Regional and Income Disparities in Cost of Living Changes: Evidence from Egypt

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Abstract

Inflation has been rising in Egypt over the last decade reaching double digit levels. It was more pronounced in rural Egypt and might have hurt the poor proportionately more, since rising food prices were a major factor behind higher prices over this period. Moreover, rising prices, as measured by the Consumer Price Index (CPI), do not accurately measure changes in the cost of living. When inflation is high, people resort to substitution to hedge themselves against a declining standard of living. To accurately monitor changes in the cost of attaining a given utility level, not a fixed basket of goods, we construct True Cost of Living Indices(TCLI) and use them to examine the regional and income disparities in cost of living changes, and the extent of the substitution bias in the CPI. Results confirm that cost of living increases have been higher in rural regions, and there were far larger regional disparities in cost of living increases over time using the TCLIs than what the CPI indicates. The substitution bias in the CPI is quite substantial ranging from 0.5 to 3 percentage points per year. This can lead to large biases in real economic indicators when deflated via the CPI, vs. the TCLI. Finally, we find strong evidence that households at the bottom of the income distribution fared much worse than those at the top. This is even more pronounced for the poorest rural households whose cost of living increases were 2.6 percentage points higher per year on average, than the richest urban households, over the period under study.

Keywords: Cost of Living changes, inflation inequality, Consumer Price Index, Substitution Bias, Poor, Egypt

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1. Introduction

Inflation has been rising in Egypt over the last decade, and this has been a top concern of large segments of society. According to a recent Pew Global Attitudes Survey, 94% of Egyptians surveyed view rising prices as a "very big problem" or a "moderately big problem", following closely after lack of employment opportunities (Pew Research Center 2014). The Egyptian economy suffered from these high inflation levels chronically in the 1980s and early 1990s, and it took strong, and somewhat painful, policy measures to bring it down in the second half of the 1990s. Inflation was relatively low in Egypt in the early years of the new Millennium. Since 2007, however, inflation reached double digits, as illustrated in Figure 1. Furthermore, inflation in this period hit the rural areas harder, which is unusual for the Egyptian economy.

Rising food prices were a major factor behind higher prices over this period. International food prices had become highly volatile during the 2007-2008 period. World food prices were rising dramatically due to sharp declines in supply after a series of droughts around the world, and the simultaneous rising demand from biofuels in the face of rising oil prices. World food prices fell in 2009 and 2010 but rose again in 2011 to even higher levels than 2007/2008 (FAO 2014). As a result, the CPI index for all items almost tripled between 1999/2000 and 2012/2013 with prices rising slightly faster in rural areas, while that for Food and Beverages more than quadrupled over the same period (see Figure 2 and Table 1). By Engel's Law, the poor tend to spend more of their budget on necessities than the rich. It is therefore plausible to expect that the cost of living might have increased faster for households at the lower end of the income distribution over this period. This paper aims to examine whether specific income groups, or residents of a particular region, faced a disproportionately large burden due to rising prices over the last few years, compared to other segments of society.

A closely related issue that is less often studied in the MENA region, is that rising prices as measured by the Consumer Price Index (CPI) do not accurately measure changes in the cost of living. A price index is a weighted average of prices, where the weight is fixed, taken to be the expenditure share allocated to each commodity in consumer expenditure budgets. This index serves its purpose well; namely, to monitor the extent of price changes over time. When inflation is high, however, we would expect people to resort to substitution to hedge themselves against a declining standard of living. To accurately monitor changes in the cost of living, variations in the cost of attaining a given utility level, not a fixed basket of goods, should be measured. This has long been recognized by national statistical agencies worldwide, including Egypt's Central Agency for Public Mobilization and Statistics (CAPMAS), and there is substantial international literature on substitution bias.

A true index of the cost of living, as originally defined by Konüs (1936), is the ratio of the minimum expenditures required to attain a particular standard of living at two different price regimes. It is 'true' in the sense that it is defined for price changes along a particular indifference curve rather than a fixed bundle, and there exists a separate 'true' cost of living index (TCLI) for each possible indifference surface (Diamond 1990, p.740). The CPI produced by CAPMAS is a fixed weight, Laspeyres type index that uses base year expenditure shares as weights. This type of index is not an accurate measure of welfare changes over time. It is the changing relative cost of a fixed basket of goods. It overestimates welfare decline due to a change in prices. When prices change consumers routinely resort to substitutions that may allow them to remain at the same utility level as before the price change and just as well off. These substitutions are not captured by the Laspeyres index since it is restricted to measuring the cost of a single bundle overtime as a proxy for a constant standard of living. Thus a Laspeyres price index overestimates the increase in the cost of the original standard of living by neglecting any opportunity for substitution that arises when the price structure changes - it assumes demand is absolutely price inelastic, which is not necessarily realistic. The obvious alternative is to take a particular indifference surface as the proxy for a constant standard of living, and define a true cost of living index (TCLI), based on that. The TCLI would therefore measure the changing relative cost of a specific level of utility over time.

In summary, this study aims to examine the extent of the regional and income inequality in changes in the cost of living over the period 2008-2016 in Egypt. I construct TCLIs that measure the changing relative cost of a specific utility level. This allows me to examine the extent of the substitution bias in the fixed bundle Laspeyres price index, similar to CAPMAS's CPI. This study has clear policy implications. Results shed light on whether specific income groups or regional residents have been at an increasing disadvantage due to rising prices. Results also provide insight into the size of the substitution bias in the CPI and whether compiling such TCLIs for different regions and income levels is warranted.

2. Review of Related Literature and the Egyptian CPI

The true cost of living index (TCLI) proposed by Konüs (1936) "compare[s] the monetary cost of two different combinations of goods which are connected solely by the condition that during the consumption of these two combinations, the general status of want-satisfaction (the standard of living) is the same" (Konüs 1936, p. 10). Taking U° as the utility level of the base year and P° and P^{1} as the prices of the base period and the current period, respectively, the true cost of living index for U° is thus:

$$C(P^1, U^\circ) \;/\; C(P^\circ, U^\circ) \qquad (2.1)$$

where C(P,U) is the cost of achieving utility level U at the price vector P.

Fisher (1927) reviewed numerous index number formulas, several of which have been used since in attempts to construct TCLIs. Diewert (1987) reviewed the theory of index numbers and various tests and other means that have been developed to choose among them. Using a test approach he concluded that Jevons' geometric index, the Fisher geometric mean index and the Walsh indexes are the best. Using a microeconomic approach he showed that the true cost of living index lies between the Paasche and the Laspeyres indexes as lower and upper bounds respectively. However, none of these indexes provide a readily calculable TCLI that measures the relative cost of a given utility level over time.

Due to the difficulty of applying any of the available formulas, statistical agencies around the world have usually used a Laspeyres-type formula in measurement of price and cost of living changes. The Laspeyres-type index uses the base period consumption patterns as weights and has the following general form:

$$I_{t,o} = \frac{\sum_{i=1}^{n} Q_{oi}\ P_{ti}}{\sum_{i-1}^{n} Q_{oi} P_{oi}} \text{ X } 100 \qquad (2.2)$$

where Q_{oi} is the quantity of good i consumed during the base period o and P_{oi} and P_{ti} are the prices of good i in periods o and t, respectively. However, the Laspeyres formula is an upper bound on the TCLI. It is a fixed weight index that does not allow for substitution and therefore leads to a difference between the TCLI and the Laspeyres-type CPI. This difference is called the substitution bias.

Manser and McDonald (1988) used superlative index numbers[1], following Diewert (1976), as TCLIs to determine the size of the substitution bias due to the CPI between 1959 and 1985 in the US. They found that the bias amounted to 0.18% per year over that period. Aizcorbe and Jackman (1993) used data for 1982 to 1991 and similar methods. They found a slightly higher bias of between 0.2% and 0.27% per year. In a more recent report, the CPI Commission

[1] 9Diewert (1976) defined a price index as "superlative" if it is exact for an expenditure function which is capable of providing a second-order differential approximation to an arbitrary twice continuously differentiable linearly homogeneous expenditure function. (The Laspeyres price index for example is not superlative because it is only a first-order Taylor approximation to the TCLI).

appointed by the US Senate concluded that the substitution bias was as high as 0.4% (Boskin et al. 1997, p. 79).

The disadvantage of the superlative index numbers proposed by Diewert(1976) is that they require the specification of a particular form of consumer utility function that describes the general preference patterns of the society. Basmann et al. (1988) discuss how important the assumed form of utility function is in that it can greatly affect the level of change calculated by the index. For example, assuming that the utility function is of the Leontief type suggested that a certain stratum of the American population lost 38% of their real income between 1972 and 1988. Using the generalized Fechner-Thurstone(GFT) form of utility function, which satisfies only a minimum set of assumptions about consumer preferences and is therefore much more general, suggests a much smaller decline in the real value of that class's income: only 8% over that period.

To bypass the difficulties and loss of generality entailed in choosing a particular form of utility function to measure the cost-of-living, Basmann et al. (1985a) used the generalized Fechner-Thurstone (GFT) form of utility function which allows the construction of TCLIs of the type discussed above. The advantage of the GFT-based TCLI is that it can be easily calculated without making any restrictive assumptions about the preferences of consumers. It does not require statistical estimation of the parameters of a system of demand functions to fit a specific utility function and the TCLIs are therefore termed non-parametric. In addition, they have an important advantage in that the only data required for their estimation is the prices and expenditures for both the base and current periods. Basmann et al.(1985a) advocate the use of GFT-based TCLI whenever no neoclassical direct utility function that fits the data very well can be found since they are generally much cheaper to construct and yield results that are just as good.

Another important issue closely related to the measurement of cost-of-living indexes is how the cost-of-living varies across households of varying socio-economic status. This is because people have widely varying consumption patterns. Price increases that are concentrated in the food and beverages group, for example, are expected to affect the cost-of-living of a household that spends 70% of its total expenditure on that category much more than its effect on the cost-of-living of a household that only spends 35% of its total expenditure on it.

S.J. Prais (1959) and J.L. Nicholson (1975) were the first to introduce the idea that different households have widely differing preferences and therefore the official CPI is not a sufficient indicator of cost-of-living changes for the whole population. Nicholson argued that the "official price indexes give each household's consumption pattern 'an implicit weight proportional to its total expenditures' " (Pollack 1980, p.l 19). Prais called this kind of index "plutocratic" and both he and Nicholson suggested an alternative "democratic" index that gives all households equal weight. Both Michael (1979) and Hagemann (1982) calculated such indexes for the USA, and they found that some groups suffer more than others but this finding is not consistently true for any one group. They both used Laspeyres type formulas which are not true cost of living measures, however. Balk (1990) used a TCLI to determine the difference in cost of living changes between various income levels. His analysis is based on a translog utility function. He found that consumers with the highest reference utility curves sustained the lowest cost of living increases over the period 1952-1981 in the Netherlands.

More recent work by Flower and Wales (2014) for the UK has found that low expenditure households faced faster rates of price increases than high expenditure households, and the difference was quite significant, averaging 1% per year over the period 2003 to 2013. There were also wide differences in the inflation experience of various types of UK households such as those with/without children, and those who were retired/non-retired. For the Czech Republic, Hait and Jansky (2014), found that between 1995 and 2010 low income households and those with pensioners faced higher inflation rates than the national average. Ley (2005) and Oosthuuizen (2007), both provide a detailed literature review of international work on this topic and both note that the majority of papers do find that different subgroups experience different inflation levels, but most did not find a consistent pattern whereby one group was consistently worse off than the others. These conclusions are also echoed in several other recent studies (see for example Levell and Oldfield (2011), Pike et al. (2008), Crawford and Smith (2002), among others).

For Egypt, Zaghloul (1992) found that prices were also rising faster in rural areas and for the food and beverages group between 1973 and 1989. Additionally, she calculated Laspeyres-type price indexes for 4 different urban expenditure groups for the period 1973 to 1989. Although the same price relatives were used, the index numbers varied significantly between income groups. Her analysis showed that the lowest income group faced higher relative CPI increases than other groups for most, though not all, years. This study too is, however, limited by the fact that it only calculates fixed-base indexes not TCLIs. AlAzzawi (1998) calculated TCLIs for Egypt for three different income groups over the period 1967 to 1997. Her results indicate that when the same price relatives are used, there is significant difference in the cost of living increases of various groups, but no one income group was consistently worse off during this period. However, when group specific prices were also incorporated in the analysis the poor in urban areas appeared to have consistently fared worse over the studied period. The present study will extend and augment these results for a more recent time period in which far- reaching economic, social and political changes have taken place, and by using more disaggregated price and expenditure data that will allow more accurate calculations of the group specific TCLIs, as well as the extent of the substitution bias in the CPI.

Process of Calculating the CPI in Egypt

After the market basket that is to be priced is chosen, based on the consumption patterns of consumers as revealed by the HIECS, the process of price collection begins. This is done on a monthly basis for the urban areas and bimonthly for the rural areas. In practice, CAPMAS officials collect prices from three different outlets in each geographic location. These outlets represent the public sector, the private sector and public markets, such as El-Obour and Boulaq markets.

When prices and weights are all available, the calculation of the index using Equation (2.2) above is made. This process is first done at a disaggregated level, e.g. for Bread and Cereals and then the larger category index (Food, Beverages and Tobacco) is calculated from the separate indexes of its components , and finally the All-Items CPI is computed in the same way. This is done for each city/governorate and then to obtain the all-urban or all-rural CPI, each city's/governorate's index is weighted by the proportion of the population that resides in it.

In what follows I will review some important issues pertaining to the calculation of the CPI, which, if inappropriately handled, could lead to serious biases in the index, and discuss their relevance to the Egyptian CPI.

Price Collection

The price collection process should be designed such that the importance of different kinds of outlets to consumers is reflected in the weight given to prices reported from each kind. The fact that the prices from each outlet are given equal weight in the calculation of the Egyptian CPI implies -without good reason- as Fares (1997) has pointed out, that the economy is divided equally into low, middle and high income groups and that each outlet type faces identical relative price changes. This may lead to some bias in the CPI. This bias could be easily corrected by including questions in future HIECSs about where the household generally buys each category of goods and weighting prices accordingly (Fares 1997).

Housing Component

Another very important source of bias in the currently published CPI is connected with the housing index number. It is calculated based on the assumption that the great majority of people in Egypt live in fixed-rent houses (Fares 1997). It is however, manifest, even to the most casual observer, that this is no longer the case. Today most people live in expensive owner-occupied houses, in furnished-rented houses that do not fall under the fixed rent laws or in informal housing which is by no means cheap. Assuming very little or no increase in the cost of housing to the average consumer, therefore, constitutes a source of downward bias in the CPI. The ideal solution to this problem is, naturally, to conduct a housing survey from which we can deduce the proper proportion of each type of housing in the economy and then accordingly give weights to price changes in each when calculating a housing index. Another solution that could be implemented immediately at almost no additional cost, is to simply issue another index minus the rent component, and compare it with the complete index (Fares 1997).

Quality Adjustment and New Goods

Accounting for quality adjustments and new goods in the calculation of the CPI must be done carefully and consistently. Price and cost-of-living indexes are designed to measure only price or cost-of-living changes. If the quality of a commodity is improved and the resulting product has a much higher price, the fact that some of this increase in price is a result of the greater worth that this product now has should be recognized when calculating the CPI. A striking example in this respect is the transition from use of the domestic broom to use of the electric hoover! The two provide basically the same service: household cleaning. When electric hoovers replaced brooms the cost of this service would have appeared to sky-rocket. However, use of hoovers provides a much faster and more convenient service which, among other advantages, has freed a lot of the consumer's (especially women's) time that can be used more profitably to perform other tasks. Similarly, new products on the market must be regularly studied and incorporated into the index so as to keep the market basket representative of actual consumption patterns. Examples of new goods that have become very important to a considerable segment of the population are the cellular phone and Electronic Mail. The method used in Egypt to account for quality changes and new goods is similar to that used in the UK, the USA and Japan and seems to be fairly adequate for this purpose (Fares 1997, p.20). One method to test this claim is to use hedonic regression analysis. This requires regressing prices on characteristics of goods to examine the relationship between price and quality. However, the issue of incorporating new goods and adjusting for quality is not the subject of this study. It is one more problem involved in the calculation of the CPI and should be analyzed separately.

Accounting for Seasonality

For goods such as fresh fruits and vegetables, price changes must be considered keeping in mind that prices fluctuate according to whether this is the beginning, middle or end of the season for that particular fruit or vegetable. Prices are unusually high at the start and towards the end of the season and in practice very few people would be willing to buy that good then. Thus weights and prices for the CPI must be set/collected taking this problem into consideration. Egypt follows a special approach in this respect. It is assumed that the majority of households allocate a particular budget to fruits per month, for example, and that they are indifferent between the various kinds available on the market, so long as the total amount of money spent on fruits does not exceed the allocated budget. The CAPMAS official in-charge of price collection will collect the prices of all fruits on the market, except those that have uncharacteristically high prices due to it being the end/beginning of their season. This will depend, to a large extent, on the official's personal judgment. The arithmetic average of the price relatives of all these fruits is then obtained and multiplied by the weight assigned to fruits as a group to obtain their price index. Thus, by eliminating seasonal peak prices, Egypt avoids seasonality induced biases in the CPI. Fares (1997) declares that "the CPI series for the last 25 years has been free of any seasonal effects" (p. 19).

Commodity Substitution Bias

The CPI is the changing relative cost of a fixed basket of goods and services. This index number differs from the 'true index of the cost of living' as defined by Konus (1936), which measures the relative cost of attaining a fixed standard of living or utility under two sets of prices. When prices change consumers resort to substitutions that may allow them to remain at the same utility level as before the price change and just as well off. These substitutions are not captured by a fixed-weight index since it is restricted to measuring the cost of a single bundle over time - it assumes absolutely price inelastic demand that is not necessarily realistic. Hence 'substitution bias' arises as a result of the failure to account for substituting a good that is less expensive for one whose price has risen, such that the consumer remains at the same level of satisfaction. Pollack (1971) proved that the Laspeyres type price index is an upper bound on the TCLI that takes a single indifference surface, rather than a single consumption bundle, as reference in its calculation. One of the objectives of this study is to measure the extent of this bias and the next section gives a detailed account of how this was done.

3. Conceptual Framework and Methodology: A TCLI Based on the Generalized Fechner-Thurstone Direct Utility Function

A TCLI is defined as the ratio of minimum expenditure levels required, under two different sets of prices, to stay at a base period standard of living. It is 'true' in the sense that it is defined for price changes along a particular indifference curve rather than a fixed bundle, and there exists a separate 'true' cost of living index for each possible indifference surface (Diamond 1990, p.740). As discussed earlier, a Laspeyres type index uses the base period level of consumption of each commodity for its computation. A TCLI however, will allow the consumer to alter his consumption basket in response to a change in relative prices such that he/she remain at the same level of utility as before the change.

To calculate a TCLI we must first specify a particular form for the consumer utility function U° and estimate the set of demand equations that result from it[2]. The approach usually followed to construct a TCLI is first to maximize a direct utility function U(X) subject to the budget constraint $P'X \leq M$ where X is the vector of commodities, P is the vector of prices and M is income (or expenditure). This yields a system of demand equations which gives information about the substitution that would occur in response to a given price change:

$$X = \phi\,(P,M) \qquad (3.1)$$

When these demand functions are substituted back into the utility function the result is the indirect utility function:

$$V(P,M)=U[\,\phi\,(P,M)] \qquad (3.2)$$

which represents the maximum level of utility that could be attained for a given set of prices and income/expenditure. When equation (3.2) is solved for the total income/expenditure M, we get the expenditure function

$$M= m(U,P) \qquad (3.3)$$

which represents the minimum level of expenditure required to reach a particular level of utility U, at prices P. A TCLI is defined as the ratio of minimum expenditure levels required, under two different price regimes, to stay at a base period utility level. It could thus be calculated as:

$$TCLI\,(P_1,P_0) = \frac{m\,(U_b, P_1)}{m\,(U_b,P_0)} \qquad (3.4)$$

where P_1 is a vector of current period prices, P_0 is a vector of reference period prices and U_b is the utility level of the base period, at prices P_b and expenditure M_b. If the base period is the same as the reference period the denominator in (3.4) becomes the actual expenditure M_0.

This was the approach most commonly applied to calculate the extent of the substitution bias before 1980. Braithwait (1980), whose analysis was the most detailed up to that time, concluded that the substitution bias in the US CPI was only 0.1% per year between 1958 and 1973. He also concluded that the higher the relative price changes, and the higher the compensated demand elasticities (i.e. the greater the substitutability), the larger the size of the bias in the CPI. However,

[2] The following exposition follows Braithwait (1980).

it was not easy to calculate the system of demand equations and researchers were restricted to the use of only a small number of commodities.

More recently, most studies that addressed the issue of substitution bias in the CPI have used superlative price indexes, introduced in 1976 by W.E.Diewert. These indexes are easier to calculate since they do not require the estimation of a complete system of demand equations. The calculation of these superlative price indexes requires information on both prices and expenditures from each period under consideration and therefore take substitution into account. Manser and McDonald (1988) used this type of index number as a TCLI to determine the size of the substitution bias due to the CPI between 1959 and 1985 in the US. They found that the bias amounted to 0.18% per year over that period. Aizcorbe and Jackman (1993) used data for 1982 to 1991 and similar methods. They found a slightly higher bias of between 0.2% and 0.27% per year. However, this type of index number assumes that consumer tastes do not change over the period under consideration. Additionally, Diewert's (1976) proof of the close approximation of a TCLI by a superlative price index is limited to the case where consumer preferences are homothetic, i.e., their income elasticities are equal to one (Moulton 1996 p. 165). A third disadvantage of this type of index is that it requires the specification of a particular form for the consumer utility function.

Verifying the assumptions of fixed preferences and homotheticity for specific consumption patterns in Egypt can be complex, and furthermore, data are not readily available. In addition, the accuracy of the TCLI calculated by either of these two methods remains subject to the degree to which the utility function chosen represents the true preferences of consumers. A very convenient form of utility function that rationalizes the construction of a TCLI is the Generalized Fechner-Thurstone (GFT) direct utility function. The advantage of the GFT-based TCLI is that it can be easily calculated without making any restrictive assumptions about the preferences of consumers. It does not require statistical estimation of the parameters of a system of demand functions that fit a specific utility function and the TCLIs are therefore termed non-parametric. In addition, they have an important advantage in that the only data required for their estimation is the prices and expenditures for both the base and current periods. This type of TCLI will be used in this study.

A Least Restrictive Form of Direct Utility Function

Traditional analysis of TCLIs assumed that consumers follow a neoclassical direct utility function where variations in budget constraint prices and expenditures are assumed to have no effect on consumer tastes. This is a sufficient (not necessary) condition for the demand functions derived from the direct utility function to exhibit regularity properties[3]. Such a neoclassical direct utility function will not, however rationalize constructing TCLIs from non-regular demand functions. Furthermore, any neoclassical direct utility function will necessarily impose certain restrictions on consumer preferences that cannot always be justified nor sometimes are they even testable. Barnett (1981) proved that whenever the strict neoclassical assumption of the independence of consumer preferences from changes in budget constraint prices and expenditures is tested empirically, the data asymptotically rejects this hypothesis by any method of testing consistently applied (Basmann et al. 1985a, p.2). Thus it seems that in order to construct a TCLI that does not make unjustifiable assumptions about consumer maximizing behavior we should find a utility function which does not impose any contestable assumptions. Further, it has been demonstrated in Basmann et al. (1988) that imposing extra restrictions on the TCLI, e.g. assuming that consumers follow a Leontief indifference curve, are not neutral in their distributional implications.

Basmann et al. (1988, p.1,2) argued that if a given neoclassical direct utility function is found to agree (i.e. is given significant likelihood ratio support) closely with the data, this does not imply that this function is unique in that sense[4]. Another direct utility function that is in better agreement with the data than the neoclassical one, can always be found. When constructing a TCLI we are interested in finding a utility function that does not make unwarranted assumptions about consumer behavior, it should have the least restrictive form possible, Seo (1973) proved that *any* system of demand functions satisfying the linear budget constraint

$$\sum_{i=1}^{n} p_i X_i = M \tag{3.5}$$

[where p is a vector of n positive prices $p = (p_1,...,p_n)$, M is total expenditure that the consumer makes on commodities $X = (X_1,..., X_n)$] must have the form:

$$X_i = \frac{g_i\ (p_1, ..., p_n, M)}{p_i \sum_{j=1}^{n} g_i\ (p_1, ..., p_n, M)} \left[M - \sum_{k=1}^{n} \gamma_k\ p_k \right] + \gamma_i,\ i=1,2,...,n \tag{3.6}$$

where $g_i(p_1,...,p_n, M) > 0$ for all i; $[M - \sum_{k=1}^{n} \gamma_k p_k] > 0$.

If we can find the utility function that, when maximized, yields equation (3.6), we can be

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[3] A system of demand functions is said to be regular if (1) it is homogeneous of degree zero in prices and total expenditures; (2) "the partial derivatives of the demand functions form a matrix of *apparent substitution terms*... that is (a) negative definite and (b) symmetric" (Basmann et al. 1985b, p.46)

[4] The following analysis is adapted from Basmann et al. (1988), Chapter 1

certain of generality since it would be a utility function that is rationalized by any system of demand functions possible. Basmann, Molina and Slottje (1984) have demonstrated that the Generalized Fechner-Thurstone (GFT) direct utility function does yield demand equations of the form (3.6) when maximized subject to the linear budget constraint (3.5). The GFT direct utility function has the following form:

$$U(X; \theta_1, \theta_2, ..., \theta_n) = \prod_{i=1}^{n} (X_i - \gamma_i)\, \theta^i, \tag{3.7a}$$

where

$$X_i > \max\{0, \gamma_i\} \tag{3.7b}$$

$$\theta_i = \theta^*_i\ (p, M; \Phi)\, e^{Ui} > 0, \qquad i=1, 2..., n, \tag{3.7c}$$

$$\theta = \sum_{i=1}^{n} \theta_i \tag{3.7d}$$

When this utility function is maximized subject to the budget constraint it gives the following demand function which is of the same form as (3.6):

$$X_i^* = \frac{\theta i\ (p, M; \Phi)}{\theta\ (p, M; \Phi) p_i} \left[M - \sum_{k=1}^{n} \gamma_k p_k \right] + \gamma_i, \quad i = 1, 2, ..., n. \tag{3.8}$$

where $\theta = \sum_{i-1}^{n} \theta_i$,

Since any system of demand functions can be written in the form (3.6), and (3.8), which is obtained by maximizing (3.7a-d), is the same as (3.6), we can conclude that "every system of demand functions necessarily results in the maximization of a direct utility function of the GFT form. In fact the GFT form is the least restricted algebraic form of direct utility function satisfying the necessary and sufficient conditions for describing the utility maximizing behavior of a consumer (or a group of consumers)" (Basmann et al. 1988, p.5).

In equations (3.7a-d), the exponent θi depends on **p** and **M** in general, and someteimes also Φ which is a vector of specified observable non-stochastic variables which affect consumers' indifference curves. Φ could be included in the specification to facilitate testing hypotheses related to, for example, changes in demographic patterns. θ_i^* is the equilibrium value of θi . $\gamma = (\gamma_1, ..., \gamma_n)$ represents the subsistence levels of commodities X_i, for all i . $\gamma = 0$ is assumed with no loss of generality, $\mathbf{u} = (u_1,..,u_n)$ is a latent random vector that has zero mean and finite positive definite variance matrix W_0 and represents stochastic changes of taste. Variations in the stochastic taste changer u causes changes in the marginal rates of substitution between commodities, in the curvature of indifference curves and higher derivatives, but maintains their convexity (Basmann et al. 1985a, p. 14). Note that X_i is the only argument of the GFT direct utility function; it is the only variable under the consumers' control. θ_i is a function of p, M, Φ and u but these are parameters of the GFT direct utility function. It is assumed that prices are a 'given' to consumers and that total expenditures are exogenous and that, contrary to the case for neoclassical direct utility functions, budget constraint prices and expenditures could have non-zero effects on the consumer indifference curves (Basmann et al. 1988, p.4 and 18).

The names Fechner and Thurstone were given to this least restricted form of utility function in recognition of the fact that L.L. Thurstone had introduced a similar direct utility function based on psychological experiments in his well-known article "The Indifference Function" in 1931. Thurstone had defined a 'satisfaction curve' which is a variant of the current concept of direct utility function. To write an equation for this curve he made five assumptions. The last of these was that "the slope of the satisfaction curve in the direction of increasing X_i, is inversely proportional to the amount X_i already possessed" (Basmann et al. 1988, p. 18) which was the same as an empirical regularity that G.T. Fechner had universalized ('the increase of a stimulus to produce a given increase of sensation bears a constant ratio to the total stimulus' (Basmann et al. 1988, p. 19). Fechner developed a logarithmic law which suggested a weighted geometric mean of quantities of commodities as a useful form of direct utility function and this is the form used for the GFT direct utility function in (3.7a-d) above (Diamond 1990, p.741).

The direct utility function form in (3.7a-d) closely resembles the Cobb-Douglas form of production function. The latter, however, assumes that the exponents of the utility function are constants and not functions of p, M, Φ or u. Actually the Cobb-Douglas utility function is a highly restricted form of the GFT direct utility function in (3.7a-d). It is because the exponent in (3.7a-d) is dependent on other variables that the Fechner and Thurstone direct utility function is given the prefix 'generalized'.

Basmann et al. (1988) claimed (p.67) that "if consumers allocate their income in accordance with the linear budget constraint, then they must maximize the GFT utility function". They explain that this is true because the GFT direct utility function is a flexible form and its flexibility stems from the fact that the parameters of the GFT weights (the θ_i's) can be specified in such a way that the resulting GFT utility function, when maximized, yields exactly the same system of demand functions as any 'standard' direct utility function, e.g. a utility function from the implicit addilog class (Diamond 1990, p.742).

The systematic parts of the exponent function 0j can be estimated either parametrically or non-parametrically. Using non-parametric estimation makes fewer assumptions and hence fewer restrictions about the form of consumer demand functions and is therefore preferred. Thus when we say that we will use a GFT-based non-parametric TCLI we are referring to the fact that we can get an estimate of θ without having to estimate the parameters of $\theta_i(p, M; \Phi)$. Data on expenditures and prices are all that is required. This is one advantage that GFT-based TCLIs have over others.

Likelihood Support for the GFT Utility Function

Basmann et al. (1988) present tests on fixed preference utility functions, which assume that, except for random disturbances, consumer tastes are invariant and independent from prices and total expenditures. They found that the data gave no likelihood support to these hypotheses; "the outcomes of the tests performed indicated that generalized Fechner-Thurstone direct utility functions that are compatible with fixed preferences were strongly rejected against the alternatives [that do not assume fixed preferences]" (p.63). They also demonstrated (pp.65-76) that the functional forms of utility functions that fit observations equally well are all 'nested within' the GFT functional form. They tested the GFT functional form against others of the GFT-CEMRS (Constant Elasticity of Marginal Rates of Substitution) class[5] and concluded that "likelihood support for any of the alternative forms against the GFT-Class is very close to zero ($0.00 * 10^{-25}$) or more. Our results...indicate that the GFT-direct Utility Function and its implied model of aggregate consumer behavior is in excellent agreement with ...[the] data" (pp.70-71).

It had always been argued that using a CPI as a proxy for a 'dedicated' TCLI, is better than using a neoclassical based TCLI. First, it may not fit the data very well and second, it makes unjustified assumptions about consumer maximizing behavior, which are not neutral in their distributional impact. The CPI makes no such assumptions and was therefore thought to be less distorting of actual cost-of-living changes over time. The use of a GFT-based non-parametric TCLI does not make any such assumptions and thus the CPI enjoys no advantage over it in that sense. Also, it does not require the estimation of a system of demand functions and is therefore just as easily calculated (as the CPI) from nothing more than observations on prices and expenditures.

GFT True Cost of Living Indexes

To construct a Kontis-type TCLI from any direct utility function we need to: (1) calculate the ratio of minimum expenditure (M^a) required to attain an indifference curve S of a particular utility function at price level P^a, to that (M^b) required to remain at S at price level P^b; (2) decide on the particular indifference curve S which is to be taken as reference in the computation of the

[5] The alternative models were: (l)GFT-CEMRS unrestricted, (2)Cobb-Douglas, (3)Leontief, (4) Relaxed CES (constant elasticity of substitution), (5) CES, (6) Leser-Houthakker, which are all of the GFT-CEMRS class.

TCLI. Following Basmann et al. (1985a,1988) and Diamond (1990), the method used here to specify S is the Modified Standard Basket (MSB) approach. In this approach a particular market basket X° is specified and the cost of living is then taken as the minimum expenditure necessary to reach the indifference curve (of some direct utility function) on which X° lies, at a given point in time (refer to Figure 3.1). To define the MSB approach we need to specify[6] :

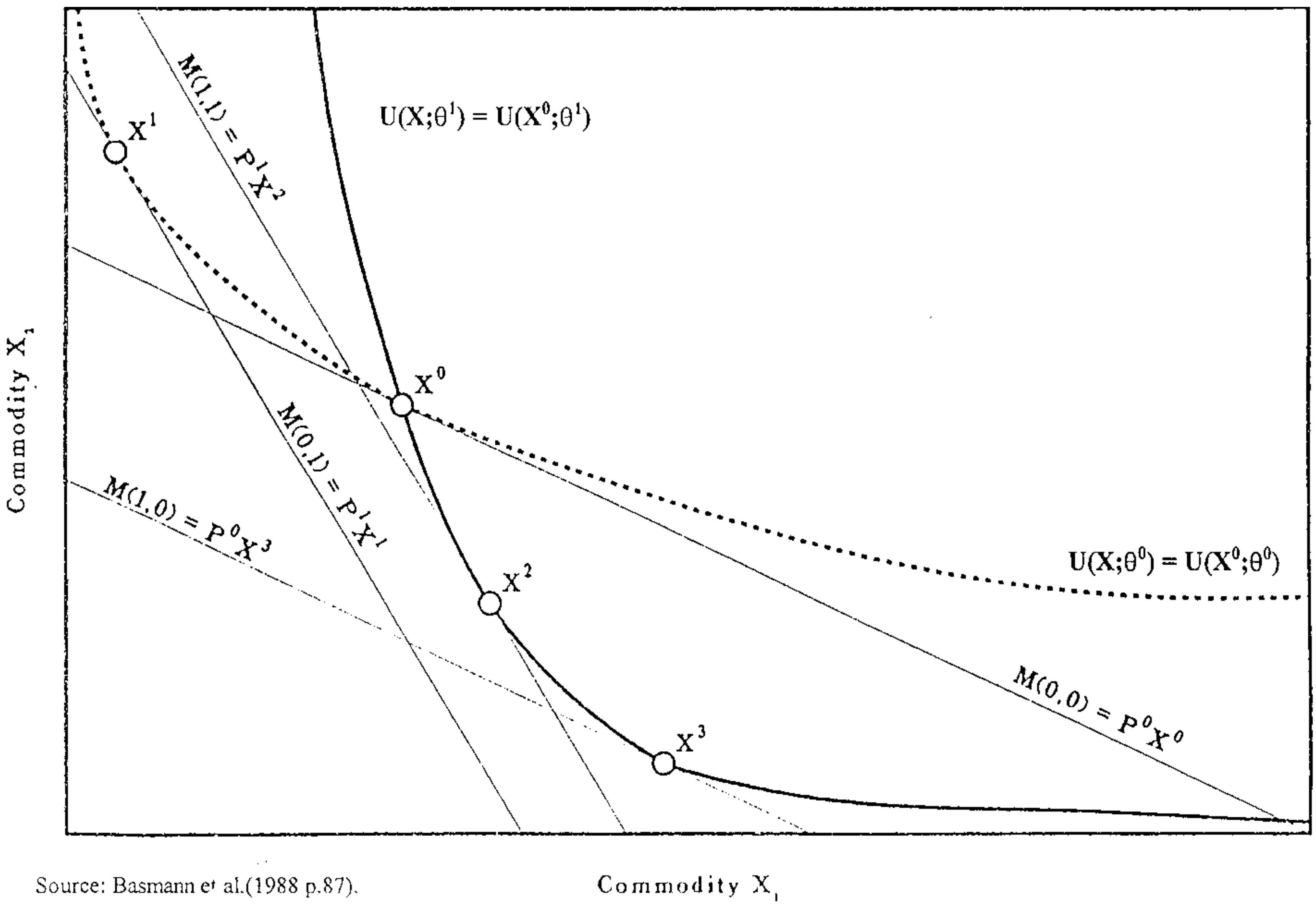
(1) a unique form of direct utility function V(X; Y);

(2) two distinct values of the parameter vector Y: Y° and Y^1;

(3) two different vectors of prices P° and P^1.

[6] The following exposition is adapted from Basmann et al. (1988, pp.86-88).

Figure 3.1 GFT Indifference Maps and MSB Minimum Expenditure Levels



Source: Basmann et al.(1988 p.87).

Since if consumers allocate their income in accordance with the linear budget constraint, then they must maximize a GFT utility function, we can assume that

$$V (X; Y) = U (X; \theta) \tag{3.9}$$

The superscripts 0 and 1 stand for parameter and price vectors in periods 0 and 1 respectively. Thus

$$U(X; \theta^0) = U(X^1; \theta^0) \tag{3.10}$$

indicates that when the parameter vector θ° is in effect, the commodity bundle X^1 is on the indifference curve. The equation:

$$U (X^0;\theta^0) = U(X^0; \theta^1) \tag{3.11}$$

implies that the utility level of the indifference curve with parameter vector θ° and containing bundle X° is equal to that of the indifference curve with parameter vector θ^1 and containing the same bundle X°.

In Figure 3.1 the dashed indifference curve is labeled $U(X^\circ;\theta^\circ)$ implying that commodity bundle X° lies on it when the parameter vector θ° is in effect. The solid indifference curve $U(X^\circ;\theta^1)$, on which X° lies as well (i.e. represents the same level of utility that the dashed indifference curve represented) but when another parameter vector, θ^1, is in effect. An explanation of the notation and movements in Figure 3.1 follows:

1. $X^\circ ... X^3$ denotes various commodity bundles, which all give the consumer exactly the same level of satisfaction, but each in a different price-preference situation.
2. M(0,0) represents the minimum expenditure required to reach the dashed indifference curve $U(X^\circ;\theta^\circ)$ given the price vector P° and this occurs at bundle X°; assume that this is the initial consumption bundle and budget constraint situation.
3. M(0,l) represents the minimum expenditure required to reach the dashed indifference curve $U(X^\circ;\theta^\circ)$ given the price vector P^1 and this occurs at bundle X^1; in moving along the dashed indifference curve from bundle X° to bundle X^1 it is assumed that consumer preferences (denoted by θ°) and level of utility are invariant, only the slope of the budget constraint changes forcing the consumer to move to another bundle (X^1) on the same indifference curve .
4. M(l,0) represents the minimum expenditure required to reach the solid indifference curve $U(X^\circ;0^1)$ given the price vector P° and this occurs at bundle X^3; if preferences were to change, the marginal rate of substitution would also change and the shape of the indifference curve would alter. This is represented by the movement from the

dashed [U(X°;θ°)] to the solid indifference curve [U(X^0; θ^1)], which yields exactly the same level of utility as U(X°;θ°) but with the new preferences θ^1. This point is not actually observable. It is specified by finding a budget constraint line that has the same slope as M(0,0) but is tangent to the new indifference curve.

5. M (1,1) represents the minimum expenditure required to reach the solid indifference curve U(X^0;θ^1) given the price vector P^1 and this occurs at bundle X^2; this is the budget constraint at both the new prices and new preferences and is the final observable point.

   X^1 and X^3 are not observable in real life but this is not a problem since all that is needed for the construction of TCLIs is the ratios of minimum expenditures. The two indifference curves in Figure 3.1 do not actually cross. U(X°;θ°) exists in the initial period only. When preferences change the new indifference curve U(X°;θ^1) replaces it. The two are only showed together to explain the MSB approach to calculating the TCLIs.

In this study we will focus on two TCLIs: TCLI(O) and TCLI(l) and their geometric mean. TCLI(O) is defined as "the compensating variation required to maintain the original level of utility given the base period parameter vector θ° as the price vector changes from the base period (P°) to the current period (P^1)" (Basmann et al. 1988, p.88), i.e. assuming preferences remain constant. Similarly TCLI(l) is 'the compensating variation required to maintain the original level of utility given the current parameter vector θ^1 as the price vector changes from the base period (P°) to the current period (P^1)" (Basmann et al. 1988, p.88), i.e., assuming changes in preferences do occur. Thus

$$\text{TCLI(O)} = \text{M(0,l)} \;/\; \text{M(0,0)} \qquad (3.12)$$

$$\text{TCLI (1)} = \text{M(1,1)} \;/\; \text{M (l,0)} \qquad (3.13)$$

$$\text{TCLI(*)} = [\text{TCLI(0) x TCLI(l)}]^{1/2} \qquad (3.14)$$

TCLI(O) is thus comparable to the CPI, since it assumes fixed preferences, but not a fixed bundle. TCLI(l) assumes that preferences have changed from the base to the current period and should be used whenever this is deemed to be the case. TCLI(*) is the geometric mean of the two and is the same as Fisher's Ideal Index formula.

Derivation of the TCLIs

The exact derivation of the TCLIs defined above was derived in Basmann et al. (1988, pp.89-91). The steps were as follows: First they assumed that γ =0. Next the demand equation (3.8) obtained by maximizing the GFT direct utility function (3.7a-d) is substituted back into the utility function. If the θ^{th} root is then calculated and M is factored out we end up with:

$$\left[U\,(X;\,\theta)\right]^{1/\theta} = \prod_{i=1}^{n} (\theta_i/\theta)^{\theta i/\theta}\ (1/P_i)^{\theta i/\theta}\ M \qquad (3.15)$$

in equilibrium :

$$P_iX_i^{*} = (\theta_i/\theta)\ M \text{ and } P_jX_j^{*} = (\theta_j/\theta)\ M \qquad (3.16)$$

since the equilibrium expenditure on any commodity $P_iX_i^*$ will equal the share (61/6) of total income/ expenditure M actually spent on that commodity. Let $P_iX_i^*=M_i$, the share of M spent on i, and likewise let $P_jX_j^*=M_j$. From (3.16) we obtain:

$$\frac{P_iX_i^{*}}{P_jX_j^{*}} = \frac{M_i}{M_j} = \frac{\theta_i}{\theta_j} \qquad (3.17)$$

In equilibrium, from (3.16) and (3.17) we obtain θ_i/θ :

$$\frac{\theta_i}{\theta_j} = \frac{P_iX_i^{*}}{M} = \frac{M_i}{M} \qquad (3.18)$$

Thus the TCLI can be estimated non-parametrically, without having to estimate values for θ_i/θ, simply by using expenditure shares instead.

To compute the TCLI we need to calculate the ratio of minimum expenditure levels M(0,l) to M(0,0) for TCLI(0) and M(1,1) to M(l,0) for TCLI(l). To compute TCLI(l), for example, recall that it is the ratio of the minimum cost of X^2 to that of X^3 (see Figure 3.1). The demand functions at X^2 and X^3 are:

$$X^2 = (\theta^1_i/\theta^1)(l/P^1 i)M\ (1,1) \qquad (3.19)$$

$$X^3 = (\theta^1_i/\theta^1)(l/P^\circ_i)\ M\ (l,0)$$

From (3.15) and (3.17) it follows that:

$$\left[U\,(X^3;\,\theta^1)\right]^{1/\overset{1}{\theta}} = \prod_{i=1}^{n} (X_i^{3})^{(\overset{1}{\theta}i/\overset{1}{\theta})}$$

$$= \prod_{i=1}^{n} (\overset{1}{\theta}_i/\overset{1}{\theta})^{(\overset{1}{\theta}i/\overset{1}{\theta})} (1/\overset{0}{P}_i)^{(\overset{1}{\theta}i/\overset{1}{\theta})}\ M\,(1,0) \qquad (3.20)$$

$$\left[U\,(X^2;\,\theta^1)\right]^{1/\overset{1}{\theta}} = \prod_{i=1}^{n} (X_i^{2})^{(\overset{1}{\theta}i/\overset{1}{\theta})}$$

$$= \prod_{i=1}^{n} (\overset{1}{\theta}_i/\overset{1}{\theta})^{(\overset{1}{\theta}i/\overset{1}{\theta})} (1/\overset{1}{P}_i)^{(\overset{1}{\theta}i/\overset{1}{\theta})}\ M\,(1,1)$$

since $\left[U\,(X^3;\,\theta^1)\right]^{1/\overset{1}{\theta}} = \left[U\,(X^2;\,\theta^1)\right]^{1/\overset{1}{\theta}}$

then:

$$\prod_{i=1}^{n}(\theta_i^1/\theta^1)^{(\theta_i^1/\theta^1)}(1/P_i^0)^{(\theta_i^1/\theta^1)}\ M(1,0) = \prod_{i=1}^{n}(\theta_i^1/\theta^1)^{(\theta_i^1/\theta^1)}(1/P_i^1)^{(\theta_i^1/\theta^1)} M(1,1) \qquad (3.21)$$

From (3.21) and (3.13) above we can obtain TCLI(l):

$$TCLI(1) = M(1,1) / M(1,0) = \prod_{i=1}^{n}(P_i^1 / P_i^0)^{(\theta_i^1/\theta^1)} \qquad (3.22)$$

Similarly we can obtain TCLI(O):

$$TCLI(0) = M(0,1) / M(0,0) = \prod_{i=1}^{n}(P_i^1 / P_i^0)^{(\theta_i^0 / \theta^0)} \qquad (3.23)$$

Since the ratio $\theta_i / \theta = M_i/M$ at equilibrium, these can be written as :

$$GFT\text{-}TCLI(O) = \prod_{i=1}^{n}(P_i^1/P_i^0)^{M_i^0 / M^0} \qquad (3.24)$$

$$GFT\text{-}TCLI(1) = \prod_{i=1}^{n}(P_i^1 / P_i^0)^{M_i^1 / M^1} \qquad (3.25)$$

Thus the non-parametric GFT-based TCLIs can be simply calculated from only price and expenditure data. Note that (3.24) is the same as the geometric average of relatives formula since the sum of the weights is 1. M_i is the expenditure on the ith commodity and M is the total expenditure in the period under consideration. The superscript o is for the base period and t is for the current period. GFT-TCLI(0)is a TCLI where changes in taste between the base and the current periods are not considered. In the GFT-TCLI(l) these taste changes are taken into consideration. The difference between the two reflects the effect of changes in taste due to price changes.

I will follow two broad strategies to answer the second and third questions that this study is concerned with, namely (2) did households at different income and expenditure levels, experience varying rates of cost of living changes over this period, and (3) did one group consistently fare worse than the others over the entire period under study.

The first strategy will follow the traditional approach of calculating separate TCLIs for each income or expenditure quantile by using the expenditure shares of the *average* household in each decile as its weights (M_i/M). A second approach is to calculate a separate TCLI for each household in the data set using its own expenditure shares, and then averaging out the changes in the TCLI for various household groups (this approach yielded almost identical results and therefore its results are not shown to save on space).

4. Data

The data used for this study consists of price and expenditure data over the period 2008-2016. Fortunately we now have access to the micro data in three comparable Household Income, Expenditure and Consumptions Surveys (HIECSs) spanning the period 2008/2009 to 2012/2013 through the Economic Research Forum. These provide data the household level expenditure shares that will be averaged out to calculate the weights for each commodity subgroup in the TCLI. This data was collected by CAPMAS as part of nationally representative random samples, initially at 5 year intervals, recently at 2-3 year intervals, covering both urban and rural Egypt. The data sets provide a wealth of information on household expenditure and income, as well as composition and other attributes of family members.

The price date is from the CPI price series for the 43 main groups of commodities published by CAPMAS on a monthly basis for the period July 2008 to March 2016 for eight regions of Egypt: Cairo, Alexandria, Suez Canal cities, Urban and Rural Lower Egypt, Urban and Rural Upper Egypt, as well as the Border region. Attempts were made to obtain a longer time series from CAPMAS however this data was only available at the annual level and only for the 12 main categories. Additionally, in 2010 CAPMAS changed the basket of goods used to collect the price data for the CPI, and hence the data for the earlier period is not directly comparable. They did publish a comparable series going back to July 2008, which is the one used here, but not for the earlier time period. To avoid inconsistencies in the price series that would make it not comparable over time, I used the comparable series available at the monthly level for July 2008 to March 2016.

5. Results

Regional Disparities in Cost of Living Increases

In this section I discuss the regional differences in cost of living increases, comparing the CPI with the constructed cost of living indices TCLI(0) and TCLI(1). The mean expenditure share for all income groups, for each commodity group available in the HIECSs, for the available years were calculated. These were used as weights in calculating the GFT-based TCLIs, to compare them with the CPI. TCLI(0) requires only the weights of the base year. For TCLI(l) uses variable weights, reflecting changing consumption patterns for each period. We do not have monthly or even annual consumption shares, since HIECSs are only performed every few years. Therefore, the weights derived from each survey were used for TCLI(l) until the year of the next survey, e.g. the weights of 2008/2009 were used for 2008 and 2009; those from the 2010/2011 survey were used for 2010 and

2011 and those from the 2012/2013 survey were used from 2012 onwards. Fortunately CAPMAS now conducts the HIECSs much more frequently than before which allows a more accurate incorporation of changes in household spending patterns over time.

Figures 3 to 10 plot the TCLI(0), TCLI(1) and the CPI for the eight regions by month. In all regions, all price indices rose sharply over this period with the year 2010 marking the point where the CPI starts to diverge form the TCLIs for most regions. Cost of living started to increase at a faster pace when measured by the TCLI than by the CPI. On average all indices rose between 13 and 17.5 percent per year (Table 2), reflecting a considerably fast rise in cost of living for all regions over this period, by all measures.

Table 2 shows the average annual change in cost of living as measured by each of the three indices over the period under study. It clearly shows a wide variance in the experience of cost of living increases depending on region of residence. The average annual increase in cost of living when measured by the CPI was highest in Rural Upper Egypt and lowest in Cairo over this period. However, when measured by the fixed weight TCLI(0) it appeared highest in the Border Regions averaging a very high 17.4 % per year over this period; and lowest in the Canal Cities and Urban Lower Egypt averaging 14% per year, which is still quite considerable. When measured by the variable weight TCLI(1), cost of living also rose fastest in the Border regions, at 16.95% per year, while the slowest increase was again in the Canal Cities at 14% per year. The gaps between regions as measured by the cost of living indices is much larger than that measured by the CPI. Using the CPI would imply that the spread between regions is at most 1.3% per year. Using the TCLI however implies spreads of between 2.9% (for TCLI(1)) and 3.4% (for TCLI(0)) per year. This reflects a much larger degree of inequality between regions in terms of the rise of the cost of living over time, than would be implied by CAPMAS's CPI.

Comparing Rural and Urban regions in the last two columns of Table 2, the cost of living rose the fastest over this period for Rural regions. Rural Upper Egypt had the second highest average annual rate of cost of living increase over this period after the Border regions (note that the Border regions are not included in either rural nor urban average in the last two rows of Table 2 since CAPMAS does not differentiate between rural and urban for the border regions in it price data), when measured by the TCLIs, and the highest by the CPI. The TCLIs however imply a higher rate of cost of living increase by about 1 percentage point per year, which is quite significant.

Substitution Bias in the CPI

Figures 3 to 10 discussed earlier clearly showed that there is a difference between the CPI and the TCLI. This difference is partly accounted for by the so-called substitution bias which arises because the fixed weight Laspeyres type CPI fails to account for the fact that when prices change consumers resort to substitutions that may allow them to remain at the same utility level as before the price change and just as well off. These substitutions are not captured by the Laspeyres index since it is restricted to measuring the cost of a single bundle overtime as a proxy for a constant standard of living. To gauge the extent of this substitution bias we calculate the average annual change in the CPI and the TCLIs. I then calculate the difference between these annual changes as measured by the CPI, and as measured by each of the two TCLIs, for each region. Table 3 presents the annual average of these difference by region as a measure of the degree of substitution bias between the CPI and each of the TCLIs. The bias in the CPI ranged between 0.5 and 3 percentage points per year for the 8 regions. In Rural Upper Egypt for example, the average annual CPI inflation was 14.48%, while if inflation is measured by TCLI(0) it is 15.56% per year over this period (15.57% if measured by TCLI(1)).

In all regions, the rise in either TCLI(0) or TCLI(1) was faster than the CPI indicating a considerable amount of substitution as a result of rising prices. There are also differences between regions in terms of degree of substitution bias. On average the substitution bias is lower in rural regions than urban region. Border region's CPI exhibited the highest amount of substation bias by both TCLI(0) and TCLI(1), followed by Alexandria according to TCLI(0) and by Cairo according to TCLI(1).

Cost of Living Changes by Income Level

Households at different income or expenditure levels are likely to be affected differently by any given change in prices, depending on how they spend their income. A sharp increase in the price of food items for example is likely to hit households at the lower end of the income distribution hardest since they spend a larger portion of their incomes on food items. To examine the difference in cost of living increases by income groups I compute the mean expenditure share for each commodity group within each of 5 quintiles of expenditure[7]. The results are in Table 4, and Figures 11 and 12. Looking first at the average for all regions, households in the bottom quintile faced the

[7] The same analysis was repeated using income quantiles rather than expenditure and the results were almost identical and therefore not shown to save on space.

highest average annual increase in cost of living, whether measured by TCLI(0) or TCLI(1). Cost of living increase is about 1.3 (0.6) percentage points higher for the households in the bottom quintile than for the mean household reported in Table 2, when measured by TCLI(0) (TCLI(1)). The gap is even bigger between households in the bottom quintile and those in the top quintile: 2.4 percentage points by TCLI(0) and 1.8 percentage points by TCLI(1). The gap between richest and poorest is highest in Cairo and the Border regions.

Looking at urban vs. rural regions, we see that rural cost of living increases for the bottom quintile were higher than the urban regions. Once again the rural areas seem to have fared worse, and moreover the poorest in the rural areas faced a higher cost of living increase than both the richer groups in rural areas and everyone in the urban areas. The gap was quite substantial between the richest quintile in urban areas and the poorest quintile in rural areas at 2.6 percentage points higher for the latter.

6. Conclusion and Policy Recommendations

This study tested whether there have been large and consistent disparities in regional cost of living increases in Egypt over the last few years. I also estimated cost of living indices for households at five quintiles of the distribution to examine whether one group has consistently fared worse over time. Finally, I estimated the degree of substitution bias in the consumer price index that arises because the CPI fails to take into consideration substitutions that households make when prices change, to allow them to stay at the same utility level.

Results confirm that indeed cost of living increases have been higher in rural regions, whether measured by the CPI or the TCLIs constructed in this study. We have also found far larger regional disparities in cost of living increases over time using the TCLIs than what the CPI indicates. The substitution bias in the CPI is also quite substantial ranging from 0.5 to 3 percentage points per year. This is quite substantial and can lead to very large biases in real economic indicators when deflated via the CPI, vs. the TCLI index.

Finally, we also find strong evidence that the households at the bottom of the income distribution fared much worse than those in the top quintiles. This is even more pronounced for the poorest rural households whose cost of living increases were 2.6 percentage points higher per year than the richest urban households, on average, over this period. Once again there were regional disparities, with the lowest quintiles being hardest hit in Cairo and the Border regions.

A few important recommendations can be made based on this analysis. First, given the large difference between cost of living changes as measured by the CPI and those measured more accurately by the TCLI that measures the cost of attaining a constant utility level, rather than a fixed consumption bundle, it is highly recommended that CAPMAS produce cost of living indices, in addition to the CPI. This will more accurately gauge changes in the cost of attaining a particular utility level and will be much more accurate when used to deflate measures such as GDP or to calculate poverty changes over time. The advantage of the method followed in this paper is that CAPMAS already has all the data it needs to compute the indices and it will not represent any additional cost to produce.

Second, given the wide variation in incidence of cost of living increases between households at different positions along the income distribution, and the clear conclusion reached in this study that the poorest, and especially the rural poorest quintiles have consistently fared worse over the last few years, it is important that CAPMAS routinely produce TCLIs for different income levels. We have already shown strong spatial and income level disparities in cost of living increases, implying that producing TCLIs along these dimensions is warranted. It is plausible that inequalities in cost of living changes across various other dimensions such as education, occupation and gender of the head of the household, might also be relevant and CAPMAS could easily produce those as well to provide policy makers with as much valuable information as possible.

Finally, given the overwhelming conclusion that rural households and in particular, rural households at the lowest quintiles, have consistently fared worse over this period, policy makers need to focus efforts first on understanding why rural areas face such higher increases in cost of living. This is likely a combination of imperfect markets and imperfect information, both of which can be improved with appropriate government policies that limit monopolistic behavior and increase access to markets and information. Second, efforts to reduce the burden of increased cost of living on the poor should be concentrated in rural regions and in other parts of the country such as the Border regions, Cairo and Alexandria where cost of living increases were fastest over this period. These could take the form of conditional cash transfers that provide the poor with cash transfers in return for participating in specific income improving activities for themselves and their children such as education and healthcare. Such programs have proven to be highly successful in other countries, the key being their emphasis on long term improvements to wellbeing rather that short term interventions such as food or fuel subsidies that do a very poor job of targeting the poor and improving their prospects of exiting poverty in the long run.

7. References

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Figure 1: Annual Inflation Rate by Region, 2004-2013

Source: Author's calculations from CAPMAS, CPI Bulletin, various issues

Figure 2: CPI and Food and Beverages CPI for Urban and Rural Areas, 1999/2000 to 2012/2013 fiscal annual average. Jan 2010=100

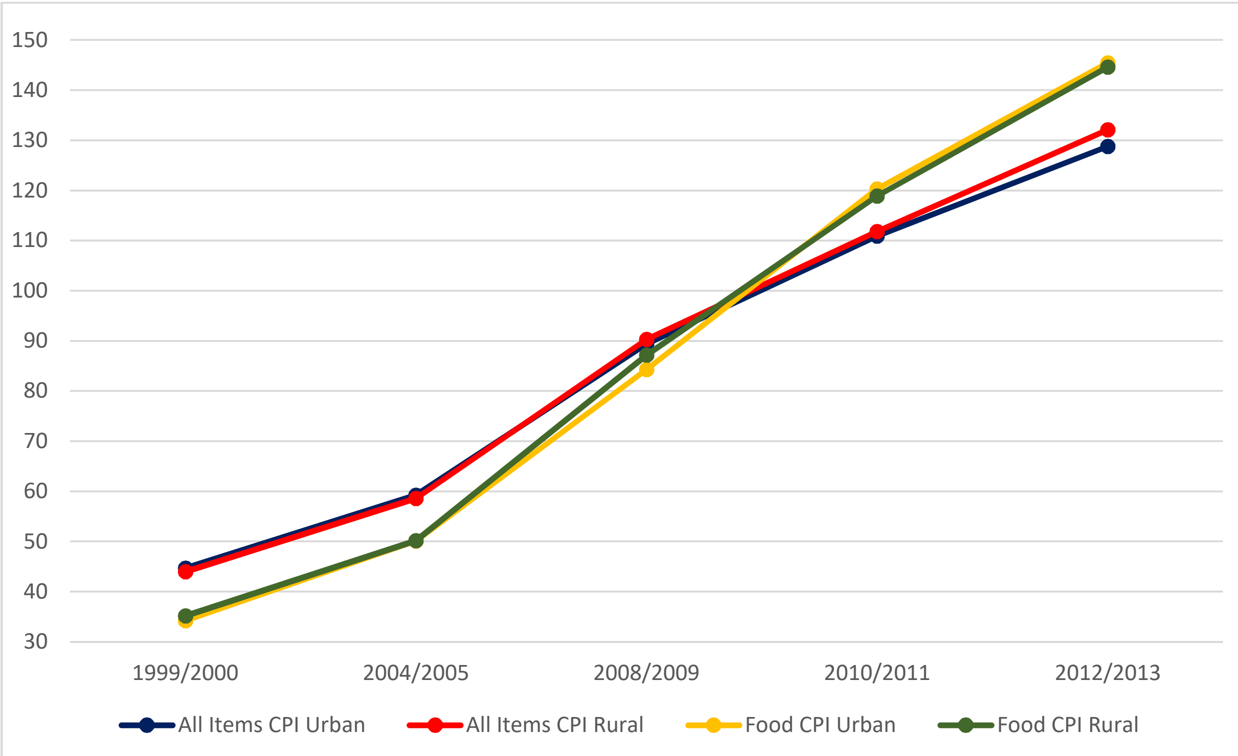

Figure 3: TCLI and CPI for Cairo, Mean Household

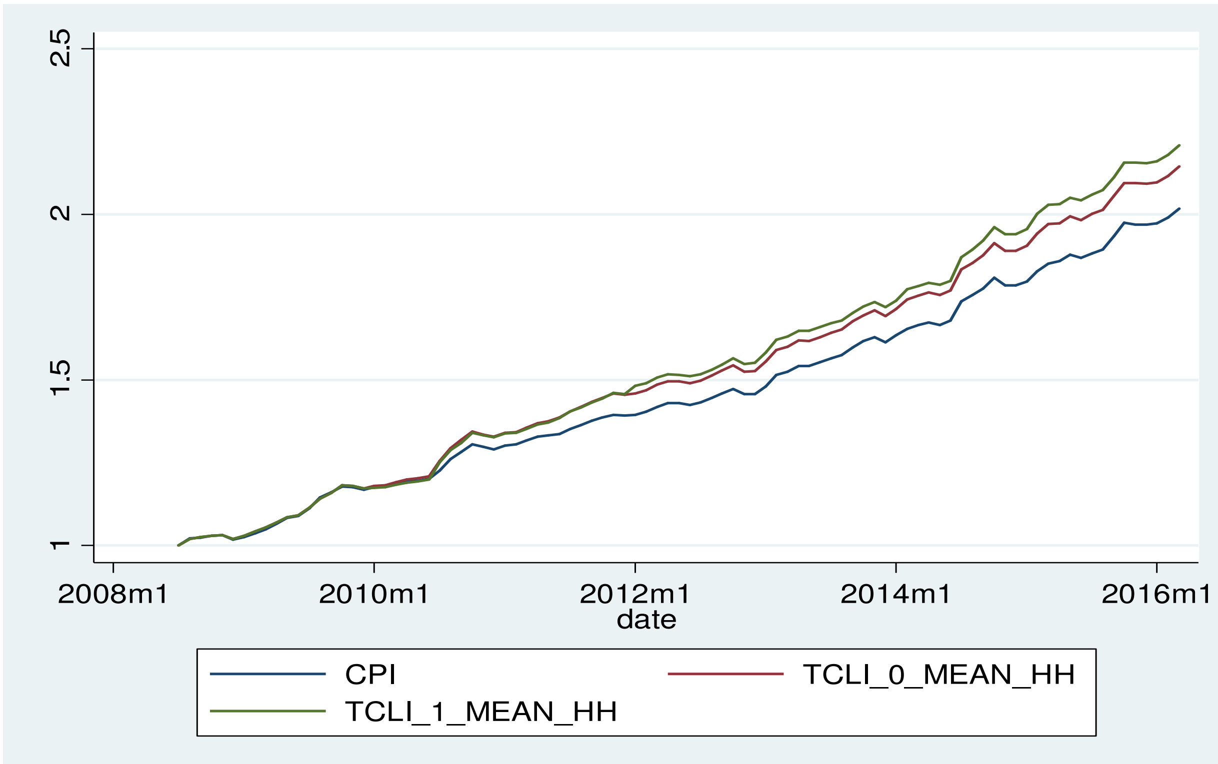

Figure 4: TCLI and CPI for Alexandria, Mean Household

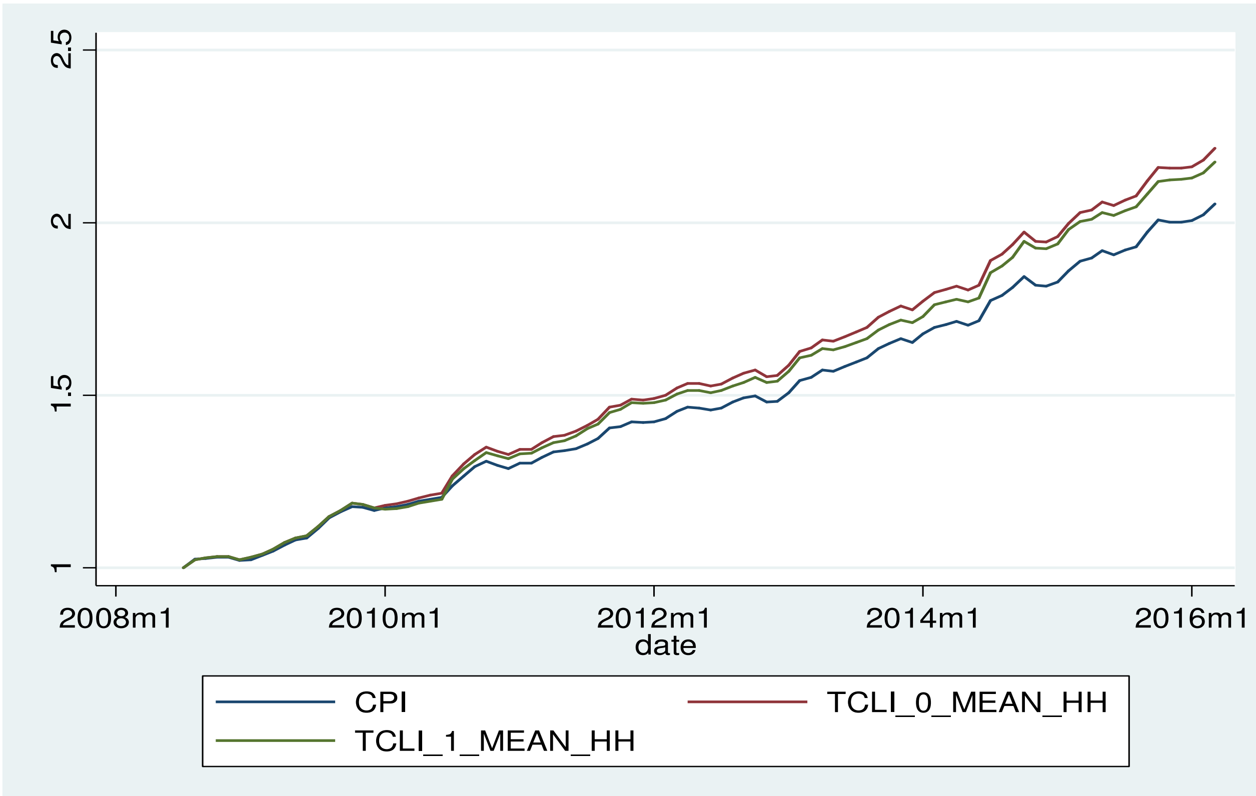

Figure 5: TCLI and CPI for Canal Cities, Mean Household

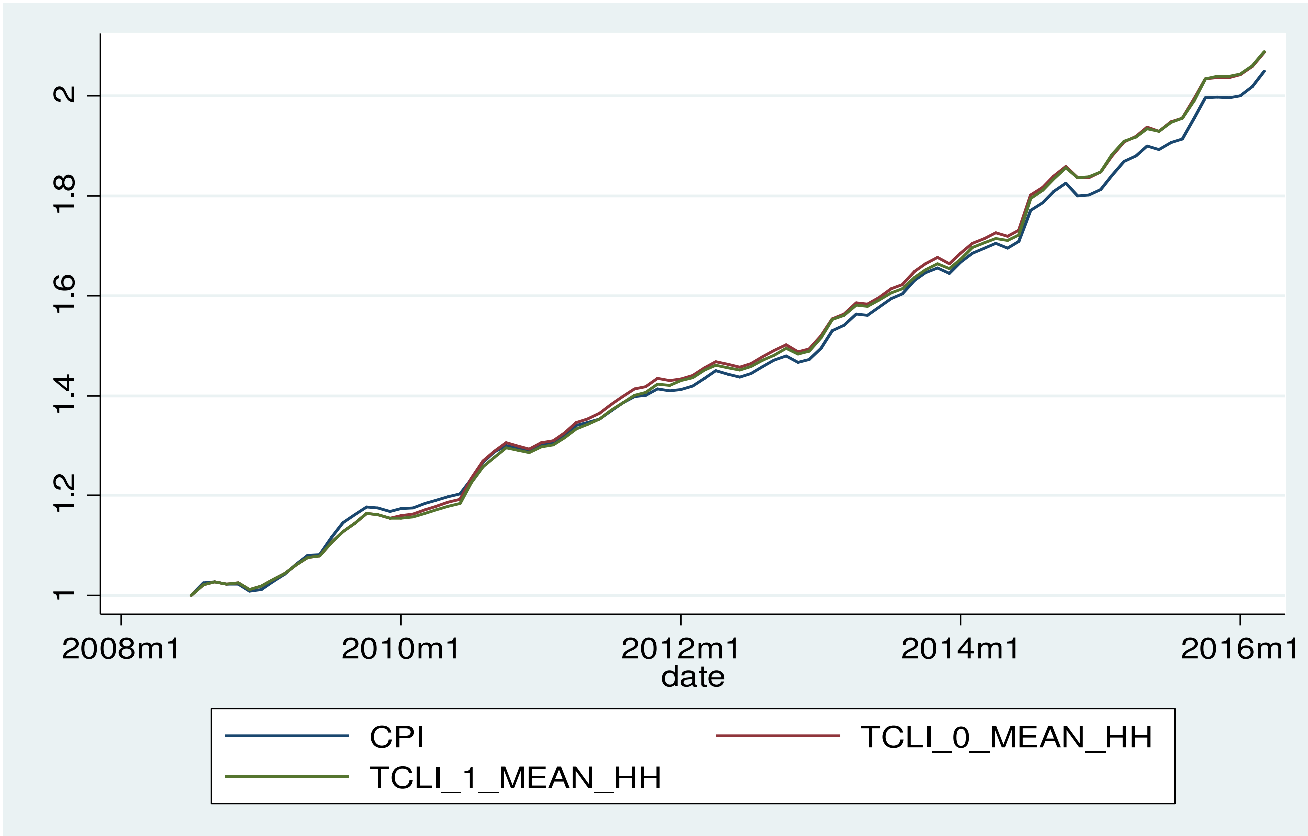

Figure 6: TCLI and CPI for Urban Lower Egypt, Mean Household

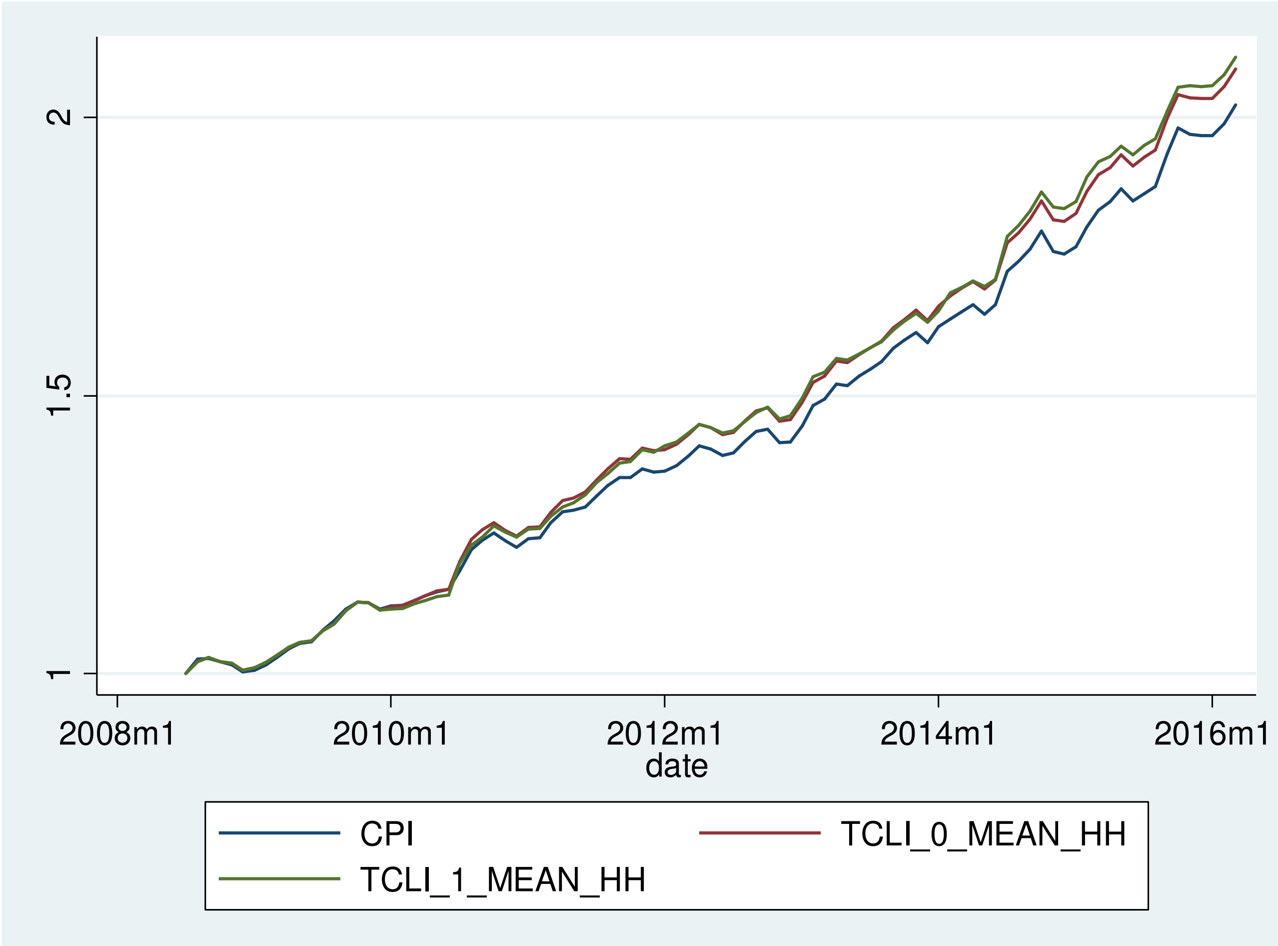

Figure 7: TCLI and CPI for Urban Upper Egypt, Mean Household

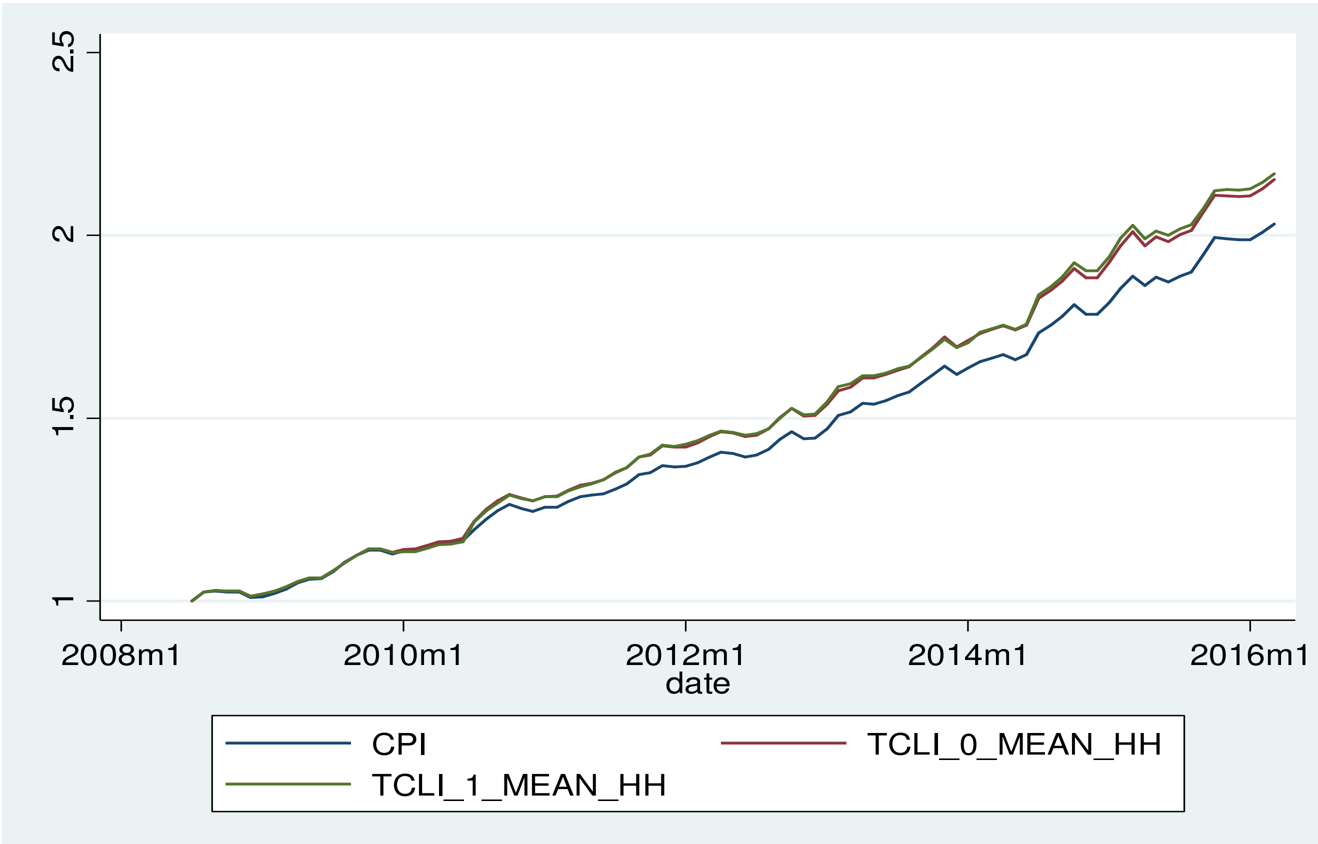

Figure 8: TCLI and CPI for Rural Lower Egypt, Mean Household

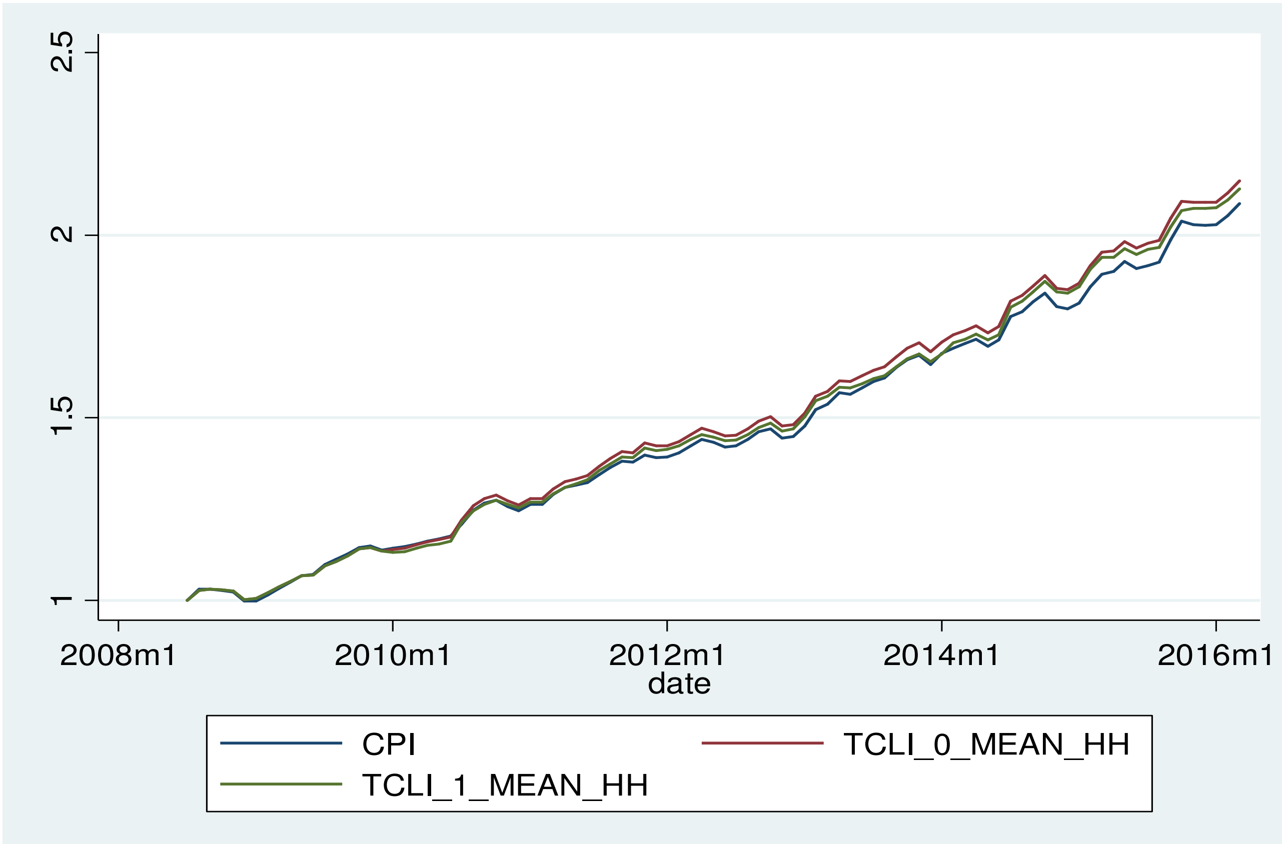

Figure 9: TCLI and CPI for Rural Upper Egypt, Mean Household

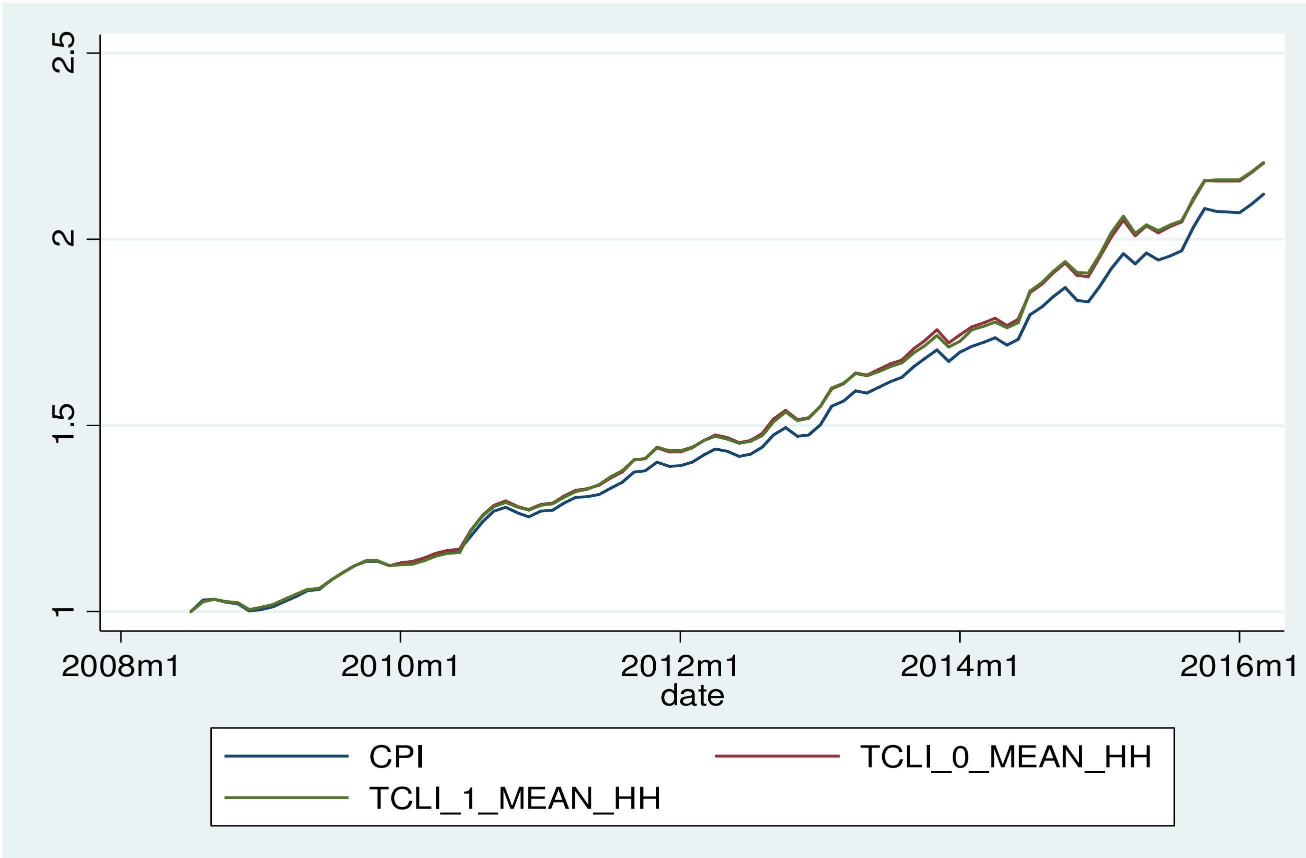

Figure 10: TCLI and CPI for Border Regions, Mean Household

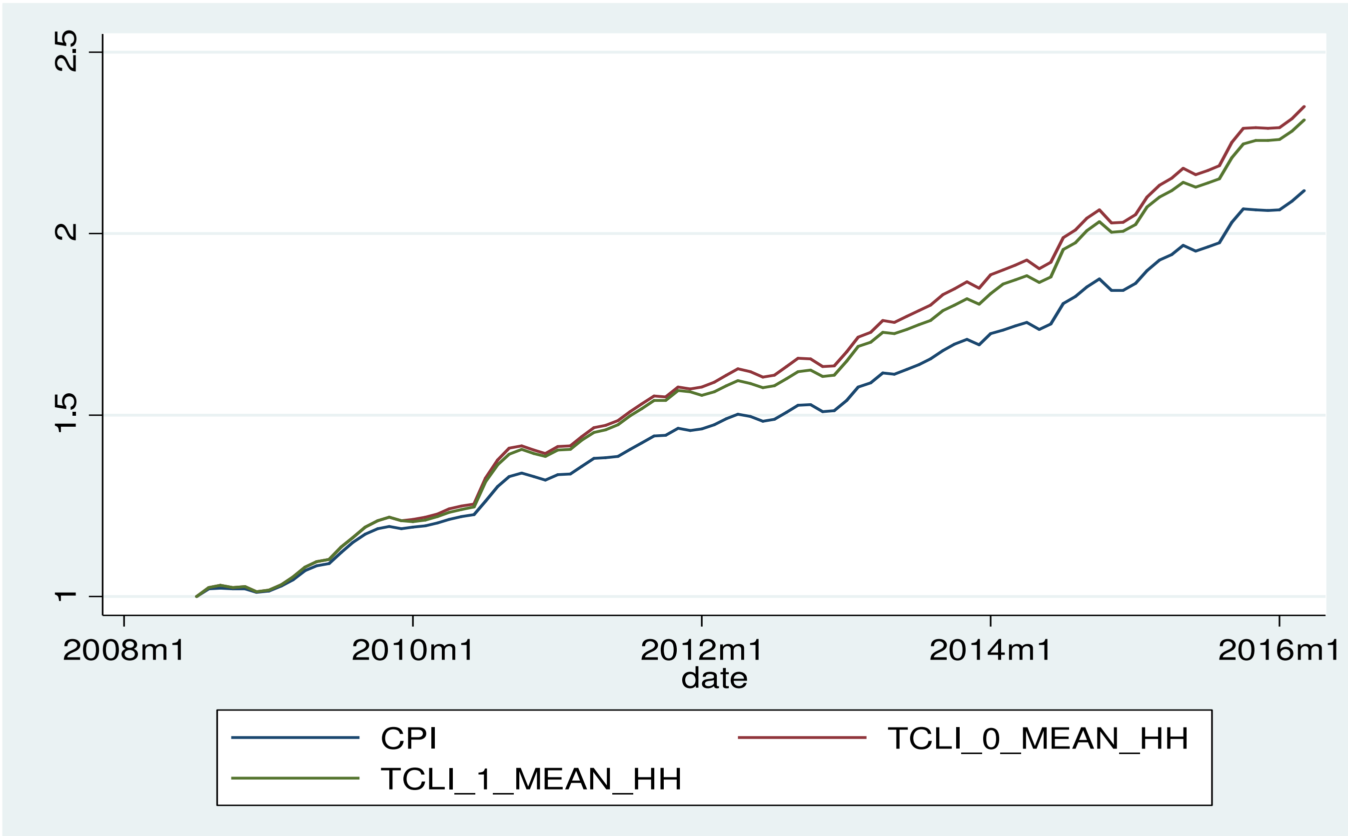

Figure 11: TCLI (0) by Region and Quintile

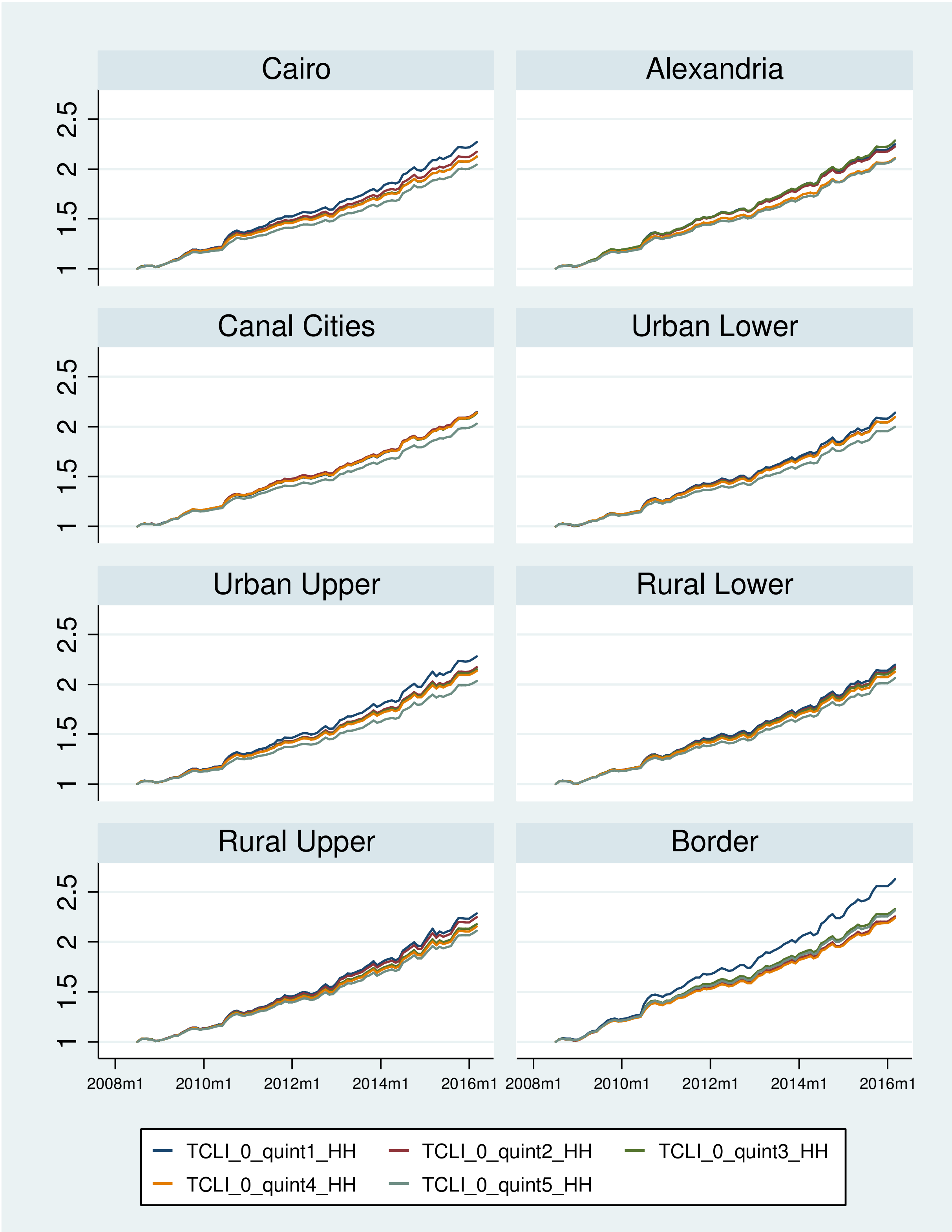

Figure 12: TCLI (1) by Region and Quintile

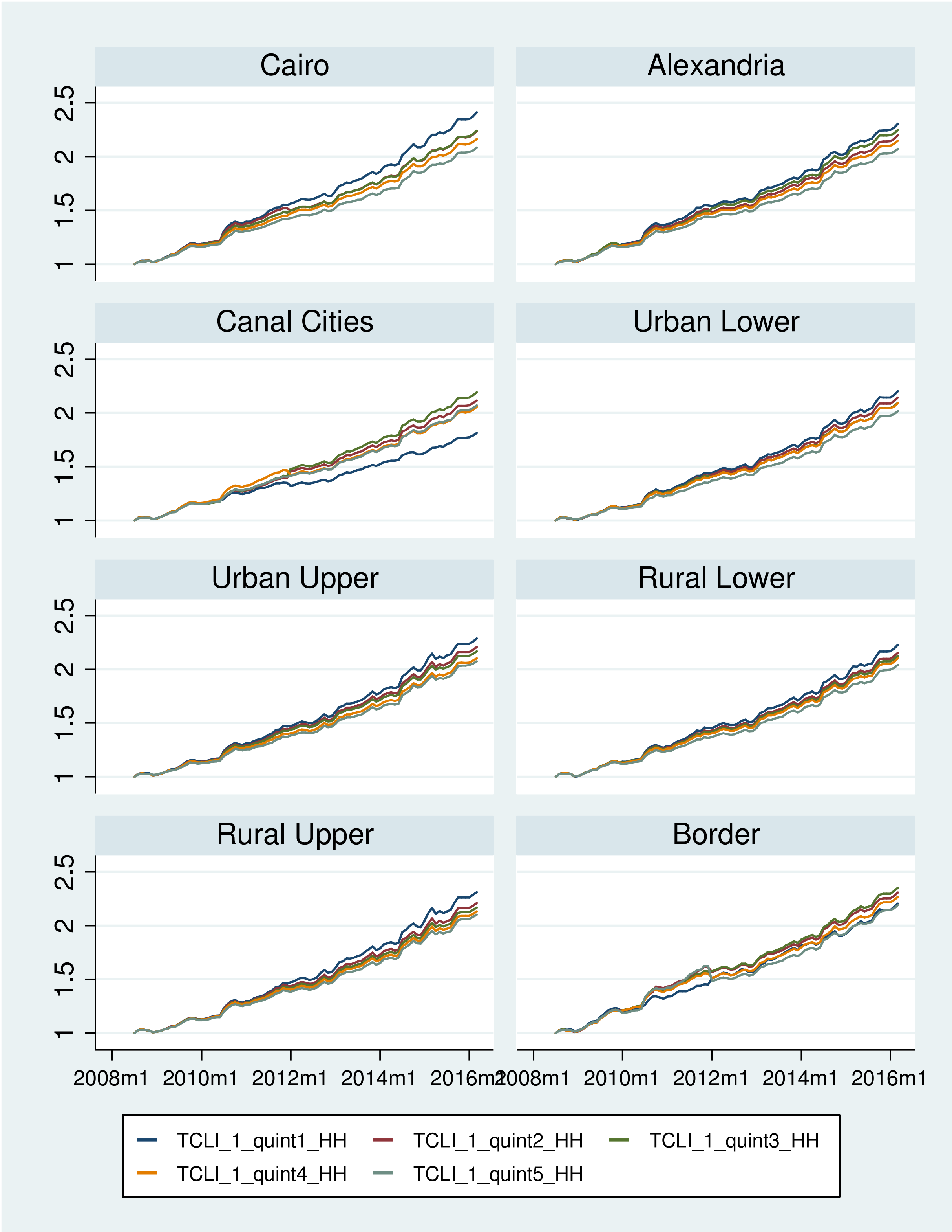

Table 1: CPI and Food and Beverages CPI for Urban and Rural Areas, 1999/2000 to 2012/2013 fiscal annual average. Jan 2010=100

	All Items CPI		**Food CPI**	
	Urban	Rural	Urban	Rural
1999/2000	44.7	43.95	34.2	35.15
2004/2005	59.2	58.55	50.1	50.15
2008/2009	89.4	90.3	84.3	87.2
2010/2011	110.9	111.8	120.3	118.9
2012/2013	128.8	132.1	145.4	144.6
Percentage Change in CPI 1999/2000 to 2012/2013	288%	301%	425%	411%

Source: Author's calculations from CAPMAS, CPI Bulletin, various issues

Table 2: Average Annual Inflation by the TCLIs and CPI; and the Annual substitution bias in the CPI by each TCLI by region

	Average Annual Inflation by		
Region	**CPI**	**TCLI1(0)**	**TCLI(1)**
Cairo	13.15%	14.77%	15.60%
Alexandria	13.60%	15.70%	15.18%
Canal	13.54%	14.03%	14.04%
Urban Lower	13.19%	14.03%	14.30%
Urban Upper	13.31%	14.87%	15.08%
Rural Lower	14.02%	14.81%	14.55%
Rural Upper	14.48%	15.56%	15.57%
Border	14.44%	17.42%	16.95%
Average all regions	**13.72%**	**15.15%**	**15.16%**
Min	13.15%	14.03%	14.04%
Max	14.48%	17.42%	16.95%
Average Urban	**13.36%**	**14.68%**	**14.84%**
Average Rural	**14.25%**	**15.19%**	**15.06%**

Table 3: Average Annual Inflation by the TCLIs and CPI; and the Annual substitution bias in the CPI by each TCLI by region

	Annual Bias in CPI relative to:	
Region	**TCLI(0)**	**TCLI1(1)**
Cairo	1.63%	2.46%
Alexandria	2.09%	1.58%
Canal	0.49%	0.50%
Urban Lower	0.84%	1.11%
Urban Upper	1.55%	1.77%
Rural Lower	0.79%	0.53%
Rural Upper	1.08%	1.09%
Border	2.98%	2.51%
Average all regions	**1.43%**	**1.44%**
Min	0.49%	0.50%
Max	2.98%	2.51%
Average Urban	**1.32%**	**1.48%**
Average Rural	**0.93%**	**0.81%**

Table 4: Average Annual Change in Cost of Living Indices by Expenditure Quintile, July 2008 to March 2016

	Quintile 1		**Quintile 2**		**Quintile 3**		**Quintile 4**		**Quintile 5**	
Region	**TCLI(0)**	**TCLI(1)**	**TCLI(0)**	**TCLI(1)**	**TCLI(0)**	**TCLI(1)**	**TCLI(0)**	**TCLI(1)**	**TCLI(0)**	**TCLI(1)**
Cairo	**16.40%**	**18.22%**	15.13%	15.96%	14.49%	16.00%	14.51%	15.03%	13.49%	13.97%
Alexandria	**16.10%**	**16.86%**	15.82%	15.48%	16.59%	16.12%	14.33%	14.81%	14.25%	13.83%
Canal	**14.80%**	**10.50%**	14.74%	14.41%	14.62%	15.39%	14.69%	13.61%	13.31%	13.82%
Urban Lower	**14.70%**	**15.54%**	14.15%	14.74%	14.15%	14.14%	14.16%	14.08%	12.91%	13.12%
Urban Upper	**16.54%**	**16.61%**	15.10%	15.55%	14.87%	15.07%	14.64%	14.23%	13.30%	13.84%
Rural Lower	**15.45%**	**15.83%**	15.10%	14.88%	14.92%	14.53%	14.53%	14.20%	13.69%	13.43%
Rural Upper	**16.63%**	**16.94%**	16.12%	15.61%	15.21%	15.09%	14.89%	14.61%	14.35%	14.22%
Border	**21.01%**	**15.56%**	16.24%	16.89%	17.21%	17.48%	16.02%	16.39%	16.98%	15.38%
Average all regions	**16.45%**	**15.76%**	**15.30%**	**15.44%**	**15.26%**	**15.48%**	**14.72%**	**14.62%**	**14.03%**	**13.95%**
Min	**14.70%**	**10.50%**	14.15%	14.41%	14.15%	14.14%	14.16%	13.61%	12.91%	13.12%
Max	**21.01%**	**18.22%**	16.24%	16.89%	17.21%	17.48%	16.02%	16.39%	16.98%	15.38%
Average Urban	**15.71%**	**15.55%**	14.99%	15.23%	14.94%	15.35%	14.47%	14.35%	13.45%	13.72%
Average Rural	**16.04%**	**16.39%**	**15.61%**	**15.25%**	**15.06%**	**14.81%**	**14.71%**	**14.40%**	**14.02%**	**13.82%**