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Vulnerability of Mexican Farm Households in a Changing Economy

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ABSTRACT

In the context of the structural transformation of the Mexican economy, we conduct a comparative analysis of incomes of farm households relative to non-farm households over the last two decades. We use household-based budget surveys from 1984 to 2004 that are collected and harmonized by the *Luxembourg Income Study*. We first examine the evolution of average farm household income relative to average non-farm household income across Mexican regions over that period. Second, we show the evolution of low-income and inequality indicators of farm households relative to non-farm households across regions and years. We then investigate whether explanations for low farm income given in the literature also apply to Mexico by econometrically testing both household socio-demographic variables and macroeconomic variables such as commodity and labour market conditions, income-earning capacity and agricultural programmes.

KEYWORDS farm households, farm incomes, agricultural transformation, agricultural policy, Mexico

JEL CODES O13, Q12, Q18

I. Introduction

Agriculture in Mexico has continued its gradual change as in many other countries undergoing an economy-wide transformation. Between 1980 and 2005, the share of agriculture in Mexico's employment declined from 27 to 16 percent and its share in total value added from 8.5 to 3.4 percent. This transformation process occurred as incomes measured in real gross domestic product (GDP) per capita grew at an annual average of 0.96 percent during the same period. Two major crises severely disrupted economic growth in that period. First, a debt crisis in 1982 caused a period of stagnation prolonged until 1988 by a terms-of-trade shock resulting from an oil

price collapse. Second, a combined currency and banking crisis in 1995 provoked a short recession. In 2001, the sharp slowdown of the United States (U.S.) economy initiated a mild recession in Mexico. After the 1995 macroeconomic contraction, real GDP per capita grew at an annual average of 2.8 percent between 1995 and 2006. During that same period, agricultural productivity measured in real value added per civilian labour in agriculture grew at a more rapid annual average of about 4.5 percent.[4]

In the course of this profound transformation, agriculture in Mexico has also been affected by the deregulation and the opening of the economy. Since Mexico joined the General Agreement on Trade and Tariffs (GATT) in 1986, it has significantly lowered its import tariffs at rates most often below the maximum allowed rate of 50 percent and converted import licenses to tariffs.[5] In 1994 the North American Free Trade Agreement (NAFTA) took effect resulting in the Mexican elimination of most trade barriers with Canada and the U.S. in 2005.[6] Since the late 1980s, the Mexican agricultural policy regime progressively changed from direct market interventions to direct income support payments under the PROCAMPO programme. This programme was launched in 1993 to help farmers cope with lower trade protection and with the removal of direct price support programmes.[7] Mexico also liberalized the property rights of the communal land called *ejido* in 1992, dismantled the agricultural state agency CONASUPO in 1999, and reduced or eliminated input, credit and insurance subsidies. As an illustration, agricultural support measured by the Producer Support Estimate (PSE) dropped from 30 percent in 1993 to 14 percent in 2005 (OECD (2006)). Ever since the switch of farm support from price protection to decoupled payments, crop production has fallen relative to the trend and has become more land intensive but less labour and intermediary input intensive.

In addition to these trade and agricultural policy reforms, Mexico has radically reoriented its social policy towards rural poverty and raised its public expenditures in poverty reduction programmes (OECD (2006)), which reversed the strong urban bias in the allocation of public resources for education, health and food programmes prevalent up to the middle of 1990s. As a consequence, the rural share in total public social expenditures rose to 30 percent in 2004, and 65 percent in the case of targeted programmes. These better targeted programmes together with economic recovery are believed to have contributed to alleviate poverty in rural areas since 1996.[8] However, poverty is still more common in rural areas than in urban areas, particularly in the Southern region (Verner (2005)). In 2004 about a quarter of the total population lived in rural areas, but this rural population included nearly half of the country's poor. In addition, the extremely unequal income distribution of Mexico has not changed much since 1992 (Verner (2005)). Reforms to agricultural policies have brought substantial improvements in the distribution of transfers among farmers but have fundamentally kept their income distribution regressive in absolute terms and, with the exception of PROCAMPO, regressive relative to income as well (OECD (2006)).

Within this general context, we first examine how incomes of farm households relative to non-farm households have progressed as well as how income distributions of farm households have evolved relative to those of non-farm households during these last two decades of fundamental changes in economic, social and agricultural policies. We then investigate to what extent potential determinants of farm household incomes have played a role in these evolutions. In particular, we test whether commodity and labour market conditions, income-earning capacity and agricultural programmes have contributed to improve incomes of farm households relative to incomes of non-farm households from 1984 to 2004.

II. Comparisons of Farm and Non-Farm Income Levels

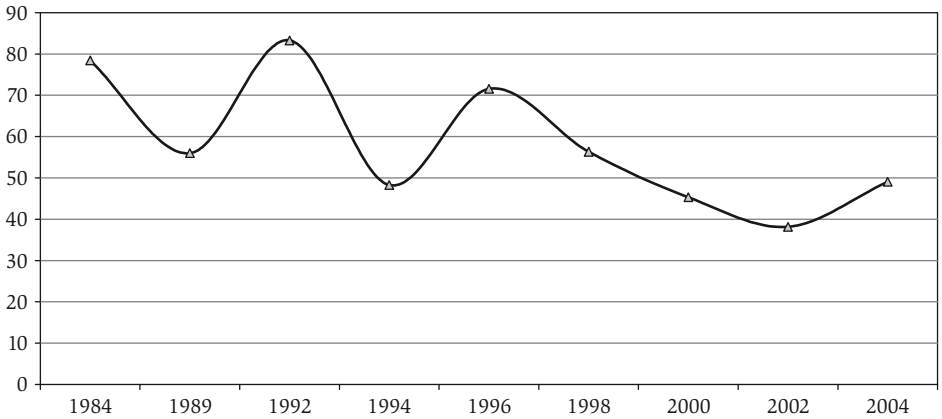
In this paper, we use the nine Mexican waves of the *Luxembourg Income Study* (LIS), a dataset which consists of harmonized household-based budget surveys from 1984 to 2004. It covers all national or foreign households living in private dwellings in Mexico and contains socio-demographic, expenditure and income data that are collected at the household and individual level.[9] The distinction between farm and non-farm households is made according to the source of the household's net disposable incomes. Following the OECD (2001) narrow definition of a farm household, a household is considered a farm household when its income from farm self-employment is equal or greater than half of its factor incomes consisting of gross wages and salaries, farm self-employment income, non-farm self-employment and cash property income. This definition, however, reduces the representativeness of small farms in our sample, since smaller farms tend to have a smaller share of their income from farm self-employment than larger farms.[10] Taking into account all these considerations, our sample consists of 11,093 farm and 103,382 non-farm households for nine survey waves from 1984 to 2004 as reported in Table A.1 in the Appendix.

Focussing on temporal evolutions, we can not fail to notice that the proportion of farm households in the sample drops from 15 percent in the 1984 wave to 5 percent in the 2004 wave. This large decline is observed in all seven regions[11] except in the Southern region, which thus maintains the highest fraction of farm households (see Table A.1 in the Appendix).

Figure 1 shows the ratio of the average net disposable income (DPI) of farm households to the average DPI of non-farm households fluctuating between 38 percent in 2002 and 83 percent in 1992 with a noticeable long-term downward trend. The peak in 1992 corresponds to a period when the PSE was at its peak. The peak in 1996 corresponds to a period of short recession that may have affected relatively less the incomes of the farm working population because of a likely longer transmission of economic downturns to the performance of their operations. It is un-

clear to what extent reforms in social and agricultural policies of the late 1990s have started to improve incomes of farm households in 2004.

A similar pattern in income ratios is observed at the regional level with, however, some differences in level across regions (see Figure A.1 in Appendix). Except for the last two waves, the average farm household income in the North region fluctuates around the average non-farm household income. This observed income parity could have several reasons. First, the farm economy in that region is actually the most productive and integrated within the general economy. In addition, rural households in that region benefit more from trade with the U.S. than those in the other regions (Hanson (2005)). The average farm household income in the Pacific and Gulf regions are about three quarters of the average non-farm household incomes while the average farm household incomes in the South, Center-North and Center regions are about two third of the average non-farm household incomes. The econometric tests in the fourth section of this paper investigate hypothetical determinants for explaining this pattern using household socio-demographic and economic data.



Source: LIS.

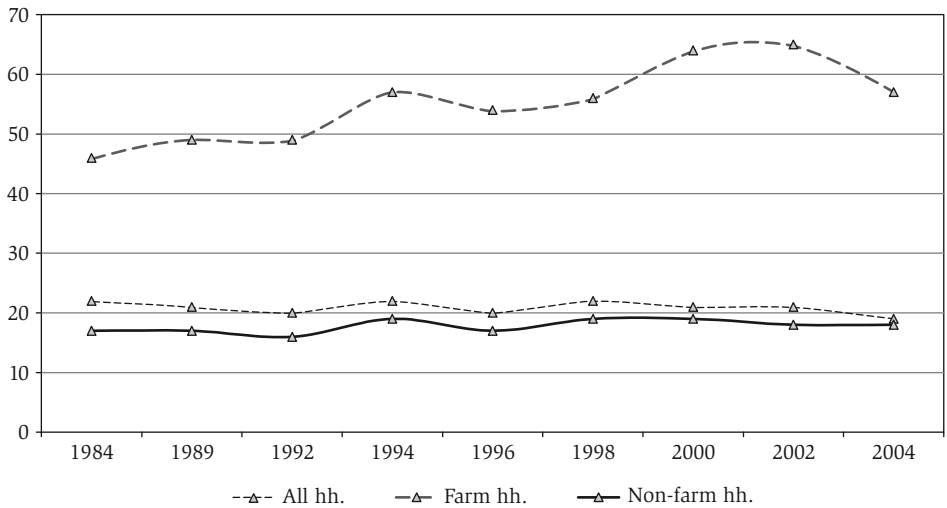
Figure 1. Ratio of average DPI of farm households to non-farm households (%) in Mexico from 1984 to 2004.

III. Comparisons of Farm and Non-Farm Income Distributions

The distribution of farm household incomes is now measured and compared to the distribution of non-farm household incomes. Three indicators of income distribution are calculated for each household category and wave. They include the low-income rate (LIR), the low-income gap (LIG) and the Gini index. The low income threshold

is defined relatively as 50 percent of the yearly median income of all households. In this way we not only avoid any arbitrary choice as to what constitute basic needs but also correlation with macroeconomic performances (Förster (1994)).

The LIR measures the cumulative proportion of households below the low-income reference. Figure 2 shows that this measure of low-income incidence is not only consistently higher for farm households, but also steadily rises during the period of observation. In contrast, the incidence of low income among non-farm households stabilizes around 18 percent.



Source: LIS.

Figure 2. Low income rate of households (%) by household category in Mexico from 1984 to 2004.

Because geographic factors are important to understand low income in Mexico, the four indicators of income distribution are also calculated by region across years.[12] The incidence of low income among farm households is systematically greater in the South, Center and Gulf regions than in the other three regions (see Figure A.2 in Appendix). Low-income incidences among farm households over the last two decades also tend to diverge among regions. The farm to non-farm LIR ratio (available upon request) is systematically higher in the North than in the South region. This implies that low-income households are much more concentrated within the farm household community in the North than in the South region.

The LIG is defined as the difference between the average income of the low-income households and the low-income reference, as a percentage of that low-income reference. Figure 3 shows that this measure of low-income intensity is consistently

higher and increasing for farm households. Here also the low-income intensity among farm households is larger in the South, Center and Gulf regions than in the other three regions (see Figure A.3 in Appendix). Low-income intensities among farm households over the last two decades also tend to diverge among regions.

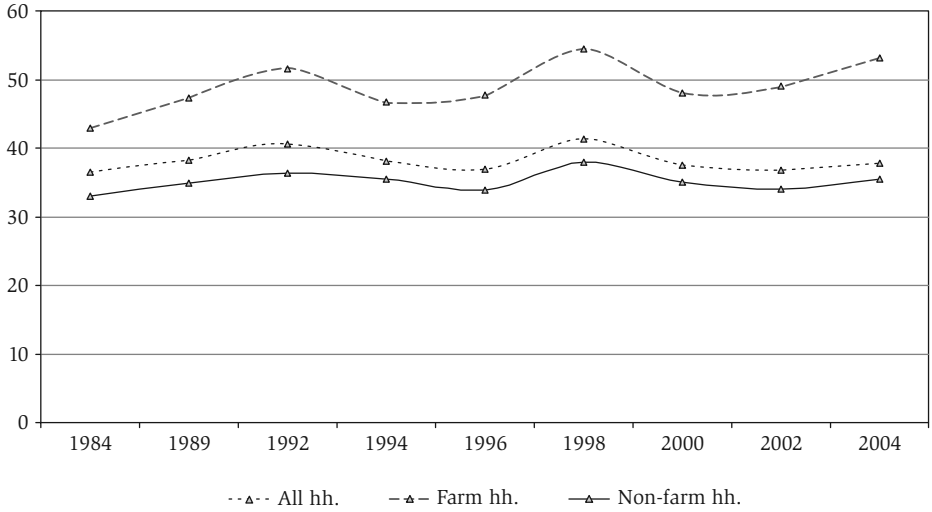


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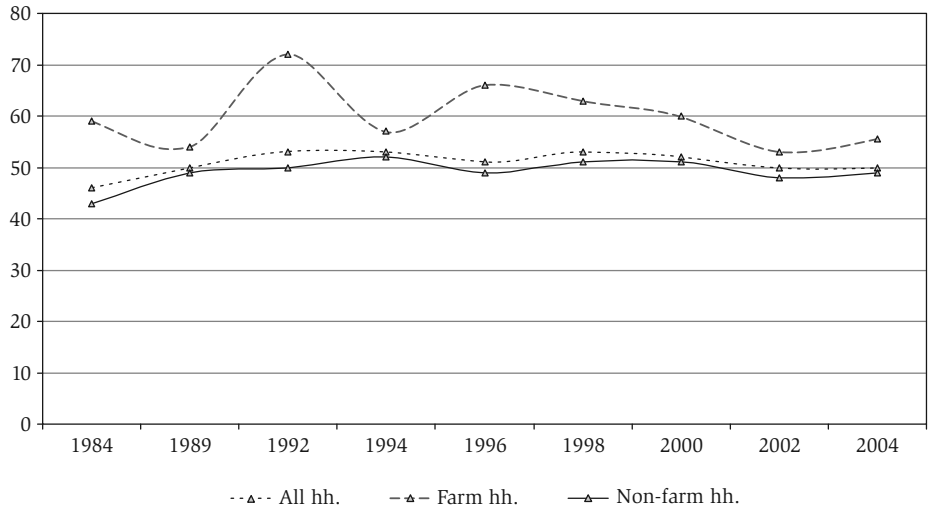
Figure 3. Low income gap of households (%) by household category in Mexico from 1984 to 2004.



Source: LIS.

Figure 4. Gini index of households (%) by household category in Mexico from 1984 to 2004.

Figure 4 shows that the Gini index, a measure of inequality of income distribution, defined in percentage as twice the area between the line of perfect equality and the Lorenz curve,[13] is also consistently higher for farm households. Despite some fluctuations during the last two decades income distributions among farm households tend here to converge among regions (see Figure A.4 in Appendix). They are systematically less equal between farm households than non-farm households in every region, in particular in the North region. This reflects the great disparity in farm types from small-scale to large-scale farms, since large-scale producers have access to financial, insurance and input markets that allow them to have higher incomes, while small-scale farmers face limited access to production factors. These figures confirm that Mexico's high income inequality has not improved much during the last two decades despite the reorientation of its social programmes towards rural poverty. The extremely unequal income distribution among farm households, however, has fallen since 1996.

Above comparisons clearly show that the incidence and intensity of low income among farm households worsened over the last two decades. These observations do not necessarily contradict the finding that rural income poverty declines from 1996 to 2002 as reported in OECD (2006). First, the income poverty measurement reported in OECD (2006) is based on an absolute subsistence minimum in terms of basic needs for food, health and education while our measurement is based on the relative approach. Second, farm households that rely for more than 50 percent of their net disposal incomes on farm self-employment form a small and decreasing share of the rural population. For instance, in 2002, farm production activities only accounted for 18 percent of the net income of rural households (OECD, 2006). For these reasons, it is therefore possible that, as the low-income incidence of *farm* households rose, the income poverty of *rural* households declined.

IV. Determinants of Household Incomes

A. Theoretical Considerations

The second section of this paper has shown that incomes among farm households are on average lower than those among non-farm households. The third section has shown greater low-income incidence and intensity and a greater income inequality among farm households than non-farm households. This section identifies possible factors that may explain these income gaps. The next section will econometrically test these factors.

Gardner (1992) distinguishes three sets of potential causes for the observed low income of farm households. First, a supply-demand model of aggregate commodities has been used to explain low and unstable farm incomes. The essential fea-

tures of this model include very inelastic demand and supply of agricultural products, a faster growth rate of supply than demand and small transitory shocks of output or demand (Schultz (1945); Cochrane (1958); Hathaway (1964); Tweeten (1971)). This commodity-based supply-demand model remained classic among agricultural economists until the 1980s.

Johnson (1953) has tested a second hypothesis, in which low farm income results from a compensating differential for skill differences and non-wage aspects of both farm and non-farm employment. Using US data, he failed to attribute the full difference in real labour returns to skill differences, which motivated the third hypothesis: labour market failures cause low farm income.

Indeed, chronically low farm incomes have been explained by the persistence of a disequilibrium between the farm and non-farm labour markets that keeps farm people with lower incomes in the farm sector (Johnson (1963)). This disequilibrium could result from transaction costs in terms of labour movement such as job search and moving expenses and, in a longer run perspective, from a mismatch between farmer's skills and off-farm job requirements.

We are thus interested in testing whether commodity and labour market conditions, income-earning capacity as well as some other factors such as agricultural programmes and regional specificities explain the observed trends and fluctuations in farm household incomes in Mexico. Commodity market conditions that could be favourable to farm household incomes are traced through the agricultural terms of trade. Labour market conditions facilitating labour mobility of farmers to non-farm sectors are not easy to translate into measurable variables. In the short run, higher unemployment in the general economy is expected to increase job search costs, as a result of fewer off-farm job opportunities. In addition, farm households in urban areas are likely to find more remunerative opportunities of employment. Economic growth is expected to have a relatively minor effect on farm incomes because of the longer adjustment lags in the farming sector. Income-earning capacity as a result of skills and experience can be captured by differences in age and education levels as in the labour market literature. Because farm household incomes can also depend on governmental interventions, we test whether subsidies allocated to farm direct payments and general agricultural services affect their incomes.

B. **Implementation**

The agricultural terms of trade (ATT) are calculated as the ratio of the deflated price indexes of agricultural products and means of agricultural production. These indexes are taken from the national Banco de México.

Unemployment is measured with the annual urban unemployment rate that is available from the Economic Commission for Latin America and the Caribbean (ECLAC). Following the official definition used in Mexico a household residing in a

locality with more than 2,500 inhabitants is considered to be located in an urban area. Economic growth[14] is measured with the annual growth rates of real GDP per capita at 2000 constant prices (chain series) that are taken from the Penn world table of Heston *et al.* (2006).

We distinguish three levels of completed education. The low education level consists of primary education. The medium level corresponds with lower secondary education. The high education level indicates successful completion of any form of formal education above the lower secondary level. Both the education level of the household head and its spouse are considered as indicators of income earning capacity, by including two dummy variables for each person (with the lowest education level acting as the base category). The remaining proxies for income earning capacity we consider are gender, age and age^2 of the household head and the number of potential income earners, measured as the number of persons between the age of eighteen and sixty-five, present in the household. Table A.2 provides descriptive statistics for all household level variables.

Subsidies for farm direct payments and general agricultural services are calculated from the producer support estimate (PSE) of the OECD for Mexico.[15] Farm direct payments were absent until 1985 and then fluctuated between four to ten percent of the total value of farm production. Subsidies for general agricultural services were on average 19 percent of the total value of farm production until 1984, but dropped to two percent between 1995 and 2005. We also test whether policy-induced agricultural price distortions affect farm household incomes. For that purpose we use the relative rate of assistance (RRA) to agriculture reported in Soloaga and Lara (2008) for Mexico.[16] The RRA generally fluctuates inversely to the real exchange rate (RER). It gradually rose from being negative in the early 1980s to positive values in the early 2000s. In 2003-04, the RRA turned negative again as a result of a drop in the nominal rate of assistance (NRA) of both agricultural importables and exportables.

The group of variables capturing agricultural terms of trade and governmental intervention are only tested for farm households.[17] To avoid a multi-collinearity problem, the ATT and RRA variables are included in two separate estimations.

Since farm household income and low-income indicators vary according to regions, regional dummies are added to control for regional specificities not accounted for in the other explanatory variables. These regional characteristics include agricultural productivity, access to input and output markets, access to land, access to financial and insurance services, access to basic public services (sanitation, health care, electricity and piped water) and infrastructure (transport and communications). An annual trend is also added to control for inflation as well as for other time-related variables such as technological progress, gradual market integration, progressive reorientation of social programmes to rural poverty, and improvement in the functioning of the farmland market thanks to the reform of property rights in the *ejido* sector since 1993.

V. Estimation Results

The econometric model is designed to test, first, whether income-earning capacity, labour market conditions, regional specificities and the passing of time differently affect individual farm household incomes compared to individual non-farm household incomes and, second, whether the commodity market conditions and agricultural programmes specifically affect individual farm household incomes. Except for real per capita GDP growth and the relative rate of assistance that are negative for some years, all the continuous variables are expressed in natural logarithm to obtain directly their elasticities.

Because we are unable to identify any exogenous instruments, the logarithm of the individual household incomes is regressed on above set of explanatory variables using simple Ordinary Least Squares. However, standard errors are adjusted to take into account the particular structure of the LIS dataset, since usual standard error estimates, assuming disturbances that are independently distributed across observations, largely underestimate the true parameter estimate standard errors. This is immediately obvious for the (national) macro-economic variables, which are constant within each period (Moulton (1990)). However, even when all variables would vary over individuals within the same period, the presence of a time-specific error-component (due to business cycle effects, for instance) would have a similar effect. In addition parameter variances are allowed to differ between farm and non-farm households. We do not assume an individual-specific error-component, because the LIS data are not panel data, but simply independent cross-sections obtained at consecutive periods. In summary, the standard errors are corrected for the fact that the data are grouped into farm and non-farm clusters that differ from year to year.

Table 1 shows two series of similar econometric results whether the agricultural terms of trade or the relative rate of assistance is included. For these two series using 113,070 household observations, the variation in explanatory variables of the model explains 73 and 72 percent of the variation in the household incomes respectively. Since both series produce very similar estimations, results are commented for the first series only.

Table 1. Cluster regressions of household income in Mexico.

Dependent variable[a]	Model with Agricultural Terms of Trade			Model with Relative Rate of Assistance		
	Coef.	Robust Std. Err.	P-value	Coef.	Robust Std. Err.	P-value
All households:						
Intercept	-389.73	50.95	0.00	-389.73	50.95	0.00
Age head	0.25	0.02	0.00	0.25	0.02	0.00
Age squared head	-0.01	0.00	0.00	-0.01	0.00	0.00
Medium education head	0.36	0.01	0.00	0.36	0.01	0.00

Dependent variable[a]	Model with Agricultural Terms of Trade			Model with Relative Rate of Assistance		
	Coef.	Robust Std. Err.	P-value	Coef.	Robust Std. Err.	P-value
High education head	0.88	0.02	0.00	0.88	0.02	0.00
Medium education spouse	0.12	0.03	0.00	0.12	0.03	0.00
High education spouse	0.41	0.03	0.00	0.41	0.03	0.00
Male head	-0.03	0.01	0.01	-0.03	0.01	0.01
Potential earners	0.12	0.00	0.00	0.12	0.00	0.00
Unemployment rate	-1.19	0.58	0.06	-1.19	0.58	0.06
Real per capita GDP growth	0.08	0.05	0.10	0.08	0.05	0.10
Urban residence	0.45	0.02	0.00	0.45	0.02	0.00
North region	0.06	0.03	0.10	0.06	0.03	0.10
Gulf region	-0.22	0.06	0.00	-0.22	0.06	0.00
Pacific region	0.03	0.03	0.34	0.03	0.03	0.34
South region	-0.36	0.04	0.00	-0.36	0.04	0.00
Center-North region	-0.11	0.03	0.00	-0.11	0.03	0.00
Center region	-0.29	0.04	0.00	-0.29	0.04	0.00
Time	0.20	0.03	0.00	0.20	0.03	0.00
Farm households (interactions with farm household dummy):						
Intercept	120.32	53.23	0.04	85.26	57.48	0.16
Age head	0.21	0.05	0.00	0.21	0.05	0.00
Age squared head	0.00	0.01	0.56	-0.01	0.01	0.52
Medium education head	0.06	0.06	0.28	0.07	0.06	0.26
High education head	0.19	0.06	0.01	0.18	0.07	0.01
Medium education spouse	0.33	0.05	0.00	0.32	0.06	0.00
High education spouse	0.48	0.12	0.00	0.44	0.12	0.00
Male head	0.17	0.05	0.00	0.17	0.05	0.00
Potential earners	-0.06	0.01	0.00	-0.05	0.01	0.00
Unemployment rate	-0.22	0.59	0.72	0.16	0.65	0.81
Real per capita GDP growth	-0.03	0.05	0.62	0.00	0.08	0.97
Urban residence	-0.08	0.04	0.08	-0.10	0.04	0.03
North region	0.50	0.12	0.00	0.52	0.12	0.00
Gulf region	0.33	0.11	0.01	0.34	0.11	0.00
Pacific region	0.50	0.14	0.00	0.51	0.13	0.00
South region	0.19	0.11	0.10	0.21	0.11	0.07
Center-North region	0.42	0.13	0.00	0.44	0.12	0.00
Center region	0.22	0.08	0.01	0.26	0.09	0.01
Time	-0.06	0.03	0.04	-0.04	0.03	0.16
Farm direct payment support	-0.05	0.02	0.01	-0.11	0.07	0.12
General agricultural service support	-0.88	0.06	0.00	-0.98	0.18	0.00
Agricultural terms of trade	2.49	0.26	0.00			
Relative rate of assistance				1.68	0.42	0.00
Number of observations	113070				113070	
R-squared	0.73				0.72	

(a) Periods of studies include 1984, 1989, 1992, 1994, 1996, 1998, 2000, 2002 and 2004. The dependent variable and independent variables Age, Age squared head, Unemployment rate, Farm direct payment support, General agricultural service support and Agricultural terms of trade are in natural logarithm.

At less than one percent of significance, the age of the household head is significantly positive but at a decreasing rate.[18] Medium and high education levels of the household head and spouse are significantly positive. As expected, higher household incomes are associated with higher age and education. The linear effect of age is higher for farm households than for the rest. Except for the middle education level of the farm household head (which is not significant), education has a further positive impact for farm households. A male household head leads to a slightly lower disposal income, but to a slightly positive net effect for farm households. The number of potential earners has a significant positive effect for farm households that is nevertheless significantly lower than its effect for non-farm households. Income-earning capacity is, therefore, not rejected as a possible explanation for variations in farm household incomes.

The unemployment rate is borderline significantly negative as expected with a negative elasticity of 1.19 for all households while real per capita GDP growth rate is less significant but positive as expected. These two macro-economic variables do not affect incomes of farm households more than incomes of non-farm households. As expected, urban residence of the household is significantly positive for all households. Proximity to urban centres offers greater off-farm opportunities for both farm and non-farm households. Labour market conditions, therefore, can not be rejected as a possible explanation for variations in farm household incomes.

Compared to the Capital region, all regions except the North and Pacific regions are significantly positive for all households while all regions except the South region are significantly positive for farm households, implying that they all positively affect incomes of farm households. The time trend is significantly positive with an elasticity of 0.20 for non-farm households and 0.14 for farm households. Regional specificities as well as time are, therefore, not rejected as a possible explanation for variations in farm household incomes.

The agricultural-terms-of-trade variable is significantly positive with a large elasticity of 2.49 in the first series. Input and output market conditions are, therefore, not rejected as a possible explanation for variations in farm household incomes. The relative rate of assistance is significantly positive in the second series. Policy-induced agricultural price distortions matter for incomes of farm households in Mexico. Since these price distortions indicate to what extent domestic market prices fare relative to international prices, their positive significance confirms that commodity market conditions matter for income of farm households in Mexico.

The farm direct payment support is significant with a small negative elasticity of 0.05 in the first series. On average, these direct payments represent between five and eleven percent of the value of farm production. In addition, the progressive PROCAMPO programme which makes on average about half of the farm direct payments between 1994 and 2004 is a producer compensation mechanism tied to land rather than to commercial sales. The PROCAMPO direct payments are then likely to be eventually capitalised into land values in the form of higher rents and generate

higher costs as mentioned in OECD (2006) and, hence, be neutralised in the farm net income. The general agricultural service support is significant with a negative elasticity of 0.88 in the first series and 0.97 in the second series. Probably too few and narrowly focused to large commercial farms, these services hardly affect farm incomes of farm households. In addition farm direct payments and general agricultural service support are calculated at the national level and, hence, are most likely to represent poorly the situation at the farm level.

In sum, with crude indicators of commodity and labour market conditions, the three hypothetical sets of explanations to low income of farm households are not rejected in case of the Mexican agriculture. Incomes of farm households are indeed subjected to commodity market conditions captured in this econometric test by agricultural terms of trade, labour market conditions captured by unemployment, economic growth and urban residence, and income-earning capacity captured by age, education level and number of potential earners in the household. Regions and time also matter. Government-imposed distortions that provide a relative protection to the agricultural sector matter but, surprisingly, not those programmes that provide farm direct payments and general agricultural services.

VI. **Conclusions**

The above analysis of farm household incomes in Mexico suggests several tentative conclusions and recommendations. First, the descriptive analysis shows that the income gap between farm and non-farm households widens over the last two decades in the process of the agriculture transformation. Second, low-income incidence and intensity are more severe among farm households than non-farm households. Low-income incidence among farm households rises over the last two decades but drops slightly in 2004 possibly thanks to social programmes that have become more targeted to rural poverty since the late 1990s. The income distribution is also more unequal among farm households than non-farm households. Income inequality among farm households, however, declines over the last decade and tends to resemble income inequality among non-farm households in some regions. Despite reforms of social and agricultural policies income remains low among farm households in 2004. Third, the econometric investigation does not reject the hypothesis that low income in Mexican agriculture can be explained by commodity and labour market conditions as well as income-earning capacity. Regions, time and government-imposed distortions also matter but, surprisingly, not economic growth, farm direct payments and general agricultural services.

Despite the limitations of this crude investigation, several general recommendations can be nevertheless suggested. First, commodity and labour market integration

matters for farm household incomes. The government should, therefore, pursue its efforts to improve the functioning of these markets, in particular by continuing investing in transport and market infrastructure, devoting additional resources to support information systems and inspection services as well as strengthening competition in rural areas. OECD (2006) reports some high concentration and non-competitive behaviour along some marketing channels that lead to higher transaction costs and lower producer prices for given retail prices. These efforts should improve the general environment for trading goods domestically and abroad.

Second, education also matters for strengthening skills not only for a greater performance of the various on-farm activities but also for a larger participation in off-farm activities, at either a part-time or full-time basis for household members. Here also the government should continue to improve education services in rural areas as stressed in OECD (2006).

Third, regional specificities affect incomes of farm households. It is, therefore, necessary to account for the regional dimension, for example, by better targeting investment in infrastructure in a view to improve the functioning of input and output markets but also in education and other public services such as health-care as they are deficient in many rural areas.

Fourth, if time reflects technological progress, then it indicates that there is also a role for the government to increase its support to research and technological development as well as to facilitate access to technology through credit. Widening the scope of such development to a panel of more diverse commodities than currently could better respond to the diversity of the Mexican farming systems and sustain production opportunities more in line with the comparative advantage of the regions as suggested in OECD (2006).

Fifth, government-imposed distortions on farm output and input markets affect farm household incomes. The government should, therefore, consider removing all remaining market distortions that still disrupt the trading of some commodities, in particular some exports such as coffee and tomatoes as indicated in Soloaga and Lara (2008).

Sixth, farm direct payments, including input subsidies, do not affect positively incomes of farm households. With the exception of the progressive PROCAMPO payments, these direct payments were not tailored to overcome deficiencies in farm household incomes. If the objective is farm income support, then these farm direct payments should be linked to income and, eventually, targeted to disadvantaged regions and farm households, particularly those experiencing temporary structural adjustment, to make these payments progressive relative to household income. We may, however, question the relevance of these direct payments on the basis of two considerations. It would be more efficient to use these public funds to widen the socio-economic development of rural areas through the improvement of the functioning of the output and input markets and the generation of employment opportunities. It would also make more sense to divert these public funds to poverty alle-

viation programmes following the general principle that social policies are much better suited to poverty concerns. Considering the prevalence of low income among farm households in Mexico, it is not clear which appropriate combination of agricultural and social policies would be the most efficient with respect to the use of scarce public funds. Although income risk has not been addressed in this paper, one development of agricultural policies that OECD (2006) suggests to handle variability in farm household incomes for Mexico would be linking farm payments to income in the form of a net income insurance scheme.

Seventh, general services to agriculture do neither affect positively farm households. To have a positive impact, these services should be reoriented towards infrastructure necessary for trading agricultural goods and public expenditures on information and communication technology, inspection and certification services and human capital development should be increased as recommended in OECD (2006). Subsiding insurance to producers to address systemic risks should also be part of these general services.

This study could not show the contribution of the financial and land markets for narrowing the income gap between farm and non-farm households. We, however, know that access to financial services and land is as important as access to output and input markets. Credit and banking services are particularly deficient in rural areas for reasons explained in OECD (2006). Moreover, low-income farm households hardly use land as collateral for bank loans. Important changes in the *ejido* land tenure system initiated in the 1990s aimed at establishing property rights so that land could then serve as collateral for loans. But, according to OECD (2006), the remaining procedural barriers and disincentives to complete land ownership and tradability refrain banks from accepting *ejido* land as collateral. They also discourage farm households to seek credits for trading land. These remaining barriers and disincentives of the reformed *ejido* land tenure system still hinder the evolution of a private land market and prevent farm consolidation and adjustment from occurring. As a result, the needed structural change of the agricultural sector is slowed. Greater economic viability of the restructured farms could have increased incomes of farm households and, in turn, facilitated their access to public services such as education and health. According to OECD (2006), the new land tenure system has, nevertheless, enabled greater participation of *ejido* household members in off-farm labour markets.

In conclusion, this paper has identified commodity and labour markets as well as income-earning capacity and regional specificities as key determinants of farm household incomes. Other available studies have also shown the importance of the functioning of the financial and land markets for farm household incomes. Economy-wide policies, therefore, matter for farm households in Mexico. Because of the prevalence of low income among farm households, there is a specific role for agricultural policy reforms but certainly not in isolation from broader economic and social policies.

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NOTES

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4.. Shares and growth rates are calculated from statistics reported by OECD.
5. Except for a panel of agricultural products that includes cereals, sugar, dry beans, potatoes, milk powder and poultry meat (see OECD (2006)).
6. Except for four agricultural products: maize, sugar, dry edible beans and milk (see OECD (2006)).
7. Until 1990 most domestic crop prices were kept above world prices by means of import tariffs and quotas. Beginning in 1991, direct payments became being made on the basis of farm land owned or input used (Soloaga and Lara (2008)).
8. From its peak in 1996 as a consequence of the macroeconomic contraction, rural poverty declined by nearly one half to 2004 (OECD (2006)).
9. The sampling frame is the *Instituto Nacional de Estadistica, Geografia e Informatica* (INEGI) sampling frame for multiple purposes, constituted by demographic and cartographic information obtained from quinquennial National Censuses. The survey structure is cross-sectional. There are no household identification numbers between waves to construct a panel dataset (see LIS for more information). The net disposable income of a household is adjusted to account for its size, using an equivalence elasticity of 0.55 (see Förster, 1994).
10. In 1997, on average, income of farm activities accounts for less than 50 percent of total household income on farms smaller than 10 hectares (De Janvry and Sadoulet (2001)).
11. The seven regions include the following Mexican states. The North region includes the states of Baja California Norte, Coahuila de Zaragoza, Chihuahua, Nuevo Leon, Sonora and Tamaulipas; the Capital region the Federal District and the state of Mexico, including the suburbs of Mexico city for 1996 and 1998; the Gulf region the states of Campeche, Quintana Roo, Tabasco, Veracruz-llave and Yucatan; the Pacific region the states of Baja California Sur, Colima, Jalisco, Nayarit and Sinaloa; the South region the states of Chiapas, Guerrero, Michoacan de Ocampo, Oaxaca; the Center-North region the states of

Aguascalentes, Durango, Guanajuato, Queretaro de Arteaga, San Luis Potosí and Zacatecas; the Center region the states of Hidalgo, Morelos, Puebla and Tlaxcala.

12. Because of the small sample size of farm households, the Capital region is excluded from the income distribution analysis performed at the regional level.
13. In economics, the Lorenz curve is a graph showing the cumulative share of income earned by the cumulative share of households from lower income. The Gini index can be calculated by the following formula (Förster (1994)):

$$G = \frac{2}{n^2 \bar{y}} \sum_{i=1}^{n} i\left(y_i - \bar{y}\right) \cdot 100$$

where n represents the number of households in the population, y_i the income of the ith household and $\bar{y}$ the average income.

14. Unemployment and real per capita GDP growth rate are not available at the regional level.
15. Subsidies for farm direct payments are expressed in percentage of the total value of agricultural production at farm gate and direct payments and subsidies for general agricultural services in percentage of the total value of agricultural production at farm gate only. Farm direct payments comprise all the payments based on output, area planted and animal numbers, historical entitlements, input use and overall farming income. Subsidies for general agricultural services comprise payments for research and development, agricultural schools, inspection services, infrastructure, marketing and promotion, public stockholding and miscellaneous.
16. The RRA is a measure of assistance to agriculture relative to non-agricultural production indicating the extent to which the policy regime of the country has an anti- or pro-agricultural bias. The NRA is a measure of assistance to agriculture indicating the extent to which the policy regime of the country generates a differential between domestic prices and what they would be without this regime (see Anderson and Valdés (2008)).
17. Because data for rural poverty programs are only available since 2000, these governmental programs are not included in the econometric estimation.
18. The degree of significance is evaluated at probability level lower than five percent given the high number of observations for the variables that vary over households.

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Appendix

Table A.1. Unweighted sample size in the LIS by year, household category and region.

Year	Category	North	Capital	Gulf	Pacific	South	Center-North	Center	Mexico
1984	All hh	1135	684	596	665	545	621	489	4735
	% Farm hh	12.25	3.95	18.79	16.54	23.67	21.10	16.77	15.42
1989	All hh	2342	1977	1229	1891	1342	1306	1444	11531
	% Farm hh	8.84	2.58	16.27	8.73	25.48	18.22	13.50	12.12
1992	All hh	1717	1906	1281	1488	959	1582	1597	10530
	% Farm hh	12.41	1.52	22.01	13.31	33.68	21.43	16.97	15.72
1994	All hh	2314	2170	1973	1479	1014	2177	1688	12815
	% Farm hh	11.50	2.21	12.47	12.44	24.95	13.96	15.17	12.15
1996	All hh	2209	1938	2582	1830	1650	2180	1653	14042
	% Farm hh	5.30	0.72	11.70	9.13	27.7	10.14	11.68	10.48
1998	All hh	1690	2059	1430	1311	1120	2233	1109	10952
	% Farm hh	5.38	1.60	12.03	10.53	19.73	10.75	14.61	9.65
2000	All hh	1697	858	2605	1222	1227	1508	991	10108
	% Farm hh	6.07	3.61	6.87	10.72	12.71	7.76	6.76	7.76
2002	All hh	3214	2253	2517	2026	2456	2972	1729	17167
	% Farm hh	3.24	1.11	6.12	7.01	17.63	8.38	9.31	7.39
2004	All hh	6023	4178	2727	2113	2574	2940	2040	22595
	% Farm hh	3.05	0.53	5.32	5.21	18.30	4.25	5.69	5.19
Total	All hh	22341	18023	16940	14025	12887	17519	12740	114475
	% Farm hh	6.37	1.55	10.58	9.59	21.61	11.76	11.80	9.69

Table A.2. Unweighted descriptive statistics of the household variables by year and household category.

	1984				1996				2004			
	All hh		Farm hh		All hh		Farm hh		All hh		Farm hh	
Variable	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
DPI	238	288	174	336	13837	24050	9182	39252	48582	96381	16211	27156
Age	44.41	15.50	49.15	15.77	44.89	15.46	50.88	15.66	46.74	15.43	51.61	15.72
Potential earners	2.39	1.28	2.32	1.23	2.40	1.28	2.34	1.29	2.29	1.24	2.15	1.24
Med. educ. head	0.14		0.02		0.19		0.06		0.21		0.07	
High educ. head	0.10		0.01		0.15		0.02		0.25		0.02	
Med. educ. spouse	0.09		0.02		0.17		0.05		0.16		0.05	
High educ. head	0.04		0.01		0.07		0.01		0.16		0.02	
Male head	0.85		0.90		0.85		0.93		0.77		0.90	
Urban residence	0.65		0.24		0.67		0.15		0.77		0.15	

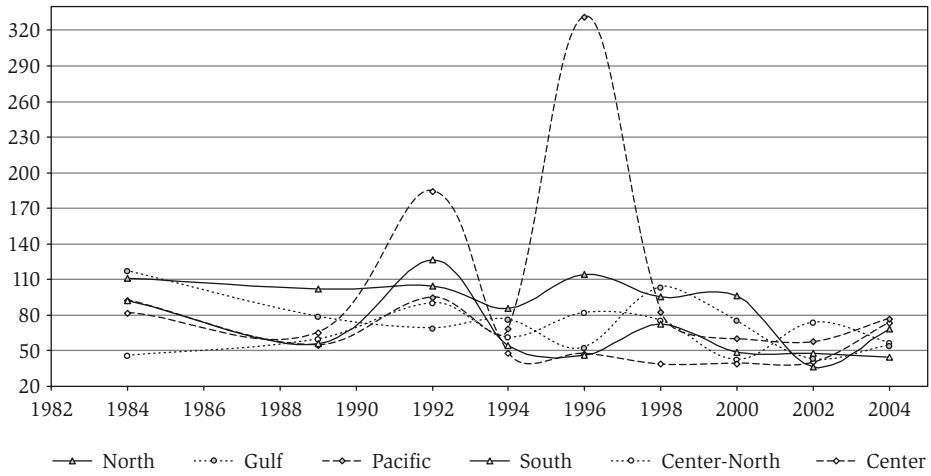

Figure A.1. Ratio of average DPI of farm households to non-farm households (%) across Mexican regions from 1984 to 2004.

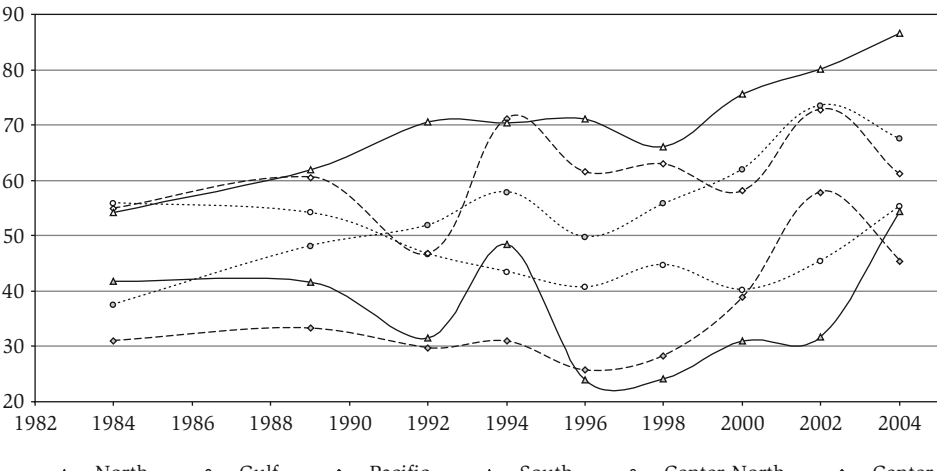

Figure A.2. Low income rate of farm households (%) across Mexican regions from 1984 to 2004.

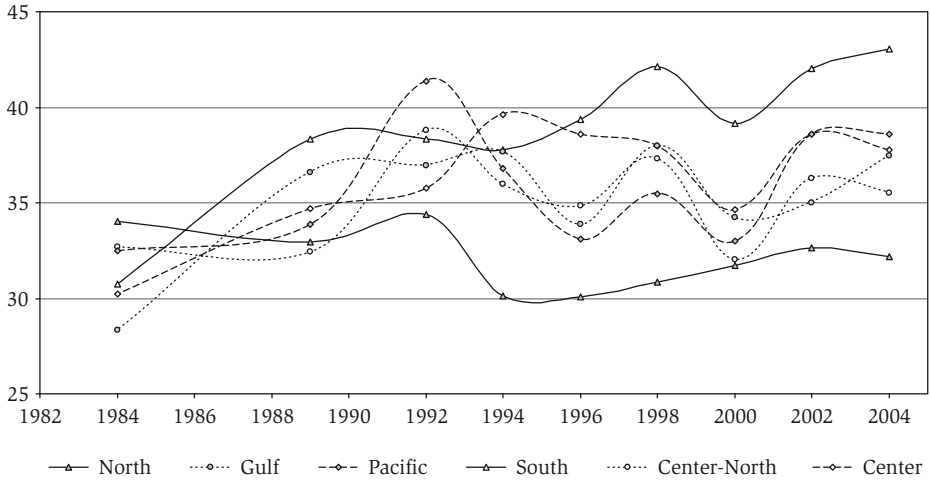

Figure A.3. Low income gap of farm households (%) across Mexican regions from 1984 to 2004.

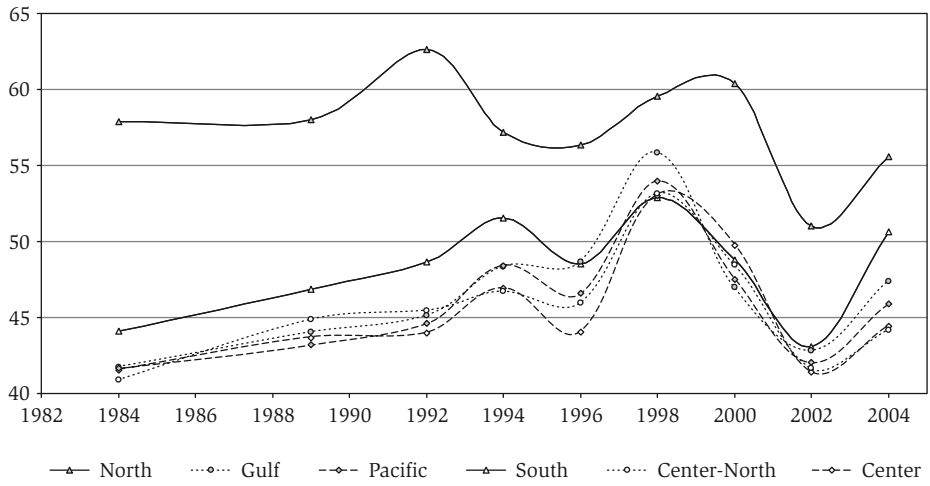

Figure A.4. Gini Index of farm households (% across Mexican regions from 1984 to 2004.