Cátedra de Integración Económica y Desarrollo Social

Working Paper No. 2006-2

An Intertemporal Comparison of Income and Welfare for Two Mexican Regions

Hector J. Villarreal

Ave. Rufino Tamayo
Garza García, Nuevo León, México
CP 66269

An Intertemporal Comparison of Income and Welfare for Two Mexican Regions

Hector J. Villarreal*
EGAP
ITESM, Campus Monterrey

Abstract

This paper compares the evolution of income (GDP per capita) with utility derived welfare indices for two Mexican regions from1992-2000. A methodology is proposed based on implicit true standard of living indices. Results show that welfare dynamics differed between regions and varied considerably compared to GDP per capita measures for the same period, thereby posing three questions: how well aggregate income measures reflect welfare, the role of CPI as a cost of living index, and the existence of different thresholds for wealth and welfare conditioned on development levels. This research reaffirms the importance of household preferences in evaluating welfare.

JEL: D60, D12, O12

Keywords: Welfare measurements, subnational economic subsystems, cost of living indices, Mexico

*I am very grateful to Jean-Paul Chavas for his guidance, encouragement and time through out the study from which this paper stems. I want to thank Brad Barham, Tom Cox, Brian Gould, Aashish Mehta, Linda Corona, Elena Podrecca, seminar participants at University of Wisconsin-Madison and EGAP (ITESM), conference participants at "Economic Growth and Distribution: On the Nature and Causes of the Wealth of Nations" at Lucca, Italy , and conference participants on “The 9th Annual Meeting of LACEA” at San José, Costa Rica for comments and suggestions.

Corresponding author: Héctor J. Villarreal, EGAP ITESM Campus Monterrey, CEDES 907-G, Av. Eugenio Garza Sada 2501, Monterrey N.L. México C.P. 64849. Tel (+52 81)8358-2000 ext 3973, email: hjvp@itesm.mx

I. Introduction

An interesting question in the empirical literature focuses on how suitable are national accounts to gauge welfare (see for example Slesnick, 1991 and 2001, and Ravallion, 2003). The issue is not trivial given that variables derived from national accounts (i.e. GDP per capita) are sometimes the sole measure employed to describe the well being of entire populations. The typical alternative, and more popular among microeconomists, is the use of income-expenditure surveys (IES) which have problems of their own, (Deaton, 1997). Despite them, IES allow to do certain kinds of analysis that would not be possible with other types of data. It has been shown that in the presence of substantial movements in relative prices, utility derived demand systems are needed to adjust costs of living and infer welfare changes (Banks et al., 1996 and Ruiz-Castillo, 1998). We argue in this paper that the relative-price effect, combined with the evaluation of welfare at a sub national level, can provide a highly misleading picture if aggregate income measures are utilized.

Mexico during the 90's presents an excellent scenario for the income-welfare discussion given that the country experienced deep structural changes in its economy and political system. First, the country switched from a relatively closed economy to a more open one by becoming one of the world's principal exporters/importers due in part to the implementation of the North American Free Trade Agreement (NAFTA) in 1994. Secondly, in 1995 the country had one of its worst economic crises in modern history, with its GDP losing several percentage points. Thirdly, as a result of the crisis, the financial system collapsed. The government was obliged to take on part of the banks' liabilities[1], and in the second half of the 90's many private banks were sold to foreign

financial institutions. Fourth, some brief, albeit significant, social disruptions occurred in the southern part of the country[2]. In addition, in 1997 when the PRI (Partido Revolucionario Institucional), which had dominated the political life of the country since the 1930s, lost control of Congress and then lost the presidency in 2000. Furthermore, new programs aimed at reducing poverty were developed during this time while some older ones were replaced or cancelled.[3] Finally, reforms in the fiscal coordination between the federation and the states occurred, which resulted in a larger percentage of public expenditures going directly to the state governments.

This research differs from previous studies about societal welfare in Mexico. Many of the earlier studies focused more on inequality issues or measuring poverty lines, rather than on household welfare (e.g. Szekely, 1998, Cortes, 2001, Hernandez, 2001). Camberos and Huesca (2001) analyze the welfare of selected income groups in northern Mexico, but focus on simulations about income changes. Rubalcava (2001) studies Mexican households' welfare from an expenditure perspective, but his methodology is based on estimating how consumption levels vary without recovering household preferences, and his study period is different: 1984-1994. Ianchovichina et al. (2002) examine welfare consequences for Mexican households due to trade reform. They do it by simulating price changes under a CGE (computational general equilibrium) framework, without estimating household preferences. Finally, Urzua (2001) estimates a demand system for Mexico and recovers household preferences. However his main purpose was to evaluate impacts of a possible tax reform, rather than considering actual welfare changes within neither a time framework, nor its correlation with wealth changes.

Rather than considering the entire country, this study will focus on two Mexican regions. The first region includes four states in the northeast (NE): Chihuahua, Coahuila, Nuevo Leon and Tamaulipas. The second region includes four states located in the southeastern (SE) part of the country: Chiapas, Guerrero, Oaxaca, and Tabasco. The rationale is to compare the evolution of wealth and welfare for two regions with very different developments in terms of income, education levels, life expectancy, etc. Despite these differences, both regions have populations that are of similar size and experienced comparable population growth during 1990-2000[4].

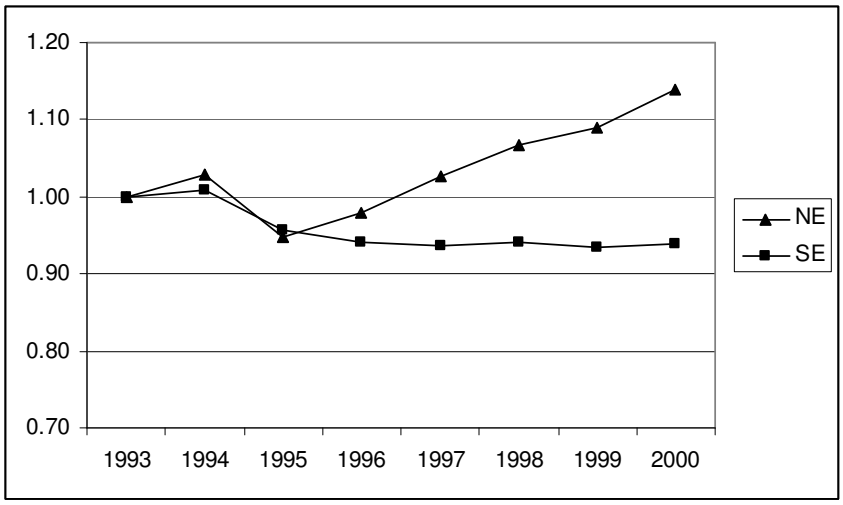

Fig.1

Figure 1 provides a description of the contrasting situation between the two regions in terms of their GDP per capita. While the 1995 crisis affected both regions, NE had a quick recovery (by year 2000 its GDP per capita was 15% above the level of 1993 in real terms). In contrast SE underperformed: the region GDP per capita fell in 1995 and stayed at that level for the next five years.

The structure of the paper is the following: In Section II the need of a behavior model is motivated and its econometric specification derived. Section III presents a description of the empirical environment. Data, variables construction and the treatment

of missing values are included in the section. Econometric results are discussed in Section IV. Section V links the statistical results with welfare measurements and conclusions are presented in VI. An appendix at the end of the paper complements the sections.

II. The Model

The model used in this paper is based on the evaluation of an implicit standard of living index that uses a true cost of living index (money metric utility measures) as a building block. The general characterization of cost of living indices stems from equation (1), i.e., the ratio of two expenditure functions, where the denominator is used as base, and the numerator takes into account the variation due to prices, demographic characteristics, etc. such that:

$$TCLI(p^1, p^0; d^1, d^0; u^*) = \frac{m^*(u^*, p^1, d^1)}{m^*(u^*, p^0, d^0)} \quad (1)$$

where TCLI is the true cost of living index, u^* is the label of the indifference curve taken as reference (which will be discussed in section IV), p^0 and $p^1$are two price vectors, d^0 and d^1 are two vectors of socio-demographic variables, and m^* is the consumer cost function (also called the expenditure function). It should be noticed that (1) is a "true" cost of living index since it is computed using as a base a recovered expenditure function rather than employing approximations. In this paper, indices are constructed to reflect adjustments in household expenditures using (1). A true standard of living index can be defined analogously to the TCLI, based on the Distance Function (Deaton 1979 and Chavas 2002). The employment of a TCLI in this study was preferred since the emphasis is done on the evolution of prices through time.

The ISLI (Implicit Standard of Living Index) is defined as:

$$ISLI(p^0, p^1, g^0, g^1, u^*, d) = \left[\frac{\frac{p^1 g^1}{p^0 g^0}}{\frac{m(u^*, p^1, d^1)}{m(u^*, p^0, d^0)}} \right] \quad (2)$$

where,

g^0 is a vector of observable Marshallian demands for the base period, and

g^1 is a vector of observable Marshallian demands for the comparison period.

Notice that the ratio $\frac{p^1 g^1}{p^0 g^0}$ can be interpreted as a change in income between periods which gives flexibility to the ISLI, because it is not necessary to know the specific consumption bundles when total expenditures (treated as income) are known. Also, by definition: $p^0 g^0 = m(u^*, p^0, d^0)$, so the same scalar normalizes both numerators.

A crucial assumption throughout this work is that demand behavior, represented by Marshallian demands, is driven by the maximization of household preferences. In other words, a well-behaved household utility function exists. In fact, by assuming the presence of a Household Welfare Function (HWF) that reflects the utility levels of all household members, it is implied that all the resources of the household are pooled and that there is a common set of preferences across household members. Demand models that utilize this framework are usually referred as "unitary" models, since the household is acting as a single unit (Alderman et. al 1995).

Given that welfare estimates calculated from (2) rely on a household welfare function recovered from an estimated demand system, improving the estimation of the system is very important. The model employed in this paper follows Villarreal (2003), from which three aspects will be brought: the discussion of rank within a demand system

and the employment of the QUAIDS specification (Banks et al., 1997); the inclusion of socio-demographic characteristics via cost modifying functions (Lewbel, 1985); and finally, the importance of disaggregated commodities and the censoring problem associated with zero consumption of some goods. These three aspects and the derivation of the model are presented formally in an appendix at the end of the paper.

III. The Data

The study covers six subpopulations, equally divided between the Northeastern and Southeastern regions of Mexico, over three different years (1992, 1996, and 2000). Consequently, six *master data sets* were produced, each containing the consumption, income, sociodemographic variables, sample weights, and a household identificator.

The main source of data for this paper comes from INEGI (Instituto Nacional de Estadistica Geografia e Informatica), who collects a household income-expenditure survey called ENIGH (Encuesta Nacional de Ingreso y Gasto de los Hogares). These surveys include a set of disaggregated consumption data, and other variables such as income and socio-demographic characteristics. The information was collected using a combination of the "booklet method" and daily interviews. The booklet method uses recall interviews in which households are asked to report their expenditures (or other relevant variable) during a particular time period (e.g. clothing expenditures in the last six months). Daily interviews focused on recording common transactions (e.g. food purchases). As pointed out by Perali and Cox (1995) this mixture of methods allows a researcher to distinguish between frequent expenditures and less frequent expenditures. Different time units are assumed depending on the related category, for example while food expenditures are recorded as weekly purchases, tuition and education expenditures

are considered on a quarterly basis, health expenditures on a bi-annual basis, etc. When correcting for censoring it is important to distinguish between no consumption decisions of the household and infrequent purchases (e.g. clothing) and model the problem accordingly. In the case of this study, the datasets employed take both into consideration.[5]

Consumption in all categories comes from monetary consumption and nonmonetary consumption in ENIGH. Categories are restricted to market goods, thus commodities/inputs such as household labor used for cooking, cleaning, etc. will not be considered. The main difference between the two categories is that monetary consumption refers to all transactions for which the household pays. Nonmonetary consumption is composed of equivalent commodities received as gifts, transfers, non-financial benefits, or household production (e.g. in farms). This is important given that without the nonmonetary information, consumption would be highly underestimated.

A decision that must be made is the number of consumer goods that will be included. When the number of commodities is small the estimation of the system simplifies, however an aggregation problem may arise, thereby making the interpretation of the recovered parameters difficult. On the other hand, when the number of commodities is large (it can be as large as 500 in the ENIGHs), the estimation of the system becomes harder and censoring issues make the estimation difficult.

In order to maintain some system complexity and detail while allowing for tractable estimation twelve commodity categories were selected for this study, six non-food categories and six food categories (defined in Table 1 of the Data Appendix). The non-food categories are almost identical to the classification presented in Perali and Cox (1995), corresponding to a very broad classification system that has been used in related

studies. The six food categories are similar to the ones used by Sabates et al. (2001). In contrast to one or two food categories commonly used in demand systems for welfare evaluations, the six categories give a much richer representation. This classification was important in terms of substitution effects, as will be discussed later in the paper. Table 2 provides the relative weight of each category (as total expenditure percentage) for the two regions.

The measurement of prices for each household's consumption profile can be divided into two general procedures: when the household consumes a particular category and when it does not (censoring). By definition when a household does not consume a certain good, the household purchases zero units. However, when a household does not purchase a commodity, it still faces a positive price for that good. Yet, a selectivity bias (Heckman 1979, Yen et. al 2003) may be embedded in the preference structure. If a selectivity bias exists and is not taken into consideration, estimated prices (for censored households) will be inconsistent. In order to test and correct for a possible selectivity bias in the non-participating households, this study applies the Heckman correction factor for selectivity bias as presented in Davidson and McKinnon (1993). Next, parameters obtained regressing prices associated with sample households on household characteristics, as well as the selectivity bias, if it exists, are used to impute prices for households that do not consume of a particular category. This procedure is more robust than working with simple means from non-censored agents. Notice that the total expenditures of households are not modified, but missing prices do not exist anymore after being imputed. Table 2 shows the evolution of relative prices.

IV. The Econometrics

The model developed in the appendix is estimated in two stages. In the first stage, probit estimates of the probabilities of consuming particular commodities were obtained for the nine categories that had a censoring problem[6]. These were: meats, dairy, fruit and vegetables, outside, other, education, health, clothing and transportation, as defined on Table 1. The nine equations were estimated independently using Maximum Likelihood. In the second stage, the system of equations was non-linearly SUR estimated using NLS (non linear least squares) in GAUSSX. Estimation was repeated using weighted NLS to solve for heterokedasticity and standard errors were corrected. This is because a two stage procedure was employed to correct censoring (mathematical appendix). In order to obtain the correct standard errors for the estimates, a variation of Amemiya's (1985) quadratic was introduced, as discussed in (Villarreal, 2003).

Given the structure of the model a possible identification problem may arise. This happens if parameters estimated from pooled data were forced to meet the theoretical restrictions on individual cross sections restrictions or if parameters estimated from a single cross section needed to comply with the restrictions of the others[7]. Thus, the necessity of estimating separately each cross section for each region. The welfare analysis of section V is performed with the parameters estimated from the year 2000 cross sections (reported in tables 3 and 4, elasticities in table 5). The implicit assumption is that household preferences do not change in a short time span. Nonetheless statistical and economic tests were performed to check robustness, that is, to explore possible qualitative changes if other year was utilized as base (not were found, the complete discussion is found in Villarreal 2003).

A series of tests were performed to check the adequacy of the model specification. Among these, a Wald test was employed to verify that there is statistical improvement using a quadratic rank 3 model versus the conventional rank 2 AIDS. The critical value for the test (χ^2 statistic with 173 degrees of freedom at a 95% confidence level is 204.7). While the computed values of the Wald statistic were 4,090 and 3,669 for the NE and SE regions respectively: so the hypothesis of AIDS (rank 2) is rejected in favor of the QUAIDS (rank 3) specification. The improvement in specification due to the incorporation of sociodemographic variables was also tested. The plain specification (with no sociodemographic variables) was soundly rejected in favor of the one implemented.

The food categories' elasticities have important differences between regions. In general, the budget elasticities for food categories are smaller in the Northeastern region than in the Southeastern region. The result is not surprising considering that the SE region has higher budget shares for the food categories as shown in table 2, (these results can be catalogued within Engel classic results). Also as predicted by theory, within food categories "basics" have the smallest budget elasticities.

The "housing" category has estimated elasticities, ranging from 0.54 to 0.67, between regions. It was expected that budget elasticities lower than 1 would be found, since changes in income have to be considered together with transaction costs (moving to another house, etc.). "Edu" (education) and "health" (health services) both have low budget elasticities. Both of these categories have possible substitutes in the public sector (highly subsidized). However, it appears that high-income groups used private educational and health services, thus the elasticities found.

As anticipated, the own-price effect was highly significant in determining the magnitude of the shares. This result coupled with the analysis of elasticities point out that relative prices matter and that substitution effects can be important when prices or taxes change. If the categories were more "aggregated", i.e. having five or six categories, instead of twelve, many of these effects would not show up, since sometimes effects with different signs would canceled out.

Cross-price effects have more ambiguous estimates for all categories. As expected, for some subsets the cross-price estimates were important. For others, the values do not appear to be economically or statistically significant. As suggested by the estimated elasticities, the cross price effects are larger in the SE region. In general, this generates more substitution between food categories. Again, this effect would be difficult to capture if food were aggregated into a single category. The cross-price effects for non-food categories are less consistent, nonetheless considerable for some categories/years.

The income effect is important for some categories, but not for all. The interpretation of this result does not mean that income is not important for the quantities demanded. It means that for some categories the direct income effect is not statistically significant in explaining the relative shares of that category with respect to others. The distinction between a direct and an indirect effect is important, because if the income effect is significant for some of the categories, indirectly it affects all the others. This is a result of a model specification that works with budget shares. Thus when income directly affects the demand of one category, indirectly it shifts the shares in all the other equations.

The quadratic effect seems to be important for some categories but not for all, similar but not identical to the results in (Banks et al., 1997). One of the differences with that

paper is their finding that the quadratic term is not important for food in general. As mentioned in section II the problem of over-aggregation may be considerable. Given the pooling of all the food elements into a single category, they may be losing important effects. This is true when doing welfare analysis, causing the estimated expenditure functions to be biased.

V. The Evolution of Welfare

Since the household records at ENIGHs come from stratified sampling, in order to reproduce the populations of each region, the ISLI needs to be weighted with the expansion factors provided by INEGI. A possible source of problems is that while the expansion factor is based on the national population, this study is concerned with regional populations (subsamples of the whole survey). The basic assumption behind this procedure is that since the subsamples (the regions covered) are a big part of the whole survey, the expansion factors will still represent their population. The alternative of ignoring the expansion factors is not possible since stratified sampling was used in the surveys, i.e. it would be equivalent to utilizing a uniform weight (Deaton, 1997). Table 6 and Graphs 3 and 4 present the results.

It should be noticed that indices are relative measures with respect to their own base periods. While comparisons can be made horizontally they cannot be performed vertically (by columns in Table 6). In other words, the "1" used as a base for 1992 corresponds to a different welfare level for each row of the table, and the comparisons between rows **do not** have any interpretation since they are using a different base and different expenditure functions between regions.[8] In table 6 indices were normalized using 1992 as a base in order to make comparisons more intuitive. So the numbers

presented in that table and used in the graphs are the ISLI indices using parameters from year 2000 cross section to evaluate the expenditure functions and then normalized by the 1992 results.

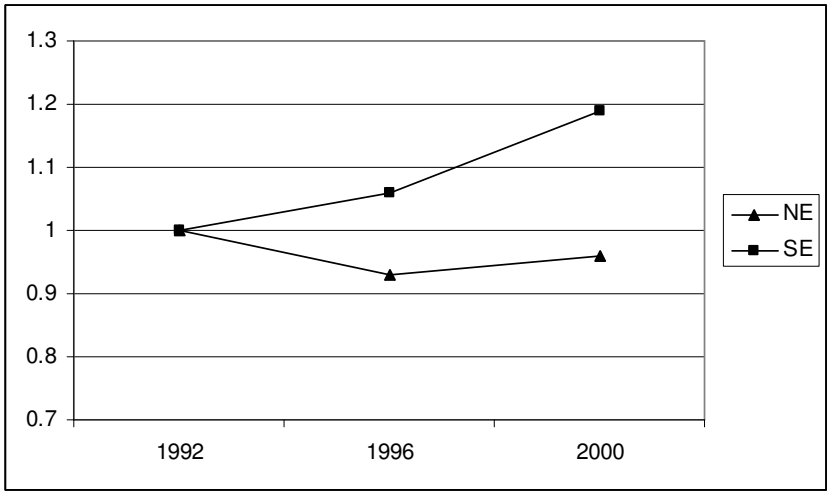

Fig. 2

The general index (Figure 2) shows that from 1992-2000 the two regions display contrasting changes in standards of living. The NE region experiences a decline that starts in 1994, deepens in 1996, and begins to improve afterwards. The 2000 ISLI remains below the 1992 level. On the other hand, the SE region has a completely different pattern, experiencing substantial improvements in its standards of living. It should be noted that these results differ drastically from the suggestions of Graph 1. The region that had a strong (relative) increase in its GDP per capita cannot recover its standard of living previous to the crisis, while the region that performed weakly in terms of GDP has large increases. A clue to this apparent paradox can be found in GDP's composition. While the NE region's GDP was increasing, those increments do not reflect themselves in households' consumption. The SE region experienced modest increases in GDP (decreasing in per capita terms); however household expenditures were more stable than

in the NE region, and it benefited from a strong decline in the prices of food and in some services (e.g. rent, health). A similar effect for China is found in (Meng et al., 2005), however, in their study poor households suffer the increase in relative food prices.

Moreover, the structural differences that are present in both regions should be considered. The information available points out that both private investment and exports grew more than GDP in the NE region, implying a reduction in total private consumption as a percentage of GDP. The expansion of house construction, which is a component of total private consumption but not of total households' expenditures, has two effects. It increases the region's GDP (but not the household expenditures), and if the supply of houses increases faster than demand it pulls the rental prices down. The latter implies smaller household expenditures, but not necessarily lower household welfare.

Two more differences between the regions can explain the results in Figure 2. The NE region is more industrialized and demands more financial services than the SE region. During the 1994-1995 economic crisis many financial services collapsed, it is possible that debts and the lack of financial services affected households' consumption patterns. Since financial services did not play an important role in the more economically isolated SE region their collapse did not affect household consumption. Government's actions should also be taken into account. The fiscal coordination between states in Mexico (administered by the federal government) redistributes resources from "rich" to "poor" regions. This can be reflected in subsidized public services (e.g. education and health), and in the expenditures of poor people who received direct cash transfers from some federal programs.

There is another explanation: the nature of the CPI (consumer's price index) that is used to put GDP in real terms. In Mexico like in many other countries the CPI is a price index that do not takes into consideration substitution effects. Moreover, despite being defined as a price index, the CPI is typically employed as a cost of living index (this is implicitly done when GDP is deflated and then used as a welfare measurement). In the presence of considerable relative price movements coped with high inflation, the CPI can perform poorly as a cost of living index compared with a utility derived "true cost of living" index (Banks et al., 1996, Ruiz-Castillo, 1998). Between December 1992 and December 2000 Mexico experienced an inflation of about 300% and drastic movements in relative prices (shown in Table 2). So using the CPI to calculate real income measures may give highly biased results (with possible important differences between regions). Notice that the index (2) presented in section II is free of this bias, since price level effects cancel out.

The indices' graphs for particular population groups help to shed some light on these results and to expand the analysis. When the variable home ownership is used as a base for comparisons, the results differ considerably conditioned on home ownership status. This is not surprising: rental prices declined significantly between 1992 and 1996. Given that expenditures in housing represent a big percentage of the total for most households, the effect of this decline should appear in the ISLI. Home-owning households (Figure 3) have similar changes in standard of living (both in magnitude and timing) to the average of the regions (the general index in Figure 2). One small difference is that for the NE region, the drop in the ISLI is slightly larger than for the overall population. In comparison it appears that households that do not own their homes have a very different

dynamic in the ISLI with respect to the homeowners (Figure 3). The result is very similar for both regions. Moreover, the decline in the ISLI for non-home owners from 1996 to 2000 coincides with the recovery in the rental prices.[9]

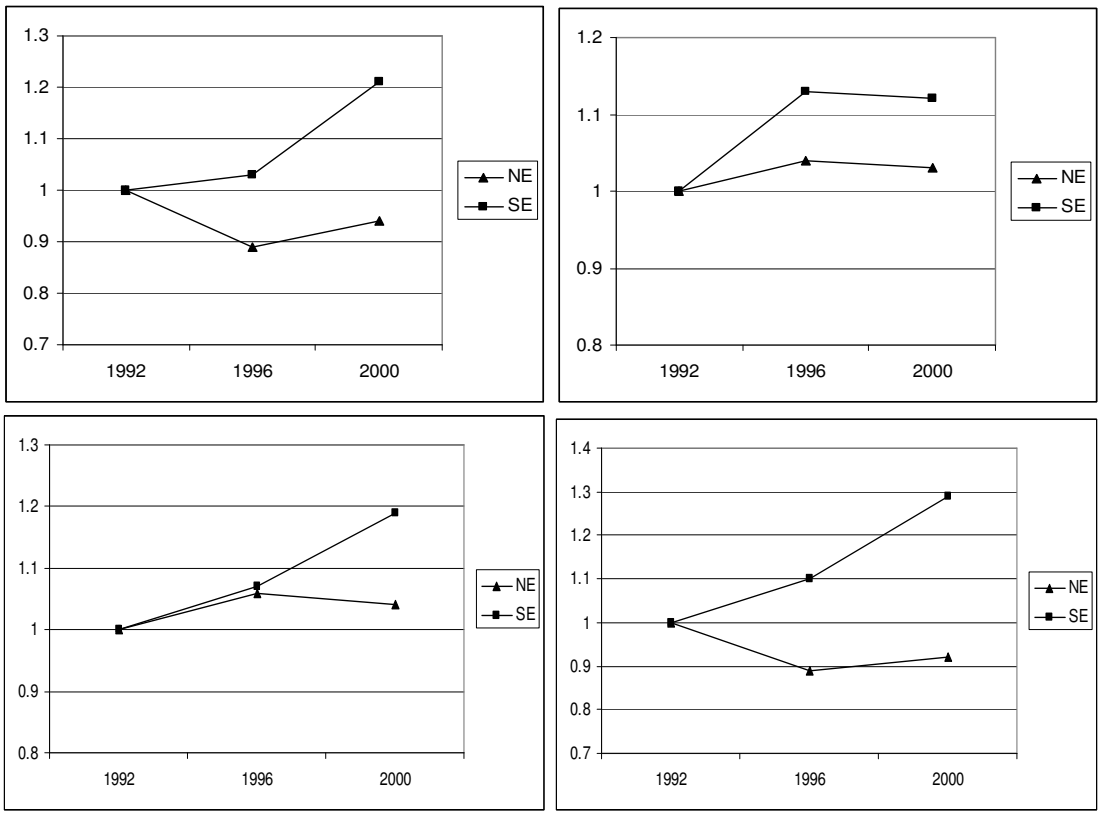

Figure 3

Given the weight of the category a sensible question is to what extent movements in the relative prices of housing are driving the whole effect. Ideally the safest way to discard that possibility is to repeat the complete analysis without this category. Unfortunately an implicit assumption is separability of preferences, which the elasticities of table 5 clearly reject. However, two results seem to keep the analysis on track: for the region that has big movements in the relative prices of the category (NE) the changes are the expected ones. While, the other region (SE) has much smaller movements in the relative prices of housing, so the results should be isolated.

Finally, also in Figure 3 it is shown the evolution of ISLI for the two regions conditional on income levels. For the SE region both groups' indices have a similar "shape" to the general index for their region (Figure 2). The main difference is that the upper income group had bigger increments in their ISLI. The result is of particular significance: despite a favorable change in prices and "stable" total expenditures, it seems that benefits are concentrating in "richer" people.

For the NE region the changes in ISLI between income groups is very different. The lower income group ends the period with a higher ISLI compared to the starting point in 1992. Their peak occurs in 1996 (however very similar in level to 2000). The upper income group in the NE region had a big decrease in their ISLI between 1992 and 1996, even though a small recovery takes place between 1996 and 2000, the ISLI remains below the 1992 level by several percent points.

When the "pictures" are put together, it seems that big losers from the mid 1990s crisis are "richer" households in the Northeastern region. The GDP in the NE grew faster than in the country (on average), but total expenditures of the rich households decreased significantly. Also, while poorer households may have benefited highly from the extension of public services (health, education), it may be the case that "richer" households demand private services, thus the potential benefit will vanish. Again, same effect as (Meng et al. 2005).

VI. Conclusions

This paper began with the question if income (measured as GDP per capita) and welfare indices followed similar paths for two Mexican regions during the period 1992-2000. The first results show (unexpectedly) that contrary to the evolution of regional GDPs, the

average standards of living in the Southeastern region improved while the average standards of living for the Northeastern region remained below their 1992 level. Plausible explanations include: the evolution of relative prices, a SE that was more isolated from the economic crisis during the mid 1990s, provision of public goods by the federation and the states, transfers of economic resources from the richer to the poorer regions, the effects of NAFTA, and the absence of financial services during the second part of the 90s. In fact, despite considerable GDP growth rates in the NE region, this growth **is not** reflected in the households' total expenditures (consumption), which instead decreased significantly between 1992 and 1996.

When particular subpopulations are taken into consideration, the results become more complicated. Indeed the variations are starker among subpopulations. In the SE region the welfare improvements are accentuated in richer households. Although positive, the improvements in standard of living for poorer households are smaller. When the price changes are included in the analysis, a hypothesis that emerges is that households that are more "well-off" than others may be taking advantage of cheaper public services such as education and health.

In the NE region a general decrease in the standards of living between 1992 and 2000 was found. However, there are some groups that are "better-off" at the end of the period compared to their initial situation: lower income households and renters. The fact that rents were lagged with respect to the general price level is one explanation. In terms of who "faced" the costs of the mid 1990s crisis, it seems that rich NE households bore a larger burden. Possible reasons include a higher dependence on a financial system that

collapsed, transfers (via the federal government of subsidies to poorer regions), and high investment rates that do not show in current consumption.

This research reinforces the idea that aggregate income measures may be incorrect indicators of welfare evolution. It also suggests that under big inflation and relative price movements, CPI performs poorly as a cost of living index. Utility derived "true cost of living" indices may tackle both problems.

Bibliography

Amemiya, Takeshi, 1985. Advanced Econometrics. Harvard University Press, Cambridge, MA.

Banks, James, Blundell, Richard, Lewbel, Arthur, 1996.Tax Reform and Welfare Measurement: Do We Need Demand System Estiamtion. Economic Journal 106, 1227-1241.

Banks, James, Blundell, Richard, Lewbel, Arthur, 1997 Quadratic Engel Curves and Consumer Demand. Review of Economics and Statistics 79, 527-539.

Camberos, Carlos M., Huesca, Luis R., 2001. Capacidad de consumo y bienestar de los hogares de Mexico y de la frontera norte. Comercio Exterior 51, 203-210.

Chavas, Jean-Paul., 2002. Notes for AAE 705. University of Wisconsin-Madison, Department of Agricultural and Applied Economics.

Christensen, Laurits R., Jorgenson, Dale W., Lau, Lawrence J, 1975. Trascendental logarithmic utility functions. American Economic Review 65, 367-383.

Cortes, Fernando, 2001. El calculo de pobreza en Mexico a partir de encuesta de ingresos y gastos. Comercio Exterior 51, 879-884.

Davidson, Russel, MacKinnon, James G, 1993. Estimation and Inference in Econometrics. Oxford University Press, Oxford, UK.

Deaton, Angus, 1979. The distance function and consumer behaviour with applications to index numbers and optimal taxation. Review of Economic Studies 46, 391-405.

Deaton, Angus, 1997. The Analysis of Household Surveys. Johns Hopkins University Press, (published for The World Bank), Baltimore, MD.

Deaton, Angus, Muellbauer, John, 1980. An Almost Ideal Demand System. American Economic Review 70, 312-336.

Gorman, William M., 1981. Some Engel Curves. In: Deaton, Angus(Ed.), The Theory and Measurement of Consumer Behavior. Cambridge University Press, Cambridge, UK.

Hausman, Jerry A., Newey, Whitney K., Powell, James L., 1995. Nonlinear Errors in Variables: Estimation of Some Engel Curves. Journal of Econometrics 65, 205-233.

Heckman, James, 1979. Sample Selection bias as a Specification Error. Econometrita 47, 153-161.

Hernandez, Enrique, 2001. Retos para la medicion de la pobreza en Mexico. Comercio Exterior 51, 860-868.

Hildenbrand, Werner, 1994. Market Demand: Theory and Empirical Evidence. Pricenton University Press, Princeton, NJ.

Ianchovichina, Elena, Nicita, Alessandro, Soloaga, Isidro, 2002. Trade Reform and Poverty: The Case of Mexico. World Economy 25, 945-72.

Lewbel, Arthur, 1985. A Unified Approach to Incorporating Demographic or Other Effects into Demand Systems. Review of Economic Studies 52, 1-18.

Lewbel, Arthur, 1991. The Rank of Demand Systems: Theory and Nonparametric Estimation. Econometrica 59, 711-730.

Maddala, G.S., 1983. Limited Dependent and Qualitative Variables in Econometrics. Cambridge University Press, Cambridge, UK.

Meng, Xin, Gregory, Robert, Wang, Youjuan, 2005. Poverty, inequality, and growth in urban China, 1986–2000. Journal of Comparative Economics

Muellbauer, John, 1976. Community Preferences and the Representative Consumer. Econometrica 44, 525-543.

Perali, Federico, 1993. Consumption, Demographics and Welfare Measurement from Barten-Gorman Preferences: Metric and Policy Applications to Colombia. Ph.D. Dissertation, University of Wisconsin-Madison.

Peralli, Federico, Cox , Thomas L., 1995. Issues in Data Management of Expenditure Surveys: An Example from the Colombian 1984-85 Urban Survey. Working Paper No. 389, AAE, UW-Madison.

Phipps, Shelley A., 1998. What Is the Income "Cost of a Child"?: Exact Equivalence Scales for Canadian Two-Parent Families. Review of Economics and Statistics 80, 157-164.

Pollak, Robert A., Wales, Terrence J., 1981. Demographic Variables in Demand Analysis. Econometrica 49, 1533-51.

Rubalcava, Luis, 2002. Living Standards in Mexico during Economic Transition: Should We Rely on a Poverty Line?. Estudios Economicos 17, 247-303.

Ruiz-Castillo, Javier, 1998. A Simplified Model for Social Welfare Analysis: An Application to Spain, 1973-74 to 1980-81. Review of Income and Wealth 44, 123-141.

Sabates, Ricardo, Gould, Brian W., Villarreal, Hector J., 2001. Household Composition and Food Expenditures: A Cross Country Comparison. Food Policy 26, 571-586.

Schonkwiler, John S., Yen, Steve T., 1999. Two-Step Estimation of a Censored System of Equations. American Journal of Agricultural Economics 81, 972-982.

Slesnick, Daniel T., 1991. The Standard of Living in the United States. Review of Income and Wealth 37, 363-386.

Slesnick, Daniel T., 2001. Consumption and Social Welfare. Cambridge University Press, Cambridge, MA.

Szekely, Miguel, 1998. The economics of poverty, inequality and wealth accumulation in Mexico. Macmillian Press, London, UK.

Urzua, Carlos M., 2001. Welfare Consequences of a Recent Tax Reform in Mexico. Estudios Economicos 16, 57-72.

Villarreal, Hector J., 2003. Evaluation of Welfare Indices for two Mexican Regions: A Microeconomic Approach. Ph.D. Dissertation, University of Wisconsin-Madison.

Yen, Steven T., Lin, Bin-Hwan, Smallwood, David M., 2003. Quasi- and Simulated Approaches to Censored Demand Systems: Consumption by Food Stamp Recipients in the United States. American Journal of Agricultural Economics 85, 458-478.

Mathematical Appendix: A Utility Derived Demand Model

A rank 3 demand system specification

Demand systems specifications having expenditure shares linear in logarithmic total expenditure[10] have been called Price-Independent Generalized Logarithmic (PIGLOG) by Muellbauer (1976) and arise from indirect utility functions that are themselves linear in total expenditures. Both the AIDS (Deaton and Muellbauer 1980) and Translog (Christensen et al. 1976) models are examples of PIGLOG demands. These models are frequently used because they have flexible specifications (they only present the standard restrictions of consumer theory), and can be integrated (passing from the indirect utility function to the implied cost function) with relative ease. However, a series of empirical Engel curve studies (for example Lewbel (1991), Hildebrand (1994), Hausman et al. (1995), Villarreal (2003), etc.) suggest that further terms in income may be required to achieve reliable estimations. In other words linearity in log-income is often not enough to provide an accurate representation of consumer behavior.

Banks et al. (1997) present a more general specification that nests the PIGLOG preferences. They begin by defining budget shares in the following form:

$$w_i = A_i(p) + B_i(p)\ln x + C_i(p) f(x) \qquad (3)$$

for goods i =1 ,..., m , where p is the m-vector of prices and A, B, C, and *f* are differentiable functions. Equation (3) states that expenditures shares are linear in the natural logarithm of income and in another function *f*(x).

In addition, Banks et al. (1997) prove that if demand systems are exactly aggregable, consistent with utility maximization and have a rank of 3, then their indirect utility functions will be of the form:

$$\ln V = \left\{ \left[\frac{\ln m - \ln a(p)}{b(p)} \right]^{-1} + \lambda(p) \right\}^{-1} \tag{4}$$

where the first term within the brackets is the indirect utility function of a PIGLOG demand system and the extra term (λ) is a differentiable, homogeneous function of degree zero in prices p.

In order to nest the AIDS model price indices are defined as:

$$\ln a(p) = \alpha_0 + \sum_{i=1}^{m} \alpha_i \ln p_i + \frac{1}{2} \sum_{i=1}^{m} \sum_{j=1}^{m} \gamma_{ij} \ln p_i \ln p_j \tag{5}$$

and

$$b(p) = \prod_{i}^{m} p_i^{\beta_i} \tag{6}$$

to complete the specification:

$$\lambda(p) = \sum_{i=1}^{m} \lambda_i \ln p_i \quad \text{where} \quad \sum_{i=1}^{m} \lambda_i = 0 . \tag{7}$$

Plugging equations (5-7) into the indirect utility function (4), and applying Roy's Identity completes the Quadratic Almost Ideal Demand System specification (QUAIDS) proposed by Banks et al. (1997):

$$w_i = \alpha_i + \sum_{j=i}^{m} \gamma_{ij} \ln p_j + \beta_i \ln \left[\frac{m}{a(p)} \right] + \frac{\lambda_i}{b(p)} \left\{ \ln \left[\frac{m}{a(p)} \right] \right\}^2 \tag{8}$$

From (4) it is possible to invert the indirect utility function to obtain the algebraic specification of the cost function:

$$\ln m^* = \ln a(p) + b(p) \left[\frac{1}{(\ln u^*)^{-1} - \lambda(p)} \right] \tag{9}$$

where m^*, a(p), b(p) and λ(p) are used as defined previously, and u^* is a representative[11] utility level. When the function λ(p) is zero, (9) becomes the expenditure specification of the AIDS model. A very important feature of the expenditure function is that once a reference utility level has been selected, it is possible to "tag" each household, and afterwards evaluate the function to obtain the corresponding minimum expenditure needed to obtain that utility.

The Inclusion of Sociodemographic Characteristics

Sociodemographic variables are crucial in determining the households' demand patterns and ultimately their welfare. In this study in order to preserve the theoretical restrictions imposed by consumer theory, Lewbel (1985) will be followed[12]. Thus modifying cost functions are defined as:

$$m^* = C(u, p, d) = f[C^*(u, h(p, d)), p, d] \tag{10}$$

where C^* is a well-behaved expenditure function, d a vector of sociodemographic characteristics (with S elements), h and f are continuous functions that have first and second derivatives and exist everywhere (except possibly in a set of measure zero). The function h will generate non-negative modified prices for every commodity and a positive modified price for at least one.

Following Pollak and Wales (1981), the technique of "translating"[13] will be applied and the following cost function is derived assuming $m^*=C=f$ and that $m=C^*$:

$$m^* = C(u, p, d) = f[m^*, p, d] = m^* P^f \quad , \tag{11}$$

where:

$$P^f = \prod_{i=1}^{m} (p_i)^{t_i(d)} \quad . \tag{12}$$

A possible interpretation for t_i is that of a commodity specific translating sociodemographic function. Following Perali (1993) for ease of estimation the translating functions will be specified as:

$$t_i(d) = \sum_{s=1}^{S} k_{is} \ln(d_s) \tag{13}$$

where k_{is} is the translating sociodemographic parameter for the ith commodity and the sth sociodemographic variable.

Modifying the embedded cost function in (8) and applying theorem 4 from Lewbel (1985), the resulting modified quadratic budget shares will be:

$$w_i = \alpha_i + t_i(d) + \sum_{j=i}^{m} \gamma_{ij} \ln p_j + \beta_i \ln\left[\frac{m^*}{a(p)}\right] + \frac{\lambda_i}{b(p)}\left\{\ln\left[\frac{m^*}{a(p)}\right]\right\}^2 \tag{14}$$

where $\ln(m^*)=\ln(m)-\ln(P^f)$.

Estimation of budget shares implies the adding-up condition of $\sum_{i=1}^{n} w_i = 1$, thus homogeneity of degree one for the cost function implies that $\sum_{i=1}^{n} t_i(d_i) = 0$. With respect to the budget shares, the standard QUAIDS restrictions will apply, and given the translating specification, the following extra restrictions on the sociodemographic characteristics are needed[14]:

$$\sum_{i=1}^{m} k_{is} = 0 \tag{15}$$

The Censoring Problem

In this study consumer behavior is specified and estimated in order to evaluate household welfare. Therefore, the model specification involves the following trade-off: a large

number of equations/commodities will give a more detailed welfare function/index but is harder to estimate, while a small number of commodities makes the system simpler, but less realistic. For example, when just three or four categories are used and the prices of a subcategory change, thereby altering relative prices in the whole system, the interpretation of the results becomes difficult.

As the number of equations increases, the main problem from an econometric point of view is the censoring issue. Censoring is defined when a household/individual does not consume a good or service in a given period. The cause for non-consumption may be related to prices, preferences, budget constraints or inventory holding. No matter the cause for censoring, the problem is that econometric estimates that neglect censoring will be biased and inconsistent.[15] In this study the censoring problem is solved by employing the consistent two-step estimator proposed by Shonkwiler and Yen (1999).

Consider the system of equations with limited dependent variables:

$$y_{it}^{*} = f(x_{it}, \beta_i) + \varepsilon_{it} \quad , \quad d_{it}^{*} = z_{it}^{'}\alpha_i + v_{it} \tag{16}$$

$$d_{it} = \{1 \text{ if } d_{it}^{*} > 0 \, , \, 0 \text{ if } d_{it}^{*} \leq 0 \} \tag{17}$$

and

$$y_{it} = d_{it} y_{it}^{*} \tag{18}$$

where:

i=1,2,...,m (for m commoditties),

t=1,2, ..., T (for T households),

y_{it} and d_{it} are the observed dependent variables,

y_{it}^{*} and d_{it}^{*} are the corresponding latent variables,

both x and z are vectors of exogenous variables,

and β and α are vectors of parameters.

Assume $[\varepsilon_{it}, v_{it}]$' are distributed bivariate normal with $\text{cov}(\varepsilon_{it}, v_{it}) = \delta_i$, with var $(\varepsilon_{it}) = \sigma_i$, and var$(v_{it})$=1. The conditional mean for the non-censored observations is:

$$E(y_{it} \mid x_{it}, z_{it}; v_{it} > -z_{it}^{'}\alpha_i) = f(x_{it}, B_i) + \delta_i \frac{\phi(z_{it}^{'}\alpha_i)}{\Phi(z_{it}^{'}\alpha_i)} \tag{19}$$

where $\phi(.), \Phi(.)$ are the univariate standard normal probability density function and the cumulative distribution function respectively.

The unconditional mean (using the complete set of observations) will be:

$$E(y_{it} \mid x_{it}, z_{it}) = \Phi(z_{it}^{'}\alpha_i) f(x_{it}, \beta_i) + \delta_i \phi(z_{it}^{'}\alpha_i) \tag{20}$$

From (x) the system of equations can be presented as:

$$y_{it} = \Phi(z_{it}^{'}\hat{\alpha}_i) f(x_{it}, \beta_i) + \delta_i \phi(z_{it}^{'}\hat{\alpha}_i) + \xi_{it} \tag{21}$$

completing the utlity derived model.

Table 1 Consumption and sociodemographic variables definitions

Basics.-This category is constituted by pure and processed products from grains (flour, bread, tortillas, pastas, etc.), legumes, and potatoes. The economic intuition behind the category is that it is integrated by the elements that constitute the core of the diet; they can be classified as low price/high energy foods.
Meats.-this category includes beef, pork, poultry, seafood and all kinds of meats, both cut and processed.
Dairy.-fluid milk and every product derived from milk are included in this category; substitutes products like margarine are not included.
Fandv (fruits and vegetables).-this category includes processed as well as natural fruits and vegetables.
Outside.-this category considers meals consumed outside the household, the variable basically captures "formal" meals, i.e. if someone buys a fruit, snack, etc., and eats it outside the household, it will not be considered.
Other.-the category that includes all the rest of the food components not included in the previous categories; it includes elements such as soft drinks, powder to prepare soft drinks, spices, sugar, sweetening products and non-dairy oils.
House.-the purpose in this category is to capture the expenditures of households on their homes: rent[16], services, home improvement and some of the furniture and hardware.
Edu.-the expenditures in the category will include tuition, education services, books, school articles, CDs, cinemas, concerts, and related activities as in Perali and Cox (1995).
Trans (transportation).-This category includes the expenses for public transportation (fees of buses, taxis, etc.) and private transportation (gasoline, diesel, and replacement parts).
Health.-this variable covers expenditures for a big set of commodities/services related to health care; medicines, medical analysis and services, minor and major operations, insurance fees, etc. (Category J at ENIGH).
Cloth.-this variable considers expenditures for clothing (including shoes) for any member of the family. Jewelry, watches and accessories in general are also considered (Category H at ENIGH).
Aother.-this category includes expenditures for commodities and services in the survey that do not appear in the previous eleven categories.
hhsize.-Total number of members in the household.
kids.-Number of household members whose age is less than 15.
h_own.-Dummy with value of 1 if the household owns the place where they live, and 0 otherwise.
rural.-Dummy with a value of 1 if the household lives in a rural area (population < 2500), and 0 otherwise.
Elec.-Dummy with a value of 1 if the household has access to electricity
refrig.-Dummy with a value of 1 if the household owns a refrigerator or fridge.

Table 2 Descriptive Statistics

Consumption and Sociodemographic Variables						
	Northeastern Region			Southeastern Region		
	1992	1996	2000	1992	1996	2000
	Consumption Categories					
Basics	4.48	6.73	4.83	12.35	12.45	8.95
Meats	4.73	4.77	4.12	11.09	8.60	7.27
Fandv	2.04	1.88	1.77	5.63	3.74	3.31
Dairy	2.25	3.03	2.93	2.92	2.58	2.37
Other	2.60	3.43	3.75	3.28	3.83	3.45
Outside	11.09	8.58	10.77	7.18	8.94	11.75
House	34.60	32.21	30.03	28.78	29.01	25.34
Edu	6.99	7.60	7.32	5.28	5.39	5.76
Health	4.85	4.26	4.55	2.58	3.70	4.25
Cloth	6.08	5.13	6.18	5.68	4.87	5.96
Trans	7.35	9.04	8.74	5.25	6.19	7.27
Aother	12.95	13.34	15.01	9.98	10.71	14.32
	Sociodemographic Variables					
Hhsize	4.22	4.15	4.01	5.17	4.86	4.3
Kids	1.42	1.39	1.32	2.22	2.07	1.58
H_own	0.69	0.66	0.65	0.82	0.8	0.77
Rural	0.12	0.13	0.12	0.46	0.47	0.46
Elec	0.94	0.92	0.98	0.81	0.79	0.94
Refrig	0.80	0.80	0.84	0.36	0.57	0.60
Relative Prices						
	Northeastern Region			Southeastern Region		
	1992	1996	2000	1992	1996	2000
	Consumption Categories					
Basics	1.00	1.00	1.00	1.00	1.00	1.00
Meats	4.76	3.54	3.40	5.10	3.70	4.23
Fandv	2.17	1.83	1.92	4.43	3.29	3.48
Dairy	1.43	0.97	1.66	1.79	1.08	1.58
Other	6.25	3.76	4.19	5.12	4.35	4.45
Outside	2.18	2.06	1.84	2.35	2.48	2.37
House	332.66	220.16	260.22	228.77	208.44	190.84
Edu	130.86	137.46	115.16	64.26	86.52	96.71
Health	84.52	42.77	46.70	48.94	30.73	37.77
Cloth	34.36	29.20	30.44	25.40	23.80	27.47
Trans	175.40	142.67	150.77	121.79	132.87	148.78
Aother	83.03	58.01	80.00	62.52	44.33	61.66

The consumption categories appear as percentages of total expenditures for the respective year and region. All the values are weighted averages. Relative prices (in the lower part of the table) are utilizing same year basics as base.

Table 3 Parameters for the Northeastern region, year 2000.

(obs=1181)												
	Basics		Meats		Dairy		Fandv		Outside		Other	
Cons.	0.573	(0.065)	0.181	(0.099)	0.078	(0.108)	0.187	(0.072)	-1.087	(0.222)	0.298	(0.073)
Pbasics	-0.017	(0.010)	-0.001	(0.007)	0.004	(0.009)	-0.007	(0.006)	0.105	(0.020)	-0.020	(0.006)
Pmeats	-0.001	(0.007)	0.013	(0.008)	0.004	(0.007)	-0.003	(0.005)	0.019	(0.020)	-0.006	(0.005)
Pdairy	0.004	(0.009)	0.004	(0.007)	0.007	(0.011)	0.001	(0.006)	0.002	(0.022)	-0.004	(0.006)
Pfandv	-0.007	(0.006)	-0.003	(0.005)	0.001	(0.006)	-0.003	(0.005)	0.034	(0.014)	-0.005	(0.003)
Pout.	0.105	(0.020)	0.019	(0.020)	0.002	(0.022)	0.034	(0.014)	-0.189	(0.067)	0.055	(0.016)
Pother	-0.020	(0.006)	-0.006	(0.005)	-0.004	(0.006)	-0.005	(0.003)	0.055	(0.016)	0.000	(0.005)
Phouse	-0.056	(0.007)	-0.019	(0.009)	-0.011	(0.009)	-0.018	(0.005)	0.105	(0.024)	-0.025	(0.006)
Pedu	-0.010	(0.009)	-0.004	(0.009)	0.003	(0.010)	-0.002	(0.005)	0.029	(0.025)	-0.003	(0.006)
Phealth	0.053	(0.010)	0.015	(0.011)	0.005	(0.012)	0.015	(0.007)	-0.150	(0.025)	0.025	(0.008)
Pcloth	-0.005	(0.006)	0.001	(0.003)	0.000	(0.003)	0.001	(0.003)	-0.016	(0.014)	0.001	(0.004)
Paother	-0.014	(0.006)	-0.008	(0.004)	-0.005	(0.004)	-0.003	(0.003)	-0.045	(0.016)	-0.001	(0.004)
ln m	-0.062	(0.012)	-0.019	(0.015)	-0.005	(0.017)	-0.018	(0.010)	0.173	(0.038)	-0.030	(0.012)
(ln m)^2	0.001	(0.001)	0.000	(0.001)	0.000	(0.001)	0.000	(0.000)	-0.005	(0.002)	0.000	(0.001)
c.factor	n.a.	n.a.	0.058	(0.027)	0.058	(0.031)	-0.004	(0.021)	0.062	(0.017)	-0.021	(0.026)
Hhsize	0.008	(0.002)	0.004	(0.002)	0.001	(0.002)	0.000	(0.001)	-0.006	(0.005)	0.004	(0.002)
Kids	0.004	(0.002)	-0.003	(0.002)	0.003	(0.002)	0.000	(0.001)	-0.003	(0.007)	-0.001	(0.002)
H_own	0.010	(0.005)	-0.001	(0.004)	0.000	(0.004)	0.001	(0.002)	-0.051	(0.011)	-0.002	(0.003)
Rural	0.014	(0.005)	-0.008	(0.004)	-0.010	(0.003)	0.008	(0.002)	-0.001	(0.013)	0.006	(0.003)
Elec	-0.040	(0.008)	-0.014	(0.013)	-0.004	(0.009)	-0.013	(0.006)	0.058	(0.040)	0.002	(0.007)
Refrig	-0.010	(0.005)	0.015	(0.005)	0.008	(0.004)	0.004	(0.003)	-0.064	(0.014)	-0.004	(0.003)
R^2	0.382		0.067		0.073		0.120		0.162		0.151	
Expec.		0.085		0.052		0.034		0.026		0.097		0.051
Pred.		0.070		0.051		0.031		0.021		0.115		0.048
	Housing		Edu		Health		Cloth		Aother		Trans	
Cons.	1.003	(0.092)	-0.201	(0.136)	-0.838	(0.114)	0.061	(0.083)	0.179	(0.075)		
Pbasics	-0.056	(0.007)	-0.010	(0.009)	0.053	(0.010)	-0.005	(0.006)	-0.014	(0.006)		
Pmeats	-0.019	(0.009)	-0.004	(0.009)	0.015	(0.011)	0.001	(0.003)	-0.008	(0.004)		
Pdairy	-0.011	(0.009)	0.003	(0.010)	0.005	(0.012)	0.000	(0.003)	-0.005	(0.004)		
Pfandv	-0.018	(0.005)	-0.002	(0.005)	0.015	(0.007)	0.001	(0.003)	-0.003	(0.003)		
Pout.	0.105	(0.024)	0.029	(0.025)	-0.150	(0.025)	-0.016	(0.014)	-0.045	(0.016)		
Pother	-0.025	(0.006)	-0.003	(0.006)	0.025	(0.008)	0.001	(0.004)	-0.001	(0.004)		
Phouse	0.018	(0.014)	0.017	(0.010)	0.069	(0.013)	-0.002	(0.006)	-0.025	(0.007)		
Pedu	0.017	(0.010)	-0.086	(0.009)	0.033	(0.014)	-0.003	(0.007)	0.009	(0.008)		
Phealth	0.069	(0.013)	0.033	(0.014)	-0.093	(0.019)	-0.005	(0.010)	-0.012	(0.011)		
Pcloth	-0.002	(0.006)	-0.003	(0.007)	-0.005	(0.010)	0.037	(0.005)	-0.005	(0.003)		
Paother	-0.025	(0.007)	0.009	(0.008)	-0.012	(0.011)	-0.005	(0.003)	0.110	(0.004)		
ln m	-0.066	(0.015)	-0.090	(0.017)	0.147	(0.017)	0.002	(0.014)	0.016	(0.014)		
(ln m)^2	-0.001	(0.001)	0.011	(0.001)	-0.006	(0.001)	0.000	(0.001)	-0.002	(0.001)		
c.factor	n.a.	n.a.	0.172	(0.019)	0.080	(0.019)	0.046	(0.023)	n.a.	n.a.		
Hhsize	-0.003	(0.003)	-0.001	(0.003)	-0.005	(0.003)	0.001	(0.001)	-0.009	(0.002)		
Kids	-0.005	(0.004)	0.014	(0.003)	0.001	(0.004)	0.001	(0.002)	0.000	(0.002)		
h_own	0.040	(0.007)	-0.002	(0.007)	0.004	(0.007)	-0.002	(0.004)	-0.007	(0.004)		
Rural	-0.016	(0.007)	-0.002	(0.007)	-0.007	(0.009)	0.002	(0.004)	0.003	(0.005)		
Elec	0.009	(0.026)	0.018	(0.038)	-0.013	(0.028)	-0.003	(0.010)	-0.023	(0.012)		
Refrig	0.036	(0.009)	-0.002	(0.008)	-0.004	(0.010)	-0.007	(0.005)	-0.004	(0.006)		
R^2	0.328		0.430		0.133		0.231		0.526			
Expec.		0.292		0.044		0.043		0.061		0.132		0.082
Pred.		0.314		0.054		0.052		0.068		0.125		0.096

The first column represents the parameters names, and the first row the categories. Parameters that begin with p stand for price parameters, (ln m) and $(\ln m)^2$ are logarithm of income and the quadratic logarithm of income respectively. C. Factor is the censoring parameter in the model of Chapter 2. Three categories: basics, house and aother, did not need the censoring correction. Hhsize, kids, h_own and rural, elc, refrig are the parameters for the equation specific translating specifications. Expec is the current budget share, while pred. is the budget share obtained with the model.

Table 4 Parameters for the Southeastern region, year 2000.

(obs=1094)												
	Basics		Meats		Dairy		Fandv		Outside		Other	
Cons.	0.754	(0.082)	0.259	(0.154)	-0.154	(0.164)	0.012	(0.076)	0.019	(0.272)	0.066	(0.066)
Pbasics	-0.066	(0.015)	-0.011	(0.011)	0.033	(0.010)	0.007	(0.006)	0.035	(0.019)	0.003	(0.005)
Pmeats	-0.011	(0.011)	0.010	(0.011)	0.014	(0.009)	0.009	(0.005)	0.009	(0.013)	-0.002	(0.004)
Pdairy	0.033	(0.010)	0.014	(0.009)	-0.024	(0.026)	0.001	(0.004)	0.002	(0.011)	0.005	(0.004)
Pfandv	0.007	(0.006)	0.009	(0.005)	0.001	(0.004)	0.006	(0.004)	-0.001	(0.005)	0.002	(0.002)
Pout.	0.035	(0.019)	0.009	(0.013)	0.002	(0.011)	-0.001	(0.005)	-0.001	(0.017)	0.004	(0.004)
Pother	0.003	(0.005)	-0.002	(0.004)	0.005	(0.004)	0.002	(0.002)	0.004	(0.004)	0.002	(0.002)
Phouse	-0.027	(0.008)	-0.027	(0.006)	-0.002	(0.006)	-0.007	(0.003)	0.001	(0.008)	-0.006	(0.002)
Pedu	-0.021	(0.011)	-0.004	(0.013)	0.008	(0.011)	0.004	(0.006)	-0.020	(0.015)	0.001	(0.005)
Phealth	0.069	(0.012)	0.019	(0.017)	-0.019	(0.013)	-0.004	(0.009)	-0.008	(0.025)	0.000	(0.007)
Pcloth	0.002	(0.008)	-0.002	(0.006)	-0.005	(0.005)	-0.001	(0.003)	-0.005	(0.006)	0.001	(0.002)
Paother	-0.009	(0.007)	-0.010	(0.006)	-0.007	(0.005)	-0.011	(0.003)	-0.014	(0.007)	-0.004	(0.002)
Ln m	-0.081	(0.016)	-0.026	(0.026)	0.025	(0.023)	0.006	(0.013)	0.004	(0.041)	0.000	(0.011)
(ln m)^2	0.001	(0.001)	0.000	(0.001)	-0.001	(0.001)	-0.001	(0.001)	0.002	(0.002)	0.000	(0.000)
c.factor	n.a.	n.a.	0.014	(0.036)	0.049	(0.058)	0.030	(0.027)	0.034	(0.044)	0.002	(0.025)
Hhsize	0.015	(0.002)	0.007	(0.002)	0.001	(0.003)	0.003	(0.001)	-0.008	(0.006)	0.002	(0.001)
Kids	0.003	(0.003)	-0.002	(0.003)	-0.001	(0.002)	0.000	(0.002)	-0.009	(0.006)	0.001	(0.001)
h_own	0.001	(0.007)	0.003	(0.007)	0.004	(0.004)	0.003	(0.004)	-0.038	(0.012)	-0.003	(0.004)
Rural	0.037	(0.007)	0.003	(0.006)	-0.004	(0.004)	0.008	(0.004)	-0.063	(0.014)	0.014	(0.003)
Elec	-0.012	(0.008)	0.045	(0.014)	-0.011	(0.008)	0.012	(0.006)	0.026	(0.025)	0.006	(0.005)
Refrig	-0.030	(0.007)	0.032	(0.006)	0.012	(0.005)	0.002	(0.004)	-0.070	(0.013)	-0.008	(0.003)
R^2	0.532		0.159		0.068		0.146		0.164		0.180	
Expec.		0.130		0.081		0.025		0.040		0.111		0.042
Pred.		0.121		0.079		0.029		0.041		0.117		0.041
	Housing		Edu		Health		Cloth		Aother		Trans	
Cons.	0.482	(0.087)	0.035	(0.126)	-0.830	(0.103)	-0.024	(0.106)	0.079	(0.078)		
Pbasics	-0.027	(0.008)	-0.021	(0.011)	0.069	(0.012)	0.002	(0.008)	-0.009	(0.007)		
Pmeats	-0.027	(0.006)	-0.004	(0.013)	0.019	(0.017)	-0.002	(0.006)	-0.010	(0.006)		
Pdairy	-0.002	(0.006)	0.008	(0.011)	-0.019	(0.013)	-0.005	(0.005)	-0.007	(0.005)		
Pfandv	-0.007	(0.003)	0.004	(0.006)	-0.004	(0.009)	-0.001	(0.003)	-0.011	(0.003)		
Pout.	0.001	(0.008)	-0.020	(0.015)	-0.008	(0.025)	-0.005	(0.006)	-0.014	(0.007)		
Pother	-0.006	(0.002)	0.001	(0.005)	0.000	(0.007)	0.001	(0.002)	-0.004	(0.002)		
Phouse	0.077	(0.005)	0.040	(0.009)	0.002	(0.012)	0.000	(0.004)	-0.029	(0.004)		
Pedu	0.040	(0.009)	-0.076	(0.010)	0.048	(0.012)	-0.002	(0.007)	0.009	(0.009)		
Phealth	0.002	(0.012)	0.048	(0.012)	-0.087	(0.020)	-0.011	(0.009)	-0.020	(0.011)		
Pcloth	0.000	(0.004)	-0.002	(0.007)	-0.011	(0.009)	0.031	(0.006)	-0.004	(0.003)		
Paother	-0.029	(0.004)	0.009	(0.009)	-0.020	(0.011)	-0.004	(0.003)	0.102	(0.004)		
ln m^1	0.020	(0.017)	-0.110	(0.018)	0.141	(0.016)	0.005	(0.015)	0.023	(0.015)		
(ln m)^2	-0.004	(0.001)	0.011	(0.001)	-0.005	(0.001)	0.000	(0.001)	-0.002	(0.001)		
c.factor	n.a.	n.a.	0.149	(0.019)	0.112	(0.021)	0.133	(0.030)	n.a.	n.a.		
Hhsize	-0.003	(0.002)	0.003	(0.003)	-0.003	(0.003)	0.001	(0.002)	-0.014	(0.002)		
Kids	-0.005	(0.003)	0.008	(0.005)	0.000	(0.003)	0.003	(0.002)	0.006	(0.003)		
h_own	0.032	(0.007)	-0.003	(0.007)	-0.002	(0.006)	-0.002	(0.004)	0.003	(0.005)		
Rural	-0.014	(0.008)	-0.002	(0.007)	0.020	(0.007)	0.008	(0.004)	-0.010	(0.007)		
Elec	-0.044	(0.015)	0.011	(0.016)	-0.018	(0.010)	-0.003	(0.008)	0.011	(0.011)		
Refrig	0.030	(0.008)	-0.001	(0.008)	0.013	(0.007)	-0.005	(0.004)	-0.002	(0.007)		
R^2	0.381		0.446		0.204		0.219		0.562			
Expec.		0.251		0.043		0.039		0.048		0.112		0.068
Pred.		0.249		0.059		0.048		0.058		0.090		0.116

The first column represents the parameters names, and the first row the categories. Parameters that begin with p stand for price parameters, (ln m) and $(\ln m)^2$ are logarithm of income and the quadratic logarithm of income respectively. C. Factor is the censoring parameter in the model of Chapter 2. Three categories: basics, house and aother, did not need the censoring correction. Hhsize, kids, h_own and rural, elc, refrig are the parameters for the equation specific translating specifications. Expec is the current budget share, while pred. is the budget share obtained with the model.

Table 5 Income (budget) and uncompensated price elasticities.

Northern Region												
	Basics		Meats		Dairy		Fandv		Outside		Other	
	Val.	s.e.	Val.	s.e.	Val.	s.e.	Val.	s.e.	Val.	s.e.	Val.	s.e.
Budget	**0.51**	(0.053)	**0.83**	(0.081)	**0.64**	(0.146)	**0.79**	(0.124)	**1.23**	(0.157)	**0.67**	(0.086)
Basics	**-0.84**	(0.054)	**0.15**	(0.073)	0.23	(0.122)	0.08	(0.141)	0.27	(0.081)	-0.09	(0.056)
Meats	**0.10**	(0.044)	**-0.76**	(0.093)	0.13	(0.117)	-0.11	(0.089)	-0.02	(0.054)	-0.09	(0.057)
Dairy	0.09	(0.048)	0.07	(0.076)	**-0.54**	(0.184)	0.04	(0.115)	-0.07	(0.067)	0.03	(0.065)
Fandv	0.03	(0.040)	0.00	(0.047)	0.04	(0.090)	**-1.11**	(0.106)	0.06	(0.045)	0.01	(0.039)
Outside	**0.46**	(0.080)	-0.01	(0.132)	-0.08	(0.239)	0.33	(0.219)	**1.46**	(0.522)	**0.47**	(0.118)
Other	-0.05	(0.027)	-0.03	(0.043)	0.00	(0.081)	-0.07	(0.063)	0.04	(0.049)	**-1.08**	(0.064)
Housing	**-0.09**	(0.041)	-0.11	(0.075)	-0.13	(0.113)	-0.11	(0.127)	-0.12	(0.114)	0.01	(0.077)
Edu	**-0.10**	(0.050)	-0.03	(0.054)	0.00	(0.105)	-0.07	(0.055)	0.07	(0.067)	-0.07	(0.053)
Health	0.02	(0.038)	-0.01	(0.039)	0.02	(0.069)	-0.05	(0.084)	-0.05	(0.068)	-0.02	(0.058)
Cloth	-0.03	(0.028)	0.03	(0.039)	0.02	(0.054)	0.01	(0.049)	-0.07	(0.042)	0.00	(0.032)
Aother	**-0.08**	(0.036)	-0.12	(0.072)	-0.10	(0.103)	-0.02	(0.093)	**-0.58**	(0.072)	0.05	(0.048)
Trans	-0.03	(0.077)	-0.03	(0.089)	-0.04	(0.249)	-0.06	(0.198)	-0.08	(0.118)	-0.03	(0.109)
	Housing		Edu		Health		Cloth		Aother		Trans	
	Val.	s.e.	Val.	s.e.	Val.	s.e.	Val.	s.e.	Val.	s.e.	Val.	s.e.
Budget	**0.72**	(0.024)	**2.72**	(0.131)	**1.65**	(0.234)	**0.96**	(0.075)	**0.90**	(0.036)	**0.63**	(0.200)
Basics	**-0.04**	(0.011)	**-0.30**	(0.113)	-0.10	(0.142)	**-0.08**	(0.039)	**-0.11**	(0.021)	-0.03	(0.122)
Meats	-0.02	(0.013)	-0.07	(0.061)	-0.03	(0.053)	0.03	(0.039)	**-0.06**	(0.024)	-0.08	(0.059)
Dairy	-0.02	(0.012)	-0.02	(0.076)	-0.01	(0.047)	-0.01	(0.036)	-0.04	(0.022)	-0.01	(0.100)
Fandv	-0.01	(0.009)	-0.07	(0.056)	-0.04	(0.050)	0.01	(0.024)	-0.02	(0.015)	0.00	(0.066)
Outside	**0.08**	(0.029)	-0.23	(0.198)	-0.23	(0.214)	**-0.25**	(0.078)	**-0.26**	(0.045)	-0.02	(0.201)
Other	-0.01	(0.010)	-0.11	(0.067)	-0.07	(0.066)	0.00	(0.027)	-0.01	(0.016)	-0.03	(0.068)
Housing	**-0.67**	(0.021)	**-0.68**	(0.180)	-0.17	(0.252)	-0.04	(0.045)	**-0.16**	(0.025)	-0.02	(0.201)
Edu	-0.02	(0.021)	**-0.63**	(0.135)	-0.14	(0.136)	-0.06	(0.033)	**-0.05**	(0.022)	0.06	(0.116)
Health	0.03	(0.018)	-0.25	(0.169)	**-0.60**	(0.229)	-0.05	(0.034)	-0.02	(0.020)	0.03	(0.127)
Cloth	0.01	(0.009)	**-0.17**	(0.041)	**-0.11**	(0.040)	**-0.41**	(0.067)	**-0.03**	(0.017)	-0.02	(0.037)
Aother	-0.02	(0.013)	**-0.65**	(0.072)	**-0.28**	(0.089)	**-0.08**	(0.041)	**-0.13**	(0.025)	0.12	(0.070)
Trans	-0.03	(0.032)	-0.02	(0.264)	-0.04	(0.227)	-0.04	(0.054)	0.00	(0.032)	**-0.64**	(0.295)
Southern Region												
	Basics		Meats		Dairy		Fandv		Outside		Other	
	Val.	s.e.	Val.	s.e.	Val.	s.e.	Val.	s.e.	Val.	s.e.	Val.	s.e.
Budget	**0.52**	(0.046)	**0.92**	(0.096)	**1.16**	(0.475)	**0.89**	(0.103)	**1.52**	(0.122)	**1.00**	(0.090)
Basics	**-1.09**	(0.044)	0.11	(0.075)	**0.76**	(0.320)	**0.17**	(0.071)	0.15	(0.113)	0.13	(0.069)
Meats	0.05	(0.039)	**-0.88**	(0.070)	**0.48**	(0.245)	**0.19**	(0.084)	0.01	(0.050)	-0.03	(0.051)
Dairy	**0.15**	(0.049)	0.04	(0.059)	-1.07	(0.662)	0.01	(0.067)	0.03	(0.050)	0.08	(0.057)
Fandv	**0.05**	(0.020)	**0.13**	(0.038)	0.02	(0.068)	**-0.85**	(0.064)	-0.03	(0.023)	0.05	(0.031)
Outside	**0.27**	(0.070)	0.10	(0.081)	0.05	(0.177)	-0.02	(0.083)	**-1.04**	(0.076)	0.08	(0.063)
Other	**0.05**	(0.019)	0.01	(0.024)	0.09	(0.086)	0.05	(0.031)	0.01	(0.019)	**-0.95**	(0.029)
Housing	0.01	(0.036)	**-0.16**	(0.069)	-0.24	(0.254)	-0.08	(0.080)	**-0.23**	(0.093)	-0.07	(0.054)
Edu	-0.06	(0.039)	-0.05	(0.047)	0.00	(0.115)	-0.04	(0.040)	0.00	(0.039)	**-0.07**	(0.030)
Health	0.03	(0.029)	-0.07	(0.052)	0.00	(0.215)	-0.02	(0.050)	0.00	(0.078)	-0.06	(0.052)
Cloth	0.00	(0.030)	-0.06	(0.041)	-0.10	(0.088)	-0.03	(0.049)	**-0.07**	(0.028)	-0.02	(0.033)
Aother	-0.03	(0.027)	-0.08	(0.058)	-0.25	(0.148)	**-0.23**	(0.068)	**-0.21**	(0.050)	-0.06	(0.043)
Trans	0.03	(0.090)	0.03	(0.092)	-0.23	(0.509)	-0.07	(0.088)	-0.13	(0.089)	-0.04	(0.080)
	Housing		Edu		Health		Cloth		Aother		Trans	
	Val.	s.e.	Val.	s.e.	Val.	s.e.	Val.	s.e.	Val.	s.e.	Val.	s.e.
Budget	**0.75**	(0.028)	**2.19**	(0.170)	**1.38**	(0.193)	**0.77**	(0.102)	**0.91**	(0.044)	0.31	(0.307)
Basics	**-0.05**	(0.015)	-0.25	(0.170)	-0.03	(0.140)	-0.05	(0.079)	**-0.12**	(0.028)	-0.05	(0.254)
Meats	**-0.08**	(0.019)	-0.04	(0.096)	0.00	(0.089)	0.00	(0.065)	**-0.10**	(0.034)	0.02	(0.102)
Dairy	-0.01	(0.028)	-0.05	(0.165)	0.03	(0.132)	**-0.16**	(0.057)	-0.04	(0.029)	-0.11	(0.210)
Fandv	**-0.02**	(0.010)	-0.03	(0.034)	-0.03	(0.040)	-0.03	(0.035)	**-0.09**	(0.020)	-0.05	(0.040)
Outside	0.01	(0.041)	-0.32	(0.233)	-0.14	(0.194)	-0.09	(0.067)	**-0.11**	(0.045)	-0.01	(0.137)
Other	-0.01	(0.009)	-0.06	(0.044)	-0.06	(0.042)	0.01	(0.023)	**-0.03**	(0.014)	-0.04	(0.042)
Housing	**-0.54**	(0.023)	**-0.56**	(0.141)	-0.20	(0.127)	-0.08	(0.065)	**-0.19**	(0.031)	-0.12	(0.197)
Edu	-0.01	(0.023)	**-0.57**	(0.157)	-0.12	(0.125)	-0.01	(0.041)	**-0.07**	(0.024)	0.08	(0.102)
Health	0.02	(0.017)	-0.13	(0.143)	**-0.42**	(0.178)	-0.06	(0.062)	**-0.05**	(0.022)	0.01	(0.199)
Cloth	0.00	(0.015)	-0.08	(0.080)	-0.10	(0.061)	**-0.36**	(0.059)	-0.03	(0.022)	-0.03	(0.062)
Aother	**-0.05**	(0.014)	**-0.54**	(0.072)	**-0.35**	(0.072)	**-0.09**	(0.047)	**-0.05**	(0.025)	0.01	(0.081)
Trans	-0.02	(0.053)	-0.10	(0.339)	-0.06	(0.286)	-0.09	(0.093)	-0.02	(0.046)	-0.59	(0.367)

Values in bold are significant at a 95% level. The table should be read column-wise.

Table 6 Weighted implicit standard of living indices (average) for the Northeastern Region (NE) and Southeastern Region (SE) in Mexico from 1992 to 2000.

		1992	1996	2000	
General	NE	1.00	0.93	0.96	Graph 2
	SE	1.00	1.06	1.19	
Home owners	NE	1.00	0.89	0.94	Graph 3
	SE	1.00	1.03	1.21	
Non-home owners	NE	1.00	1.04	1.03	Graph 4
	SE	1.00	1.13	1.12	
Low Income	NE	1.00	1.06	1.04	Graph 5
	SE	1.00	1.07	1.19	
High Income	NE	1.00	0.89	0.92	Graph 6
	SE	1.00	1.10	1.29	

Figure 1 GDP per capita index for the Northeastern region (NE) and Southeastern region (SE) at constant prices (1993=1). Source: INEGI, constructed by author.

Figure 2 General ISLI for the Northeastern Region (NE) and Southeastern Region (SE).

Figure 3 Welfare Evolution. The upper squares describe welfare evolution with respect to homeownership. The graph on the left represents homeowners, while the graph in the right corresponds to non-homeowners. The lower squares describe welfare evolution with respect to household income. The graph on the left represents households in the lower five income deciles, while the graph in the right corresponds to households in the top five income deciles.

[1]This happened through FOBAPROA (Fondo Bancario de Protección al Ahorro), which eventually became IPAB (Instituto para la proteccion del ahorro bancario).

[2]The "Ejercito Zapatista" (guerrilla movement) appeared in January of 1994. While they were active for just a few days, together with other guerilla organizations, they have remained as a latent source of conflict in rural areas in the southeastern part of Mexico.

[3] An example is the implementation of PROCAMPO, which gives cash transfers to the farmers based on the amount of land they plant, and the disappearance of CONASUPO (a government intermediary that bought agricultural products guaranteeing minimal prices).

[4] The population for NER was 12 million, and for SER 12.8 million in December 2000. NER had a net population growth of approx. 22.9% and SER had a net population growth of approx. 23.2% in the period 1990-2000. In year 2000, the GDP per capita of the NER region was about three times the one at SER. Source: INEGI (Instituto Nacional de Estadistica Geografia e Informatica).

[5] All the categories are standardized under a common time framework (quarterly), afterwards price indices are calculated for the respective items. The procedure is not detailed here because of space reasons, however it could be provided upon request.

[6] The other three categories (basics, housing, and another) present a very small number of non-participating households.

[7] I want to thank a keen commentator for raising the point in a previous version of this paper.

[8] As explained in section IV, it was assumed that the preference structure was different between regions. Hence the regional demand systems were estimated independently.

[9] This does not imply that the movements in the home rental prices are the only variable causing variations in the ISLI for this group.

[10] From now on I will use logarithmic income and logarithmic total expenditure indistinctly.

[11] A particular indifference curve in the dense space.

[12] If sociodemographic variables were included in the right-hand side of the demand equations without further structure, it will not be possible to recover the household cost function.

[13]Pollak and Wales (1981) present two ways of incorporating sociodemographic characteristics into demand systems: scaling and translating. In this study just translating is included. Perali (1993) uses both

techniques and compares their performance. Phipps (1996) employs exclusively scaling. It should be notices that in principle the modification of cost functions (Lewbel 1985) is more general that both techniques.

[14] Described in Perali (1993) and employed for identification.

[15] A detailed description of the problem and its consequences can be found in Maddala (1983).

[16]ENIGH's provide a value for imputed rent for that households that are owners of the place they live, this information extremely simplifies the construction of the variable.