditional goods, if those relative prices are close to one, given their tastes and cultural background. [11]

4. A behavioral model and its properties

The smallest peasant farm only produce corn and its secondary products and occasionally beans. For these farmers the following model is proposed to represent the economics of the marginalized peasantry.

4.1 Assumptions

The Model assumes the population growth rate as an endogenous variable relating actual and past population in a first difference equation as in recent Neo-Malthusian dynamic models.[12] Technology, for the marginalized peasant as discussed above, is unique with fixed technological coefficients of production as in Ricardian production functions. [13] Given that one wants to analyze what could happen if peasant farmers grow corn and beans (as seems to be a frequent case), it is considered that both products are jointly produced. Because of the soil and agro-ecologic conditions already discussed, yields for both products are quite low. (the observed ones). Following the argument of Schultz, peasant production is efficient[14]; and I propose that consumption is as well, assuming that the utility function of the peasant family is separable by subutilities, with the one corresponding to food being linearly explained by the technological properties or nutritional characteristics of alternative goods. Following Malthus and Marx, food costs, and by extension housing costs, enter as costs of reproducing the labor force (the unit of analysis). [15] The smallest farm producers are assumed to be price takers both as sellers and buyers of inputs and factors and for consumption goods; however, they have a reservation expected wage for the cultivation of their own land that is situated between 0 - 100 percent of the market rural wage.

Corn market prices are assumed to equal the mean long-run international prices, including transaction costs and NAFTA conditions; while nominal prices of beans are assumed to increase little above the inflation rate during the period 1994-97, and then to keep constant for the remaining years of analysis 1998 - 2003, due to NAFTA import tariff structure, and to that beans is not a widely traded commodity as yet. [16]

4.2 Model for the marginalized peasantry

Under the above assumptions the model is specified as:

1... $\text{MAX } Y = P_m Q + PP_m q + P_f F + PP_f f + P_z Z - CA - CPROD$

Maximize net income = income from selling corn and beans in the market and to themselves (at production price), and from either labor or other products net value; less food costs and the production cost of corn and beans

Where Y = net income, Pm = corn market price, Q = amount of corn sold in the market, PPm = corn producer's price, q= amount of corn household consumed, Pf = beans market price, F = amount of beans sold in the market, PPf = beans production price, f = amount of beans household consumed, Pz = market price (or wages) of other goods (labor) sold by the peasant family, Z = amount of goods (labor), sold in the market, CA = food and housing costs, CPROD = production costs.

Subject to:

2... $CA = PP_m q + PP_f f + \Sigma_i X_i P_i + HC$

Food costs = consumption of corn and beans produced by the peasant family valued at producers price plus other foods costs, including corn and beans bought in the market, and housing cost

Where Xi = amount of consumer goods bought by the peasant family in the market, Pi their associated prices, and HC = housing costs.

3... $CPROD = PP_m M + PP_f B$

Corn and beans production direct costs valued at producer's prices. Where M = corn production, and B = beans production

Because of joint production, it is assumed that costs of inputs and factors, except for those of seeds and corn byproducts, are common to both. Therefore, mean costs to each one are:

4... $PP_m = \Sigma_i v_i d_{1i} + w d_2 + R d_3 + P_{seedm} d_{4m} - k_1 P_{rm}$

5... $PP_f = \Sigma_i v_i d_{1i} + w d_2 + R d_3 + P_{seedf} d_{4f}$

where $1/d_{1i} = (M+B)/I_i$, $1/d_2 = (M+B)/J_1$, $1/d_3 = (M+B)/T$,

$1/d_{4f} = M/Seed_f$, $1/d_{4m} = M/Seed_m$, $1/d_{3m} = M/T$, $1/d_{3f} = B/T$

Where d_{1i}=inverse physical yields or technical coefficients of inputs expressed in tons of input per ton of production (corn and beans). d_2, d_3, d_{4m}, d_{4f} = technical coefficient of labor, land, corn seeds, beans seeds, respectively. Seed prices, P_{seedm} and P_{seedf}, are either market or producer prices of corn and beans, whichever is lower. T is utilized land in hectares, I_i amount of inputs, J_1 labor work-days, w = wages, R = land rent, v_i = price of inputs. k_1 P_{rm} is the unit value of recuperations (corn byproducts), being k_1 the proportion of byproducts per ton of corn, and P_{rm} its market price or opportunity cost.

6... $M = q + Q$, which represents corn production and its allocation for household consumption and sale in the market.

7... $B = f + F$, which represents beans production and its allocation for household consumption and sale in the market.

8... $X^*_m = X_m + q$, total corn consumption (X^*_m) equals corn bought in the market plus farm produced consumption .

9... $X^*_f = X_f + f$, total beans consumption (X^*_f) equals beans bought in the market plus farm produced consumption.

10... $J \geq J_1 + J_2$, total labor supply is allocated to corn, and other goods production (work-days/household).

11... $RM = k_1 M$, quantity of corn byproducts.

12.. $Z P_z = k_2 J_2 P_z$, production of other goods or income from selling family labor in the market, including transportation cost: for example if $k_2 = 1$, transport costs are null, while if $k_2 = .5$, it takes 50% of wages ($P_z = w$). J_2 are the non agricultural work-days.

13... $J = m$ POB , labor supply as a proportion of household members in work-days per family.

14... $POB = (1 + r)POB_{-1}$, household size expressed in terms of itself lagged a period, and its net growth rate, r.

15... $T \leq T^*$, cultivated and disposable land.

16... $M = 1/d_{3m} T$, $B = 1/d_{3f} T$, quantity of corn and beans produced as specified by the Ricardian production functions.

4.3 Nutritional relations

The traditional basket of a typical marginalized family includes corn (X_m), chili and other vegetables (X_{ch}), beans (X_f), potatoes (X_{po}), and sugar (X_s). Bread and cooking oil might be added. Calories per kilogram of goods are represented by the C's, where subindexes stand for specific goods. Here, W_c represents the caloric value of the traditional goods basket per capita, and is expressed as:

17... $W_c = C_m X^*_m + C_{ch} X_{ch} + C_f X^*_f + C_{po} X_{po} + C_s X_s$.

Similarly, E stands for protein content per kilogram of a specific consumer good (subindex), while W_e equals the protein value of the traditional goods basket percapita, which is expressed as:

18... $W_e = E_m X^*_m + E_{ch} X_{ch} + E_f X^*_f + E_{po} X_{po} + E_s X_s$.

The vitamin value of the traditional goods basket percapita W_h is expressed as:

19... $W_h = H_m X^*_m + H_{ch} X_{ch} + H_f X^*_f + H_{po} X_{po} + H_s X_s$.

The H stands for vitamin content per kilogram of consumer good. As before, the subindex corresponds to a specific good.

The mineral value of the traditional goods basket percapita is:

20... $W_{mi} = L_m X^*_m + L_{ch} X_{ch} + L_f X^*_f + L_{po} X_{po} + L_s X_s$.

Where, W_{mi} is the mineral value of the traditional goods basket percapita, and L is the mineral content per kilogram of a specific consumer good (subindex).

For the family, the nutritional requirements are:

21...POB $W_c(.) \geq$ POB W^*_c ; household minimum caloric requirements.

22... POB $W_e(.) \geq$ POB W^*_e ; household minimum protein requirements.

23... POB $W_h(.) \geq$ POB W^*_h ; household minimum vitamin requirements.

24... POB $W_{mi}(.) \geq$ POB W^*_{mi} ; household minimum mineral requirements.

4.4 Properties

From the above expressions, the Lagrangian can be written as:

25... $LL = (P_m - PP_m) d_{3m} T + (P_f - PP_f) d_{3f} T - P_m q - P_f f + k_2 w J_2 - HC - [P_m X_m + P_{ch} X_{ch} + P_f X_f + P_{po} X_{po} + P_s X_s] - \{(1+r) POB_{-1}\}^* \{G_1[W^*_c - W_c()] + G_2[W^*_e - W_e()] + G_3[W^*_h - W_h()] + G_4[W^*_{mi} - W_{mi}()\} - G_5[T - T^*] - G_6 [J_1 + J_2 - m(1+r)POB_{-1}]$, where G1,...,G6 stand for the shadow prices -- Lagrange multipliers -- of calories, proteins, vitamins, minerals, land, and labor, respectively.

Applying the Kuhn - Tucker conditions [17] one gets, at the optimum:

4.4.1 For $T > 0$, $LL'_T = 0$: $G_5 = (P_m - PP_m) d_{3m} + (P_f - PP_f) d_{3f}$.

At the optimum, the shadow land rent equals the small farmers' profits of corn and beans, each one weighted by its yield.

For $T = 0$, $LL'_T \leq 0$: $G_5 \geq (P_m - PP_m) d_{3m} + (P_f - PP_f) d_{3f}$.

Land is not utilized when its shadow rent is lower than peasant's corn and beans profits, each one weighted by their yields.

4.4.2 For $q > 0$, $LL'_q = 0$: $PP_m = (1+r)POB_{-1} [G_1 C_m + G_2 E_m + G_3 H_m + G_4 L_m]$.

Marginalized household's corn (beans) production is consumed by the household if its producer price equals its nutritional characteristics per household, valued at their shadow prices.

For $q = 0$, $LL'_q \leq 0$: $PP_m \geq (1+r)POB_{-1} [G_1 C_m + G_2 E_m + G_3 H_m + G_4 L_m]$. Corn (beans) is not consumed by the household if its producer price is no lower than its nutritional characteristics per household, valued at their shadow prices.

4.4.3 For $X_m > 0$, $LL'_{Xm} = 0$: $P_m = (1+r)POB_{-1} [G_1 C_m + G_2 E_m + G_3 H_m + G_4 L_m]$.

Corn (beans) is bought in the market if its market price equals its nutritional characteristics per household, valued at their shadow prices.

For $X_m = 0$, $LL'_{Xm} \leq 0$: $P_m \geq (1+r)POB_{-1} [G_1 C_m + G_2 E_m + G_3 H_m + G_4 L_m]$.

Corn (beans) is not bought in the market if its market price is not lower than the optimal nutritional corn characteristics per household, valued at their shadow prices.

4.2.4 For $M > 0$, $LL'_M = 0$: $P_m = PP_m$

For corn (beans) to be produced, producer and market prices are equal to each other.

For $M = 0$, $LL'_M \leq 0$, or $PP_m \geq P_m$

No corn (beans) is produced if its producer price is not lower than its market price.

4.2.5 For $r > 0$, $LL'_r = 0$:

$m G_6 = G_1[W^*_c - W_c(.)] + G_2[W^*_e - W_e(.)] + G_3[W^*_h - W_h(.)] +$

$+ G_4[W^*_{mi} - W_{mi}(.)]$, or :

$m = (G_1/G_6)[W^*_c - W_c(.)] + (G_2/G_6)[W^*_E - W_E(.)] + G_3/G_6)[W^*_H +$

$- W_H(.)] + (G_4/G_6)[W^*_L - W_L(.)]$

For the family to grow, at the optimum, the labor supply parameter (m) should equal the sum of weighted relative shadow prices of nutritional basket components per unit of labor shadow price. Weights are excess nutritional requirements. Given that the relationship is homogeneous of zero degree, any relative rise (fall) of labor shadow price is compensated by an equal relative rise (fall) of the others shadow prices, objective substitution effect.

For $r = 0$, $LL'_r \leq 0$:

$m \leq (G_1/G_6)\,[W^*_c - W_c(.)] + (G_2/G_6)\,[W^*_E - W_E(.)] + (G_3/G_6)\,[W^*_H - W_H(.)] +$

$+(G_4/G_6)\,[W^*_L - W_L(.)]$.

For the family to remain of same size in its land, labor supply parameter (m) should not be greater than the sum of weighted relative shadow prices of nutritional basket components by unit of labor shadow price. Weights are excess nutritional requirements.

If $-1 < r < 0$, the inequality strictly holds, and the peasant family eventually abandons the land.

4.2.6 For $X_i > 0$, $LL'_{Xi} = 0$: $P_{Xi} = POB\,[G_1 C_i + G_2 E_i + G_3 H_i + G_4 L_i]$

For the i^{th} good of the peasant's food basket to be consumed, at the optimum, its market price must equal the household's value of its nutritional properties priced at their shadow prices.

For $X_i = 0$, $LL'_{Xi} \leq 0$: $P_i \geq POB\,[G_1 C_i + G_2 E_i + G_3 H_i + G_4 L_i]$.

For the i^{th} good of the peasant's food basket not to be consumed, at the optimum, its market price must be no lower than the household's value of its nutritional properties priced at their shadow prices.

5. Results.

Due to the own nature of the Kuhn-Tucker conditions, the properties already discussed do not offer numerical answers. So, I ran several experiments focused to answer the questions stated at the introduction, force des motifs of this paper, basically why the marginalized producer continues to grow maize, and when if ever he would abandon such activity, under several scenarios. Other answers offered by the model optimization which enrich the topic are reported too, such as both the peasant household's food basket composition and his net real income, as well as the shadow prices for nutritional contents, labor, and land.

Results were grouped in two sets: the first one based on the assumption that corn and byproducts is the only enterprise; the second introduces corn and beans to be jointly produced. For all the results, the settings for the period of analysis are: i) corn and beans real market prices, both, taken from SARH, INIFAP and CP --estimated in accordance with the NAFTA-- and shown in note 16; ii) constant values, during all the period of analysis, for both production costs in real terms, population growth rate and labor force share of total population; iii) two categories of labor -- one associated with the use of machinery which is skilled and does not include members of the households under analysis, the other non-skilled of the peasant households. Data used in the models are shown in tables 2, 3A, 3B, 4, and 5, and note 16.

Under the above settings, the model has been computed using the following controlled experiments, one at a time: 1) only the marginalized farmer's reservation wage varies considering three levels of reservation wages: 0, 50 and 100 percent of the rural market wage; 2) the peasant unit is given either a zero direct income transfer or a lump sum transfer, ceteris paribus, as to simulate the Mexico's Program of Direct Income Transfers (PROCAMPO) [18] -- I assume that the household unit is given real n$ 330 as the income transfer, that is not exactly what they will be getting permanently, but amounts at nominal prices the one per hectare announced by PROCAMPO during its transitional phase. The income transfer corresponding to the final phase has not been officially determined, as yet --; 3) the marginalized farmer is offered with two labor market locations, one reachable by foot with transportation costs are set to zero, the other located within a 50 mile radius with transportation costs by bus are set to real n$ 6; 4) the analysis permits the inclusion of a discount factor that, if constant, does not significantly alter the results.

5.1 Results when corn and its byproducts are the only peasant enterprise, (tables 7, 8 and 9).

5.1.1 The peasant household's reservation wage varies. Answers provided by the model are that the lower the reservation wage the longer time span the peasant unit will continue cultivating corn, other things being held constant. In fact, at 100 percent reservation wage, the poorest peasant stop producing corn by the year 1997; if reservation wage is zero, they stop production at the year 2000.

5.1.2 The producer unit is given either a zero or a non-zero direct income transfer. Model optimization shows that a direct income transfer has no effect in delaying or accelerating these farmers' decisions to continue or to stop cultivating corn, as is shown in tables 7-9. For instance, table 8 shows that the last year for corn cultivation is 1997 when transport costs are nil, regardless of the income transfer. Accordingly, direct income transfers of the Program of PROCAMPO do not change the poorest peasants' decisions of when to stop corn cultivation.

5.1.3 The marginalized farmer is offered with two market labor locations. Optimizing results are that the greater the transportation cost for traveling to their work place, other things held constant, the longer the time span marginalized peasants remain cultivating corn. Tables 7-9 show that there is one year difference in the critical year in abandoning corn production when transport costs go from zero to n$ 6.0/day (from 1999 to 2000) when reservation wage is nil.

For any of all the above controlled experiments it was found that :

5.1.4 Maximum real net income at the critical year is always lower than it was at the starting period as a consequence of higher corn prices in the earlier years. Of course, an income subsidy, zero transport cost and zero reservation wage offer, all together, the highest net income (Table 9); while the lowest net income occurs with non-zero transport cost, 100 percent reservation wage, and no income subsidy. Therefore, liberalization of corn markets in of an income subsidy leave the marginalized peasantry worse off than otherwise.

5.1.5 Corn and chili and other vegetables predominate in the peasant household diet with consumption exactly at the same amount each year (293 and 312 kilograms, respectively); these amounts just cover their minimum subsistence requirements. Below these levels they suffer malnutrition. Workdays dedicated to corn are 1.8 percent of the disposable ones. Corn which is not consumed within the peasant household is sold on the market.

5.1.6 Land shadow prices are higher whenever both reservation wage and transport costs are lower, and an income subsidy obtains. When land is not cultivated, its shadow price drops to zero, as is to be expected.

5.1.7 Labor shadow price equals the market wage net of transport cost, as is to be expected.

5.1.8 Beyond the critical years (abandonment of farming) the marginalized peasantry buys corn in the market and remain on their land as long as employment is close to their land. Otherwise, they will migrate to other places, either rural or urban. The earliest critical year is 1997, while 2000 is the longest away.

5.1.9 Real shadow prices of minimum nutritional requirements are highest for vitamins at n$ 20 per miligram, with protein costing n$ 0.4 to 0.7 per gram. Caloric and mineral shadow price are valued as free goods, which is understandable due to their relatively abundant availability in maize relative to the other nutritional requirements. In other words, in buying vitamins and proteins, calories and minerals are gotten free.

5.2 Corn and beans produced jointly, (tables 10, 11, and 12).

5.2.1 For all of the controlled experiments specified above (1-3), the model's optimizing results show that the critical years under this regimen, that is with corn and beans produced jointly, do not occur within the analyzed period (1991-2003). It follows that in order for land to remain in production it is important to cultivate corn and beans jointly rather than getting income subsidies, paying transport costs, and lowering reservation wages.

In what follows, I used the controlled experiments to detail some of the quantified effects on other variables such as consumption on farm production, food basket composition, land shadow prices:

5.2.2 Effects of variations of the peasant household's reservation wage on consumption. Answers provided by the model are that the lower the reservation wage, the longer time span the peasant unit will continue consuming on farm corn production and the higher the land shadow price, other things held constant -- from 1999 to 2001, with a land shadow price of n$ 121/hectare to n$ 300/hectare, for reservation wage rates set at 100 and 0 percent of the market wage, respectively.

5.2.3 Effects of income subsidy and transport costs for traveling to work places on shadow land rents. Regardless of transport costs, whenever an income subsidy is included, land shadow prices increase.

For any of all the above controlled experiments it was found that :

5.2.4 Until the years 2001 or 2002, peasant household's diet is made up of 179.1 kilograms of corn either on farm produced or bought in the market, 46.3 k of farm produced beans, and 312.5 kilograms of other vegetables, including chili. Corn production not consumed by the household is sold in the market.

5.2.5 After the years of 2002 or 2003 the model result is that the peasant household continues producing corn and beans, but they are entirely sold in the market; the household's diet shifts to 292.5 kilograms of corn, and 315.5 kilograms of other vegetables (including chili) and bean consumption drops to zero; and the peasant family buys all of its corn and chili for consumption purposes in the market.

5.2.6 Real shadow prices of minimum nutritional requirements are highest for vitamins at n$ 20 per miligram and n$ 0.3 per gram of protein. Calories and minerals again are free goods, showing zero shadow prices.

5.2.7 As in 5.1.4, for the case where corn is the only peasant enterprise, maximum real net income during the analyzed years is always lower in the later years than at the starting period. Of course a direct income transfer, a zero transport cost and a 100 percent reservation wage all together, offer the highest net income (Table 12); lowest net income occurs with a non-zero transport cost, a zero percent reservation wage, and no income subsidy (Table 11). It follows that the liberalization of corn markets in the absence of an income subsidy leaves the marginalized peasantry worse off than otherwise.

6. Conclusions

There is little room for modifying the productivity of the poorest peasant cultivators using existing technological packages within the next of five to eight years. This means that the most efficient one is the traditional one. Government investment in productive infrastructure has negligible possibilities for increasing corn yields on the poorest peasant lands; the only alternative being to bring water from far away places, which would mean having to pump it up to 6000 feet of elevation, or even having to desalinize it. Of course, these actions are impossibly costly. There might be some opportunity to invest in creating very efficient seeds which in the long run could improve corn and bean yields.

If policy calls for the marginalized peasantry to stay on their land for the next decade or more, they need to be encouraged to jointly cultivate corn and beans, even at very low yields (800 kilograms and 360 kilograms per hectare, respectively). This action would also result in the peasantry being better off from their view point in that they would receive higher net real income. By extension, they might also be encouraged to produce their own chili and vegetables. Government programs to slow down migration should rely on the joint production of corn and beans and emphasis on vegetables production, especially if urban employment is constrained by labor market failure due to barriers to entry by unions, or because job skill requirements are not matched by the abilities of the new entrants. Needed training will take some time.

If peasant households are only corn growers, the effects of liberalizing and gradually eliminating import tariffs (as under NAFTA) on the corn market will result in eliminating corn production by the marginalized peasantry as earliest as 1997 or at the latest in 2000. This will occur even if income subsidies are made by the government.

For the mono-cultural corn growers, if they can find jobs where transport costs are less than 40 percent of wages, and when they can commute daily, they will continue growing corn until 1999. Otherwise they will migrate mainly to the cities. This means that construction of highways, and other public works which should tend to facilitate local employment for the displaced peasant could temporarily delay migration.

Assuming that the subutility function for foodstuff of the marginalized peasant household is characterized by the nutritional properties of the goods, the basic diet of these families is made up of corn, chili and other vegetables, and beans. Other products which happen to be consumed by them, including wheat products, -bread and pasta-, potatoes, sugar, and cooking oil do not enter into the basket because of their higher relative prices and comparatively lesser nutrient contents. These results have been objectively determined, independently of tastes, or cultural and social values.

A Neo-Malthusian optimization model, with efficient consumption, resulted in a good representation of the economics of marginalized peasantry; it incorporates the peasant household as the unit of analysis, it being both the producer and consumer. In the model, land per household has been fixed, and migration is included. The peasant's land is utilized as a productive factor, as is his house. The model includes costs of living and production, and maximizes the family's net income. It is connected to rest of the economy through market prices for all grains, as well as through labor markets.

The most advantaged of the displaced peasants will be those peasants who can find a job close to their lands, who cultivate corn and beans jointly, and who get a direct income subsidy. On the other hand, within the analysis nothing can be concluded concerning the other part of this displaced group as to whether they will be better or worse off with NAFTA. It depends on whether or not they can find a job, and what their wages will be.

TABLE 1									
Spring -Summer 1991. Frequency distributions of corn growers, harvested area and corn production.									
Land	Farmers			Harvested area			Production		
classes hectares	thousands	relative percent	cumulative percent	thousands of hectares	relative percent	cumulative percent	thousands of tons	relative percent	cumulative percent
0-1	967	39.9	39.9	771	13.2	13.2	1,150	10.4	10.4
1.1-2.0	657	27.1	67.0	1162	19.9	33.1	1,517	13.7	24.1
2.1-3.0	330	13.6	80.7	885	15.1	48.2	1,489	13.5	37.6
3.1-4.0	198	8.2	88.8	731	12.5	60.7	1,403	12.7	50.3
4.1-5.0	94	3.9	92.7	438	7.5	68.2	733	6.7	57.0
5.1-6.0	58	2.4	95.1	323	5.5	73.7	737	6.7	63.7
6.1-7.0	26	1.1	96.2	180	3.1	76.8	371	3.4	67.1
7.1-8.0	34	1.4	97.6	268	4.6	81.4	616	5.5	72.6
8.1-12.0	37	1.5	99.1	379	6.5	87.9	970	8.7	81.3
12.1-16.0	11	0.5	99.6	178	3.0	90.9	521	4.7	86.0
16.1-20.0	1	0.0	99.6	216	3.7	94.6	523	4.7	90.7
20.1 +	9	0.4	100.0	314	5.4	100.0	1,010	9.3	100.0
total	2,422	100.0		5,845	100.0		11,040	100.0	

SOURCE.- SARH., National Survey of costs, technical coefficients and yields of the agricultural production. Corn. Spring- Summer of 1992

TABLE 2				
Corn and Byproducts.Technical Coefficients and Mean Costs of Production*				
	Input Price Vi	Technical Ii/hectare	Coefficients Ii/ton	Input Costs Vi di
Labor				
Non-skilled (work-day)	15.000	7.000	8.750	131.250
Skilled (work-day)	23.438	4.000	5.000	117.190
Fertilizers (tons)	753.200	0.250	0.313	235.375
Tractor Rental (work-day)	13.635	4.000	5.000	68.175
Land (hectares)	200.000	1.000	1.250	250.000
Seed (tons)	715.000	0.018	0.023	16.088
Gross Mean Production Cost				818.078
Less Byproduct Recuperation	70.000		4.000	-280.000
Net Mean Production Cost				538.078
* All prices and costs are in Mexican n$ of 1992. Exchange rate was US$ 1.00 = n$ 2.9				

Source.- Secretaria de Agricultura y Recursos Hidraulicos (SARH) (Secretariat of Agriculture and Water Resources), Subsecretaria de Agricultura, Instituto Nacional de Investigaciones Forestales, Agricolas y Pecuarias (INIFAP) and the Colegio de Postgraduados (CP)(Postgraduate School). Programa de Modernizacion de la Agricultura Sintesis Ejecutiva y Anexos Tecnicos (Modernization of the Mexican Agriculture. Executive Synthesis and Technical Annexes), Estados Seleccionados (Chossen States) Mexico (1993).

TABLE 3A Corn and Beans Jointly Produced* Technical Coefficients and Mean Costs of Production of Corn	Input Price Vi	Technical li/hectare	Coefficients li/ton	Input Costs Vi di
Labor				
Non-skilled (work-day)	15.000	7.000	8.7500	131.250
Skilled (work-day)	23.438	4.000	5.0000	117.190
Fertilizers (tons)	753.200	0.250	0.3125	235.375
Tractor Rental (work-day)	13.635	4.000	5.0000	68.175
Land (hectares)	200.000	1.000	1.2500	250.000
Seed (tons)	715.000	0.018	0.0225	16.088
Gross Mean Production Cost **				776.051
Less Byproduct Recuperation				-280.000
Net Mean Production Cost				496.051

* All prices and costs are in Mexican n$ of 1992. Exchange rate was US$ 1.00 = n$ 2.9

** Common inputs for corn and beans are labor, fertilizer, tractor and land.

Source.- Secretaria de Agricultura y Recursos Hidraulicos (SARH) (Secretariat of Agriculture and Water Resources), Subsecretaria de Agricultura, Instituto Nacional de Investigaciones Forestales, Agricolas y Pecuarias (INIFAP) and the Colegio de Postgraduados (CP)(Postgraduate School). Programa de Modernizacion de la Agricultura Sintesis Ejecutiva y Anexos Tecnicos (Modernization of the Mexican Agriculture. Executive Synthesis and Technical Annexes). Estados Seleccionados (Chossen States) Mexico (1993).

TABLE 3 B Corn and Beans Jointly Produced* Technical Coefficients and Mean Costs of Production of Beans	Input Price Vi	Technical li/hectare	Coefficients li/ton	Input Costs Vi di
Labor				
Non-skilled (work-day)	15.000	7.000	8.7500	131.250
Skilled (work-day)	23.438	4.000	5.0000	117.190
Fertilizers (tons)	753.200	0.250	0.3125	235.375
Tractor Rental (work-day)	13.635	4.000	5.0000	68.175
Land (hectares)	200.000	1.000	1.2500	250.000
Seed (tons)	2100.000	0.018	0.0500	105.000
Mean Production Cost **				864.963

* All prices and costs are in Mexican n$ of 1992. Exchange rate was US$ 1.00 = n$ 2.9

** Common inputs for corn and beans are labor, fertilizer, tractor and land.

Source.- Secretaria de Agricultura y Recursos Hidraulicos (SARH) (Secretariat of Agriculture and Water Resources), Subsecretaria de Agricultura, Instituto Nacional de Investigaciones Forestales, Agricolas y Pecuarias (INIFAP) and the Colegio de Postgraduados (CP)(Postgraduate School). Programa de Modernizacion de la Agricultura Sintesis Ejecutiva y Anexos Tecnicos (Modernization of the Mexican Agriculture. Executive Synthesis and Technical Annexes). Estados Seleccionados (Chossen States) Mexico (1993).

TABLE 4

Rural Household's Relative Shares of Food Expediture in Total Expediture (rf), and of Corn Expediture in Total Food Expediture (cf), by Income Deciles

	total	i	ii	iii	iv	v	vi	vii	vii	ix	x
rf	2.3	6.4	6.0	5.1	4.0	3.6	2.9	2.5	2.1	1.6	0.6
cf	5.8	11.4	11.6	9.6	7.5	7.6	6.1	5.5	5.2	4.3	2.2

Source.- National Institute of Statistics, Geography and Information (INEGI). National Survey of Income-Expenditure of Households, Mexico 1989

TABLE 5

Observed and Recommended Nutrient Contents of the Peasant Family's Diet

family members	age	calories (calories/day)		proteins (grams /day)		minerals (miligrams / day)		vitamins	
		obs.	recomm.	obs.	recomm.	obs.	recomm.	obs.	recomm.
father	35-54	2251	2500	50.2	83	1005	500	163	1075
mother	35-54	1534	1850	74.7	71	644	500	98	1068
son	14-18	1251	3000	50.1	75	1005	700	163	1080
daughter	11--18	1542	2300	38.0	67	640	700	86	1073
son	0-10	1134	2000	38.0	52	460	500	54	561
daughter	0-10	1044	2000	38.0	52	406	500	44	561

Sources.- National Survey of Nutrition of the Rural Sector. Instituto Nacional de Nutricion Salvador Zubiran (Mexico's National Institute of Nutrition):
Comision Nacional de Alimentacion, Mexico 1989
Interviews with Dr. Abelardo Avila Curiel Coordinator General of the National Survey of Nutrition, and Guillermina Gutierrez, Researcher at the Instituto Nacional de Nutricion, Mexico 1992.

TABLE 6

Nutritional Contents of the Typical Peasant's Foods

product	quantity (grams)	calories (calories)	proteins (grams)	fiber	vitamins (miligrams)	Ca.	Mg.	Na.	K.
white corn	100	362	7.9	4.5	3.3	159	0	0	0
tortilla	100	224	5.9	4.3	20.0	108	140	24	1406
beans	100	332	19.2		0.0	228			
chili	100	35	2.3	1.5	122.5	35	25	7	340
refined sugar	100	384	0.0		0.0	0			
pasta	100	340	9.4	0.0	1.3	26	0	2	197
bread (bolillo)	70	292	8.4	0.0	1.3	39	22	1565	94
cooking oil	100	884	0.0	0.0	0.0	0	0	0	0

Source.- Muñoz Miriam, Hernandez Mercedes, Roldan Antonio, Nutritional Value Tables of Foods Consumed in Mexico. The National Institute of Nutrition. Mexico 1992

TABLE 7

Model Results. Monocultivation of Corn

Reservation Wage = 1.0 Market Wage

(n$ of 1992, kilograms, hectares, and workdays)

Last year of corn cultivation	1996	1997	1996	1997
Starting Net Income (1991)	7964	4927	8373	4758
Income transfers	0	0	330	330
transport costs	0	6	0	6
Net income	7797	4185	8128	4515
Land/household	1.5	1.5	1.5	1.5
Land Shadow Prices	10.79	2.54	10.79	2.54
Labor Allocated to farm	10.5	10.5	10.5	10.5
Labor Allocated to nonfarm	589.5	589.5	589.5	589.5
Labor Shadow Prices	15	9	15	9
Corn Production	1200	1200	1200	1200
Corn Consumption	292.5	292.5	292.5	292.5
Vegetable and Chili Consumption	312.4	312.4	312.4	312.4
Protein Shadow Price/gram	0.006	0.006	0.006	0.006
Vitamin Shadow Price/miligram	19.3	19.3	19.3	19.3

Note 1: The income transfer is estimated as the product of the farmer's corn production (1.2 ton) times its price subsidy -- the difference between guarantee and international prices at Mexico City

Note 2: Calorie and mineral shadow prices are zero for the period modeled.

Note 3: Beans consumption is zero for the period modeled.

Note 4:In the year 1992 the exchange rate was US$ 1.00 = n$ 2.9

	TABLE 8 Model Results. Monocultivation of Corn Reservation Wage = O.5 Market Wage (n$ of 1992, kilograms, hectares and workdays)			
Last year of corn growing	1997	1998	1997	1998
Starting Net Income (1991)	8062	4526	8392	4856
Income transfers	0	0	330	330
transport costs	0	6	0	6
Net income	7818	4210	8149	4515
Land/household	1.5	1.5	1.5	1.5
Land Shadow Prices	12	6.4	12	6.4
Labor Allocated to farm	10.5	10.5	10.5	10.5
Labor Allocated to nonfarm	589.5	589.5	589.5	589.5
Labor Shadow Prices	15	9	15	9
Corn Production	1200	1200	1200	1200
Corn Consumption	292.5	292.5	292.5	292.5
Vegetable and Chili Consumption	312.4	312.4	312.4	312.4
Protein Shadow Price/gram	0.005	0.003	0.005	0.005
Vitamin Shadow Price/miligram	19.44	19.44	19.44	19.44

Note 1: The income transfer is estimated as the product of the farmer's corn production (1.2 ton) times its price subsidy -- the difference between guarantee and international prices at Mexico City

Note 2: Calorie and mineral shadow prices are zero for the period modeled.

Note 3: Beans consumption is zero for the period modeled.

Note 4:In the year 1992 the exchange rate was US$ 1.00 = n$ 2.9

	TABLE 9 Model Results. Monocultivation of Corn Reservation Wage = 0.0 Market Wage (n$ of 1992, kilograms and hectares)			
Last year of corn growing	1998	1999	1988	1999
Starting Net Income (1991)	8161	4526	8491	4954
Income transfers	0	0	330	330
transport costs	0	6	0	6
Net income	7845	4249	8175	4579
Land/household	1.5	1.5	1.5	1.5
Land Shadow Prices	12	6.4	12	6.4
Labor Allocated to Farm	10.5	10.5	10.5	10.5
Labor Allocated to non-Farm	589.5	589.5	589.5	589.5
Labor Shadow Prices	15	9	15	9
Corn Production	1200	1200	1200	1200
Corn Consumption	292.5	292.5	292.5	292.5
Vegetables and Chili Consumption	312.4	312.4	312.4	312.4
Protein Shadow Price/gram	0.004	0.004	0.004	0.004
Vitamin Shadow Price/miligram	19.59	19.6	19.6	19.6

Note 1: The income transfer is the product of the farmer's corn production (1.2 ton) times the corn price subsidy. This subsidy is the difference between guarantee and international prices at Mexico City

Note 2: Calorie and mineral shadow prices are zero for the period modeled.

Note 3: Beans consumption is zero for the period modeled.

Note 4:In the year 1992 the exchange rate was US$ 1.00 = n$ 2.9

TABLE 10

Model Results. Corn and Beans Jointly Produced

Reservation Wage = 1.0 Market Wage

(n$ of 1992, kilograms, hectares and workdays)

Last Year Modeled	2001	2003	2001	2003	2001	2003	2001	2003
Starting Net Income (1991)	8596	8596	5049	5049	8916	8916	5379	5379
Income Transfers	0	0	0	0	330	330	330	330
transport Costs	0	0	6	6	0	0	6	6
Net Income	8103	8027	4565	4490	8433	8358	4896	4820
Land/Household	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Land Shadow Prices		121.2		163.2		121.2		163.2
Labor Allocated to Farm	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
Labor Allocated to non-Farm	589.5	589.5	589.5	589.5	589.5	589.5	589.5	589.5
Labor Shadow Prices		15		9		15		9
Corn Production	1200	1200	1200	1200	1200	1200	1200	1200
Corn Bought in the Market	179.1	292.5	179.1	292.5	179.1	292.5	179.1	292.5
Vegetables and Chili Consumption	315	312.4	315	312.4	315.5	312.5	315.5	312.5
Beans Production	540	540	540	540	540	540	540	540
Beans Consumption on farm prod.	46.3	0	46.3	0	46.3	0	46.3	0
Protein Shadow Price/gram		0.003		0.003		0.003		0.003
Vitamin Shadow Price/miligram		19.81		19.81		19.81		19.81

Notes 1 and 2 as on Table 8

Note 3: For the period 1991-2000 consumption of corn on farm production is estimated by the model to stay around 179 kilograms per peasant family.

Note 4:In the year 1992 the exchange rate was US$ 1.00 = n$ 2.9

TABLE 11

Model Results. Corn and Beans Jointly Produced

Reservation Wage = 0.5 Market Wage

(n$ of 1992, kilograms, hectares, and workdays)

Last Year Modeled	2001	2003	2001	2003	2001	2003	2001	2003
Starting Net Income	8700	8700	5164	5164	9031	9031	5494	5494
Income Transfers	0	0	0	0	330	330	330	330
transport Costs	0	0	6	6	0	0	6	6
Net Income	8208	8129	4671	4592	8537	8459	5001	4922
Land/Household	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Land Shadow Prices		188.9		230.9		188.9		230.9
Labor Allocated to Farm	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
Labor Allocated to non-Farm	589.5	589.5	589.5	589.5	589.5	589.5	589.5	589.5
Labor Shadow Prices		15		9		15		9
Corn Production	1200	1200	1200	1200	1200	1200	1200	1200
Corn Bought in the Market	179.1	292.5	179.1	292.5	179.1	292.5	179.1	292.5
Vegetables and Chili Consumption	315	312.4	315	312.4	315.5	312.5	315.5	312.5
Beans Production	540	540	540	540	540	540	540	540
Beans Consumption on farm prod.	46.3	0	46.3	0	46.3	0	46.3	0
Protein Shadow Price/gram		0.003		0.003		0.003		0.003
Vitamin Shadow Price/miligram		19.81		19.81		19.81		19.81

Notes 1 and 2: as on Table 8.

Note 3: as on Table 11.

Note 4:In the year 1992 the exchange rate was US$ 1.00 = n$ 2.9

TABLE 12

Model Results. Corn and Beans Jointly Produced
Reservation Wage = 0.0 Market Wage
(n$ of 1992, kilograms, hectares and workdays)

Last Year Modeled	2002	2003	2002	2003	2002	2003	2002	2003
Starting Net Income	8815	8815	5278	5278	9145	9145	5608	5608
Income Transfers	0	0	0	0	330	330	330	330
transport Costs	0	0	6	6	0	0	6	6
Net Income	8268	8250	4731	4694	8598	8560	5051	5023
Land/Household	1.5	0	1.5	0	1.5	0	1.5	0
Land Shadow Prices		256.6		298.6		256.6		298.6
Labor Allocated to Farm	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
Labor Allocated to non-Farm	589.5	589.5	589.5	589.5	589.5	589.5	589.5	589.5
Labor Shadow Prices		15		6		15		9
Corn Production	1200	1200	1200	1200	1200	1200	1200	1200
Corn Bought in the Market	179.1	292.5	179.1	292.5	179.1	292.5	179.1	292.5
Vegetables and Chili Consumption	312.4	312.4	312.4	312.4	312.4	312.4	312.4	312.4
Beans Production	540	540	540	540	540	540	540	540
Beans Consumption on farm production	46.3	0	46.3	0	46.3	0	46.3	0
Protein Shadow Price/gram		0.003		0.003		0.003		0.003
Vitamin Shadow Price/miligram		19.81		19.81		19.81		19.81

Notes 1 and 2 as on Table 8
Note 3: For the period 1991-2001 consumption of corn on farm production is 179 kilograms per family
Note 4:In the year 1992 the exchange rate was US$ 1.00 = n$ 2.9

Notes

1 See: (a) C. Engels and Segarra C., Government Intervention in the Mexican Livestock Sector, United States Department of Agriculture (USDA). (1990). (b) R. Perez, Protecciòn de los Productos Agropecuarios de Mèxico (Protection of the Agricultural Products of Mexico). Secretaria de Agricultura y Recursos Hidraùlicos (SARH). (Secretariat of Agriculture and Water Resources) Mèxico (1990). (c) P. Reyes. Los Productos Pecuarios de Mèxico, Diseño de Politicas de Proteccion, (The Livestock Products of Mexico. Protection Policy Design). SARH. Mexico (1991). (d) A. Webbs, J. Lopez, and R. Penn, Estimates of Producer and Consumer Subsidy Equivalents. Government Intervention in Agriculture, 1982-87. United States Department of Agriculture (USDA). Statistical Bulletin No. 803. Washington DC (1990).

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4 J. Mathus and A. Puente, Economic Impacts of Free Trade on Mexican Agriculture: A PAM Approach. Paper presented at the Western Agricultural Economics Association Meeting. July 12-15, Colorado Springs, Colorado (1992).

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Basic trade conditions for Mexican corn imports are: initial import tariff in 1994 equal to 215 percent, constantly decreasing to zero at year 2009. Initial quota 2.5 million tons from US, and one thousand tons from Canada, with yearly increases of 3.0 percent. Bean import tarriffs initiate at 135 percent in the year 1994, reaching the zero level in the year 2009.

Corn and beans prices were taken from the work cited on note 6. They estimated corn prices using the long-run average international prices of corn, an inflation rate of 7 percent during 1994-97 and then 4.5 percent for the remaining period 1998-2009, and with constant transaction costs for transport, financial services and warehousing charges. This methodology is usually followed by the Secretariat of Agriculture and Water Resources (SARH) and the governmental enterprise encharged with promoting trade for agricultural producers, Apoyos a la Comercializacion Agropecuaria. On the other hand, given that beans is not a widely traded commodity, its nominal prices were assumed to increase, little above the estimated inflation, because of NAFTA's initial high import tariffs, until year 1997, and then to remain constant during the period 1998-2003. Estimations are as follows:

Real Prices of Corn and Beans (new pesos of 1992/ton)													
Years	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Corn prices	822	715	701	776	752	683	619	558	504	452	405	360	320
Beans prices	2100	1800	1800	2000	2100	2200	2400	2161	1942	1738	1548	1372	1204

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