

## Living Affordability in Singapore by Income Groups

Singapore Centre for Applied and Policy Economics (SCAPE) Project  
(<http://www.fas.nus.edu.sg/ecs/scape/index.html>)

Department of Economics, NUS  
March 2014

The standard measure of cost of living is the consumer price inflation measured by changes in the Consumer Price Index (CPI). The CPI captures prices of a given basket of consumer goods and services. Consumer price inflation itself does not indicate whether living affordability has been improving or not. Affordability by definition requires an assessment of expenditure in relation to income. The often used indicators like real income or real wages are also not complete indicators of living affordability. A low income household, for example, may have to spend all its real income to sustain a certain relative standard of living. The most informative way to assess living affordability, therefore, is to examine the trends of household consumption expenditure relative to household income for different income groups and for different expenditure categories. A steady increase in the expenditure-income ratio (*EIR*) indicates deteriorating affordability. However, a steady drop in the *EIR* may not necessarily mean improving affordability. Income in this exercise refers to income from work.

### Key findings

- Overall resident household expenditure-income ratio has trended downward. This may not necessarily mean improving living affordability if households save more in anticipation of lumpy expenditures such as housing, healthcare and children's education in a rising cost environment. They do so by cutting on flexible expenditures.
- The lowest 30% of the income ladder show expenditures more than their incomes. This indicates that government transfers play a key role for these households.
- Currently a median income household spends about 80% of its income on consumption and those in the 81st-90<sup>th</sup> income percentile spend about 40%.
- Housing, health and transport stand out as rising expenditures relative to income. Housing *EIRs* have trended upward across all income groups and housing consumes the largest proportion of income. Health *EIRs* have remained remarkably below 6% for those above the bottom income decile. Transport *EIRs* for the bottom 20% of the income ladder have fallen indicating improved affordability, while that of middle income groups have risen. The difference comes primarily from a steep rise in private transport costs.
- Education expenditures of higher income groups have increased whereas that of the bottom 20% of the income ladder remained the same or declined. This needs further analysis.
- Clothing and footwear spending seems to take a tumble during economic downturns.
- Contrary to initial expectations, expenditure on recreation and culture has declined resulting in a sharp decline in the corresponding *EIRs*. This is consistent with saving in anticipation of large and lumpy expenditures.

---

**Queries:** Tilak Abeysinghe, Department of Economics, NUS

**Acknowledgements:** Thanks are due to Chan Kok Hoe for inspiring this project idea and Damien Huang for able research assistance. Thanks are also due to Department of Statistics for providing data on household income and expenditure by income deciles. Lunch and tea discussions with Lee Soo Ann, Ho Kong Weng, Chan Kok Hoe, and Damien Huang provided valuable inputs to this study.

## 1. Introduction

The standard measure of cost of living is the consumer price inflation measured by changes in the Consumer Price Index (CPI). The CPI captures prices of a given basket of consumer goods and services. Consumer price inflation itself does not indicate whether living affordability has been improving or not. Affordability by definition requires an assessment of expenditure in relation to income. The often used indicators like real income or real wages are also not complete indicators of living affordability. A low income household, for example, may have to spend all its real income to sustain a certain relative standard of living. The most informative way to assess living affordability, therefore, is to examine the trends of household consumption expenditure relative to household income for different income groups and for different expenditure categories.

What prevents us from engaging in such an exercise is the lack of data. The Singapore household expenditure survey (HES) is conducted every five years. It is primarily used to obtain the base-year weights for CPI computations. Although the HES summary report provides detailed information on income and expenditure by broad categories it cannot be used to provide timely information on living affordability in between surveys. In this exercise we put together different data sources and interpolate income and expenditure data by income groups to provide a living affordability measure by income deciles at quarterly frequency.

The household consumption expenditure share of household income as a percent (which we denote as expenditure-income ratio, *EIR*) defines our measure of living affordability. Note that *EIR* is the same as the better known average propensity to consume (APC). Since APC is usually defined for the aggregate economy ( $APC = \text{aggregate consumption expenditure to disposable income ratio}$ ) we prefer using the terminology *EIR* at the household level. This indicator is particularly useful in tracking living affordability of low income groups.

## 2. Data

We used different interpolation techniques to compile quarterly data series on resident household expenditure and income by income deciles for different expenditure categories ([see Appendix for the interpolation methods used](#)). Expenditure refers to average monthly household expenditure and income refers to average monthly household income from work including employer's CPF contributions. The key reference points for household expenditure are the HES years 1997/98, 2002/03 and 2007/08. We were able to obtain income data only for nine deciles. We denote them by P10, P20,...,P90. Note that P10 represents the income percentile 1<sup>st</sup> - 10<sup>th</sup>, P20 represents 21<sup>st</sup> - 30<sup>th</sup> and so on.

## 3. Overall expenditure

Figure 1a and 1b (also [Table 1](#), separate excel sheet) show overall household expenditure and expenditure-income ratios<sup>1</sup> of Singapore resident households by income deciles (denoted by percentiles P10, P20,...,P90) since 1998Q1. The salient features that emerge from Figure 1 are the following.

---

<sup>1</sup> We have taken 4-quarter moving average of *EIRs* to smooth out random fluctuations.

1. Until the onset of the global financial crisis overall expenditures have increased only slowly. After 2008 there has been a rapid increase in the expenditures especially among higher income groups.

2. Given that expenditure tends to fall only slowly during economic downturns, upward swings in *EIR* are primarily a result of a fall in income or slowing of income growth. Income growth slowed down substantially over the period 1998-2003 because of a number of major shocks, Asian financial crisis, IT bust and SARS. In fact, the lower 50% income groups experienced a fall in their incomes over this period. The next upswing of *EIR* occurs in 2009 as a result of the global financial crisis.

In general there is a slight downward trend in *EIR* since 2004. In fact, the HES data show a long-term downward trend of *EIR* across all income groups; the overall *EIR* has dropped from 85% in 1978 to 51% in 2008.<sup>2</sup> The downward trend in *EIR* may be interpreted as an improvement of living affordability. We have to bear in mind, however, that households may constrain current consumption expenditures and increase savings in anticipation of lumpy expenditures such as buying a house, paying for unexpected large healthcare bills and sending children overseas for further education.

3. The households in the lowest 30% of the income ladder spend more than their income ( $EIR > 100\%$ ). There are two possibilities for this observation. First, household expenditure includes imputed rent for owner occupied housing and it could be argued that imputed rent over-estimates household expenditure. How to treat imputed rent in household expenditure is an important question.<sup>3</sup> Although about 90% of households own houses in Singapore, there is a large churn-over in the housing market because, apart from new buyers, many households try to upgrade from smaller units to bigger ones and buy additional units for renting. Therefore, the percentage of households who have fully paid their mortgages is unlikely to be very high. For mortgage-holding households imputed rent captures the mortgage payments although the two items may not match exactly.<sup>4</sup> However, the link between imputed rent and mortgage payments needs to be studied further before we draw firm conclusions from the current data.

Second, household income we have is income from work and does not include government transfers and other income sources. We have to note, however, that the income and expenditure data in the HES, which reports income from all sources and excludes imputed rent, shows results similar to that in Figure 1b. For the lowest income quintile (bottom 20%) the expenditure-income ratios in 2002/03 and 2007/08 were 151% and 138% respectively. The ability of low income households to spend more than their income highlights that government transfers play a key role for these households. It is also useful to note that if low income groups constitute a larger proportion of retirees, they could be drawing down their savings to maintain consumption expenditures. Nevertheless, above results indicate that the lower 30% of the income ladder (not just the bottom 10% or 20%) needs extra attention in the Government's welfare program.

---

<sup>2</sup> This is in line with falling APC analyzed in Abeysinghe and Choy (2004).

<sup>3</sup> Note that household expenditure does not include mortgage payments.

<sup>4</sup> Average monthly imputed rent for owner occupied housing in 1997/98 HES was \$624. From Yearbook of Statistics data on mortgage debt per household and using a mortgage loan rate of 8%, approximate monthly mortgage payment per household in 1998 was \$794. At times when the mortgage rate is very low, imputed rent will over-estimate the mortgage payments.

3. The *EIR* estimates for 2013 show that households in the 40<sup>th</sup> income percentile spend about 86% of their income on consumption. Those in the median income group spend about 80% and those in the 90<sup>th</sup> percentile spend about 40%.

#### 4. Rising expenditures relative to income

In general housing, health, and transport stand out as expenditures that have risen relative to income (Figures 2-4, Table 1).

##### **Housing**

Most noteworthy upward trend occurs in housing *EIRs* (Figure 2b), an indication of deteriorating housing affordability.<sup>5</sup> What Figure 2b shows is short-term housing affordability (quarterly housing expenditure to income ratio). It is worth noting that in our detailed study of housing affordability<sup>6</sup> we focus on long-term housing affordability. We measure long-term housing affordability by house price (plus upfront expenses) to lifetime income ratio. This method avoids the problems associated with the mismatch between mortgage payments and imputed rent mentioned earlier. Interestingly both long-term and short-term housing affordability numbers show similar trends and magnitudes.<sup>7</sup> Across all income groups, housing constitutes the largest expenditure item. Housing expenditure above 30% of income is usually defined as unaffordable. Figure 2b shows that even those in the 30<sup>th</sup> income percentile have moved into unaffordable range by 2013 as a result of rising house prices and rents. When compulsory components of housing expenditures increase and consume a large proportion of household income, households have to cut other more flexible expenditure components.

##### **Health**

Figure 3a shows that health expenditures have trended upward across all income groups. However, the crisscrossing of expenditure lines, which is more apparent in *EIRs* in Figure 3b, is a bit puzzling. The health *EIRs* in general show an upward trend over 1998-2003, the period during which the lower 50% of the income ladder observed a drop in their incomes. After 2003 health *EIRs* show a mild increase for six income groups and a drop for the other three. We cannot think of a good reason for this drop for P20, P50 and P80, therefore, a data anomaly cannot be ruled out. Table 1 shows that over the decade since 2003 health expenditures of higher income groups (ignoring deciles having decreases) have increased substantially relative to their income growth.

As of 2013 the bottom 10% spent about 11% of their income on health while the rest spent less than 6%. It is not exactly clear to us whether payments from Medisave accounts are fully captured in household health expenditures. If it does, low health expenditures relative to income, which compares well with national level figures on health expenditure, is remarkable. This probably reflects that Singaporeans engage more in preventive healthcare than in clinical healthcare.

---

<sup>5</sup> Housing covers expenditure on housing and utilities and excludes furnishing, household equipment and routine maintenance.

<sup>6</sup> Abeyasinghe and Gu (2011, 2013) and SCAPE website: <http://www.fas.nus.edu.sg/ecs/scape/housing.html>.

<sup>7</sup> This further affirms our argument in Section 3 that imputed rent should not be excluded from housing expenditures.

## ***Transport***

Figure 4a shows that transport expenditures have been stable over 1998-2008 and started trending upward only after 2008; this is also only for those above the first income quintile. The lowest income groups seem to stick to public transport and as a result their transport expenditures have remained stable throughout. In fact, the lowest 10% has had a slight drop in their transport expenditures. This is likely to be a result of government subsidies.

The *EIRs* in Figure 4b show interesting changes in trends. Transport *EIRs* for some income groups have trended upward till 2003 because of falling incomes over this turbulent period. Since then till 2008 the *EIRs* drop because of rising incomes. After 2008 both absolute and relative transport expenditures have trended up except for the lowest 20% income group. The upward trend of transport *EIRs* for higher income groups is a result of rising private transport costs. Those in the 30<sup>th</sup>, 40<sup>th</sup> and 50<sup>th</sup> income percentiles are the ones who faced the highest increase in transport costs relative to their incomes. For these groups transport expenditure constitutes more than 15% of their incomes, the third biggest expenditure item after housing and food.

## **5. Stable expenditures relative to income**

Education and communication expenditures show a steady rise but the corresponding *EIRs* in general stabilize or drop slowly after 2003 (Figures 5 and 6, Table 1).

### ***Education***

Figure 5a shows a situation that needs considerable attention; education expenditures of higher income groups (above P20) have increased whereas that of the lowest 10% has dropped. The next income group has maintained a negligibly small rise. As a result, the *EIRs* (Figure 5b) of the lowest 20% show a steady drop while other income groups observe stable or slightly downward trend after 2003. Education and social mobility are closely linked and the inability of low income groups to spend on education beyond the public school system will sustain their disadvantage. Low income groups receive government subsidies and transfers for education. Would this be enough to offset their disadvantage against high income groups needs to be examined.

### ***Communication***

Figure 5a shows that communication expenditures have increased steadily across all income groups. However, these expenditures relative to income (Figure 5b) increased only till 2003 and then stabilized or dropped slightly. It is likely that the estimated communication expenditures have not fully captured the rising use of smart phones and broadband internet connections.

## **6. Falling expenditures relative to income**

Expenditures on food, clothing, and recreation show a substantial drop relative to income (Figures 7-8). In particular the drop in recreation expenditures stands out.

## **Food**

Figure 7a shows that food expenditures, just as in the case of transport expenditures, have remained stable till 2008. Since 2008 food expenditures record a moderate increase resulting from higher food prices propelled by global conditions.

Food expenditures consist of food & non-alcoholic beverages and food serving services. The HES 2007/08 shows that 62% of food expenditure was on food servings services. Despite such a large proportion spent at food serving outlets, food *EIRs* (Figure 7b) have trended downward across all income groups. This partly highlights a general phenomenon that as income rises, the proportion spent on food drops (Engel's law). This also indicates that increase in food prices at food serving outlets has not outstripped income growth. As of 2013 the bottom 10% spent more than 30% of their income on food whereas those in the 90<sup>th</sup> percentile spent less than 7%. Median income households spend about 15% of their income on food.

## **Clothing & footwear**

Figure 8a shows an interesting phenomenon; clothing & footwear expenditures dropped over 1998-2003 during which incomes either dropped or income growth slowed down. Over this period other expenditures remained the same or increased. It appears that clothing & footwear industry is among the first to suffer from economic downturns. Despite the general rise in clothing & footwear expenditures after 2003, these expenditures relative to income have trended downward substantially (Figure 8b, Table 1).

## **Recreation & culture (The casualty)**

While other expenditures increased after 2008, recreation & culture expenditures have fallen across all income groups (Figure 9a). Between 1998 and 2003 there has been an increase in recreation & culture expenditures for higher income groups (top 40%) but since then the trend has been downward. Other income groups have cut down these expenditures throughout. As a result, relative to incomes, recreation & culture expenditures show the most precipitous drop across all income groups (see Table 1). This is quite anomalous because we expect recreation & culture expenditures to increase as incomes increase. This is not happening because households cut on flexible expenditures when essential expenditures increase. As stated earlier, housing expenditure is one of them. Moreover, households tend to save more in anticipation of lumpy expenditures on healthcare and children's education by cutting flexible expenditures.

Changing expenditure share patterns can be seen in Figure 10, which plots expenditure shares of income for each income decile separately.

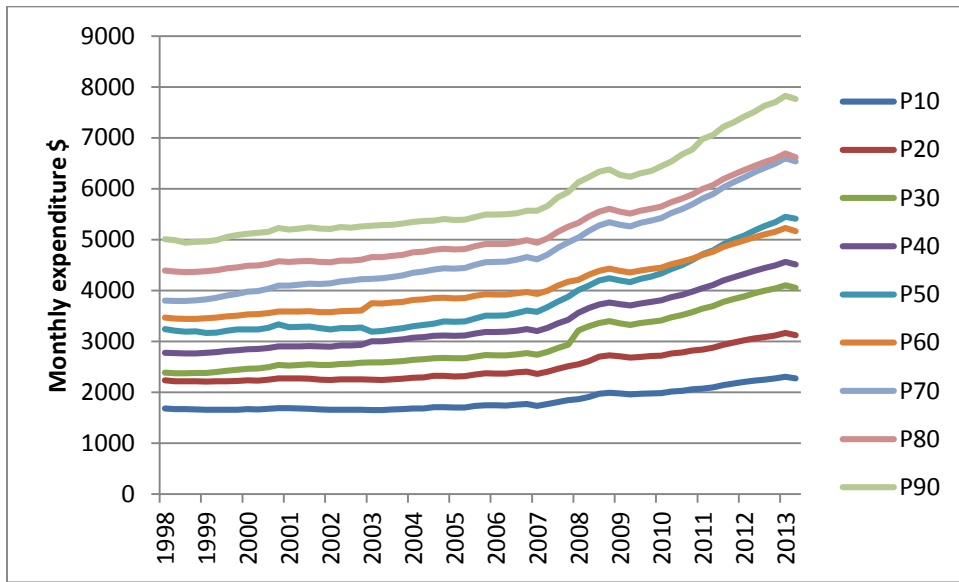


Figure 1a. Overall expenditure by income percentiles

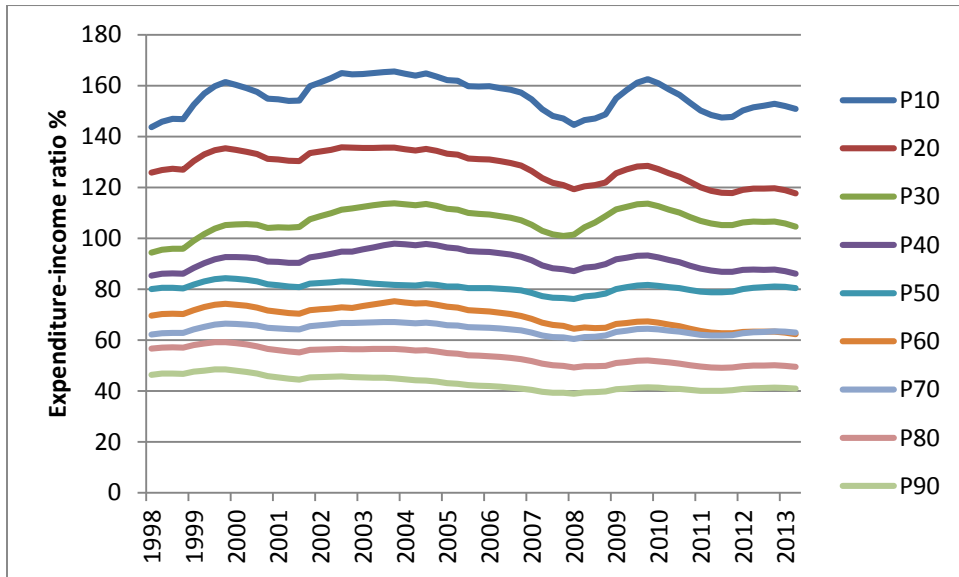


Figure 1b. Overall living affordability: (expenditure-income ratio) by income percentiles

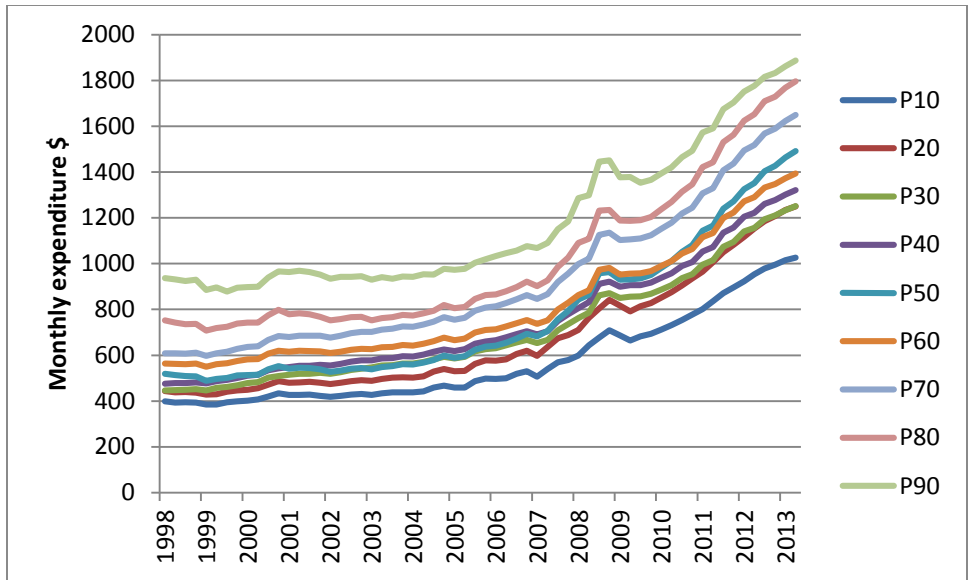


Figure 2a. Housing expenditure by income percentiles

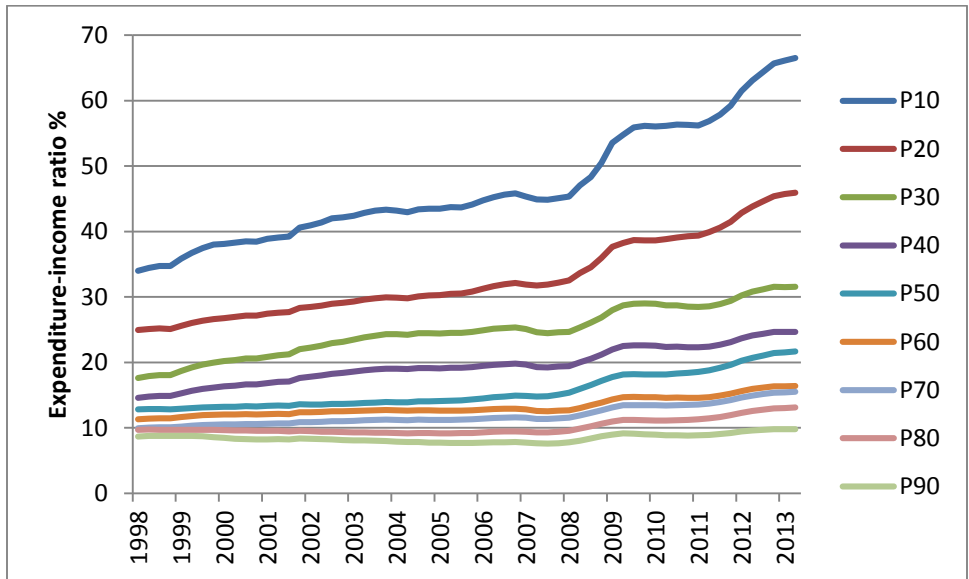


Figure 2b. Housing affordability: (expenditure-income ratio) by income percentiles



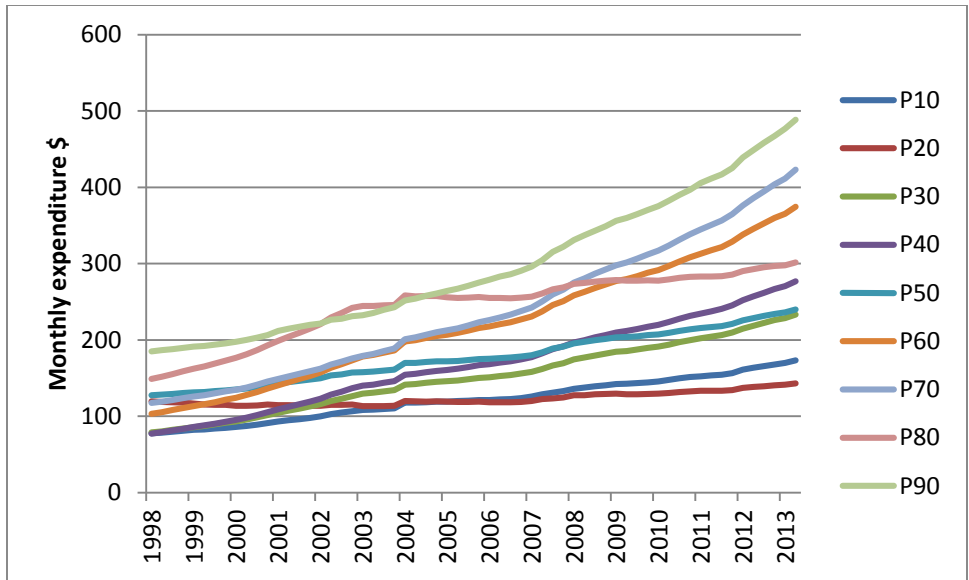


Figure 3a. Healthcare expenditure by income percentiles

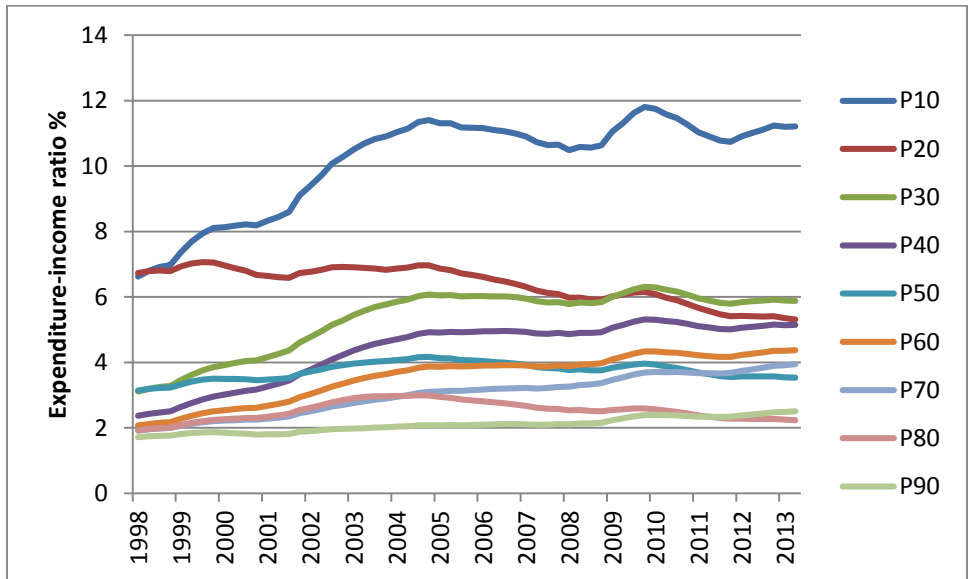


Figure 3b. Healthcare affordability: (expenditure-income ratio) by income percentiles

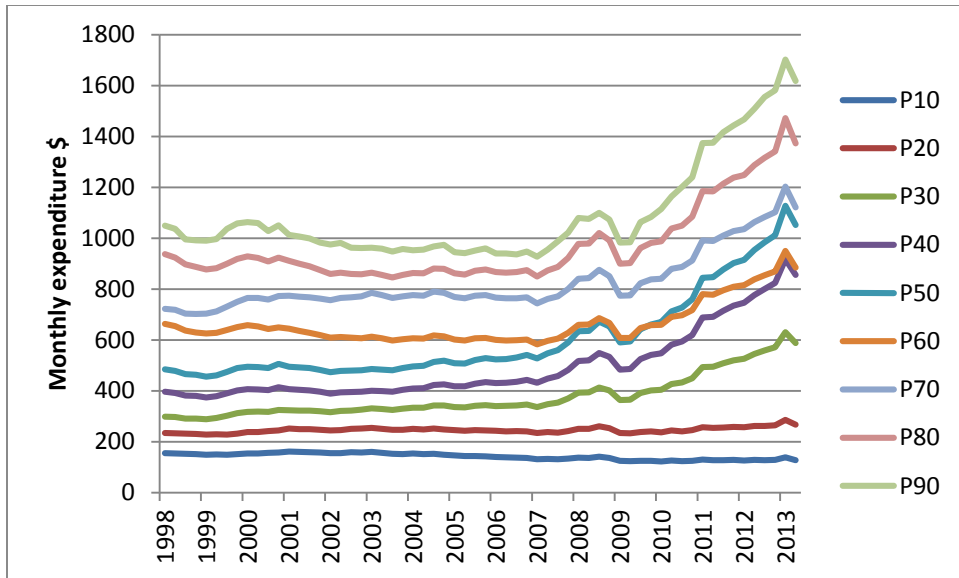


Figure 4a. Transport expenditure by income percentiles

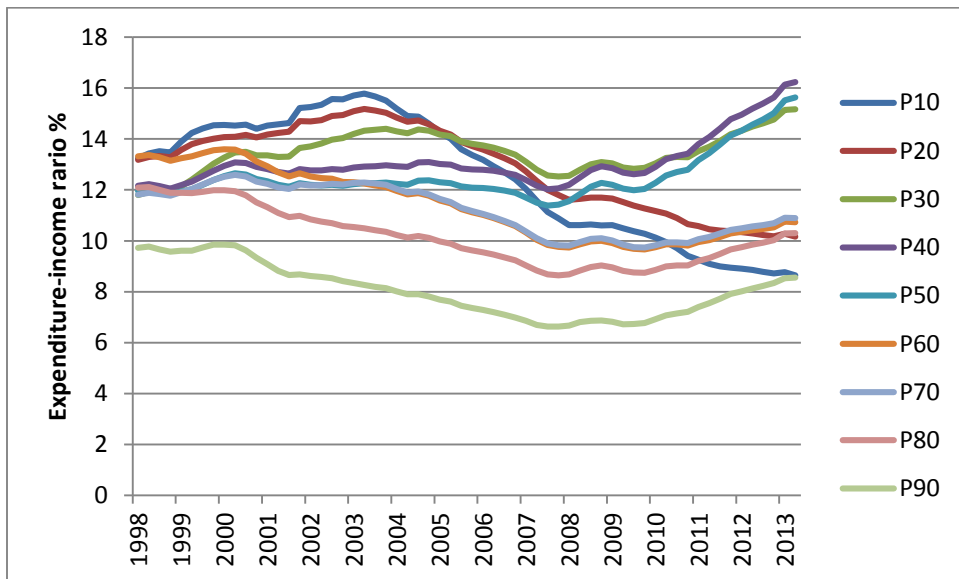


Figure 4b. Transport affordability: (expenditure-income ratio) by income percentiles

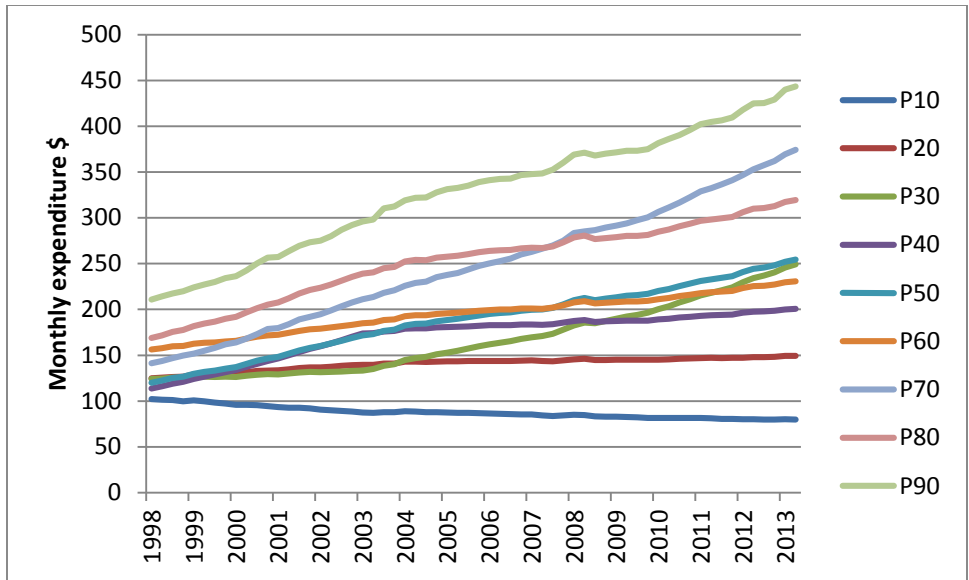


Figure 5a. Education expenditure by income percentiles

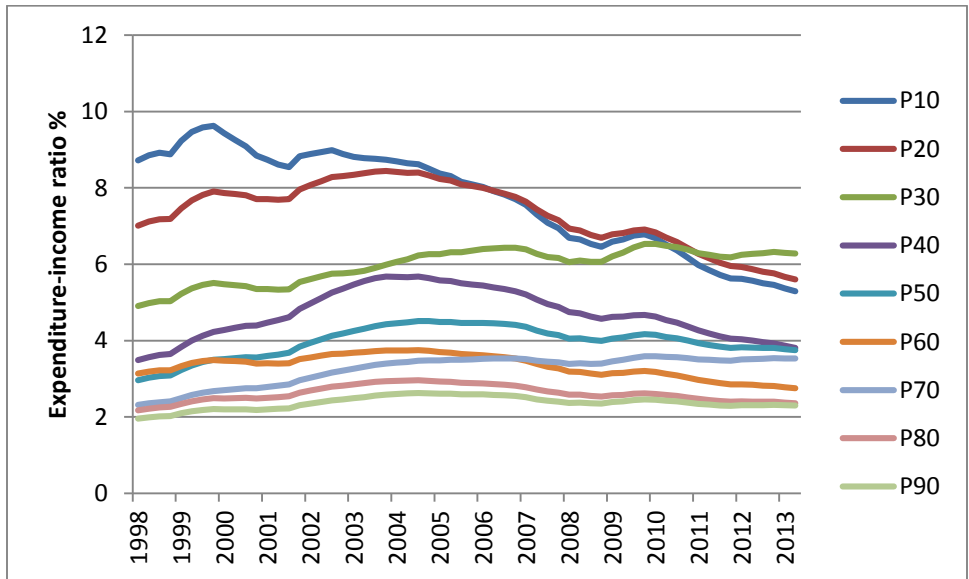


Figure 5b. Education affordability: (expenditure-income ratio) by income percentiles

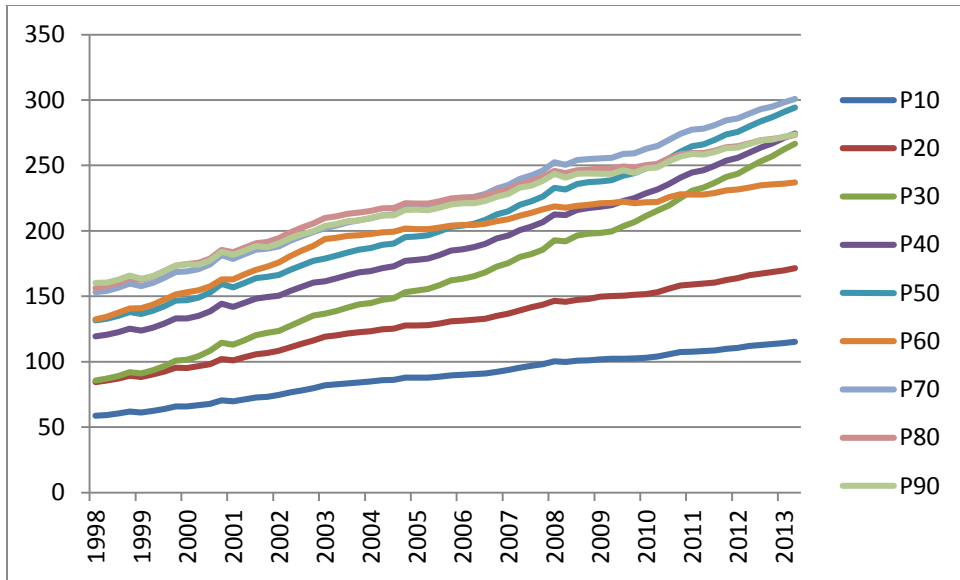


Figure 6a. Communication expenditure by income percentiles

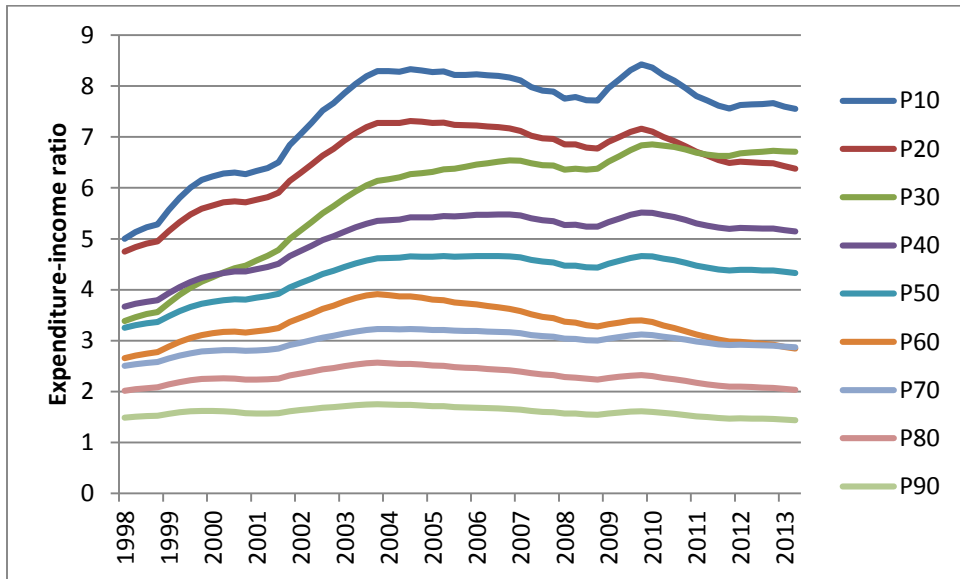


Figure 6b. Communication affordability: (expenditure-income ratio) by income percentiles

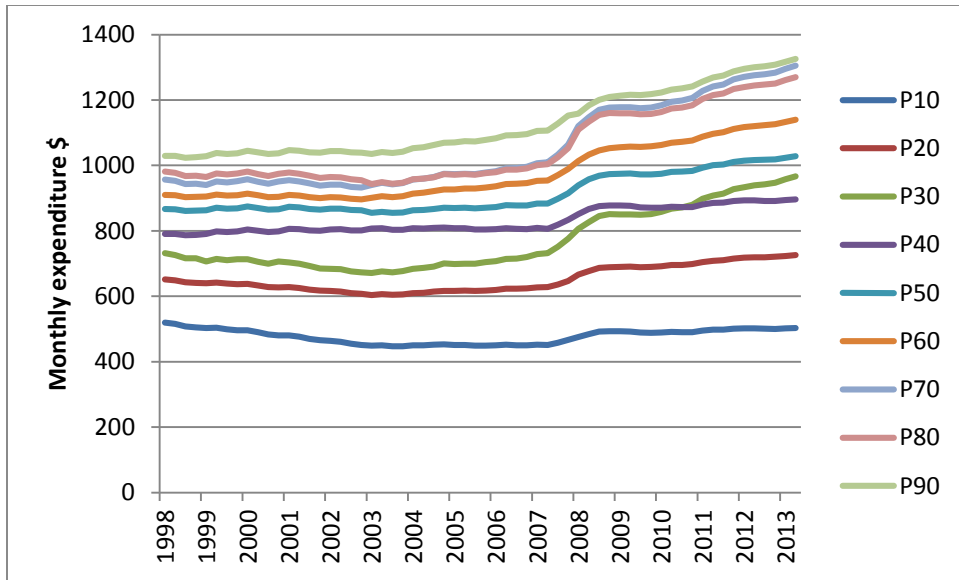


Figure 7a. Food expenditure by income percentiles

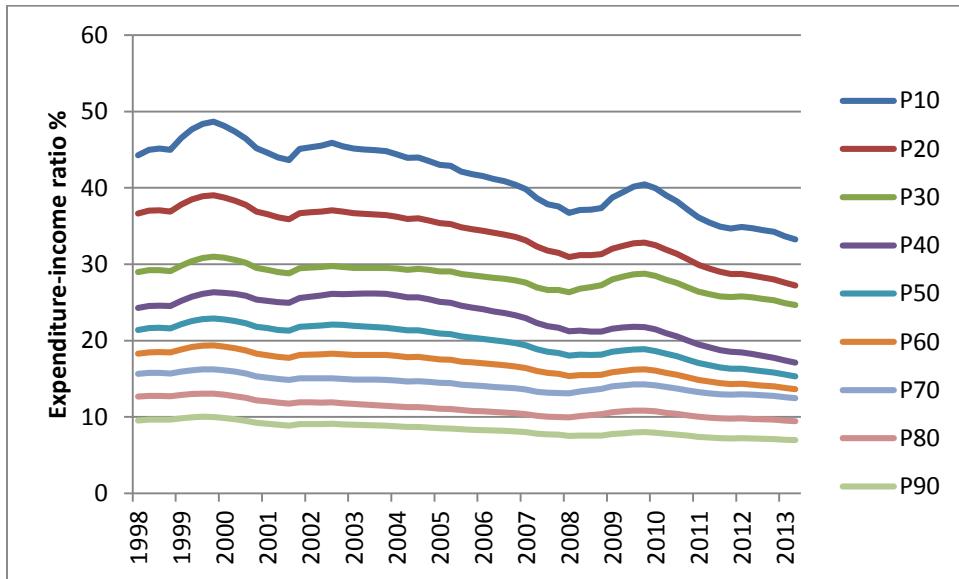


Figure 7b. Food affordability: (expenditure-income ratio) by income percentiles

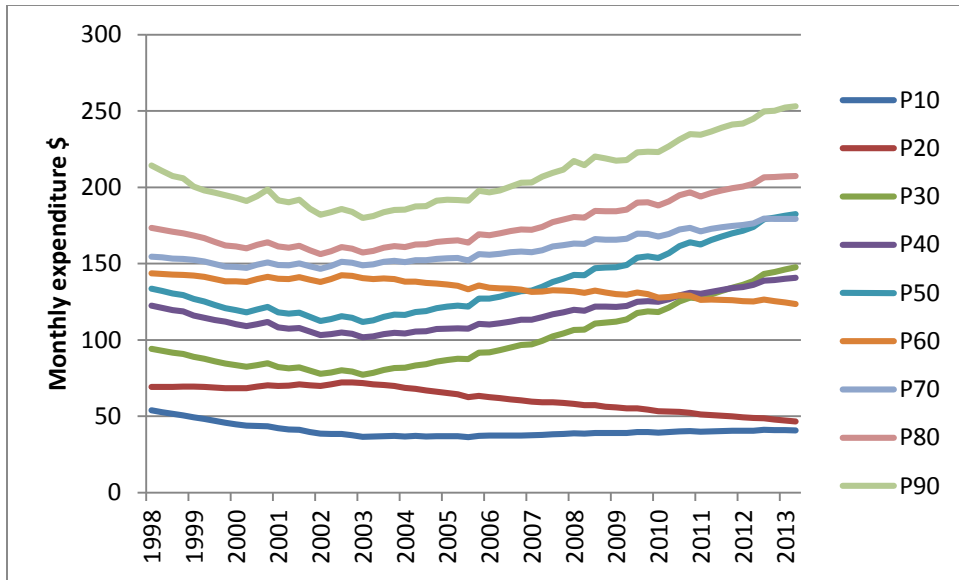


Figure 8a. Clothing & footwear expenditure by income percentiles

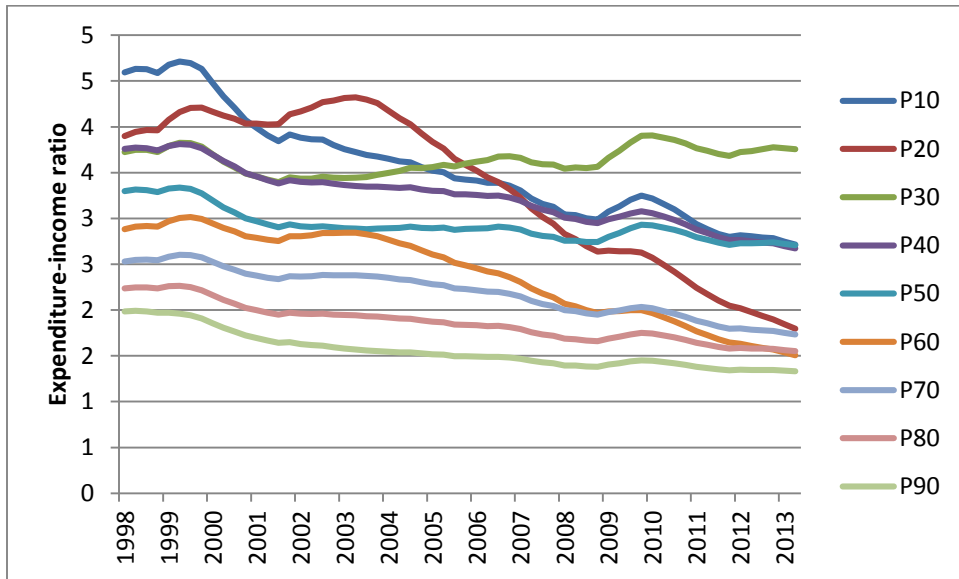
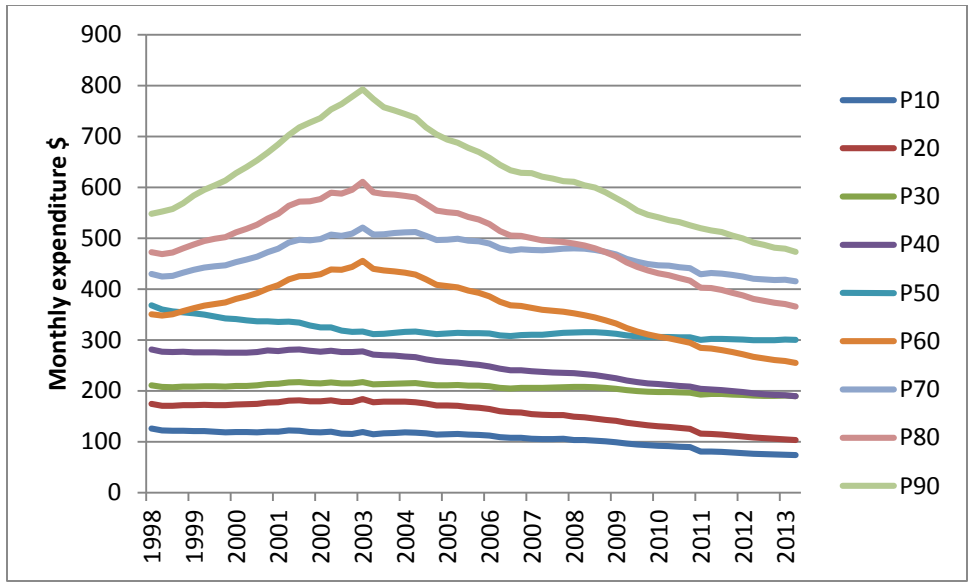
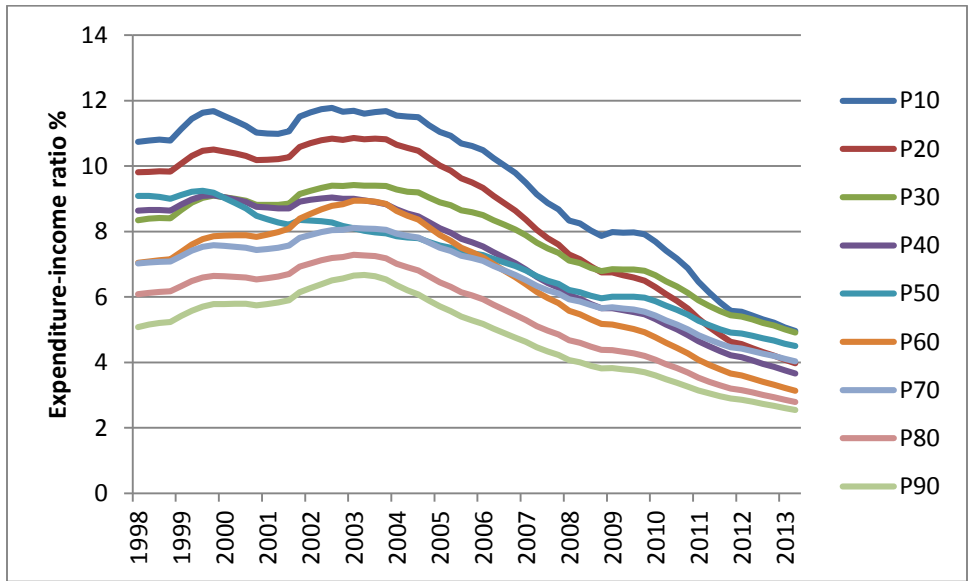


Figure 8b. Clothing & footwear affordability: (expenditure-income ratio) by income percentiles



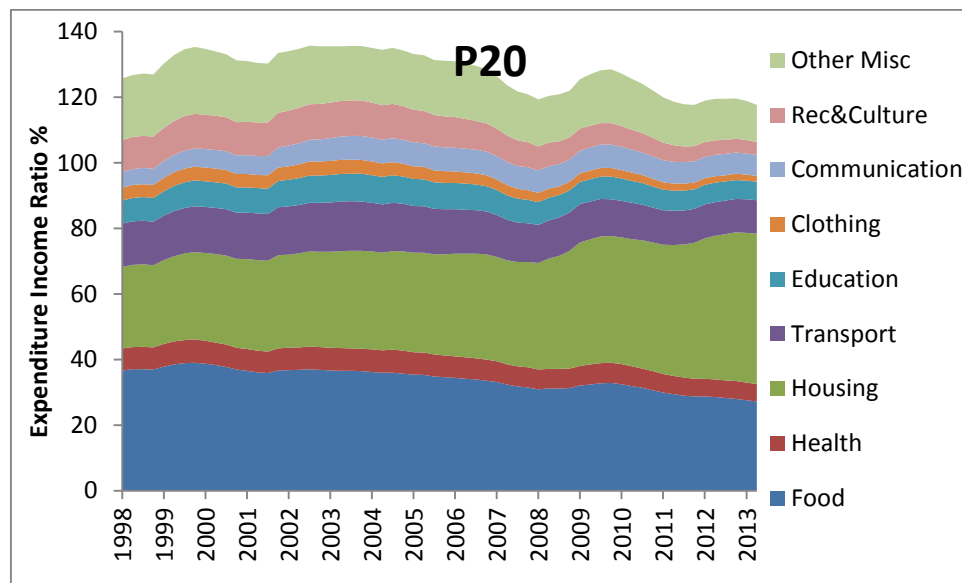
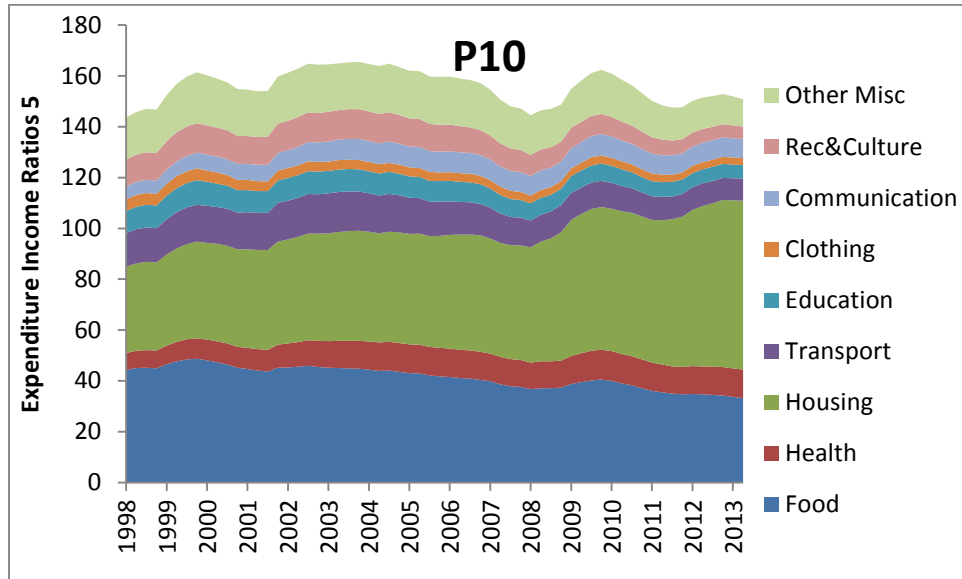
**Figure 9a. Recreation & culture expenditure by income percentiles**



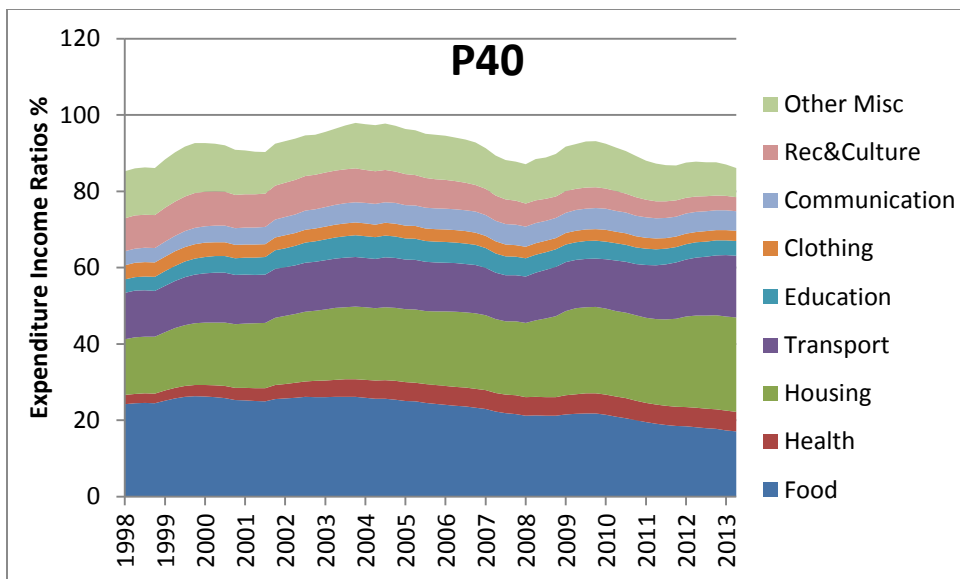
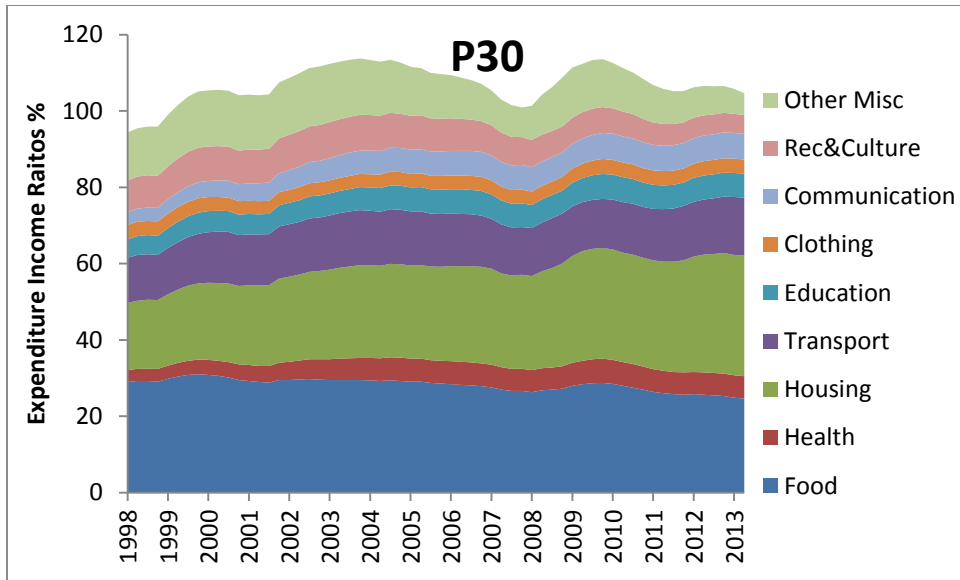
**Figure 9b. Recreation & culture affordability: (expenditure-income ratio) by income percentiles**

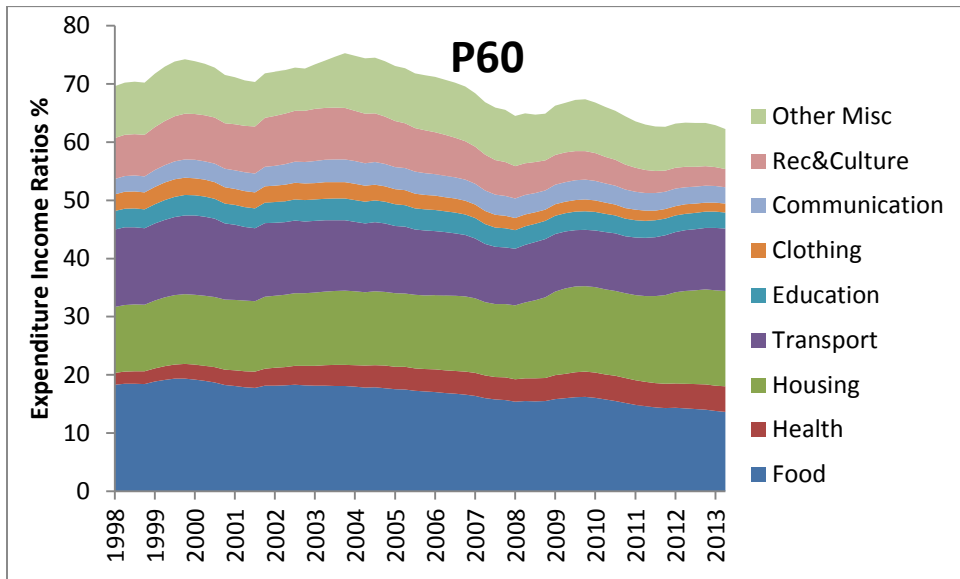
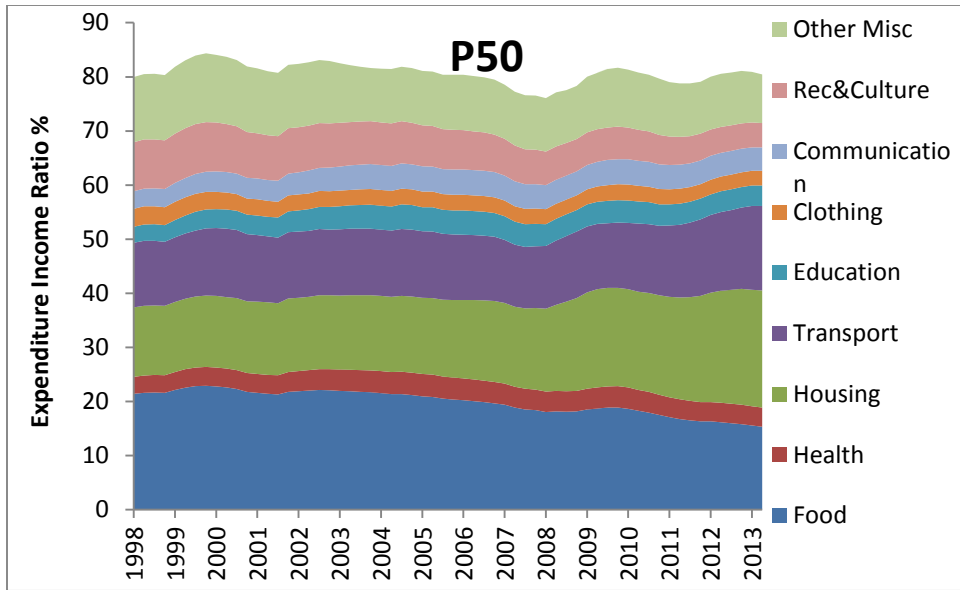
[Table 1](#) (separate excel sheet)

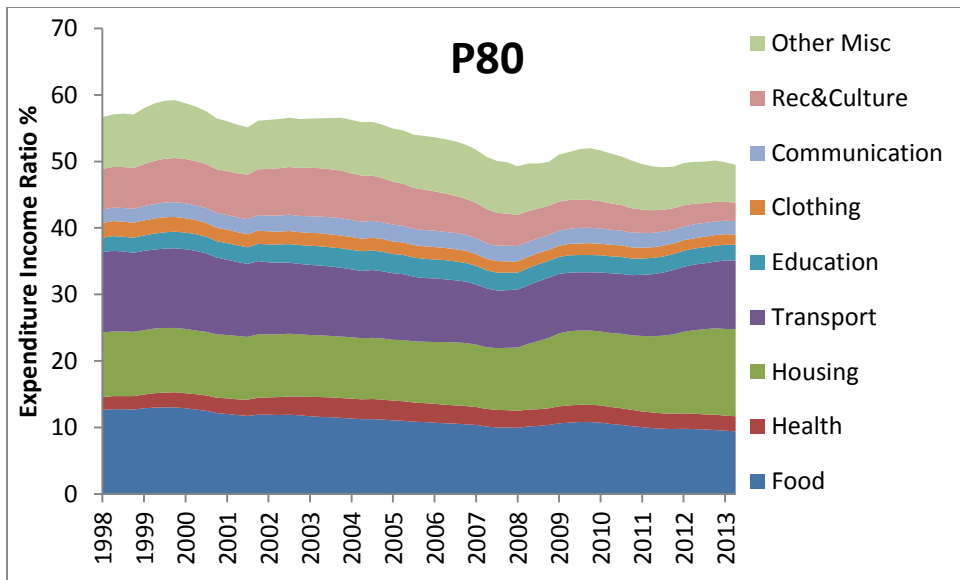
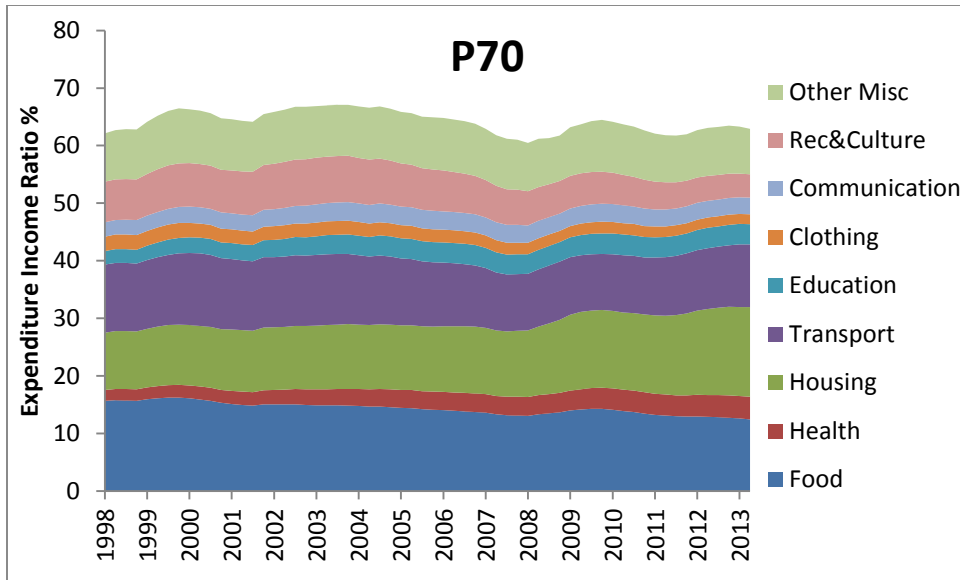
Figure 10 (below) shows expenditure share of income for each income decile P10 – P90

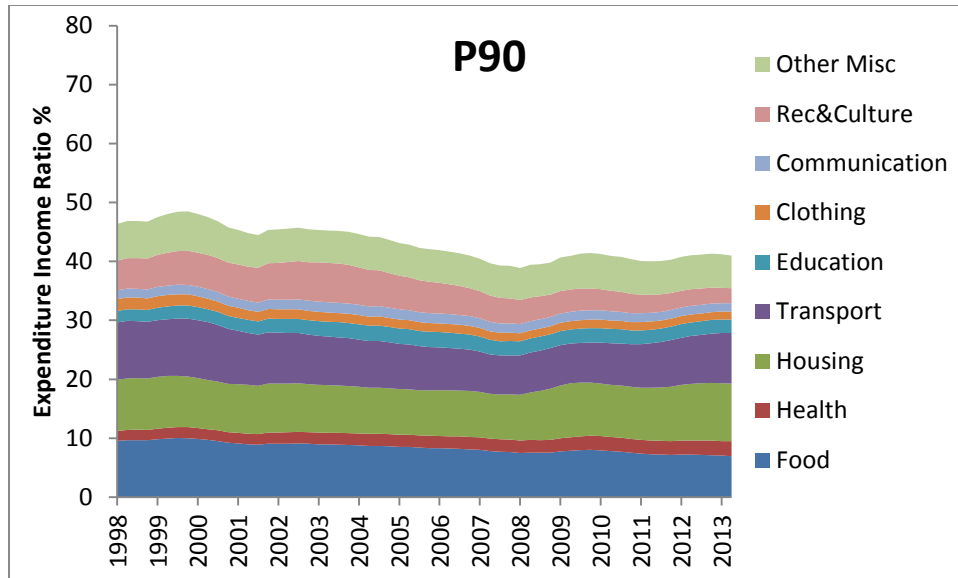












## Appendix: Data and Methodology

Monthly CPI by expenditure categories is readily available. However, CPI by income groups for eight major expenditure categories<sup>8</sup> is available only half yearly and that is also only for three major income groups, lowest 20%, middle 60% and highest 20%. Household expenditure is available only every five years. The household expenditure survey (HES) report does not provide expenditure data by income deciles. The Department of Statistics (Government of Singapore), at our request, provided us resident (Singapore citizens and permanent residents) household expenditure by income deciles for major expenditure categories for the survey years 1997/98, 2002/03 and 2007/08. The expenditure figures represent average monthly household expenditure. The Department of Statistics also provided us resident household income from work by income deciles. Average monthly household income that includes employer's CPF contributions is available annually only from 2000. Prior to this, household income without employer's CPF contribution are available for 1990, 1995 and annually since 1997. We were able to obtain income data only for nine deciles. We denote them by P10, P20,...,P90. Note that P10 represents the income percentile 1<sup>st</sup> - 10<sup>th</sup>, P20 represents 21<sup>st</sup> - 30<sup>th</sup> and so on. Data for the top income group (91<sup>st</sup> - 100<sup>th</sup>) are not available because of non-representative sample sizes.

Since none of the required data series are available at quarterly frequency we have to use interpolation methods to convert them to quarterly frequency. For this we use a mixture of a mixed-frequency regression technique developed by Aboysinghe (1998) and the Chow-Lin related series method (see Aboysinghe and Gulasekaran, 2004).

To convert annual household income data to quarterly frequency we used average wage (average monthly earnings) data that are available quarterly since 1980. After an initial experimentation with annual income and wage data we assume the following dynamic regression relationship at quarterly frequency:

<sup>8</sup> The eight categories are food, clothing & footwear, housing, transport, communication, education & stationary, health care, and recreation & others.

$$y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 w_t + \beta_3 w_{t-1} + u_t \quad (1)$$

where  $y_t$  and  $w_t$  are the logarithm of household income and average wage respectively. Since  $y_t$  is observed only annually, to estimate the parameters of (1) Abeyasinghe (1998) introduced a transformation to convert (1) to annual frequency without losing quarterly data on  $w_t$ . This leads to a non-linear model and we used a non-linear least squares method to obtain the parameter estimates of (1). For illustration, the estimated regression over 1997-2011 for the lowest income decile is:<sup>9</sup>

$$\hat{y}_t = -0.436 + 0.917 y_{t-1} + 1.791 w_t - 1.667 w_{t-1}, R^2 = 0.65. \quad (2)$$

(0.435)      (0.075)      (0.822)      (0.808)

where the numbers in parentheses are standard errors. Using 1997 income as a starting value for  $y_1$  we can obtain the predicted values  $\hat{y}_t$  at quarterly frequency using quarterly  $w_t$  series. We used minor intercept adjustments where necessary to align  $\hat{y}_t$  with observed  $y_t$ .

Computing the expenditure series was a lot more challenging. First step was to generate CPI data by income group for the eight major expenditure categories. Half-yearly CPI data for the three income groups mentioned above (lower, middle, upper) are available since 1993. These figures are assigned to June and December of each year. We used the monthly CPI for each major category as a predictor variable and used the Chow-Lin method to generate monthly CPI by the three income groups for the eight major categories. If  $P_t^j$  is the CPI for the  $j$ th category (available monthly) and  $P_t^{ij}$  is the CPI of the  $i$ th income group for the  $j$ th category (available half-yearly) then we assume the relationship  $P_t^{ij} = \beta_0 + \beta_1 CPI_t^j + u_t^{ij}$ , where  $t$  is the monthly time subscript. To simplify computations we assume  $u_t^{ij}$  to be white noise. Using half-yearly (average) data we can estimate the regression  $P_\tau^{ij} = \beta_0 + \beta_1 CPI_\tau^j + u_\tau^{ij}$ , where  $\tau$  is the half-yearly time subscript. Then the predicted monthly  $\hat{P}_t^{ij} = \hat{\beta}_0 + \hat{\beta}_1 CPI_t^j$  plus  $\hat{u}_t^{ij}$  allocated to each month of the half year provides the required interpolated CPI series. Monthly data were then converted to quarterly frequency.

To compute quarterly expenditure series by different categories we used the five-yearly HES figures as the base figures set against the middle month (March) of the survey year. This corresponds to the first quarter. We then used CPI inflation rate to obtain a first round of quarterly estimates of household expenditures. If household expenditure (at quarterly frequency) is  $E_t^{ij}$  and the CPI inflation rate is  $p_t^{ij} = (P_t^{ij} / P_{t-1}^{ij}) - 1$  then  $E_{t+1}^{ij} = (1 + p_{t+1}^{ij}) E_t^{ij}$ . Since  $p_t^{ij}$  is available only for three broad income groups we assumed that the inflation rate for the lower 20% holds for both P10 and P20 income groups. Similarly the inflation rate for the middle 60% is assumed to hold for P30,...,P80 income groups. The inflation rate for the upper 20% is assumed to hold for the P90 income group.

The above method of generating the expenditure data assumes that the consumption basket remains constant between the five year survey intervals. Obviously this is not a valid assumption and we notice that the interpolated consumption expenditures fall short of the numbers of the next survey year. To fix

---

<sup>9</sup> Since income surveys are conducted in the mid year we assign the annual income figures to the third quarter of each year. The average income ratio with and without employer's CPF contribution is about 1.1. We multiplied the income data before 2000 by 1.1 to align them with income since 2000.

this problem we used a regression of the following form to obtain a second round of expenditure estimates:

$$\ln E_t^{ij} = \ln E_{t-1}^{ij} + \beta_0 + \beta_1 \Delta \ln CPI_t^{ij} + \beta_2 \Delta \ln Y_t^i + \beta_3 \Delta \ln X_t^j + u_t^{ij} \quad (3)$$

where  $Y_t^i$  is household income of the  $i$ th income group and  $X_t^j$  is any other relevant variable for the  $j$ th expenditure category. For example, for expenditure on housing  $X$  represents the overall rental index. Where such a variable is not available the regression is run without  $X$ . After estimating (3) using quarterly data, we use dynamic simulations to obtain improved estimates of  $E_t^{ij}$ . The starting values  $E_1^{ij}$  are the survey year figures. Intercept adjustments were made to align the simulated expenditure figures with survey figures.<sup>10</sup> This methodology allows easy updating of the numbers until the next survey figures become available.

After generating household income and expenditure by income deciles at quarterly frequency we can easily compute the expenditure ( $E$ )-income ( $I$ ) ratio ( $EIR$ ) to measure living affordability:

$$EIR_t^{ij} = E_t^{ij} / I_t^i, \quad i \text{ income decile, } j \text{ expenditure category.} \quad (4)$$

## References

- Abeyasinghe, T. (1998). "Forecasting Singapore's quarterly GDP with monthly external trade", *International Journal of Forecasting*, 14, 505-513.
- Abeyasinghe, T. and Choy, K.M., (2004). "The aggregate consumption puzzle in Singapore" *Journal of Asian Economics*, 15, 563-578.
- Abeyasinghe, T. and Gu, J. (2011). "Lifetime income and housing affordability in Singapore", *Urban Studies*, 48, 1875-1891.
- Abeyasinghe, T. and Gu, J. (2013). "Estimating bubbles and affordable housing price trends: A study based on Singapore". SCAPE Working Paper 2013/01. <http://www.fas.nus.edu.sg/ecs/pub/wp-scape/1301.pdf>.
- Abeyasinghe, T. and Gulasekaran, R., (2004). "Quarterly real GDP estimates for China and ASEAN4 with a forecast evaluation", *Journal of Forecasting*, 23, 431-447.
- Abeyasinghe, T., Himani, and Lim, J. (2011) "Equity in Singapore's healthcare financing", *Challenges for the Singapore Economy After the Global Financial Crisis*, edited by P. Wilson, Singapore: World Scientific.

---

<sup>10</sup> Note that the intercept term in (3) captures the trend of the dependent variable.