

Development Policies Favoring Non-Agricultural Income Do Not Improve Caloric Intake of Rural Mayan Families in Campeche, Mexico

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Abstract: Designers of recent international policies expect positive food-security effects of non-agricultural employment and income in poor rural areas. Researchers examine the effects of non-agricultural income sources on caloric intake of rural Mayan families of Northern Campeche, Mexico. Nutritional, economic and social information was obtained from a 2007 census of 237 families in four communities and daily per Capita Caloric Intake was estimated per family (CSI). Results show that only agricultural income based on mechanized maize cultivation and associated productive subsidies increased CSI. Rural income based on non-productive poverty subsidies, maquila factories, the construction industry and self-employment led to lower CSI.

Key words: Non-agricultural income, caloric intake, subsidies, poverty, Mayans, Mexico

INTRODUCTION

During the 1990s, concern regarding malnourishment in developing countries led to numerous studies and debates regarding its causes. A prominent topic was the relationship between income and caloric intake (Abdulai and Aubert, 2004). In a recent study, Babatunde *et al.* (2010) state that there has been an intense debate in the last 2 decades, on the exact nature of the relationship between income and caloric intake (Gibson and Rozelle, 2000). Two points of view have emerged within the empirical literature. The first holds that the level of per capita caloric intake has a strong positive but non-linear relationship with income and that increases in income will lead to substantial increase in caloric intake (Grimard, 1996; Subramanian and Deaton, 1996).

The second suggests that linkage between income and caloric intake is weak and therefore increases in income will not result in substantial improvement in caloric intake (Behrman and Deolalikar, 1987; Bouis and Haddad, 1992). Given these divergent opinions, there is a need for more empirical research which analyzes the income-calorie relationship in specific settings and provides plausible results which could be used to generate appropriate policy responses. A factor which has been insufficiently considered in many case studies is the effect of new sources of income derived from recent policies which set positive expectations for food-security related consequences of non-agricultural activities in poor

rural settings (e.g., services, wage-labor in nearby urban settings). Mayan families and communities of Northern Campeche have experienced profound socioeconomic change in the past 30 years. Local and national public policy, the market and international interests have driven this change originally referred to as modernization, later as development and recently as combating poverty.

In the 1970s in the context of the economic model of import substitution which promoted production for a national market, the regional economy was based on the traditional Slash and Burn (S and B) polyculture system (maize, beans and squash) with little or no government support. The system was complemented by small-scale fruit and vegetable production, backyard small-animal raising use of forest resources, hunting, beekeeping and elaboration of handcrafts. The combination of these activities provided the majority of resources for families diet, housing and fuel.

At the end of the seventies, the governmental Integrated Rural Development Program (PIDER in Spanish) initiated a project in the region to clear land for mechanized agriculture (Schuren, 2003). Under PIDER, the agricultural frontier was broadened to land suitable for mechanized farming and families were induced towards monocrop maize production with use of hybrid seed, agrochemicals and machinery. Nevertheless, this industrial agricultural system only benefited the small minority of communities and landowners with access to suitable land. The remaining communities continued to

practice S and B agriculture with little or no government support. The Mexican economic crisis during the 1980's led to increased public deficits, lower exchange rates and increased cost of servicing the foreign debt.

These economic changes led to a loss of faith in the viability of the state-directed import substitution model. Thus, by the mid-80s, Mexico undertook a new economic model, adopting the strategy of minimizing state intervention in the economy, under the supposition that this would lead to improved well-being and efficient, market-driven distribution of resources. The neoliberal model as this strategy is known, consisted of a set of structural reforms including measures such as privatization of state businesses, elimination of price subsidies and free trade. This economic model was promoted throughout Latin America during the 1980s and early 1990's by international financial organizations under the program known as the Washington Consensus (Stiglitz, 2005).

In Mexico and in the studied region, these measures led to a change in orientation of subsidies. Production subsidies, previously granted through price adjustments and agricultural inputs were now granted via income to producers through the Program of Direct Support to Maize Production (PROCAMPO in Spanish). The aim of this program was to make subsidies compatible with the process of free trade. A second form of productive subsidy was the Alliance Program (Alianza in Spanish) oriented toward improving farmers abilities and promoting technological development in order to increase productivity and competitiveness in a free market context (OECD, 1997).

Non-productive or social subsidies were channeled through the Human Development Opportunities Program (Oportunidades in Spanish) which focused on reducing extreme poverty in both rural and urban areas. This program was derived from the National Solidarity Program (PRONASOL in Spanish) and the Health, Education and Nutrition Program (PROGRESA in Spanish) and implemented with the support of international financial institutions in order to counteract deterioration of living conditions during the structural adjustment years. All these programs are still operating in the studied region. In Mexico, the main political argument behind the North American Free Trade Agreement (NAFTA) has been that family wellbeing can be achieved through productive specialization driven by comparative advantages.

Free trade through NAFTA has had two important effects in the region, it has favored non-agricultural employment through establishment of the maquila textile industry during the late-nineties and it has exposed maize producers to external competition under asymmetric

production and subsidy conditions. This has impoverished producers and has forced many toward self-employment in services and commerce. With all these transformations in the regional economy, the diversity of income sources (especially, non-agricultural sources) available to families has grown substantially. Some studies indicate that non-agricultural income is an option for escaping poverty (Reardon *et al.*, 2001) and improving food security (Ruben and van der Berg, 2001) in rural environments. Nevertheless, it is not clear which if any of the neoliberal policies implemented are (actually) improving the population's living conditions and specifically which income sources are contributing to improving dietary conditions and why. The purpose of this study was to identify the range of variation of caloric consumption among Mayan families of Northern Campeche and determine to what extent the families have attained caloric sufficiency to explain the effect of specialization of families in various economic activities as well as those sources of income which determine variation in caloric intake to determine the nature and extent of the correlations between different sources of income and level of caloric intake and to explain from an economic point of view how different sources of income affect the level of caloric intake.

Study area: This study was carried out in the region known as Camino Real which includes the municipalities of Hecelchakan, Calkini and Tenabo, located in the Northeastern part of the state of Campeche, Mexico. Regional climate is warm-sub-humid with summer rains. Average annual precipitation is 950 mm and average temperature is 27.8°C. According to the FAO/UNESCO classification, the association of Lithosols and Rendzina soils predominates in the Western plains of Campeche these are generally shallow and rocky. Traditional S and B agriculture and extensive cattle ranching is practiced on these soils. Luvisols and Nitisols predominate in the eastern hills, characterized by deep soils where mechanized maize agriculture is practiced.

The region has been inhabited since colonial times by Yucatan Mayans and 49.8% of the current population over the age of 5 speaks the Mayan language. In this area, four representative communities were selected: Xkakoch and Chunhuas of the municipality Calkini, located in the Western part of the region and ordering the Los Petenes Biosphere Reserve (LPBR); Nohahal, located to the East in the municipality of Hecelchakan and Santa Cruz in the central area also in Hecelchakan. Families of this region are employed in a wide range of activities. Previous studies show that the majority of families of communities of the Eastern part of the region (including

Table 1: Income structure (%/year) of families in four Mayan communities

Income sources	Santa Cruz	Xkakoch	Chunhuas	Nohalal
Maize production	4.54	20.16	13.34	52.12
Charcoal sales	-	11.75	15.31	-
Cattle raising	0.31	-	2.96	8.99
Beekkeeping	0.62	1.18	0.17	2.66
Backyard/Patio	4.15	2.54	2.96	0.85
Handcraft sales	-	2.35	5.93	-
Subtotal:Agricultural income	9.62	37.98	40.67	64.62
Brick laying	47.77	7.05	28.10	0.24
Maquila factory	10.22	31.02	11.85	-
Services	23.96	-	3.61	1.77
Migrant remittances	-	-	-	6.07
Subsidies	8.43	23.95	15.77	27.30
Subtotal:Non-agricultural income	90.38	62.02	59.33	35.38
Total	100.00	100.00	100.00	100.00

Modos de vida y seguridad alimentaria de los mayas de Campeche

Nohalal) obtain their income from agricultural employment. Those located to the West (including Chunhuas and Xkakoch) combine agricultural and non-agricultural employment in relatively equal proportions. Those of the central area, bordering municipal seats (including Santa Cruz) are mainly dedicated to non-agricultural employment (Table 1). Although, a single type of activity predominates in each location in all areas both types of employment are present.

The relative importance of each type of activity varies among communities and among families within the same community. This variation depends on available resources and capabilities such as access to land and financial resources, membership in agricultural organizations and social networks, educational level and skills, productive infrastructure, family structure and organization, employment opportunities and government programs (Schuren, 2003).

MATERIALS AND METHODS

Information was obtained through a questionnaire including two sections (Socioeconomic and dietary) containing open and closed questions. Due to the small number of families per community and in order to obtain reliable information, a census was carried out for each location. A total of 237 families participated in the census: 22 from Xkakoch, 49 from Chunhuas, 65 from Nohalal and 101 from Santa Cruz.

The questionnaire was applied from March-May, 2007. The socioeconomic section gathered information regarding number of family members, age, sex, education, income sources (including government subsidies), expenses, agricultural production, membership in agricultural organizations and housing characteristics. The dietary section recorded food availability that is the amount and type of food coming into the home during the 7 days period prior to applying the questionnaire. With this data and with the help of nutritional value tables,

calories consumed per capita weekly were estimated. Based on results of the questionnaire, a Family Caloric Sufficiency Index (CSI) was constructed and used as a proxy indicator of Food Security (FS). The CSI of an individual is the ratio of calorie intake and demand. This demand is calculated as recommended caloric requirements, adjusted for age, sex and physical activity according to the World Health Organization (WHO) international criteria (Hoddinott, 2002). Supply, demand and CSI were estimated for each family, based on its member composition. When Family (CSI) = 1, the family achieves caloric sufficiency. The opposite occurs when Family (CSI) <1. Hereafter, the researchers will refer to family (CSI) simply as (CSI).

In order to analyze the effect of income on CSI, three regressions were carried out. The first explored the relationship between CSI and total income, the second CSI and income sources grouped into agricultural and non-agricultural employment and the third CSI and different sources of family income. The regressions were analyzed with and without atypical values. For regressions 2 and 3, Eigenvalues and Condition Indices were determined in order to detect multi-collinearity. Furthermore in order to evaluate effect of income on CSI, per capita spending on food was used as a proxy variable for income and income-caloric consumption elasticity was determined. Finally in order to analyze the effect of agricultural production on CSI, simple regressions were carried out which correlated CSI with surface cultivated and consumption of maize grown for self-sufficiency.

RESULTS AND DISCUSSION

Upon carrying out regressions with and without a typical values, no significant differences were found with respect to the parameters of the models. Therefore, results presented include the regressions which include all values. Similarly, in the multiple regressions which relate CSI with agricultural and non-agricultural income and in that of CSI with the various income sources, no significant redundant information was found among variables and thus the variables were not found to be related among each other. CSI ranged from values <1.0 (caloric insufficiency) to 1.5 (caloric excess). However, the former were much more frequent than the latter. Total income, made up of the sum of income from all activities of the families shows a positive correlation with CSI ($p = 0.001$) as reported in much but not all of the literature. Nevertheless, the relationship was extremely weak ($R^2 = 0.048$) due to the amplitude of data dispersion which increases towards the lowest income levels (Fig. 1). This suggests that total income as a variable is a very poor predictor of CSI variation and more importantly that

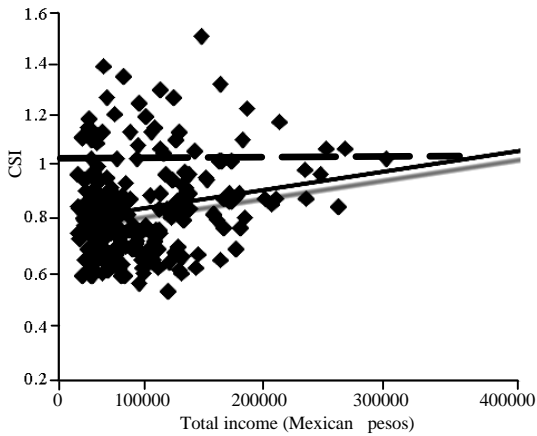


Fig. 1: Total income vs. caloric sufficiency index. The dashed line indicates the threshold of insufficient caloric intake

Table 2: Relationships between total income and caloric sufficiency index

Variables	Coefficient	Sign	p-values	Significance	R ²
Total income	5.43E-007	+	0.001	***	0.048
Constant	0.813	+	0.000	***	

Dependent variable: Caloric Sufficiency Index (CSI); *, **, ***Significant at 10, 5, 1%, respectively, NS: Not Significant

Table 3: Relationship of agricultural and non-agricultural income to caloric sufficiency index

Variables	Coefficient	Sign	p-values	Significance	R ²
Agriculture income	6.16E-007	+	0.000	***	0.101
Non-agricultural income	6.09E-007	-	0.000	***	
Constant	0.853	+	0.000	***	

Dependent variable: Caloric Sufficiency Index (CSI); ***Significant at 1%

distinct sources of income at low income levels might relate in different ways to CSI. The various sources of family income may be grouped into Agricultural Income (AI) and Nonagricultural Income (NAI).

AI includes monetary and non-monetary income derived from maize production, non-maize agricultural income and production subsidies. NAI includes income from wages, services and commerce and social subsidies (Table 2). In Fig. 2, the vertical axis represents CSI and the horizontal axis AI and NAI, expressed in thousands of Mexican pesos per year. The dichotomic grouping of income in the regression indicates that agricultural income is positively and significantly related to CSI and negatively but not significantly related to non-agricultural income. This means that non-agricultural income does not contribute to improving caloric consumption but neither does it worsen it (Table 3). Meanwhile, the determination coefficient improves with respect to the regression which relates total income to CSI (0.048 vs 0.10). In summary, grouping income into agricultural and non-agricultural income indicates that the former is positively correlated with CSI while the latter is not correlated (Fig. 2) implying

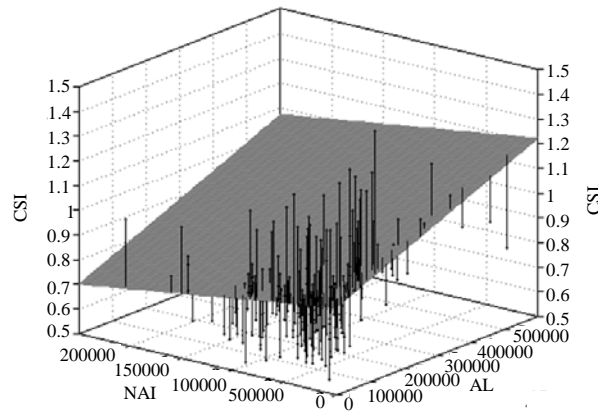


Fig. 2: Relationship of Agricultural Income (AI) and Non-Agricultural Income (NAI) to CSI (N = 237)

Table 4: Relationship between component of income and Caloric Sufficiency Index

Variables	Coefficient	Sign	p-values	Significance
Maize income	5.44E-007	+	0.042	**
Non-productive subsidy income	4.65E-006	-	0.008	***
Productive subsidy income	2.72E-006	+	0.037	**
Agricultural income excluding maize	0.101	-	0.134	NS
Income from wages	0.067	-	0.290	NS
Income from services and commerce	0.071	-	0.266	NS
Constant	0.857	+	0.000	***

Dependent variable: Caloric Sufficiency Index (CSI); *, **, ***10, 5 and 1%, NS: Not Significant, R² = 0.131

that only agricultural income and production subsidies improve dietary conditions while wage income does not lead to an improvement in diet in the studies region. Given that rural family income has many sources, these were disaggregated in order to in which direction and to what extent they affect CSI. Thus, total income was disaggregated into maize income, non-maize agricultural income, wages from employment, income from services and commerce, income from non-production subsidies and income from production subsidies. Upon separately relating each component of income to CSI, it was found that maize income and income from production subsidies were positively correlated with CSI with a statistically significant relationship.

Non-production subsidies are negatively and significantly correlated with CSI. Agricultural income (excluding maize), wages and services and commerce were not significantly correlated with CSI (Fig. 3 and Table 4). Caloric sufficiency is associated with maize income >\$40,000 Mexican pesos and production subsidies >\$10,000 Mexican pesos. The regression of income sources and CSI indicates that income from maize,

Table 5: Estimation of income-caloric intake elasticity

Regression Variables	Coefficient	Sign	p-values	Significance	R ²	Elasticity
Lineal Per capita food spending	0.000124	+	0.000	***	0.51	0.51
Constant	0.411109	+	0.000	***		

Dependent variable: Caloric Sufficiency Index (CSI), ***Significant at 1%

Table 6: Coefficient values obtained through simple regression

Variables	Constant	β	p-values	Significance	R ²
Total surface	0.829	0.050	0.000	***	0.081
Mechanized surface	0.831	0.005	0.000	***	0.087
S and B surface	0.866	-0.025	0.104	*	0.011
Maize for self-supply	0.807	0.100	0.000	***	0.084
Maize for self-supply per capita	0.778	1.037	0.000	***	0.161
Proportion of produced maize for self-supply	0.793	0.134	0.000	***	0.082

Dependent variable: Caloric Sufficiency Index (ISC), *Significant at 10%; ***Significant at 1%

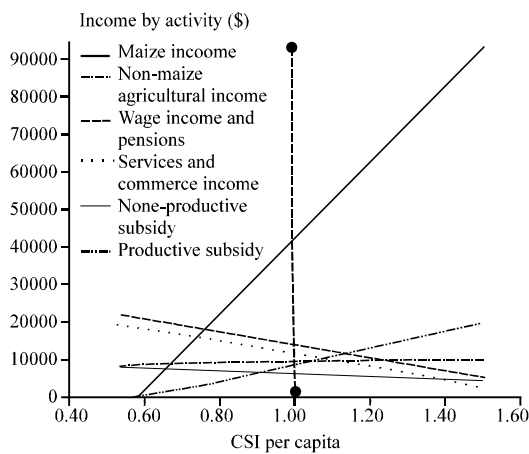


Fig. 3: Total income vs. caloric sufficiency index evaluate

production subsidies and non-production subsidies is significantly correlated with CSI. However, the first two have a positive correlation and the last a negative correlation. Mean while the determination coefficient marginally improves with respect to the regressions which relate agricultural and non-agricultural income to CSI (0.10 vs. 0.131).

Upon using per capita food spending as a proxy variable for income, it was determined that income-caloric intake elasticity is 0.51 when estimated via lineal regression (Table 5). Logarithmic regression did not statistically improve this estimation. No significant differences exist in CSI of families with and without access to land. Nevertheless, among families with access to land, larger plot size is related to improved CSI.

This relation derives from possessing land in which mechanized agriculture is practiced (Hereon referred to as mechanized land) but not with S and B land tenancy. Furthermore, families which satisfy consumption to a greater extent (absolute or per capita) with maize agriculture have higher CSI's (Table 6).

Relationships between income and CSI: The regression relating total income to CSI shows a positive and significant relationship. This agrees with international studies which demonstrate that with greater per capita income, dietary conditions improve (Webb and Block, 2010). Nevertheless in the case study, the relationship between total income and CSI is extremely weak and is reflected in the low correlation and therefore, the low value of the determination coefficient.

This is explained by the triangular shape of the relation between these two variables. More specifically, the minimum CSI value reported at different levels of total income does significantly increase with higher income but while high income predicts higher CSI, low income admits a wide spectrum of CSI values both above and below Caloric Sufficiency (CSI = 1). Other conditions could have contributed as well to overall data dispersion, namely cognitive problems and social convenience problems related to information provided by the families. Cognitive problems include scales of measurement order of questions, the way in which the questions are expressed and mental effort required in order to respond to them. Problems of social convenience are produced when those interviewed do not wish to displease the interviewer and adjust their answers (FAO, 2005).

Other factors are cultural-dietary, food exchanges and extrapolation of consumption from weekly to annual. The low correlation between income and subnutrition (energetic consumption below the minimum recommendation) has been documented in a variety of regional and national studies. For example, CEPAL has estimated that 40% of subnutrition in Latin America and the Caribbean is explained by extreme poverty as measured by income. In a recent study carried out in 29 low and middle income nations from 1980-2077, Webb and Block (2010) found that increase in per capita income improves dietary conditions. Their estimates reveal that on average, an increase of 10% in per capita income reduces delay of child growth by 3.2% and low weight by

7.4%. In the relationship between income and caloric intake, the former has frequently been substituted by spending due to its high correlation with income.

Studies from various countries in which food spending has been used as a proxy variable for income reveal that income-caloric consumption elasticity varies from 0.24-0.5. In India, for example, Subramanian and Deaton (1996) estimated elasticities from 0.3-0.5 for poor families. In Brazil, Strauss and Thomas (1995) determined that elasticities vary from 0.24-0.33 for low income families and tend to hover around zero for wealthy families. In Mexico, Hoddinott *et al.* (2000) calculated an elasticity of 0.4 for low income families and 0.2 for high income families. In the study reported here income-consumption elasticity was estimated to be 0.5 that is a 10% increase in per capita income (spending) increases caloric consumption by 5%.

Relationship between CSI and agricultural and non-agricultural income: Improvement in dietary conditions has been positively correlated with increase in agricultural income and non-agricultural income. Nevertheless, the income contribution is differentiated. Webb and Block (2010) determined that delay in child growth diminishes at a greater rate upon increasing agricultural income than upon increasing non-agricultural income. They demonstrate that growth in the agricultural sector, especially among small producers is at least twice that of growth of the non-agricultural sector.

Similarly in Honduras, Ruben and van der Berg (2001) found that a 10% increase in agricultural income improves caloric consumption by 0.8% while a 10% increase in non-agricultural income only increases caloric consumption by 0.3%. These researchers show that growth of agricultural income is positively related to property size, possession of irrigated land and years of education. Babatunde and Qaim (2010) show that farm and off-farm activities contribute equally to improved food security and nutrition in rural Nigeria.

More specifically, Babatunde and Martinetti (2010) show that principally remittances contribute to higher food production and farm income by easing capital constraints thus, improving the family's well-being in multiple ways. Their econometric analysis confirmed that remittance income had a positive and significant effect on caloric consumption but no effect on dietary quality, consumption of micronutrients and childhood nutritional status. In Northern Campeche, researchers found that a 10% increase in agricultural income improved CSI from 0.30-0.44%. Meanwhile, non-agricultural income is negatively correlated with CSI but this relationship is not statistically significant. Upon breaking down income

sources we found that income specialization through maize production and production subsidies contributes to improving CSI while income specialization through non-production subsidies lowers CSI. Income from wages, services and commerce and agricultural income-excluding maize did not correlate with CSI.

Over the past 20 years, Mexican and international agencies have held that national integration into the globalization process is the key to escaping poverty. The international pact known as the Millennium Development Objectives (MDO) envisions the transformation of the globalization process into a positive force for all world citizens. That is the benefits derived from globalization should be equitably distributed with the goal of combating economic and social inequality (UN Millennium Project, 2005). With this strategy, the Food and Agriculture Organization (FAO) concentrates its poverty and hunger reduction efforts on increasing agricultural productivity as a means for improving agricultural and rural incomes (FAO, 2005). In Northern Campeche, the process of economic globalization has had different effects on caloric intake for families with access to mechanized land with access to low-quality agricultural land and without land. Families with access to mechanized land whose income mainly originates from agricultural production, especially maize sales have a better diet in terms of caloric consumption. These families own >5 ha. Nevertheless, they represent a minority, 20% of all families in the region and communities studied. In the face of the adverse context of free trade for maize, producers are opting for various strategies. Families who use a greater level of mechanization (Nohalal) are beginning to increase scale of production through land rental, horizontal integration of maize and livestock production and land use intensification. Greater use of mechanization has implications for subsidies received by families. Subsidy policies are clearly differentiated for commercial producers and those who produce for self-supply.

Commercial producers and those with high productive potential such as mechanized maize growers of Nohalal receive the majority of agricultural subsidies. S and B producers of Xkakoch and Chunhuas mainly receive social or non-agricultural subsidies. CSI of families obtaining their income from maize sales depends mainly on their access to land. Nevertheless, land rights per se do not guarantee improvement in caloric consumption. Rather, calorie sufficiency critically depends on plot quality and size as well as on gender. Furthermore, families with mechanized land are favored by the public policy environment which supports mechanized maize cultivation over traditional S and B agriculture. After the 1994 signing of NAFTA, textile maquila factories were

established in the study region under the Investment Attraction Program (PAI in Spanish) directed by the Campeche state government. Although, manufacturers have effectively created new sources of employment, wages are only slightly above minimum wage. In 2007, average monthly income from this activity was <\$US200 and monthly per capita income for these families was \$40, covering only 80.2% of the cost of the food basket.

Rather than reducing poverty, state-promoted job creation in local maquila factories has served as a mechanism for international businesses to obtain extraordinary profits. Employment generated by maquila factories has however, contained emigration of young men and women. Most maquila factories worldwide carry out their assembly operations using imported products and non-qualified, low wage labor (Gerber, 2001). Unfortunately, this is precisely the type of maquila installed in the region. Part time work as bricklayer is another important non-agricultural job for men of landless families. In 2007, their monthly per capita family income amounted to \$50 for a master bricklayer and \$20 for assistants (100 and 42% of the cost of the food basket, respectively). Another income source among landless families is self-employment in areas such as motorized transport of people and goods and very small general stores which on average covers 93% of the cost of the food basket.

Low income obtained from non-agricultural employment has led to organizational and productive restructuring of families. Women formerly devoted to domestic labor now participate in the labor market in order to complement family income. Furthermore, a greater number of youth abandon school in search of employment, reducing possibilities of improving their abilities and future living conditions. Theorists hold that non-agricultural employment is an option for escaping poverty (Araujo, 2004; De-Janvry and Sadoulet, 2001; Reardon *et al.*, 2001) and improving food security (Ruben and van der Berg, 2001). Nevertheless, their analysis shows that non-agricultural employment is an alternative for rural families with greater resources (land and capital) who generally possess a higher educational level and greater possibilities of participating in activities which are highly productive and highly remunerated. Rural indigenous families with fewer resources and a low educational level are left with few alternatives and condemned to employment in poorly productive and poorly remunerated activities.

The globalization process and agricultural policy: According to World Bank statistics, the so-called

globalization process which began in the 1980s has been associated with reduced poverty in many parts of the world but results have varied among and even within countries (Nissanke and Thorbecke, 2006; World Bank, 2001). China and India, two of the most densely populated countries in the world are among the winners of the globalization process due to a spectacular reduction in number of poor people (Ravallion, 2006; World Bank, 2001). In India, Chad (2003) studied the effect of neoliberal reforms on poverty reduction and food security.

In his study, he considered 1983 to be the year prior to the reforms, 1987-88 the beginning of reforms and 1993-94 and 1999-2000 the consolidation of reforms. Results reveal a reduction in poverty from 1987-88 to 1999-2000 of 30.1-21.0% for rural agricultural families and from 55.3-39.7% for rural wage earning families. Nevertheless from 1983 to 1993-94, caloric intake diminished from 1,908 Kcal per capita to 1,819 Kcal for rural agricultural families and from 2,289-2,277 Kcal for rural wage earning families. In 1990-2000, caloric intake was 2,278 Kcal for rural wage earning families and 1948 Kcal for rural agricultural families. Differences in caloric intake between agricultural and wage-earning families were associated with different consumption patterns. Rural wage earning families slightly decreased their consumption of grains but increased to a greater extent consumption of fruit and meat.

However, agricultural families abruptly decreased consumption of grains but did not replace this loss with consumption of fruit and meat. These changes in consumption were due to the accelerated growth in sales of fruit, vegetables, milk and meat provoked by the free market economy which did not reach the poorest sectors of the population. This demonstrates the strategic importance of production of basic grains in order to achieve food security especially for the poorest families. Webb and Block (2010) showed that prevalence of delay in child growth decreases more rapidly in countries whose economic transformation is accompanied by agricultural subsidies compared to countries without subsidies. This suggests that a policy of agricultural subsidies may accelerate poverty reduction and improve dietary conditions (Webb and Block, 2010).

In China, Du *et al.* (2004) examined the effect of income growth on the pattern of dietary consumption of families of low, median and high income in 1989, 1991, 1993 and 1997. Findings show that upon increasing per capita income, caloric intake diminished 106 Kcal on average across income levels. Reduction in caloric intake was accompanied by a change in pattern of dietary consumption, especially in low and median income

families. There was a clear tendency of substitution of traditional foods such as rice and wheat by products high in calories and fats. These changes in consumption are positively correlated with an increase in overweight and obesity from 10.3-15.4% and an increase in non-transmittable illnesses such as hypertension, diabetes and cancer.

These tendencies suggest that if policy measures are not taken such growth in income could result in damaging health effects of excess caloric intake ($CSI > 1.5$), especially for the poorest families. In other parts of the world such as Latin America, the income distribution gap is increasing. In this region poverty affects on average 43% of the population, including 19% who live in extreme poverty. Specifically in Mexico, 20 years after having embraced the globalized economy, poverty levels are only slightly lower than those recorded in the early 90s and may again be increasing as a result of the 2008 economic crisis. In 2007, the National Council for Evaluation of Social Development Policy reported that in Mexico, 19.5% of rural families suffered food poverty, 26.5% suffered poverty of capabilities and 47.2% suffered patrimonial poverty.

Based on 2005 statistics in the study region, incidence of food poverty, poverty of capabilities and patrimonial poverty was on average, 10% greater than that reported on a national level. Data indicate that poverty increased in 2010. Argues that in order to overcome poverty, the Mexican economy must grow at least 7% annually in order to create one million new jobs for the population which each year is incorporated into the labor market. Yet from 1989-2010, GNP only increased an average annual 2.83% (IMF, 2011).

Economic growth is a necessary but not sufficient, condition for overcoming poverty. The researchers have shown how in rural Campeche, existent badly paid jobs are insufficient to cover basic human needs. Employment generated must be well remunerated (The World Bank, 2008). For this, greater investment is necessary in education and training (Echeverria, 2000; Yunez-Naude and Taylor, 2001). In Mexico, estimated that having completed elementary school implies a 24% higher income than having not attended any school. Completing secondary school yields on average a 34% increase in income. The greatest yields are for high school and college education, reaching an average increase of 50 and 78%, respectively. In Mexico, since the introduction of structural adjustment reforms, policies focusing on combating poverty have been implemented (PRONASOL in 1988, PROGRESA in 1998 and Oportunidades in 2002). These policies have improved health and education levels

(World Bank, 2004). However, they have not led to poverty reduction due to the absence of well-paid employment opportunities. This has led to social frustration and increasing migration to the United States and urban areas within Mexico.

These programs are criticized for focusing on efficient government spending and political transparency without sufficiently addressing economic growth and income distribution. Another, issue related to policies aimed at overcoming poverty is long-term financial sustainability. In Mexico, the future of these policies depends mainly on availability of government resources through petroleum sales which represent close to 40% of government income. However, according to current extraction levels, known petroleum reserves are equivalent to approximately 11 years of extraction. Failing to invest in exploration of additional oil reserves or broaden sources for tax collection puts fiscal sustainability at risk (WB (World Bank), 2007). This complicated scenario has been worsened by the bullish tendency of world food prices provoked by increase in petroleum prices, greater demand for bio-fuels, growing demand for food in China and India, droughts affecting some food-producing nations and financial speculation thus, threatening food security in many countries (Trostle, 2008). The price of maize, the basis of the Mexican diet increased 134.7% from March 2007-2008 (ERS, 2008).

Projections by the OECD-FAO (2007) for world grain prices for the next 10 years indicate that prices will remain higher than those of the previous decade. In Mexico and particularly in the region of study, the recent price increase tortillas, a food essential to the Mexican diet and which represents a high percentage of caloric intake is sure to have negative impacts on food security. Nevertheless, this will have a greater negative impact on families dedicated to wage labor than those dedicated to commercial or traditional agriculture due to the fact that for the former all food consumed is purchased in conditions in which salaries are losing acquisitive power. The neoliberal strategy of relying on the world market for access to cheap food while dismantling national grain production worked while prices remained relatively low. Nevertheless, price increases over the past 2 years have evidenced the limits of this strategy.

Currently in order to confront increase in food prices and the national production deficit, the government again is turning to the free market. The Mexican emergency food program actions in support of the family economy was created in reaction to the complete opening of the national market to importation of maize, beans, wheat, rice, sorghum and soybeans. Additionally, families receiving

the Oportunidades program are granted an additional \$10 month⁻¹. This scheme which does not include production subsidies, continues to exclude the majority of rural families who produce largely for self-supply.

CONCLUSION

In Northern Campeche, 30 years of regional public policy which primarily subsidizes mechanized production and promotes non-agricultural activities in a rural setting has led to diversification of economic activities. Nevertheless, living conditions and diet have not improved for the great majority of families. Mechanization of maize cultivation shows a tendency to increase CSI. However, this only benefits families with access to good quality land who receive a majority of their income from maize sales. This includes approximately 20% of all families in the region.

Subsidies may have a variety of effects on family CSI. On the one hand, those with access to poor quality land as well as those without land who largely depend on social subsidies have a lower CSI than those with access to good-quality land who receive subsidies for maize production. This demonstrates the need for modifying agricultural policy.

RECOMMENDATIONS

The globalization process has promoted industrialization and growth of non-agricultural employment in the rural region of study, experiences worldwide suggests that globalization should be accompanied by policies of agricultural subsidies, especially, for small-scale producers. This would result not only in a greater food supply but also more families would achieve food security as represented by CSI. This proposal proves to be contrary to the current agricultural policy which since, the signing of the North American Free Trade Agreement in 1992 has gradually dismantled small-scale production of basic grains for local and national consumption, favoring vegetables, fruits and flowers for export.

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REFERENCES

Abdulai, A. and D. Aubert, 2004. Nonparametric and parametric analysis of calorie consumption in Tanzania. *Food Policy*, 29: 113-129.

- Araujo, C., 2004. Can non-agricultural employment reduce rural poverty: Evidence from Mexico. *Cuadernos Economicos*, 41: 383-399.
- Babatunde, R.O. and E.C. Martinetti, 2010. Impacts of migrant remittance on food security and nutrition of farming household in Kwara State, Nigeria: Working papers. Department of Agricultural Economics and Farm Management. Nigeria, http://pagesperso.dial.prd.fr/dial_pagesperso/dial_eve_shocks/pdf/150_Babatunde.pdf.
- Babatunde, R.O. and M. Qaim, 2010. Impact of off-farm income on food security and nutrition in Nigeria. *Food Policy*, 35: 303-311.
- Babatunde, R.O., A.O. Adejobi and S.B. Fakayode, 2010. Income and calorie intake among farming households in rural Nigeria: Results of parametric and nonparametric analysis. *J. Agric. Sci.*, 2: 1916-9760.
- Behrman, J.R. and A.B. Deolalikar, 1987. Will developing country nutrition improve with income? A case study of rural India. *J. Political Economy*, 95: 492-507.
- Bouis, H.E. and L.J. Haddad, 1992. Are estimates of calorie-income fxelasticities too high?: A recalibration of the plausible range. *J. Dev. Econ.*, 39: 333-364.
- Chad, R., 2003. Impact of trade liberalization and related reforms on India's agricultural sector, rural food security, income and poverty. Proceedings of the GDN Meeting, January 2004, New Delhi, India.
- De-Janvry, A. and E. Sadoulet, 2001. Income strategies among rural households in Mexico: The role of off-farm activities. *World Dev.*, 29: 467-480.
- Du, S., T.A. Mroz, F. Zhai and B.M. Popkin, 2004. Rapid income growth adversely affects diet quality in China-particularly for the poor. *Soc. Sci. Med.*, 59: 1505-1515.
- ERS, 2008. Cash price. Selected U.S. Commodities. Economic Research Service.
- Echeverria, G.R., 2000. Options for rural poverty reduction in Latin American and Caribbean. CEPAL, 70: 151-164.
- FAO, 2005. FAO and the challenge of the millennium development goals. The road ahead. Rome, Italy.
- Gerber, J., 2001. Uncertainty and growth in Mexico's maquiladora sector. *Borderlines*, 9: 1-15.
- Gibson, J. and S. Rozelle, 2000. How elastic is calorie demand? Parametric, nonparametric and semiparametric results for urban Papua New Guinea. *J. Dev. Stud.*, 38: 23-46.
- Grimard, F., 1996. Does the poor's consumption of calorie respond to changes in income: Evidence from Pakistan. *Pak. Dev. Rev.*, 35: 257-283.

- Hoddinott, J., 2002. Targeting: Principles and Practice. In: Food security in Practice, Hoddinott, J. (Ed.). 1st Edn., IFPRI, Washington D.C., pp: 89-101.
- Hoddinott, J., E Skoufias, R. Washburn, 2000. The impact of Progresa on consumption: A final report. International Food Policy Research Institute Washington D.C., http://evaluacion.opportunidades.gob.mx:8010/441c7c1a3d30adf64e0e724174a9d527/impacto/2000/ifpri_2000_hoddinott_consumption.pdf.
- IMF, 2011. World economic Outlook database. International Monetary Fund, <http://www.imf.org/external/pubs/ft/weo/2011/01/weodata/weoselgr.aspx>.
- Nissanke, M. and E. Thorbecke, 2006. Channels and policy debate in the globalization inequality-poverty nexus. *World Dev.*, 34: 1338-1360.
- OECD, 1997. Review of agriculture policies in Mexico. 1st Edn. Organisation for Economic Co-operation and Development. National Policies and Agriculture Trade, Paris.
- OECD-FAO, 2007. Agricultural outlook 2007-2016. <http://www.oecd.org/dataoecd/6/10/38893266.pdf>.
- Ravallion, M., 2006. Looking beyond averages in the trade and poverty debate. *World Dev.*, 34: 1374-1392.
- Reardon, T., J. Berdegue and G. Escobar, 2001. Rural nonfarm employment and incomes in Latin America: Overview and policy implications. *World Dev.*, 29: 395-409.
- Ruben, R. and M. van der Berg, 2001. Nonfarm employment and poverty alleviation of rural farm households in Honduras. *World Dev.*, 29: 549-560.
- Schuren, U., 2003. Reconceptualizing the post-peasantry: Household strategies in Mexican ejidos. *Rev. Eur. Estudios Latinoamericanos Caribe*, 75: 47-64.
- Stiglitz, J., 2005. The post Washington consensus. Initiative for Policy Dialogue, Columbia University. New York.
- Strauss, J. and D. Thomas, 1995. Human Resource: Empirical Modeling of Household and Family Decisions. In: Handbook of Development Economics, Behrman, J. and Srinivasan T.N. (Eds.), Vol. 3, North-Holland, Amsterdam pp:1883-2023.
- Subramanian, S. and A. Deaton, 1996. The demand for food and calories. *J. Political Econ.*, 104: 133-162.
- The World Bank, 2008. Agriculture for development. World Bank Development Report, 2008. http://siteresources.worldbank.org/INTWDR2008/Resources/WDR_00_book.pdf.
- Trostle, R., 2008. Global Agricultural supply and demand: Factors contributing to the recent increase in food commodity prices. USDA-ERS. WRS-0801. <http://www.ers.usda.gov/Publications/WRS0801/>.
- UN Millennium Project, 2005. Investing in developing: A practical plan to achieve the millennium development goals. United Nations Earthscan, New York.
- WB (World Bank), 2007. Mexico 2006-2012: Creating the foundations for equitable growth. Report number 39993-MX.
- Webb, P. and S. Block, 2010. Support for agriculture during economic transformation: Impacts on poverty and undernutrition. Proceedings of the National Academy of Sciences of the United States of America, Jan 19, 2010, USA.
- World Bank, 2001. Globalization, Growth and Poverty: Building an Inclusive World Economy. Oxford University Press, New York.
- World Bank, 2004. Poverty in Mexico: An assessment of conditions, trends and government strategy. Report No. 28612-ME. The World Bank, Washington DC.
- Yunez-Naude, A. and J.E. Taylor, 2001. The determinants of nonfarm activities and incomes of rural households in Mexico, with emphasis on education. *World Dev.*, 29: 561-572.