SMALL-SCALE CORN AND LIVESTOCK MEXICAN FARMERS

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INTRODUCTION

The North American Free Trade Agreement (NAFTA) combines countries with deep economic differences in a process of trade liberalization, and this experience was unknown worldwide. The contrasts between Mexico and its other two North American partners are striking in terms of their agricultural structures and this is particularly so between the Mexican and the U.S. corn subsectors. This difference has lead some analysts and politicians to predict that with NAFTA, corn production in Mexico will tend to disappear and hundreds of thousands of Mexicans will be displaced from the rural sector.

Mexico's rural economy is itself heterogeneous. This, in addition to the contrasts between the agricultural sectors of the North American countries, raises doubts about the possibility of attaining economic harmonization of the grain and livestock subsector of the three countries.

The main purposes in this paper are to analyze quantitatively the impacts of policy reforms on small-scale corn and livestock farmers in Mexico, and to discuss some of the results in the context of the issues of concern in this Workshop, i.e., competition of the North American corn and livestock subsectors and their economic harmonization in the three countries.

The paper begins with an overview of the adjustment processes that Mexico's agricultural sector has experienced since the beginning of the nineties; and discussion of the expectations about the impacts on Mexican agriculture that this process of reforms may bring about, and discussion of characteristics of the Mexican corn and livestock subsectors. With this background, our analytical model—a village-wide general equilibrium model of rural households—is used to quantify the impacts of policy changes on small-scale corn and livestock producers. The application of this model is to a typical village in Central Mexico. The paper ends with a discussion of our findings in relation to the NAFTA and agricultural policies.

THE ADJUSTMENT PROCESS

A decade before the beginning of NAFTA's negotiations, the governments of Mexico began a radical change in development strategy. It has consisted in moving public policy from import substitution to outward orientation, which has meant considerable reduction of government intervention in the economy.

Among other measures, the liberalization process in agriculture consisted of abolition of import controls of "basic staples", elimination of producers' price supports, reduction or elimination of State owned enterprises' activities in buying, importing, storing, processing and selling staples such as corn, beans, rice, wheat, oilseeds and barley, reduction of government subsidies in rural credit and insurance, privatization of agricultural parastatals and the irrigation

system, and liberalization of property rights in land (the latter known as the Ejidal Reform. See details in Yunez-Naude, A.).

For Mexico, NAFTA cannot be taken exclusively as an accord to liberalize agricultural trade among the three North American countries. Until the eighties, the agricultural sector of Mexico was heavily influenced by governmental policies and interventions. The domestic agricultural reforms that the Salinas Administration initiated before and during the beginning of the negotiations were a signal to the United States that the Mexican purposes of liberalizing the sector were serious and lasting. Those reforms are still in place and in line with the commitments of the last two Mexican governments under NAFTA and the Uruguay Round.

The liberalization process included the Ejidal Reform and a major reduction of the activities of CONASUPO (The National Company of Popular Subsistence), the major governmental agricultural agency regulating prices, and involved in trade, storage, processing and distribution of staples. These reforms meant the abolition of prohibitions of leasing and selling Ejidal lands (those distributed to peasants after the Revolution of 1910), and the elimination of the support prices CONASUPO granted to 12 crops and to milk, but not to corn and beans.

Under NAFTA, Mexico implements tariff rate quotas (TRQs) to agricultural commodities that the Salinas' Administration considered sensitive for Mexican producers. They include corn, dry beans and some animal products (dried milk) (Shagam, S.D. and D. Plunkett). The Mexican government plans to eliminate the TRQs for corn and milk by the year 2003. Up to the beginning of the nineties, CONASUPO controlled the trade of corn, imported the grain to cover the differences between domestic supply and demand and settled a producers' support price (or guaranteed price) higher than the international price. CONASUPO still intervenes in the corn and powdered milk markets by importing them and, together with SECOFI (the Ministry of Commerce), by allocating their quotas. CONASUPO is still the sole importer of milk powder to implement its program of milk distribution for the young poor; it then auctions the balance of its purchases to the private sector. In the case of corn, it still subsidizes millers for the production of "tortillas" for the consumption of the poor. However, private direct imports of corn are now allowed, with part of the quota assigned to the private sector's requests.

In addition, CONASUPO, together with the Ministry of Commerce, establish a producers' "minimum" or "intervention" price for corn. For milk (and for other crops) the government negotiates prices with their producers. Domestic price of corn is fixed taking into account macroeconomic phenomena, the grain's international price and transportation costs. CONASUPO is now "a last instance buyer" of corn if farmers cannot get a higher price in the market. However, government interventions in the corn market have meant that the domestic price of corn is still considerably higher than its international price.[1] Consequently, reduced intervention is still a policy option to fully liberalize corn market as reform programs continue. This is the case of corn and powdered milk under NAFTA. For these commodities, the tariff rate quotas established by Mexico in NAFTA will be eliminated between the years 2003 and 2008.

[1] According to official data, the difference between the corn support price and the average import price of corn (volume of corn imports divided by its value) is around 40 percent. A similar difference is present in the relation between the average domestic price of corn and its average import price (Source: Mexican Ministry of Agriculture).

EXPECTATIONS AND FACTS

The last two Administrations and the current one expect that, with economic liberalization, macroeconomic stability is going to be achieved. In addition, they expect that reform, together with NAFTA, will promote savings and foreign investment, and a new vigorous stage of sustained economic development. With respect to the agricultural sector, the reduction of state intervention is expected to lead to efficient use of the resources of rural Mexico. Market forces will reallocate scarce rural resources to activities such as horticultural and livestock production, where the country has comparative advantage. Governments have not been too worried about the consequences of this change on food self-sufficiency and on rural emigration.

In contrast, the critics of the liberalization processes and NAFTA are worried about food self-sufficiency and pessimistic about the absorption by industry and services of workers displaced from the rural economy. Based on the argument that Mexican staple and livestock producers are not competitive and on the fact that a big proportion of the labor force is engaged in these activities, they foresee that, with trade liberalization, the domestic supply of food will be sharply reduced and millions of people will be displaced from the rural sector (Calva, 1995).

Mexico's agricultural sector has grown at rates below its population growth since the seventies (that is before and after the reforms). However, domestic agricultural supply did not sink from 1991 to 1996. Corn production increased during 1992 and 1993 and remained at this level during 1994-96 (SAGAR, 1994). In part, this latter phenomenon is explained by the fact that government still supports corn production, which has meant a higher relative price of corn with respect to other competitive crops. It may also be related to the fact that a portion of small-scale farmers producing corn is isolated from the agricultural products' markets and/or to policy changes. (Notwithstanding, their production is considered in government statistics).

STRUCTURAL ADJUSTMENT AND SMALL-SCALE FARMERS

Most of the studies, discussions and official expectations on the effects of the reforms and NAFTA on the agricultural sector are too aggregated and do not emphasize the enormous heterogeneity prevailing in Mexico's countryside. This is the case of the production of corn and livestock and its products, where large, entrepreneurial, modern and capitalized farms coexist with small-scale and poor farmers.[2] It is also frequent in traditional economic analyses to ignore the fact that, historically, most of the corn production—the basic foods in Mexicans' diet—is done not by modern agriculture, but by family units of small-scale production and consumption, using rainfed land, and whose members are also engaged in activities other than the production of corn. These additional sources of small-farmers' income include livestock, an activity that ranges from cattle raising to the production of eggs. A typical family agricultural unit in Mexico has therefore

[2] For example, during 1991 farmers with more than 8 hectares (ha.) of irrigated land cropped with corn obtained more than 5.5 tons per ha. of the grain, whereas units with 2.3 ha. of rainfed land got less than 1.4 tons per ha of cropped corn (Yunez-Naude, A. et al.: 76). Similar contrasts exist in Mexico's livestock sector. For example, 67 percent of the bovine herd producing milk is also used by small farmers to produce meat. This subsector only contributes to 30 percent of the domestic supply of milk, whereas the specialized farmers produce 54 percent of the total supply with just 8 percent of the bovine milk-producing herd (Davalos Flores, J.L.)

diversified sources of income, coming from the involvement of their members in crop production, livestock, articrafts, commerce and in regional, domestic and the U.S. labor markets (Taylor, J.E. and A. Yunez-Naude, Ch. 4: forthcoming).

The significance of small-scale farmers in the production of corn is illustrated by the fact that this grain is by far the most important crop in Mexico with around 70 percent of it is obtained in rainfed farms whose owners have around two hectares of land (Zedillo, E. and Taylor and Yunez-Naude, op.cit.).[3]

Another feature of Mexico's agricultural sector is that an important portion of staple and livestock production comes from small-scale farmers which is not marketed—it goes to the family's own consumption—using family (non-waged) labor.[4] This means that a segment of small-scale farmers face incomplete agricultural product and labor markets, making the notion of competition an inappropriate analytical tool.

Rural Mexico is hence characterized by a patchwork of staple surplus-producing regions and local economies producing little or no surplus for regional or national markets. In the latter economies, the price of staples is likely to be endogenous and so, their producers will not be affected directly if the government decides to eliminate their price supports. Notwithstanding the isolation of a portion of small-scale farmers in staple and livestock markets, they are linked to regional and national inputs and manufacturing markets, as well as to the national and international labor markets. A typical Mexican rural household requires manufactured goods produced elsewhere in Mexico, and members of the unit work for a wage in the region, in the rest of Mexico or in the United States. Part of the income earned by family members in these labor markets is sent as remittances to the family unit, which are frequently an important component of the unit's budget.

Explicit consideration of these phenomena is fundamental to economic harmonization of North American agricultures and for doing rigorous impact analyses of NAFTA, policy reforms and alternative agricultural development strategies. Unfortunately, nationwide data on factor use, production, consumption and market linkages at the rural household level are not available. Therefore, empirical studies of these characteristics have to rely on surveys designed for these purposes.

Professor J.E. Taylor University of California (Davis), and I have been coordinating such efforts during the last years by doing surveys to rural households, representative of small-scale farming in Mexico. Among other information, the surveys capture data of representative households' production of agricultural and non-agricultural commodities; on their consumption of goods and services; on the use of family labor inside and outside the unit; and on the households'

[3] During the first half of the nineties, the contribution of corn to agricultural GDP was 15 percent, its production employed 14.2 percent of workers engaged in agriculture and its cultivation occupied more than 35 percent of total cropped land. In contrast, the combined contribution to agricultural GDP, employment and used land of the three crops that follow corn (sugar, sorghum and beans) is less than that of corn (Salinas de Gortari, C. and J.L. Calva).

[4] An official national survey on corn production during 1991-92 shows that more than 30 percent of it is used for the production units' own consumption (human, animal or as seeds for future cultivation), and that around 20 percent of the total labor costs come from use of family labor. See Yunez-Naude, A.et al., : 81-2).

relations with village, regional, national and foreign (US) input, product and labor markets. With this data base, we have built village-wide general equilibrium models to estimate the impacts of policy reforms on small-scale staple and livestock producers of rural Mexico.

VILLAGE GENERAL EQUILIBRIUM MODELING

The village-wide model we propose to use to estimate the impacts of policy reforms on small-scale corn and livestock-producing farms has a social accounting matrix (SAM) as its data base.[5] The village SAM is built from information obtained for this purpose in surveys applied to a sample of representative households. The village general equilibrium model (VGEM) integrates micro-economic, household-farm modeling into a village general-equilibrium framework, making it possible to capture both direct and indirect impacts of policy and other exogenous changes on rural economies. This modeling approach captures the diversified nature of rural households' activities and second round effects of policy changes, through their impacts on expenditures and production in household-farm economies. Economic linkages among household-farms transmit direct impacts of policy changes to other households inside and outside the rural sector. These linkages may either dampen or magnify the effects of policy reforms, and they may alter or even reverse the impacts of policies on production, incomes and migration.

This technique can be used to develop stylized village models to explore the implications of failure in selected rural markets in shaping agricultural and trade policy impacts. This is the case of market failures caused by high transactions' costs in the corn sector, which buffer the rural economy from changes in its price.

The VGEM is applied to a typical village in the central State of Michoacan: it is formed by corn and livestock farmers, whose family members are also engaged in non-agricultural production as well as in waged labor and in migration activities.[6]

The Model

In our VGEM we consider explicitly important features of small-scale agricultural production in Mexico, such as the participation of households in local and national inputs, product and labor markets. We also take into account migration to the United States, that is, the main and usually only linkage of Central Mexico's small-scale family farmers with the "rest of the world." The model captures production and expenditure linkages within the village and between the village and the rest of Mexico, including village households' consumption and production demand for manufactured goods. Mexico-to-U.S. migration and internal migration are modeled explicitly as a function of the returns to migration and the returns to family labor in the village.

The model consists of five blocks of equations: (1) a household-farm production block, (2) a household-farm income block, (3) an expenditure block, (4) a set of general equilibrium

[5] The model was built in a joint research effort with Prof. J.E. Taylor, financed by the William and Flora Hewlett Foundation and the Pacific Rim Research Program (University of California).

[6] This methodology can easily be extended to other typical villages and to encompass larger regions, including village-town economies. We have some of this research underway.

closure equations, and (5) a price block. (The model equations are presented in Appendix 1 of Taylor, J.E., A. Yunez-Naude and S. Hampton).

The household-farm production sector includes three productive sectors (corn, livestock and non-agricultural), and one commercial sector that serves to "import" primarily manufactured goods into the village from the rest of Mexico. Production in each of the sectors is carried out with four factors: family labor, hired labor, physical capital and land. Contrasting traditional neoclassical household-farm models, it is not assumed that family and hired labor are perfect substitutes. The production technology in each sector is specified as Cobb-Douglas. The demand for nonfactor (intermediate) inputs, including manufactured inputs imported into the village (for example, fertilizer for corn production), is determined through the use of fixed input-output coefficients.

Household-farms are assumed to maximize utility defined on consumption goods and leisure. On the production side, this implies maximizing net farm income from the four production activities given market prices for output and either market or shadow prices for factors of production and intermediate inputs. Endogenous shadow prices include the family wage, which equals the marginal utility of leisure divided by the marginal utility of income. Physical capital and land inputs are fixed in the short run, but family and hired labor are variable inputs.

The household-farm sector in our model consists of three groups: small or subsistence farm households with fewer than 2 hectares of land, a middle group with 2 to 8 hectares of land, and largeholder households with more than 8 hectares of land. Household-farm income is the sum of wage income; capital, land and family-labor value-added from household-farm production activities; and migrant remittances. Mexico-to-U.S. migration and internal migration are a function of the differential between household group-specific average migrant remittances and the shadow price of family labor in village production activities. The expenditure block includes the consumption demand for village products and manufactured goods produced elsewhere in Mexico, leisure, savings, including investments in physical and human capital (schooling), taxes, and household-to-household transfers.

The general-equilibrium closure equations include local market-clearing conditions for factors and goods, a village savings-investment balance, and a village trade balance equation. For goods and factors for which the village is a price-taker in regional markets (that is, village tradeables), the market-clearing conditions determine net village marketed surplus. For nontradeables, they determine local prices. The savings-investment balance constrains village investments in physical and human capital to be self-financed, that is, out of household-farm savings. The trade equation constrains the value of village exports of goods and factors to equal the value of village imports. It represents the redundant equation in our village Computable General Equilibrium (CGE) system.

Prices of village tradeables are fixed, determined by markets outside the village. Prices of village nontradeables are determined by the interaction of local supply and demand. Family wages adjust to ensure that family time allocated to village production activities, to migration and to leisure equals families' total time endowments. Because land is assumed fixed, its price is also

endogenous, equal to its marginal value product in village production activities. It is most appropriate to view these VGEM as stylized models of Mexican village economies in different market settings, estimated with household-farm survey data.

Policy Simulations and Results

Three sets of simulations are discussed using our VGEM to explore the impacts of actual and alternative agricultural policy changes on production, incomes, migration and trade. The first simulation explores the impact of a 40 percent reduction in government price supports for corn. This decrease is similar to the prevailing difference between the domestic and the international price of corn and is plausible in areas of rural Mexico where farmers had relatively easy access to the government guaranteed price such as villages located near CONASUPO's purchase points. At the other extreme, villages that have not had access to the guaranteed price due to high transaction costs of getting harvests to government purchase points are not likely to experience price declines of this magnitude.

The second experiment simulates PROCAMPO, a government program in which direct subsidy payments compensate farmers for the decreased value of their harvests resulting from lower staple prices. This set combines a 40 percent staple price decrease with a subsidy payment equal to 40 percent of the base value of the farmers' corn harvest.

The third simulation explores an alternative to PROCAMPO, the allocation of government savings from reducing corn price supports to increase staple productivity by 10 percent.

Two models were estimated to include the effects of policy changes in different market settings: Model 1 assumes perfect commodity and hired labor markets (that is, all goods and hired labor are tradeable), and in Model 2 the village is completely cut off from the outside market of corn and labor, and so their prices are endogenous.

First Experiment A summary of the findings from the first simulation using Model 1 is reported in the first column of the Table of Results.[7] The 40 percent drop of corn-price reduces corn output by 28 percent, revealing a high output-price elasticity of corn production. This drives down the shadow value of family labor and land, but by a small percentage amount compared to the magnitude of the staple price change (by 0.5 percent and 2.2 percent, respectively). In response to the decreased profitability of producing corn, households reallocate resources away from the grain production toward other activities, with output increases of 1.8 percent in livestock and 1.1 percent in nonagricultural production. As the shadow value of family labor in village production decreases, migration increases (by 1.3 percent), and family leisure demand also rises (by 2.4 percent).

Total household-farm income declines, but by a small amount relative to the corn price change. Nominal income falls 1.6 percent. The high degree of diversification in the village means

[7] The figures in the table show percentage changes with respect to the base model solution. Model 2 of this experiment is not included in the table since, due to its isolation from the staple markets, the reduction of the price of corn has no effects on the village's economy.

that, *ceteris paribus*, a given percentage decrease in corn price translates into a much smaller percentage decrease in total income. The impact of the price change on nominal income is dampened further by the reallocation of family resources away from corn production. In real terms, small-holder households benefit from the income change; their average income rises by just under 9 percent. These households are marginal producers of corn and therefore lose relatively little on the production side. As heavy consumers of corn, however, they benefit from the price reduction on the consumption side. Subsistence household-farms also benefit from the expansion of nonfarm activities, to the extent that they supply labor to those activities, and from higher migration income. They lose to the extent they supply labor to corn producers.

Largeholder farms also benefit slightly in real terms (1.5 percent) from the corn price change. As growers of corn, they lose as a result of the price decrease. However, largeholder households are major producers of livestock, for which corn as feed is an input. They are also engaged in non-farm production, which increases as a result of the lower profitability of corn production. Finally, as consumers they benefit from the lower price of corn, although to a smaller extent than subsistence households because of their relatively low marginal propensity to consume grain.

Middle farmers benefit the least in real-income terms (1.0 percent). For this group, increased value-added from non-corn production, migration income and the benefits of a lower corn price on the consumption side barely compensate for the decline in income from corn production.

Corn price liberalization negatively affects trade linkages between the village and the outside world. As corn production contracts, purchases of intermediate inputs by village producers decline slightly (by 0.8 percent). The income elasticity of demand for manufactured goods produced outside the village is large, however. Hence, villagers' demand for manufactures contracts (by 1.6 percent) as a result of the income change. This finding reflects the importance of rural-urban growth linkages that imply negative repercussions of rural income declines for the urban economy.

Second Experiment Our second set of experiments simulates the effect of a direct income subsidy designed to compensate staple producers for the negative income effects of price liberalization. Such a subsidy is the centerpiece of Mexico's PROCAMPO program, a decoupled support scheme for staple producers which began to be implemented in the autumn/winter season of 1993-94. As in the first experiment, we assume a 40 percent decrease in the price of corn. Payments to farmers are calculated as a function of the price change times baseline production. The results of the PROCAMPO simulation for Models 1 and 2 are displayed in columns 2 and 3 of the Table of Results.

TABLE OF RESULTS (Percentage Change From Base)

Sector	Experiment 1 Price Reduction of Corn Model 1*	Experiment 2 PROCAMPO Model 1*	Experiment 2 PROCAMPO Model 2**	Experiment 3 Agricultural Productivity Model 1*	Experiment 3 Agricultural Productivity Model 2**
Corn Production Prices	-28.3	-28.5	1.1	-17.6	10.6
	(-40.0)	(-40.0)	(-2.5)	(-40.0)	(-5.0)
Livestock	1.8	1.8	-0.3	13.0	11.4
Nonagricultural Production	1.1	0.1	-2.7	-2.3	-3.4
Shadow Prices					
Family Labor	-0.5	0.0	1.4	1.1	1.8
Hired Labor	N.A.	N.A.	-0.4	N.A.	-0.65
Capital	-1.6	1.4	-0.6	10.1	8.6
Land	-2.2	-2.3	0.2	8.4	10.3
Household-Farm Incomes:					
Total Nominal	-1.6	0.9	6.9	3.5	5.1
Total Real	1.7	4.2	6.6	6.9	5.6
Real, By Household Group:					
Small-holder	8.8	10.3	3.2	14.6	6.9
Medium-holder	1.0	2.7	4.3	6.5	5.8
Large-holder	1.5	5.0	9.2	6.5	5.4
Consumption:					
Leisure	2.4	4.2	4.7	5.4	3.3
Staples	64.2	68.0	3.4	72.3	10.6
Manufactures	-1.6	0.7	6.5	3.6	5.1
External Linkages:					
Migration	1.3	0.1	-3.5	-2.8	-4.6
Net Imports:					
Intermediate	-0.8	-1.4	1.6	-0.4	1.2
Final	-2.5	1.0	9.5	5.7	7.9
Total	-1.6	-0.3	5.5	2.5	4.5

* Perfect commodity markets

** Missing labor and staple markets

Source: Taylor, J.E., A. Yunez-Naude and S. Hampton.

If the village is linked with the commodity markets (Model 1), the subsidy results in an overpayment to farmers, because the corn income loss is partially compensated by the reallocation of family resources into livestock and migration activities. Total households' nominal income increases slightly (by 0.9 percent) and real incomes rise for all household groups in the two models. In Model 1, the income subsidy completely nullifies the decrease in the marginal utility of leisure, and hence, the shadow value of family labor, relative to Experiment 1. The subsidy therefore dampens the migration effect of price liberalization, resulting in little change from the base.

The PROCAMPO subsidy nearly eliminates the negative impact of staple price reform on trade linkages between the village and the rest of Mexico. However, demand for intermediate goods produced outside the village decreases by a greater percentage amount than before because of the negative effect of the income subsidy on village corn production. By contrast, consumption demand for village (final) imports increases by 1.0 percent. So the combined effect of production and consumption linkages is a small decrease (0.3 percent) in village imports from the rest of Mexico.

The third column of the Table of Results reports the simulated effects of PROCAMPO for a village characterized by a closed staple market (Model 2). In this case, households benefit from the income subsidy without being directly affected by the staple price change. The interaction of local supply and demand schedules for staples determines the endogenous local staple price. In the first instance, the PROCAMPO subsidy increases household-farm incomes by an amount equal to 40 percent of the base value of corn production. This increases household-farms' consumption demand for normal goods, including nontradeables (leisure and corn). The family wage increases and stimulates local production of the corn (by 1.1 percent). It, together with a higher family wage, produces a contractionary effect on nonstaple production, specially nonagricultural output, which falls by 2.7 percent. The higher family wage discourages migration; it decreases by 3.5 percent. That is, migrant workers are called home to benefit from the higher value of their labor. The migration effect of PROCAMPO in this closed staple-market economy stands in contrast to the findings reported by Model 1 (second column of the Table of Results).

The existence of village nontradeables creates local income linkages. They, together with the direct benefits of the subsidy, result in an increase in total household nominal income of 6.9 percent (in real terms, 6.6 percent). The impact on village trade is positive. The demand for intermediate goods from the rest of Mexico increases only slightly (1.6 percent) because of the contraction in nonagricultural production. However, higher household incomes stimulate trade in consumer goods (9.5 percent). As a result, total village imports increase by 5.5 percent.

Third Experiment Our third experiment explores the implications of allocating fiscal savings from corn price liberalization to public investments designed to raise the productivity of family resources in village activities. The experiment is done to compare governmental policies' alternative to PROCAMPO. So, instead of direct income transfers, the public sector can use these resources in rural education or infrastructure works that raise productivity of family inputs in agricultural production. The simulation is based on an input productivity increase in the shift parameters in staple and livestock production by 10 percent.[8] This is equivalent to raising the marginal value products of all factors in crop and livestock production by 10 percent, as might result from factor-neutral technological change.

[8] The choice of a 10 percent productivity increase can be taken as arbitrary, but it is not out of line with impacts of education and technological change on productivity in Mexico. For example, in an econometric study on rural productivity, education and migration of eight villages in Mexico, we found that, controling for participation in different households' activities, a one person increase in family members with more than nine years of education is significantly associated with a 13 percent increase in household income from staple production. This result can be explained by the fact that households with higher education are those more highly capitalized and more closely linked to outside markets (Taylor, J.E. and A. Yunez-Naude, in press).

A rise in agricultural productivity combined with the corn price decline generates substantial increases in real income for all household groups using either of the two models (fifth and sixth columns of Table of Results). Total income gains are substantially greater in both real and nominal terms than under the PROCAMPO experiment. In the scenario where staples are tradeable (Model 1), corn production declines, but this decline is one third smaller than without the productivity increase (18 percent, compared with 29 percent in Experiment 2). Higher marginal profitability leads households to reallocate resources into livestock production, which increases as much as 13 percent. The productivity increase reverses the decline in the shadow value of family labor resulting from the corn price decrease in Experiment 1. As a result, migration now decreases (by 2.8 percent) rather than increasing.

In the closed corn market scenario (last column of the Table of Results), increased marginal productivity in agricultural production raises the supply of corn (by 10.6 percent) while driving down the local corn price (by 5 percent). It also stimulates production of the agricultural tradeable (livestock), although by less than in Model 1, where the economy is not constrained to be self-sufficient in staples. These agricultural activities compete with nonagricultural production for nontradeable factors (family and hired labor). As a result, nonagricultural output falls by 3.4 percent, and the family wage increases (by 1.8 percent). The higher family wage results in a decrease in migration (by 4.6 percent). Total nominal income rises by 5.1 percent, and real income jumps 5.6 percent. All households gain in both nominal and real terms from the rise in agricultural productivity in both models.

Despite the contraction of nonagricultural production in the village, higher household incomes stimulate trade linkages on the consumption side. As a result, total village imports increase by 4.5 percent.

In short, the presence of village nontradeables creates income linkages and price effects that alter, both quantitatively and qualitatively, the impacts of productivity gains on local incomes and production. Income effects generally are larger and tend to magnify linkages between the village and the outside world in traded-goods markets. Nevertheless, nontradeables create inefficiencies in local and regional production, diverting scarce resources into the production of nontradeables in which the village may not enjoy a comparative advantage in regional markets. They also constrain the supply response of tradeables. This is illustrated by a smaller livestock supply response to the productivity increase and also by a larger negative impact on nonagricultural production in the closed corn market scenario (last column of the Table of Results).

SUMMARY AND CONCLUSIONS

The results of the impact analysis based on VGEM contrast with findings of other studies in some important respects. A Nationwide Computable General Equilibrium Model that includes migration (Robinson et al.) estimates that NAFTA and, in particular, the drop of the price of corn will have a much higher increase in migration to the U.S.—around 40 percent as compared with our estimation of 1.3 percent from Model 1. The main reason for the difference is that, due to the diversified nature of small-farms activities, a drop in the price of corn translates into a much

smaller decrease in total farm income. In other words, with our modeling approach we consider the options that small farms have in getting income from sources different from corn production (livestock, nonagricultural production and waged labor). In addition to this, our model captures subsistence staple producers with deficits of corn production that benefit from the drop of the price of corn.[9]

Another study, extensively used by the critics of NAFTA and agricultural liberalization, compares the U.S. price of corn with the costs (monetary and non-monetary) of producing this crop in Mexico by small farmers. Considering the result that the U.S. price is lower, the author of this research concludes that corn production in Mexico will tend to disappear and rural emigration will sharply increase (Calva, 1995). The problem with this analysis is that it is partial (Calva isolates the production of corn from other small farmers' activities and sources of income), uses wages to evaluate family labor costs, and implicitly assumes no transaction costs for small farmers.

Our findings based on a stylized VGEM applied to a typical village of small producers of corn and livestock leads to the conclusion that the effects of NAFTA and the liberalization of the producer price of corn on the domestic supply of this grain will be lower than the predicted effect of other studies. [10] In addition, small farmers' livestock production is likely to increase with these reforms.

However, these results do not mean that small-scale farm production is to be ignored in the design of Mexico's agricultural policies. In a sense, this has been the official position in Mexico. It is reflected by the fact that PROCAMPO is based on income subsidies to all farmers producing staples, as well as by the separation the last two Administrations have done between their agricultural economic policies from their poverty alleviation policies.[11] By contrast, our model results show that using scarce public resources to enhance agricultural productivity in villages of small-scale staple and livestock producers can increase their households' incomes, reduce rural emigration and increase rural demand for manufactured goods. In addition, this type of policy may enhance the rural non-farm economy, a process that has accompanied the successful development processes of East Asian countries. Government targeted investments in rural education and infrastructure are also fundamental for the development of rural markets. The existence of these markets is a requirement for reducing transaction costs faced by small-scale farmers as well as for including the notion of competition into the analysis of the effects of policy reforms on small-scale farmers.

The suggestions of public investments directed to villages of small-scale producers do not contradict the purpose of harmonizing North American agricultural policies, if we take that to mean the elimination in Canada, Mexico and the United States of prevailing subsidies to (modern) agricultural producers and government direct intervention in agriculture.

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[9] Another difference is that a micro economy-wide model compared with a national CGE model needs fewer assumptions to estimate and calibrate the model, given the availability of household-farm survey data.

[10] De Janvry et al. obtain similar conclusions using a different modeling approach and data.

[11] I am refering to the current Administration policy called PRODUCE, which is basically directed to subsidize only those farmers with competitive potential, and to SOLIDARIDAD, the poverty alleviation program initiated by President Salinas de Gortari which is separated, formally and administratively from PROCAMPO and PRODUCE.

In fact, our discussion leads to the conclusion that economic harmonization between Mexico and its North American partners' corn and livestock sectors is not going to happen soon or even in the medium run.

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