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Measuring Cost of Living for Ordinary Residents in Cities: A New Index

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Abstract

Cost of living is an important indicator to track and monitor basic living standards for cities. There is no reliable and consistent index available in the literature for comparing the cost of living across different major cities to guide policy analysis. Commercial cost of living surveys, while very useful in facilitating compensation decisions for expatriate managers, are inadequate as they do not account for differences in consumption patterns among cities and also do not consider differences in lifestyles between ordinary residents and expatriates across cities. In this context, this paper makes a pioneering attempt in the literature to come up with a comprehensive way to measure the cost of living for ordinary residents of 103 cities in the world. One of the features of the paper's empirical methodology is that it makes a distinction between the cost of living for expatriates and ordinary residents. We focus on the results pertaining to ordinary residents in this paper.

Keywords: cost of living, ordinary residents, expatriates

JEL Classification: E30, E310, E370

1. Introduction and Motivation

There has been broad-based growth in wealth for cities all over the world, albeit increasingly unequal within and across cities. Some cities tend to grow faster than others, particularly the global financial centers. The world's top global financial centers like London, New York, Singapore or Hong Kong connect the wider economy to the global financial community and consistently compete amongst themselves to attract the best human capital, allowing them to become hubs of creativity and innovation which invariably has a bearing on their economic growth. Concurrently, as cities become increasingly open and interconnected, they are more susceptible to external shocks that trigger volatility in their growth that also give rise to significant costs in terms of an unstable macroeconomic environment for cities. This consequently leads to fluctuations in prices, employment as well as varying shares of private and public consumption.

In this context, the cost of living in a city becomes a pivotal indicator to track and monitor basic living standards, especially in large global cities that are also global financial centers. Tracking cost of living is not only useful for employers and employees but matters even more for policy makers, multinational corporations (MNCs) and governments. While changes in cost of living over time could be measured by the Consumer Price Index (CPI), there is no reliable and consistent index yet for comparing the cost of living across different major cities to guide policy analysis. Commercial cost of living surveys, while useful for facilitating compensation decisions with regard to expatriate managers, are inadequate as they do not account for differences in consumption patterns among cities. Moreover, these surveys do not take into consideration differences in lifestyles between ordinary residents and expatriates.

Furthermore, it is our contention that some popular existing studies from private corporate houses are highly misleading and have handled figures without sufficient qualifications on methodology and assumptions. One of the best known studies is entitled "Prices and Earnings" by Wealth Management Research UBS. The UBS Prices and Earnings Report 2009 – A Global Purchasing Power Comparison, for instance, attempts to compare and rank the purchasing power of average wages and relative cost of living across 73 global cities using New York as the benchmark. According to the UBS Wealth Management Research, the UBS Report on "Prices and Earnings Comparison" was first published in 1971

and has generated "high level of interests" based on "frequent inquires received". The UBS Report was updated in August 2010. We are surprised by the UBS Report's over-simplification on differences amongst cities, lack of rigour in the adopted methodology and inaccuracy of the data employed. One should be cautious, as we attempt to show in this paper, in using the findings of the UBS Report in undertaking policy analysis and drawing critical conclusions. We found that their various findings on Singapore are markedly different from our studies.

UBS for instance stated that its report included "more than 30,000 data points". However, the report covers 75 cities with 154 items of goods and services and 14 separate occupations. This means that the occupational wages and prices in the UBS Report are not representative since only approximately three data points per item or occupation are collected for each city. To conduct international comparisons, UBS uses a number of simplifying assumptions and standardisations, which do not accurately reflect the true situation since cities are basically very different from one another. One of the major flaws in the UBS report is its assumption that the occupation profile is the same across cities. Under this assumption, the employment structure in Singapore would be similar to those of the cities in developing countries. The fallaciousness of this global comparison was exacerbated by the "limited selection of goods and services with adjustments to individual components based on the weighting in the European consumer price index" or the "Western European consumer preferences" (UBS, 2009).

Upon re-examining the UBS case on Singapore, we found some of the assumptions made inevitably resulted in a significant downward bias in the purchasing power of our wages. Firstly, the UBS Report understates wages in Singapore. UBS uses a common occupational profile, based on global averages, to derive the average wage of each city. This occupation profile, however, severely understates the percentage of Professionals, Managers, Executives & Technicians (PMETs) in Singapore, thus resulting in an average wage that is much lower than the true average wage in Singapore. The percentage of PMETs in our resident workforce in 2009 was 52% (Ministry of Manpower, 2009), significantly higher than the 9% assumed by UBS which was not mentioned in the report but made available upon request. The downward bias is more severe in Singapore's case compared to some of our other Asian neighbours which have relatively fewer PMETs in their workforce. Singapore residents' share of Production, Transportation Operators and General Labors (PTOGLs) and Clerical, Sales & Service Workers (CSRWs) positions are respectively 24% and 24% (Ministry of Manpower, 2009), much lower than the 58% and 33% assumed by the UBS Report, thus again resulting in an average wage much lower than the true average wage in Singapore.

UBS appears to have excluded Central Provident Fund (CPF) contributions from the calculation of net wages for Singapore. However, the CPF system in Singapore, which is a national pension scheme, is in fact a defined contribution system with individual accounts where the CPF contributions, apart from providing for retirement, are also extensively used for housing, medical and educational expenses prior to retirement (Central Provident Fund Board, 2015). Therefore, CPF contributions should be included as part of wages and not be considered as tax payments.

Secondly, price levels constructed by UBS overstate the cost of living in Singapore. The report uses a common European basket of goods and services to reflect costs of living across all cities. This would have caused an upward bias in the cost of living in Singapore as Western consumption goods tend to be more expensive in Asian cities. In the case of Singapore, this paper found weights on basket of goods and services for food, clothing and household appliances quite different from the European baskets commonly adopted in the UBS Report, which again could lead to significant distortions.

UBS uses rents of private housing in the construction of the price levels (including rental). In Singapore's case, however, the majority of Singapore's population stay in public housing and median rents in public housing are more than 30% lower than the figure used in the UBS Report. There appears to be some discrepancies in the price levels of specific categories. For example, prices of home electronics and household appliances: The UBS report puts Singapore's price level above that of Mumbai, which is counterintuitive as visitors from India tend to spend twice as much on electronics as the average tourist in Singapore (Singapore Tourism Board, 2013). On restaurants, the UBS report puts Singapore's price level slightly above that of many Western European cities (including Paris) which are known for their expensive restaurant meals. The discrepancies may have resulted from the small number of data points for each city.

The above discussion highlights the need to exercise caution in the use and interpretation of data. The UBS Report is targeted towards its investment banking, asset management and wealth management clients to aid decisions on travel and relocation, which explains UBS' decision in selecting a Western basket of goods and services in the construction of the price index. However, it would be inappropriate to compare a Western consumption pattern against an assumed workforce composition with only nine percent PMETs, as they pull in contradictory directions. It is also important to consider country-specific issues, such as the difference between the CPF system in Singapore and Western social security systems. The difficulty in the interpretation of the results and various technical and data shortfalls means that the findings of the UBS Report are not robust and they have understated wage levels and overstated price levels in

Singapore. Thus UBS could have mistakenly ranked Singapore at the bottom one-third amongst the 73 cities. Through the use of more representative data from the World Bank and government statistical agencies, this paper finds that the purchasing power of wages in Singapore is better than what the UBS Report suggested.[1]

Measuring cost of living for ordinary residents in cities is an issue which the academic literature has failed to adequately address. In this paper, we make the first attempt in the literature to come up with a comprehensive way to measure the cost of living for ordinary residents of 103 cities in the world. One of the features of our empirical methodology is that we make a distinction between the cost of living for expatriates and ordinary residents. We focus on the results pertaining to ordinary residents in this paper and would also like to emphasise that more often than not, the popular literature measuring cost of living tends to conflate the two, which we believe is methodologically flawed.[2] Finally, we would like to note that while we compute rankings for 103 cities, for reasons of brevity, we discuss in detail only the results for the top five cities that are renowned global financial centers as a means of illustration.

The remainder of the paper is structured as follows. Section 2 discusses the related literature on how to measure cost of living and in the process highlights the gaps in the literature that our paper attempts to fill. Section 3 outlines in detail the methodology used for constructing cost of living indices for 103 cities. The findings of the paper focusing on the trends in cost of living for the top five global financial centers in the world, viz. London, Hong Kong, Singapore, Tokyo and Zurich, with New York being used as the base city are discussed in Section 4. Section 5 concludes the paper and outlines future research areas.

2. Literature Review[3]

At the outset, it is important to emphasize that traditional economics literature has overwhelmingly focused on constructing cost of living indices as a broad framework to measuring the changes in costs of consumption necessary to sustain a standard of living. This has also been the guiding theoretical framework of measuring consumer price indices (CPI) in several advanced economies like the US. The literature pertaining to the controversies of whether a cost of living index should be the guiding basis for the measurement of CPI is quite old and still continues to this day (For a detailed discussion, see Triplett, 2000).

Interestingly, the concept of cost of living index is enmeshed with the broader idea of standard of living, however vague a term that might be. As the related literature notes, standard of living has been termed as an "elusive" and "complex" concept, more specifically from the point of view of measuring it (Bennett, 1937). While there is no consensus on how exactly one defines a standard of living, it is intuitive to argue that no metric that measures standard of living in absolute terms can be convincing enough in terms of its adequacy to reflect the entirety of the concept and hence the need to measure in relative terms. That being said, it is easier said than done because relative measures of standard of living also give rise to a whole host of methodological complications about relative comparisons and benchmarks which reduce their external validity.

Admittedly, despite the considerable difficulty confronting the measurement of standards of living, it appears that the discourse in the traditional economics literature about standard of living measurement appears to be intertwined with that of the discussion about cost of living, more specifically centered on consumption and income based measures. For instance, Blackorby and Russell (1978) posit that there is a direct proportional relationship between standard of living and cost of living, defining the cost of living index as "the ratio of costs of realizing a particular indifference surface or

[1]For more discussion, see Tan *et al*. (2015). It is pertinent to note that the two other popular studies on cost of living that exists today come from the Economist Intelligent Unit (EIU) and Mercer. On the one hand, the EIU annual World Cost of Living Index includes only cost of living for expatriates and the study is based on a single weight for the basket of goods and services which is geared towards Western consumption pattern. We suspect the ranking of the EIU study is sensitive to the choice of base city as in reply to our enquiry, EIU said "the reality is that the availability of goods and services and factors like rounding of numbers means that rebasing a city will produce slightly different results" which our approach would not (Jon Copestake, email message to ACI staff, Yuan Randong, September 8 2014). On the other hand, the Mercer study on Cost-of-Living Information Services is updated annually and provides only the ranking of cities according to cost of living for expatriates with no index value, and the Report offers the key to designing accurate expatriate compensation packages, accessible here: https://www.imercer.com/products/cost-of-living.aspx

[2]Mercer, EIU and other popular measures tend to conflate the two.

[3]This section is based on and builds upon Tan and Luu (2016).

level of real income at different prices". Pope (1993) explicitly ties down the cost of living as the relationship between per capita income and standard of living, where in the standard of living experiences upward mobility with a rise in average per capita income of individuals in a country.

If one moves beyond the treatment of cost of living indices in the context of consumption and price indices, there is a tangential strand of academic literature stemming from the urbanisation field that places cost of living as a necessary but insufficient condition for good "quality of life," especially in cities. There has been a burgeoning academic literature following the influential contributions of Florida (2002) that has recognized cities as the primary drivers of innovation and economic growth. While several urban centers globally have become hubs of creativity and innovation, one of the crucial indices that comes under the scanner in the context of global cities is the cost of living in such cities. To be sure, cost of living tends to be only one among a considerable number of dimensions to be factored in while benchmarking cities and assessing their "quality of life" as such.

Once again, the related literature is vague and there are no firm definitions for what the term "quality of life" should stand for. There are several locational and place-based features that constitute the basis of quality of life. Rogerson (1999) and Hasan (2007) provide a detailed discussion of these various attributes that form the basis of quality of life in the related literature. Despite the lack of consensus, several studies focusing on quality of life tend to include factors encompassing the physical environment, cost of living, specifically relating to food, housing costs and accessibility, healthcare and education relating to costs, access and quality (See Rogerson, 1999 and Hasan, 2007 and references cited within for the list of studies in this strand of literature).

Beyond conventional academic studies, the idea of quality of life has also been popular among several private and consulting organizations like the Economist Intelligence Unit (EIU) and Mercer, which also produce cost of living indices that we noted earlier in the introduction. One of the earliest studies in this direction was with the publication of the *Places Rated* Almanac, as noted by Rogerson (1999, p.969), which was a US based study ranking 354 metropolitan areas on the basis of various quality of life factors including cost of living that reflected the liveability of a place. While the study of rating the liveability of different cities based on various parameters is quite popular, there is no consensus on the appropriate measurement and interpretation of measures of the quality of life, whether it is at the city level or the aggregate country level. Interestingly, the notion of standard of living can be so broad that it can also be understood from the perspective of the freedom of individuals, a theme that heavily resonates in the works of Sen (1984). Though several alternative methods are being posited in the literature to measure standard of living, it is important to underline that these are all inter-linked in one way or the other. Whether one treats cost of living as a subset of standard of living or quality of life it is pivotal to not lose sight of the inter-linkages between these various notions.

Despite the disparate strands of literature, consumption based measures of standard of living appear to have stood the test of time, especially in the economics literature. The theoretical basis of the cost of living index as used in the traditional economics literature goes as far back as Konus (1939). Pollack (1989) and Diewert and Nakamura (1993) also provide useful reviews of the methodological issues surrounding cost of living indices. The relevant literature presents two approaches to designing and constructing cost-of-living indices. The former approach employs the use of estimated demand equations. However, this approach becomes increasingly difficult to execute at detailed disaggregation levels. This is attributable to the certainty that the number of parameters needing estimation in an extensive consumer demand system rises with the square of (one less than) the number of commodities. Moreover, the data involved in such analyses is subject to considerable aggregation, leading to an underestimation of their substitution bias estimate; the impact of substitution in consumption within various categories could be obfuscated by the aggregation process (Boskin *et al*., 1998; Braithwait, 1980; Goldberger and Gamaletsos, 1970).

The latter approach basically requires the computation of index numbers, typically at highly disaggregated levels. The most renowned index number formula is the Laspeyres index -- the ratio of the costs of a basket of goods in a particular time period (whereby statistical outcomes are accumulated) under two distinct price sets. This index measures fluctuations in the cost of a fixed basket of goods. It is based on the assumption that price changes do not induce substitution. This conscious omission of the substitution effect inevitably leads to an index that is subject to estimation errors (Afrait, 2004; Braithwait, 1980; Boskin *et al*., 1998).

A cost of living index could thus be used to record price fluctuations and provide users with the facility to glean comparisons between time periods of the minimum expenditure required to attain similar utility levels. It could also be expressed as the ratio of the expenditure needed in the derivation of a certain indifference curve of order preferences under the auspices of two price systems. The fundamental assumption for this index is that the average utility level and the impact of other factors (includes epidemics, government transfers, impact of disasters and taxes) remain constant (Gordon and Griliches, 1997; Pollack, 1975).

Price fluctuations brought about by technological change and variables impacting costs and quality result in consumers

consistently changing their consumption behavior. With rising affluence, consumer demand has also invariably tilted towards services and to products and services with greater quality, variation and comfort. This trend augmented by technological progress has led to a proliferation in the range of products and services (e.g. high-tech consumer products and IT services) over the past few decades, rendering the process of recording price fluctuations relatively more exigent (Boskin *et al*., 1998; Gordon and Griliches, 1997; Berndt, Griliches and Rappaport, 1995).

Traditional cost of living indices are however susceptible to significant bias. This could be attributed to inadequacies in making the requisite adjustments for variations in the quality of products and services procured by consumers. In addition, they fail in sufficiently accounting for the potentially increased utility provided by newly available products to consumers. The weaknesses presented by these gaps are compounded by price discrepancies across various retail outlets (Abraham, Greenlees and Moulton, 1998). In the case of the aforementioned Laspeyres index, an upward bias could result from the earlier cited failure to account for the impact of newly available products and services which provide comparable if not greater utility to buyers. The introduction of superior new products and services (assuming if they secure considerable market dominance) invariably exert significant downward pressure on overall prices. However, the impact of this trend is omitted, culminating in an index that tends to over-estimate the actual cost of living (Stigler, 1961; Noe and von Furstenberg, 1972). Researchers have long been cognisant of this inherent positive substitution bias in the Laspeyres index but have not, to date, succeeded in adequately addressing this issue (Dumagan and Mount, 1997). Moreover, these indices are usually driven by the impracticable assumption that the environment is not exposed to the vagaries of change; they omit the considerable impact of variations in demography, consumer trends and technology on the cost of living (Gordon and Griliches, 1997).

In an increasingly globalised world with its ever shifting demographics, cost of living indices should take into account the fact that a city's denizens often comprise the locals and expatriates. The costs of living between these two groups tend to be different due to their differing lifestyles, incomes and spending patterns. This paper expands on the earlier work in Tan *et al*. (2015) which makes a clear distinction between the cost of living for locals and expatriates across cities worldwide (Tan and Luu, 2016).

3. Methodology for Constructing Cost of Living Indices

For the purpose of this paper, the ordinary residents are assumed to follow local consumption preferences which differ from country to country. The framework that we propose on the cost of living for ordinary residents, with its 10 Consumption Categories, is an overarching, comprehensive and systematic way of examining cost of living in each city globally.

We have defined cost of living for ordinary residents according to 10 Consumption Categories: (1) Food & Non-alcoholic Beverages, (2) Alcohol & Tobacco, (3) Clothing, (4) Housing Rents & Utilities, (5) Household Supplies & Domestic Help, (6) Health, (7) Transport, (8) Recreation, (9) Education, and (10) Miscellaneous Goods & Services (see Figure 1).

Figure 1. The 10 ACI Consumption Categories

Source: Authors.

New York has been chosen as the base city for the study, with other cities being benchmarked against it. Apart from its reputation as a leading global city, New York is made the base city to facilitate comparison as similar studies on cost of living, wages and purchasing power have also used New York as the benchmark. The index values of New York are always 100.00.

As a summary measure of the overall cost of living in each city for the ordinary residents, we have derived the Cost of Living Index for Ordinary Residents which is made up of the 10 Consumption Categories. A larger Cost of Living Index for Ordinary Residents implies that the city is more expensive for the ordinary residents to live in. In contrast, a smaller Cost of Living Index denotes lower cost of living. Further, ordinary residents who live in cities with Cost of Living Index larger (smaller) than 100.00 face higher (lower) cost as compared to their counterparts in New York. Rankings are produced by arranging the index scores in each city in descending order. In other words, cities which are ranked at the top of the ranking are more expensive than those at the bottom.

3.1 Data Sources

The construction of the Cost of Living Index for Ordinary Residents requires data on prices, weights, inflation rates, nominal expenditure per capita, real expenditure per capita and exchange rates.

The price data for all 10 Consumption Categories, with the exception of Miscellaneous Goods & Services, are acquired from the EIU CityData,; the EIU CityData are available in local currency every year over the study period, from 2005 to 2013. On the other hand, the price data for Miscellaneous Goods & Services, reported in US dollar, are obtained and estimated from 2003, 2006, 2009 and 2012 UBS Prices and Earnings study.

Weights data are derived based on International Comparison Program (ICP) survey conducted by the World Bank and household expenditure surveys in various countries. As the World Bank ICP survey is implemented every six years, the 2005 and 2011 round of the ICP survey are referenced. The value of all weights data ranges from zero to one and together they sum to unity.

The data on inflation rate, nominal expenditure per capita and real expenditure per capita are used to construct the Cost of Living Index for Ordinary Residents as part of the adjustment factors. The annual inflation rates are mainly obtained from the World Bank World Development Indicators over the study period. On the other hand, the data on nominal expenditure per capita and real expenditure per capita are acquired from the World Bank ICP survey. As mentioned earlier, we only use two rounds of ICP survey with timeframes relevant to our study period, namely the 2005 and 2011 ICP survey.

As some price data and all wage data are reported in local currency, exchange rates are needed to convert those data into a common currency for comparison. In order to smooth the effects of daily fluctuations in the currency market, we use the yearly average exchange rate which is calculated based on the daily average exchange rate retrieved from the Bloomberg Terminal. All exchange rates used in this study are expressed in local currency against US dollar and they are listed in Appendix Table A1.

3.2 Assumptions Made

Partly due to data limitations, we have made several plausible assumptions when constructing the Cost of Living Indices for Ordinary Residents.

First, ordinary residents living in different cities of the same country are assumed to have the same consumption pattern, which varies from country to country and is different from that of the expatriates. In contrast to the expatriates who tend to enjoy western consumption preferences and gear towards high-end and lifestyle products, the consumption pattern of ordinary residents is influenced by geographical location, social values and cultural affiliation in the respective countries.

Second, consumption pattern of ordinary residents is assumed to change over time. The change in spending preference of ordinary residents partially affected by the variation in prices and quality of goods and services is reflected in different sets of weights being used for ordinary residents in each year.

Third, as ICP survey is conducted every six years, the proxy for the nominal expenditure per capita and real expenditure per capita in years not covered under the study would be based on exchange rates and inflation rates.

Finally, as the data for inflation rates, nominal expenditure per capita, real expenditure per capita, nominal monthly wages and mean weekly working hours are not available at city level, the national level data would be used as the proxy.

3.3 Constructing the Cost of Living Index and Ranking for Ordinary Residents

This section details the data and methodology used to construct the Cost of Living Index and Ranking for Ordinary Residents in 103 cities. The world's major 103 cities that are covered in our empirical exercise span six continents including Asia, Australasia, Europe, Middle East, North and South America and are shown in Appendix, Table A2.

Ordinary residents follow country-specific weights, which are influenced by geographical locations, social values and cultural affiliations in the respective countries. These country-specific weights are derived by analyzing the World Bank ICP surveys and household expenditure surveys conducted by relevant census departments and statistical agencies in various countries across the years.

The computation of Cost of Living Index and Ranking for Ordinary Residents, requires data on inflation rate, nominal expenditure per capita and real expenditure per capita as part of the adjustment factors. Most of the inflation rate data are acquired from the World Bank World Development Indicators with the following exceptions:

a. The inflation rates for Argentina from 2005 to 2013, Chile from 2005 to 2009 and Venezuela from 2005 to 2008 are retrieved from International Financial Statistics.

b. The inflation rates for Taiwan from 2005 to 2013 are retrieved from Taiwan Directorate General of Budget, Accounting and Statistics, PC-AXIS database.

c. The inflation rates for United Arab Emirates from 2005 to 2007 and 2012 to 2013 are retrieved from United Arab Emirates National Bureau of Statistics.

The nominal expenditure per capita and real expenditure per capita on the 10 Consumption Categories for each country and the world are obtained from the World Bank ICP survey. The overall nominal (or real) expenditure per capita is the sum of the nominal (or real) expenditure per capita on the 10 Consumption Categories. This dataset is almost complete except for two countries:

a. The data for United Arab Emirates are missing in 2005 round of ICP survey. Qatar data are used as the proxy.

b. The data for Argentina are missing in 2011 round of ICP survey. Brazil data are used as the proxy.

3.3.1 Computation of Cost of Living Index and Ranking for Ordinary Residents

$$\text{Cost of Living Index for Ordinary Residents in city m} = \frac{CP^{EIU}_{C,m} \times \frac{NP^{ICP}_{C}}{NP^{EIU}_{C}}}{CP^{EIU}_{US,NY} \times \frac{NP^{ICP}_{US}}{NP^{EIU}_{US}}} * 100 \qquad \text{(Equation 1)}$$

where

m = city;

C = the country where city m is located in;

NY = New York;

US = United States;

$$CP_{C,m}^{EIU} = \sum_{i=1}^{n} P_{C,m,i} \times W_{C,i} \quad \text{(Equation 2);}$$

i = item;

n = number of items in the consumption basket;

$P_{C,m,i}$ = average price of item i in city m of country C;

$W_{C,i}$ = weight of item i within Cost of Living Index for Ordinary Residents in country C;

$$NP_{C}^{ICP} = \frac{\text{index of nominal expenditure per capita for country C}}{\text{index of real expenditure per capita for country C}} \quad \text{(Equation 3);}$$

$$\text{index of nominal expenditure per capita for country C} = \frac{\text{nominal expenditure per capita for country C}}{\text{nominal expenditure per capita of the world}};$$

$$\text{index of real expenditure per capita for country C} = \frac{\text{real expenditure per capita for country C}}{\text{real expenditure per capita of the world}};$$

NP_{C}^{EIU} = mean $CP_{C,m}^{EIU}$ from all cities within country C.

The Cost of Living Index for Ordinary Residents is made up of three main components, namely $CP_{C,m}^{EIU}$, NP_{C}^{ICP}, and NP_{C}^{EIU}. Firstly, $CP_{C,m}^{EIU}$ is constructed using the average price of each item, $P_{C,m,i}$, and its respective weight. For ordinary residents, the weight of each item, $W_{C,i}$, are country-specific as they reflect the different consumption pattern of ordinary residents in each country. These baskets of goods and services tend to follow the local pattern of consumption. Moreover, the weights of all items that together describe the total cost of living in each city will sum up to unity. In mathematical expression, $\sum_{i=1}^{n} W_{C,i} = 1$. As for the prices, first, we take an average of all prices collected from the various sales location for the same item in each city, followed by converting the average prices which are reported in local currencies into US dollar. The prices and weights are then combined using Equation 2 to obtain$CP_{C,m}^{EIU}$.

$$CP_{C,m}^{EIU} = \sum_{i=1}^{n} P_{C,m,i} \times W_{C,i} \quad \text{(Equation 2)}$$

where

m = city;

C = the country where city m is located in;

i = item;

n = number of items in the consumption basket;

$P_{C,m,i}$ = average price of item i in city m of country C;

$W_{C,i}$ = weight of item i within Cost of Living Index for Ordinary Residents in country C.

As the EIU data are reflective of the prices and consumption behavior of the expatriates at city level while World Bank ICP data are indicative of that of ordinary residents at the national level, some adjustment needs to be introduced to $CP_{C,m}^{EIU}$ in order to construct the Cost of Living Index for Ordinary Residents. We thus use two adjustment factors, namely NP_{C}^{ICP} and NP_{C}^{EIU}.

For the first adjustment factor, NP_{C}^{ICP}, it is constructed using data from the ICP which include both the nominal expenditure per capita and real expenditure per capita for each country as well as the world. All data used are denominated in US dollar and NP_{C}^{ICP} is as defined in Equation 3.

$$NP_{C}^{ICP} = \frac{\text{index of nominal expenditure per capita for country C}}{\text{index of real expenditure per capita for country C}} \quad \text{(Equation 3)}$$

where

C = country;

$$\text{index of nominal expenditure per capita for country C} = \frac{\text{nominal expenditure per capita for country C}}{\text{nominal expenditure per capita of the world}};$$

$$\text{index of real expenditure per capita for country C} = \frac{\text{real expenditure per capita for country C}}{\text{real expenditure per capita of the world}}.$$

The NP_C^{ICP} could be understood as the price level per unit real consumption for ordinary residents living in country C. In other words, it is the cost of living for ordinary residents in country C based on the ICP survey. This adjustment factor is multiplied to $CP_{C,m}^{EIU}$ to introduce the cost of living for ordinary residents based on ICP survey. The constraint of this adjustment factor is that it is available at national level only.

Since the ICP data are available at six-year intervals and only the 2005 and 2011 survey rounds are relevant for our study period, we proxy for NP_C^{ICP} for 2006-2010 and 2012-2013 by taking into account extra information in exchange rates and inflation rates. The NP_C^{ICP} in 2006 to 2010 are thus constructed as Equation 4.

$$NP_{C,T}^{ICP} = NP_{C,2005}^{ICP} \times \frac{\text{Exchange Rate}_{C,2005}}{\text{Exchange Rate}_{C,T}} \times \prod_{t=2006}^{T}(1 + \text{Inflation rate}_{C,t}) \; \forall \; T \in (2006, 2007, 2008, 2009 \text{ and } 2010) \quad \text{(Equation 4)}$$

where

C = country;

T = year;

$NP_{C,T}^{ICP} = NP_C^{ICP}$ in year T;

$\text{Inflation rate}_{C,t}$ = yearly average inflation rate for country C in year t;

$\text{Exchange Rate}_{C,T}$ = yearly average exchange rate between country C and the United States in year T (expressed as local currency unit per US dollar).

For instance, if we want to construct the $NP_{C,2007}^{ICP}$ (i.e. the NP_C^{ICP} for country C in 2007), we would first need to multiply $NP_{C,2005}^{ICP}$ by the 2005 exchange rate between country C and the United States (expressed as local currency unit per US dollar), then multiply it with the cumulative inflation rate between 2005 to 2007, and lastly divide it by the 2007 exchange rate between country C and the United States (expressed as local currency unit per US dollar). As mentioned above, we could understand NP_C^{ICP} as the cost of living for ordinary residents living in country C based on the ICP survey. As such, the $NP_{C,2005}^{ICP}$ could be understood as the cost of living for ordinary residents in 2005, calculated based on US dollar, so that we have a common basis for comparison. This figure is thus subjected to the 2005 exchange rate between country C and the United States. In order for us to construct the $NP_{C,2007}^{ICP}$, we would need to remove the effect of exchange rate in 2005 and at the same time introduce the effect of exchange rate in 2007. Moreover, during the 2005 to 2007 period, the inflation rate would affect the cost of living for ordinary residents. Thus we have also incorporated the cumulative inflation rate into the equation.

By applying the same rationale, the NP_C^{ICP} in 2012 and 2013 can be constructed using the following Equation 5.

$$NP_{C,T}^{ICP} = NP_{C,2011}^{ICP} \times \frac{\text{Exchange Rate}_{C,2011}}{\text{Exchange Rate}_{C,T}} \times \prod_{t=2012}^{T}(1 + \text{Inflation rate}_{C,t}) \; \forall \; T \in (2012 \text{ and } 2013) \quad \text{(Equation 5)}$$

where

C = country;

T = year;

$NP_{C,T}^{ICP} = NP_C^{ICP}$ in year T;

$\text{Inflation rate}_{C,t}$ = yearly average inflation rate for country C in year t;

$\text{Exchange Rate}_{C,T}$ = yearly average exchange rate between country C and the United States in year T (expressed as local currency unit per US dollar).

The NP_C^{ICP} for the period 2006-2010 are calculated based on $NP_{C,2005}^{ICP}$, while the NP_C^{ICP} for the period 2012-2013 are calculated based on $NP_{C,2011}^{ICP}$; this difference in calculation methodology could result in some break in result trends between 2010 and 2011. Indeed, the "Purchasing Power Parities and Real Expenditures of World Economies: Summary of Results and Findings of the 2011 International Comparison Program" by the World Bank has cautioned us against comparing data from the 2005 survey to that of the 2011 (The World Bank, 2011). One of the main reasons cited was the change in methodology used for these two rounds of surveys. As such, we have segmented the findings of our study on Cost of Living for Ordinary Residents based on two sub-periods, 2005 to 2010 and 2011 to 2013. This is one of the constraints of our study.

As for the second adjustment factor, NP_C^{EIU}, it is constructed based on $CP_{C,m}^{EIU}$ as defined in Equation 3.4.2 using the following Equation 6.

$$NP_C^{EIU} = \frac{1}{N_C}\sum_{m \in C} CP_{C,m}^{EIU} \quad \text{(Equation 6)}$$

where

m = city;

C = the country where city m is located in;

$N_C =$ number of cities in country C;

$CP_{C,m}^{EIU}$ is as defined in Equation 2.

The NP_C^{EIU} is the mean value of $CP_{C,m}^{EIU}$ from all cities within country C. It could be understood as a proxy for general level of $CP_{C,m}^{EIU}$ in country C. In other words, it reflects the cost incurred by ordinary residents living in country C based on the EIU data. In the calculation of Cost of Living Index for Ordinary Residents, this adjustment factor is used to divide $CP_{C,m}^{EIU}$. This would serve to offset the effect of using expatriates' consumption basket as well as the effect of using national level data.

Therefore, the two adjustment factors, NP_C^{ICP} and NP_C^{EIU}, are applied to the $CP_{C,m}^{EIU}$ using Equation 1 to construct the Cost of Living Index for Ordinary Residents in each city.

$$\text{Cost of Living Index for Ordinary Residents in city m} = \frac{CP_{C,m}^{EIU} \times \frac{NP_C^{ICP}}{NP_C^{EIU}}}{CP_{US,NY}^{EIU} \times \frac{NP_{US}^{ICP}}{NP_{US}^{EIU}}} * 100 \quad \text{(Equation 1)}$$

There is an alternative approach to parse Equation 1 and interpret its structure, which would offer another vantage point from which we could gain a clearer view on the issue of controlling for utility in constructing the Cost of Living Index and Ranking for Ordinary Residents. As mentioned previously, the term NP_C^{ICP} could be understood as the price level per unit real consumption for ordinary residents living in country C based on data from ICP surveys, which is standardized against the world level as defined by Equation 3. Since the term NP_C^{ICP} could be construed as the standardised price per unit real consumption of goods and services for ordinary residents in a country, it actually by itself forms a measure of the cost of living for ordinary residents while controlling for the utility level, or standard of living, across the countries for which NP_C^{ICP} is calculated, as it pins down the level of such consumption at a fixed amount across countries.

Had the ICP achieved a finer degree of granularity by conducting their surveys and compiling the data at city levels (at least in those representative cities under our study per each country with each city being a statistical unit), we could have been able to exclusively use the ICP data to construct a cost of living index for ordinary residents in cities around the world. Since the ICP data are only available at national level in reality, we could still make use of such data by incorporating them into the construction of the index for the cost of living for ordinary residents, as reflected by

including the term NP_C^{ICP} into Equation 1, while integrating it with some relevant factors to arrive at a practical proxy for the variations among cities within each country in terms of the cost of living for ordinary residents. The inclusion of the ratio between $CP_{C,m}^{EIU}$ and NP_C^{EIU} into Equation 1 could be viewed as providing such a proxy for generating the city level variations in a specific country C.

As defined by Equation 2, $CP_{C,m}^{EIU}$ gives a measure of the cost of living index for ordinary residents with their own consumption patterns but using the prices of the consumption items for expatriates as in the EIU data, assuming such data for prices would generally correlate with the data for prices of the counterpart items in the consumption basket for ordinary residents in each city. As defined by Equation 6, NP_C^{EIU} is simply the average of the values of $CP_{C,m}^{EIU}$ for all the cities within country C. Thus, the ratio between $CP_{C,m}^{EIU}$ and NP_C^{EIU} (i.e. the former divided by the latter) could be viewed as an indicator of how high the cost of living is for ordinary residents in a particular city as compared to the national average, as a value of one for this ratio would mean that city m is on par with the national average level of country C in terms of the cost of living for ordinary residents, and a value above or below one will imply that city m has higher or lower cost of living for ordinary residents as compared to the national average level of country C respectively. Combining this ratio with the term NP_C^{ICP} as in Equation 1, therefore, would provide an assessment of the cost of living for ordinary residents for each city, utilizing the available relevant datasets from both ICP at national level and EIU at city level.

To the extent that the term NP_C^{ICP} controls for utility across countries as it is in essence a standardized price index for per unit real consumption, and that the introduction of the ratio between $CP_{C,m}^{EIU}$ and NP_C^{EIU} proxies for the variations among cities within a country while maintaining such controlling for utility, the Cost of Living Index for Ordinary Residents so constructed in Equation 1 to allow the comparison in cost of living for ordinary residents across cities around the world also controls for utility. It is extremely important to put in explicit efforts to control for utility or standard of living when conceptualizing a framework and designing a methodology for comparing cost of living, as in essence the notion of cost of living should directly relate to the amount of monetary expenses required for maintain a certain standard of living or generating a certain level of utility for the person who spends that amount.

A cost of living index or ranking constructed without controlling for utility would be meaningless, as a higher or lower index value for the cost of living may be mostly a result of higher or lower utility and better or worse standard of living associated with such level of living expenses, or in other words, one would never ascertain whether he is comparing apples to apples. Hence, without controlling for utility, the results of any cost of living analysis would be of limited use as the resultant ranking or comparison could only be done on an inherently unfair basis. Some may argue that such attempts to control for utility could never be perfect, as utility is affected by the natural endowment of the city such as climate, landscape, natural scenery and so on, which may not be captured by monetary data in terms of prices in the markets for goods and services. While that statement is certainly true as those factors do affect a person's utility level or standard of living, we should bear in mind that it is not the total utility level or overall standard of living that is of our concern here. Rather, we are focusing on a subset of the total utility or overall standard of living that is underpinned by the results of consuming goods and services. Some may point out that controlling for the utility generated by the consumption of goods and services is still not the perfect approach, as the quality of services may differ and so do the types of goods available in different regions of the world. Nevertheless, we should strive, as conceptually mulled in the analysis framework and concretely reflected in the methodology, to control for utility by making explicit efforts in order to make the comparison in cost of living meaningful.

The Cost of Living Index for Ordinary Residents reflects the cost of consuming all goods and services in the consumption basket of ordinary residents living in city m relative to those in New York. With New York chosen as the base city, the Cost of Living Index for Ordinary Residents in New York will always be 100.00. Finally, the Cost of Living Ranking for Ordinary Residents could be generated by arranging the Cost of Living Index for Ordinary Residents in each city in a descending order. A city which is more expensive (cheaper) for the ordinary residents to live in will have a larger (smaller) Cost of Living Index and thus occupy a higher (lower) position in the Cost of Living Ranking for Ordinary Residents.

One advantage of our methodology lies in the fact that the Cost of Living Ranking for Ordinary Residents would not be sensitive to the choice of base city. Whether the base city is chosen to be New York, Beijing, Tokyo or any other city,

the ranking would remain the same. This property of the ranking methodology for cost of living analysis is crucial for the objectivity of the research, because one does not know a priori the order of the ranking prior to conducting the calculation to arrive at the results and one's subjective choice of the base city should not interfere with the order of the ranking. If, for example, using New York as the base city would yield a different sequence in the ranking for cost of living as compared to the case where London is used as the base city, such inconsistency would be indicative of dubious results. Consequently, the validity of such rankings and its reliability as a source of reference to a global audience is highly questionable.

3.3.2 Constructing the 10 Consumption Categories Indices and Rankings for Ordinary Residents

Beside the Cost of Living Index and Ranking for Ordinary Residents, our study also constructs indices and rankings for each of the 10 Consumption Categories. This allows us to not only look at the overall cost of living in a particular city, but also to examine the cost of certain Consumption Categories, for example Food & Non-alcoholic Beverages, Transport or Housing Rents & Utilities. The Consumption Category j Index for Ordinary Residents in city m is defined as Equation 7.

$$\text{Consumption Category j Index for Ordinary Residents in city m} = \frac{CP^{EIU}_{C,m,j} \times \frac{NP^{ICP}_{C,j}}{NP^{EIU}_{C,j}}}{CP^{EIU}_{US,NY,j} \times \frac{NP^{ICP}_{US,j}}{NP^{EIU}_{US,j}}} * 100 \quad \text{(Equation 7)}$$

where

m = city;

C = the country where city m is located in;

NY = New York;

US = United States;

$$CP^{EIU}_{C,m,j} = \sum_{i=1}^{n_j} P_{C,m,i} \times \omega_{C,i} \quad \text{(Equation 8);}$$

i = item;

j = Consumption Category of which item i is in;

n_j = number of items in Consumption Category j;

$P_{C,m,i}$ = average price of item i in city m of country C;

$\omega_{C,i}$ = normalized weight of item i based on its Consumption Category for country C;

$$NP^{ICP}_{C,j} = \frac{\text{index of nominal expenditure per capita on Consumption Category j for country C}}{\text{index of real expenditure per capita on Consumption Category j for country C}} \quad \text{(Equation 9)}$$

$$\text{index of nominal expenditure per capita on Consumption Category j for country C} = \frac{\text{nominal expenditure per capita on Consumption Category j for country C}}{\text{nominal expenditure per capita on Consumption Category j of the world}};$$

$$\text{index of real expenditure per capita on Consumption Category j for country C} = \frac{\text{real expenditure per capita on Consumption Category j for country C}}{\text{real expenditure per capita on Consumption Category j of the world}};$$

$NP^{EIU}_{C,j}$ = mean $CP^{EIU}_{C,m,j}$ from all cities within country C.

Similar to the Cost of Living Index for Ordinary Residents, the Consumption Category j Index for Ordinary Residents is made up of three parts, namely $CP^{EIU}_{C,m,j}$, $NP^{ICP}_{C,j}$, and $NP^{EIU}_{C,j}$. Firstly, $CP^{EIU}_{C,m,j}$ is constructed using two inputs, the prices and weights. As for the weights data, the normalized weight of each item based on its respective Consumption Category, $\omega_{C,i}$, are employed instead. $\omega_{C,i}$ is obtained by dividing the weight with the sum of all the weights of items belonging to the same consumption category. In mathematical form, $\omega_{C,i} = \frac{W_{C,i}}{\sum_{i \in j} W_{C,i}}$. The normalized weights of all items within the same consumption category would sum to unity (i.e. $\sum_{i=1}^{n_j} \omega_{C,i} = 1$). The normalized weight of each item, $\omega_{C,i}$, is

also country-specific as the weights reflect the different consumption pattern of ordinary residents in each country. We could then combine these $P_{C,m,i}$ with their respective normalized weights, $\omega_{C,i}$, to obtain the $CP^{EIU}_{C,m,j}$ using Equation 8.

$$CP^{EIU}_{C,m,j} = \sum_{i=1}^{n_j} P_{C,m,i} \times \omega_{C,i} \quad \text{(Equation 8)}$$

where

m = city;

C = the country where city m is located in;

i = item;

j = Consumption Category of which item i is in;

n_j = number of items in Consumption Category j;

$P_{C,m,i}$ = average price of item i in city m of country C;

$\omega_{C,i}$ = normalized weight of item i based on its Consumption Category for country C.

We could understand $CP^{EIU}_{C,m,j}$ as the cost of consuming all goods and services enjoyed by the expatriates that are under that particular Consumption Category j by ordinary residents but with ordinary residents' own consumption pattern.

As the EIU data are reflective of the prices and consumption behavior of the expatriates at city level while World Bank ICP data are indicative of that of ordinary residents at the national level, some adjustment factors need to be introduced to $CP^{EIU}_{C,m,j}$ in order to construct the Consumption Category j Index for Ordinary Residents. We thus use two adjustment factors, namely $NP^{ICP}_{C,j}$ and $NP^{EIU}_{C,j}$.

For the first adjustment factor, $NP^{ICP}_{C,j}$, it is constructed using data from the ICP which include both the nominal expenditure per capita and real expenditure per capita for each country as well as the world. All data used are denominated in US dollar and $NP^{ICP}_{C,j}$ is as defined in Equation 9.

$$NP^{ICP}_{C,j} = \frac{\text{index of nominal expenditure per capita on Consumption Category j for country C}}{\text{index of real expenditure per capita on Consumption Category j for country C}} \quad \text{(Equation 9)}$$

where

C = country;

$$\text{index of nominal expenditure per capita on Consumption Category j for country C} = \frac{\text{nominal expenditure per capita on Consumption Category j for country C}}{\text{nominal expenditure per capita on Consumption Category j of the world}};$$

$$\text{index of real expenditure per capita on Consumption Category j for country C} = \frac{\text{real expenditure per capita on Consumption Category j for country C}}{\text{real expenditure per capita on Consumption Category j of the world}}.$$

The $NP^{ICP}_{C,j}$ could be understood as the price level per unit real consumption of Consumption Category j for ordinary residents living in country C. In other words, it is the cost of consuming Consumption Category j for ordinary residents in country C based on the ICP survey. This adjustment factor is multiplied to $CP^{EIU}_{C,m,j}$ to introduce the cost of consuming Consumption Category j for ordinary residents based on ICP survey. The constraint of this adjustment factor is that it is available at national level only.

Since the ICP data are available in 2005 and 2011 only, we construct $NP^{ICP}_{C,j}$ for 2006 to 2010 and 2012 to 2013 by taking into account extra information in exchange rates and inflation rates, which reflect the key factors affecting the comparison of cost of various Consumption Categories for ordinary residents living in different countries. The $NP^{ICP}_{C,j}$ in 2006 to 2010 are thus constructed as Equation 10.

$$NP^{ICP}_{C,j,T} = NP^{ICP}_{C,j,2005} \times \frac{\text{Exchange Rate}_{C,2005}}{\text{Exchange Rate}_{C,T}} \times \prod_{t=2006}^{T} (1 + \text{Inflation rate}_{C,t}) \; \forall \; T \in (2006, 2007, 2008, 2009 \text{ and } 2010) \quad \text{(Equation 10)}$$

where

C = country; T = year;

$NP^{ICP}_{C,j,T} = NP^{ICP}_{C,j}$ in year T; $\text{Inflation rate}_{C,t}$ = yearly average inflation rate for country C in year t;

$\text{Exchange Rate}_{C,T}$ = yearly average exchange rate between country C and the United States in year T (expressed as local currency unit per US dollar).

For example, if we want to construct the $NP^{ICP}_{C,j,2007}$ (i.e. the $NP^{ICP}_{C,j}$ for country C in 2007), we would first need to multiply $NP^{ICP}_{C,j,2005}$ by the 2005 exchange rate between country C and the United States (expressed as local currency unit per US dollar), then multiply it with the cumulative inflation rate between 2005 to 2007, and lastly divide it by the 2007 exchange rate between country C and the United States (expressed as local currency unit per US dollar). As mentioned above, we could understand $NP^{ICP}_{C,j}$ as the cost of consuming Consumption Category j for ordinary residents in country C based on the ICP survey. As such, the $NP^{ICP}_{C,j,2005}$ could be understood as the cost of consuming Consumption Category j for ordinary residents in 2005, calculated based on US dollar, so that we have a common basis for comparison. This figure is thus subjected to the 2005 exchange rate between country C and the United States. In order for us to construct the $NP^{ICP}_{C,j,2007}$, we would need to remove the effect of exchange rate in 2005 and at the same time introduce the effect of exchange rate in 2007. Also, during the 2005 to 2007 period, inflation rate would affect the cost of consuming Consumption Category j for ordinary residents. We have therefore incorporated the cumulative inflation rate into the equation as well.

By applying the same rationale, the $NP^{ICP}_{C,j}$ in 2012 and 2013 could be constructed using the following Equation 11.

$$NP^{ICP}_{C,j,T} = NP^{ICP}_{C,j,2011} \times \frac{\text{Exchange Rate}_{C,2011}}{\text{Exchange Rate}_{C,T}} \times \prod_{t=2012}^{T}\left(1 + \text{Inflation rate}_{C,t}\right) \forall\, T \in (2012 \text{ and } 2013) \quad \text{(Equation 11)}$$

where

C = country; T = year;

$NP^{ICP}_{C,j,T} = NP^{ICP}_{C,j}$ in year T; $\text{Inflation rate}_{C,t}$ = yearly average inflation rate for country C in year t;

$\text{Exchange Rate}_{C,T}$ = yearly average exchange rate between country C and the United States in year T (expressed as local currency unit per US dollar).

Since the $NP^{ICP}_{C,j}$ for the period 2006-2010 are calculated based on $NP^{ICP}_{C,j,2005}$, while the $NP^{ICP}_{C,j}$ for the period 2012-2013 are calculated based on $NP^{ICP}_{C,j,2011}$, we might expect to see some break in trend for results between 2010 and 2011. The reasons for this observation have been discussed in the earlier.

As for the second adjustment factor, $NP^{EIU}_{C,j}$, it is constructed based on $CP^{EIU}_{C,m,j}$ as defined in Equation 8 using the following Equation 12.

$$NP^{EIU}_{C,j} = \frac{1}{N_C}\sum_{m \in C} CP^{EIU}_{C,m,j} \quad \text{(Equation 12)}$$

where

m = city;

C = the country where city m is located in;

$N_C =$ number of cities in country C;

$CP^{EIU}_{C,m,j}$ is as defined in Equation 7.

The $NP^{EIU}_{C,j}$ is the mean value of $CP^{EIU}_{C,m,j}$ from all cities within country C. It could be understood as a proxy for general level of $CP^{EIU}_{C,m,j}$ in country C. In other words, the cost incurred by ordinary residents living in country C for consuming all goods and services under that particular consumption category based on the EIU data. In the calculation of Consumption Category j Index for Ordinary Residents, this adjustment factor is used to divide $CP^{EIU}_{C,m,j}$. This would serve to offset the effect of using expatriates' consumption basket as well as the effect of using national level data.

Therefore, the two adjustment factors, $NP^{ICP}_{C,j}$ and $NP^{EIU}_{C,j}$, are applied to the $CP^{EIU}_{C,m,j}$ using Equation 7 to construct the

Consumption Category j Index for Ordinary Residents in each city.

The Consumption Category j Index for Ordinary Residents reflects the cost of consuming a specific Consumption Category by ordinary residents living in city m relative to those in New York. For example, the Transport Index for Ordinary Residents in city m illustrates the transport cost for ordinary residents living in city m relative to their counterparts in New York. With New York chosen as the base city, the Consumption Category j Index for Ordinary Residents in New York will always be 100.00.

Likewise, the Consumption Category j ranking for Ordinary Residents is obtained by arranging its corresponding Consumption Category j Index in a descending order. Cities which are ranked at the top of the ranking are more expensive than those at the bottom. For a more elaborate treatment of how the 10 Consumption Categories Indices and Rankings for Ordinary Residents are constructed, see Tan and Luu (2016).

As in the case of constructing the Cost of Living Index and Ranking for Ordinary Residents, our methodology in constructing the 10 Consumption Categories Indices and Rankings for Ordinary Residents has the same advantage that the rankings generated would not be sensitive to the choice of base city.

4. Empirical Findings

We conduct the exercises explained above for 103 cities between 2005 and 2013. The entire Cost of Living rankings for Ordinary Residents in 103 World's Major Cities from 2005-2013 are furnished in Table A2. In the interest of space, we provide the trends in cost of living indices that we construct as explained above for the five cities which are global financial centers, namely London, Hong Kong, Singapore, Tokyo and Zurich. Since we use New York as our benchmark city, we discuss below the trends in cost of living rankings for these global financial centers, based on the consumption categories that we developed. It is worth reiterating that the rankings were generated for 103 cities in total and it is merely for the purposes of illustration that we focus on the global financial centers here.

All the figures illustrated below capture the Cost of Living and 10 Consumption Categories Rankings for Ordinary Residents in the top global financial centers listed earlier. The horizontal axis denotes the years in the study period while the vertical axis shows the rankings of a particular city. Rankings range from first to 103rd with first meaning the highest cost and 103rd indicating the lowest cost.

4.1 London

London, the capital city of the United Kingdom, is renowned for its ethnic and cultural diversity with more than 300 languages spoken within the city. The city's Cost of Living Ranking for Ordinary Residents, as denoted by the grey bars, declined sharply from 12th to 38th between 2005 and 2010, but rose from 26th to 21st between 2011 and 2013 (see Figure 2). For a more rigorous comparison of rankings, we have split the analysis into two sub-periods.

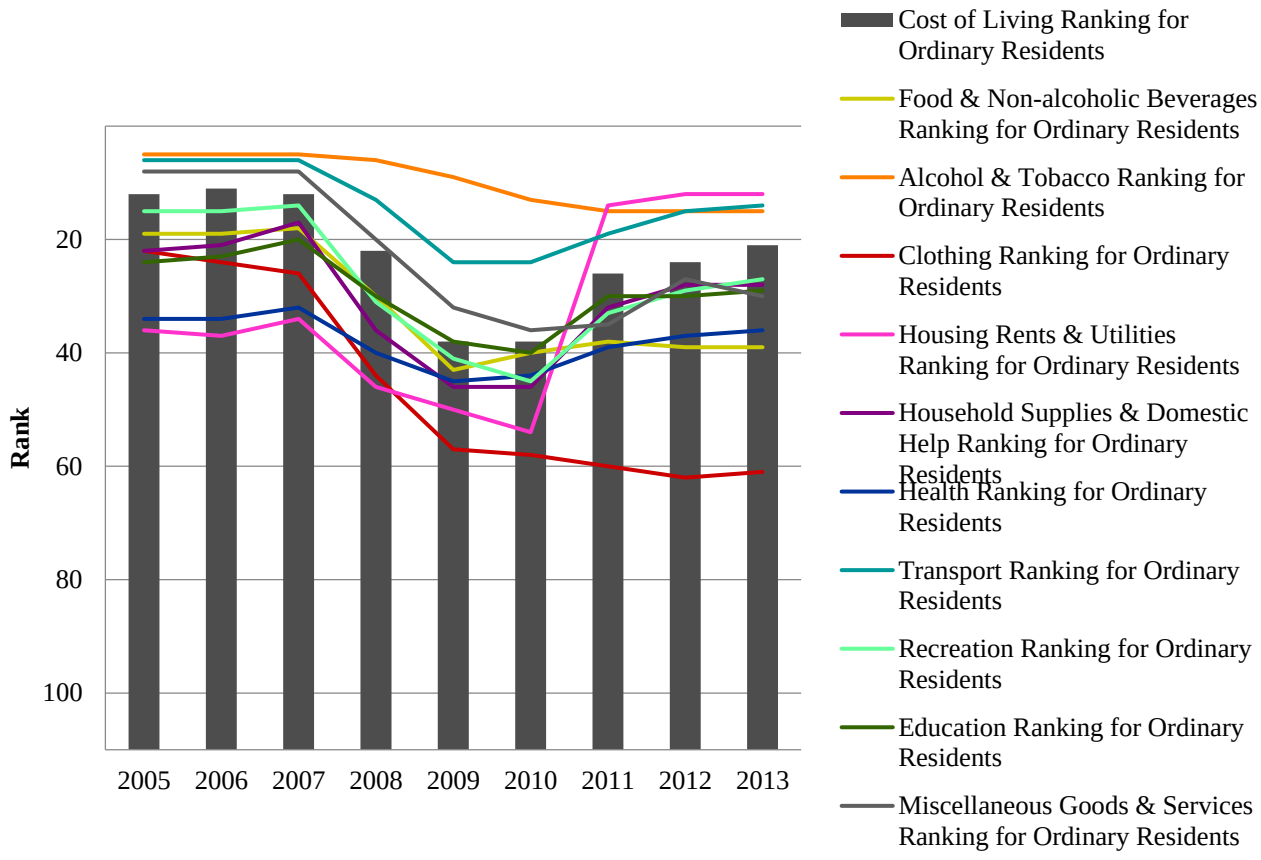

Figure 2. Cost of Living and 10 Consumption Categories Rankings for Ordinary Residents in London, Great Britain

Source: Authors

The rankings of all categories went down over the first sub-period from 2005 to 2010. In particular, Clothing Ranking fell 36 places from 22nd in 2005 to 58th in 2010. Household Supplies & Domestic Help Ranking slipped 24 spots from 22nd to 46th between 2005 and 2010. Food & Non-alcoholic Beverages ranking moved down 21 places from 19th to 40th over the first sub-period. Housing Rents & Utilities and Transport Rankings both dropped 18 spots from 36th to 54th and sixth to 24th, respectively, between 2005 and 2010. Health and Education Rankings declined from 34th to 44th and 24th to 40th, respectively, over the same sub-period.

In the second sub-period between 2011 and 2013, Transport Ranking jumped five places from 19th to 14th. Household Supplies & Domestic Help Ranking went up four spots from 32nd in 2011 to 28th in 2013. Health Ranking moved up three places from 39th to 36th over the same sub-period. Housing Rents & Utilities was the highest ranked category for the entire second sub-period as its ranking rose from 14th in 2011 to 12th in 2013. Education Ranking went up slightly from 30th to 29th between 2011 and 2013. In contrast, Clothing and Food & Non-alcoholic Beverages Rankings both slipped one spot from 60th to 61st and 38th to 39th, respectively, over the same sub-period, making them the lowest and second lowest ranked category in 2013.

4.2 Hong Kong

Situated on the southern coast of China, Hong Kong is widely renowned for its advanced public transportation network with 90% of the population relying on it – the highest rate in the world. The city's Cost of Living ranking for Ordinary Residents, as denoted by the grey bars, declined from 56th to 62nd between 2005 and 2010, but rose from 63rd to 59th between 2011 and 2013 (see Figure 3).

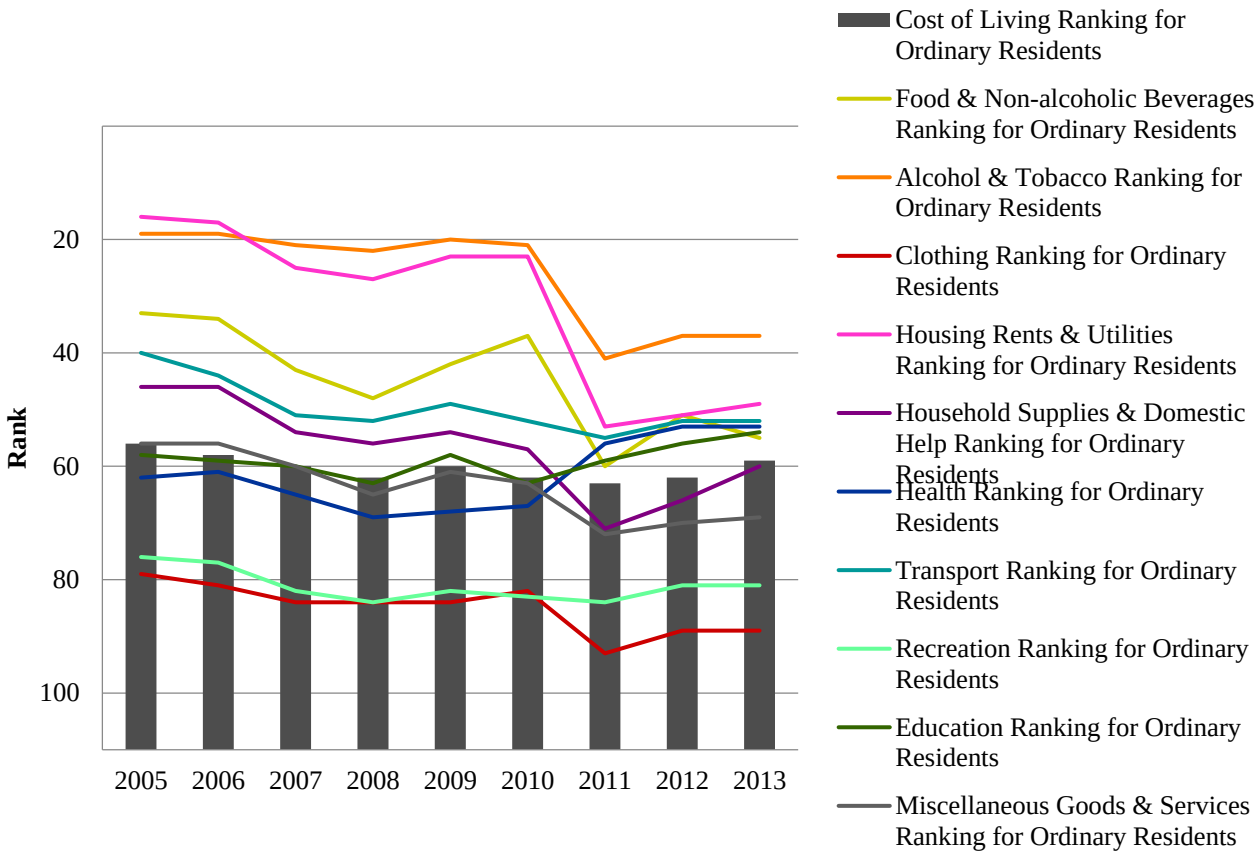

Figure 3. Cost of Living and 10 Consumption Categories Rankings for Ordinary Residents in Hong Kong, China

Source: Authors

Splitting the analysis into two sub-periods, we find that the rankings of all 10 categories declined over the first sub-period between 2005 and 2010. In particular, Transport Ranking fell 12 places from 40th in 2005 to 52nd in 2010. Housing Rents & Utilities Ranking slipped seven spots from 16th to 23rd between 2005 and 2010. Health and Education Rankings both moved down five places from 62nd to 67th and 58th to 63rd, respectively, over the first sub-period. Food & Non-alcoholic Beverages ranking went down from 33rd in 2005 to 37th place in 2010.

In contrast, all categories rose in rankings in the second sub-period from 2011 to 2013. Household Supplies & Domestic Help saw the most remarkable rise in ranking as it jumped 11 places from 71st in 2011 to 60th in 2013. Food & Non-alcoholic Beverages and Education Rankings moved up five spots from 60th to 55th and 59th to 54th, respectively, between 2011 and 2013. Housing Rents & Utilities Ranking climbed four places from 53rd in 2011 to 49th in 2013, making it the second highest ranked category throughout the second sub-period after Alcohol & Tobacco. Health and Transport Rankings both went up three spots from 56th to 53rd and 55th to 52nd, respectively, over the second sub-period. Clothing was consistently the lowest ranked category between 2011 and 2013 although its ranking rose from 93rd to 89th over the same sub-period.

4.3 Singapore

Widely renowned as one of the four Asian Tigers, Singapore has developed rapidly into one of the world's major commercial and financial hubs since its independence in 1965. The city-state's Cost of Living Ranking for Ordinary Residents, as denoted by the grey bars, moved up five places from 58th to 53rd between 2005 and 2010, and jumped seven places from 55th to 48th between 2011 and 2013 (see Figure 4).

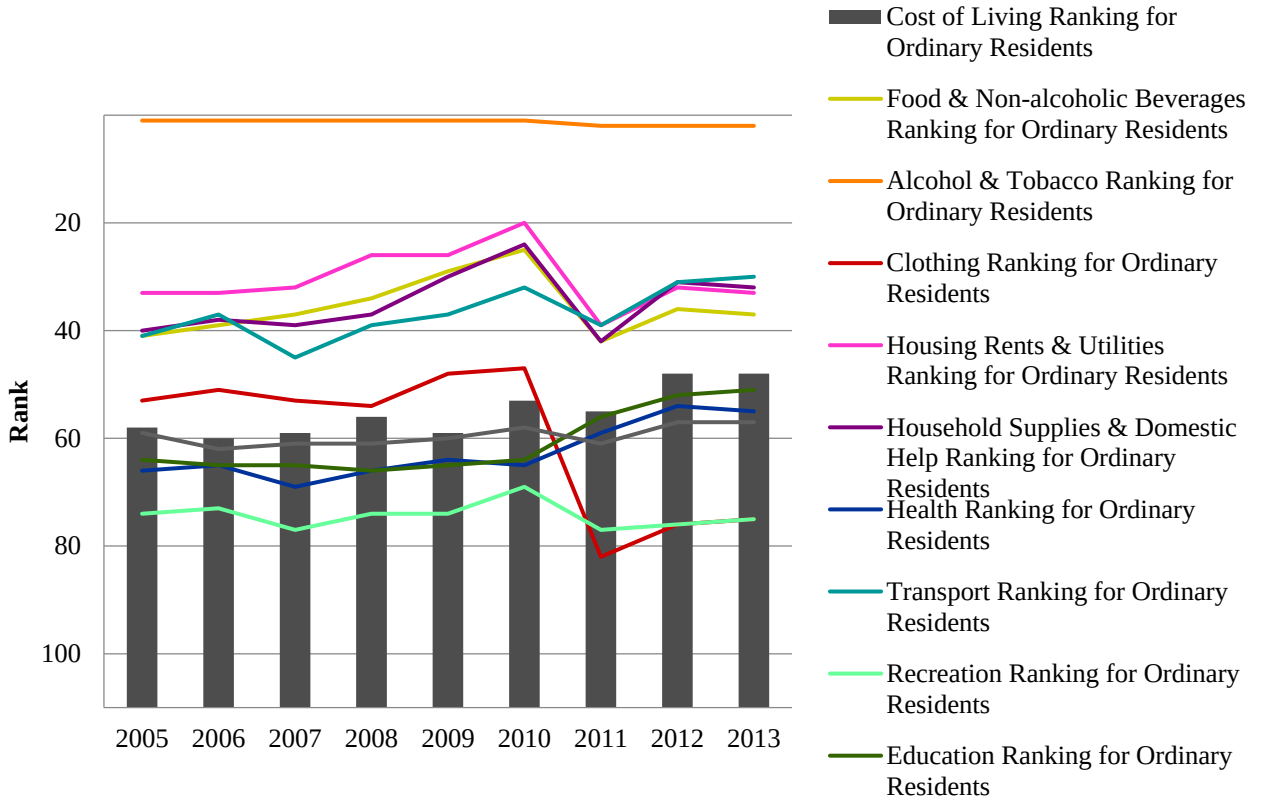

Figure 4. Cost of Living and 10 Consumption Categories Rankings for Ordinary Residents in Singapore, Singapore

Source: Authors

In the first sub-period from 2005 to 2010, Food & Non-alcoholic Beverages and Household Supplies & Domestic Help registered the most significant rise in ranking as they both climbed 16 spots from 41st to 25th and 40th to 24th, respectively. Housing Rents & Utilities Ranking jumped 13 places from 33rd in 2005 to 20th in 2010. Transport Ranking went up nine spots from 41st to 32nd over the first sub-period. Health Ranking rose more modestly from 66th in 2005 to 65th in 2010. Education Ranking fell from 64th in 2005 to 66th in 2008 before rising back to 64th in 2010.

In the second sub-period between 2011 and 2013, Household Supplies & Domestic Help saw the sharpest increase in ranking from 42nd to 32nd. Transport Ranking climbed nine places from 39th in 2011 to 30th in 2013, making it the second highest ranked category in 2013. Housing Rents & Utilities Ranking moved up six spots from 39th to 33rd over the second sub-period. Food & Non-alcoholic Beverages and Education Rankings both jumped five spots from 42nd to 37th and 56th to 51st, respectively, between 2011 and 2013. Health Ranking went up four places from 59th in 2011 to 55th in 2013. Nonetheless, these upward trends appear to be levelling off. Alcohol & Tobacco consistently remained as the highest ranked category for the entire study period though its ranking dropped from first in the first sub-period to second in the second sub-period. Consequently, Singapore was the second most expensive city in terms of Alcohol & Tobacco in 2013. In the Clothing and Recreation categories, Singapore was relatively inexpensive, as it achieved the lowest rank for both categories in 2013 at 75th place.

4.4 Tokyo

Tokyo, the capital of Japan, serves as an international financial hub as well as a center for the country's electronics, publishing and broadcasting industries. The city's Cost of Living ranking for Ordinary Residents, as shown in the grey bars, rose from 10th to ninth position between 2005 and 2010, but declined from 10th to 22nd between 2011 and 2013 (see Figure 5).

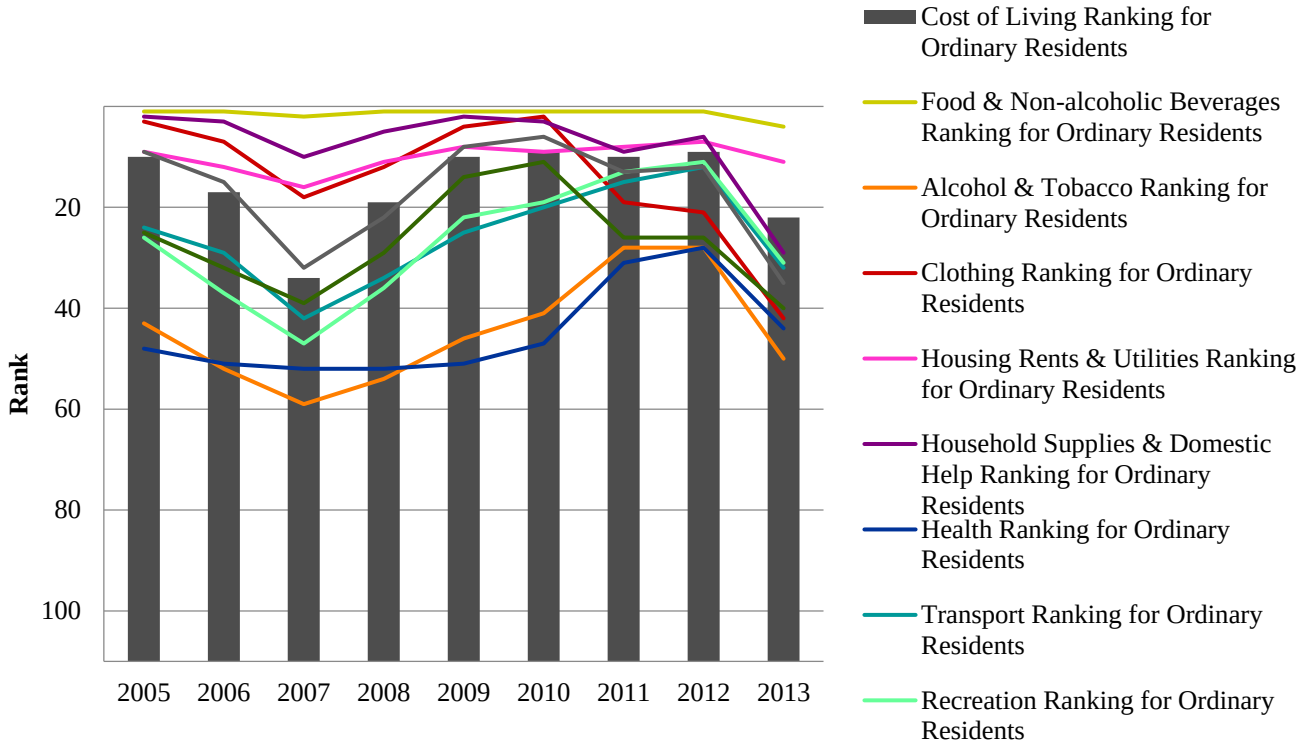

Figure 5. Cost of Living and 10 Consumption Categories Rankings for Ordinary Residents in Tokyo, Japan

Source: Authors

During the first sub-period, from 2005 to 2010, Education registered the most significant rise in ranking as it climbed 14 places from 25th to 11th. Transport Ranking moved up four spots from 24th to 20th between 2005 and 2010. Health Ranking jumped one place from 48th in 2005 to 47th in 2010. Housing Rents & Utilities Ranking fell from ninth position in 2005 to 16th in 2007 before rising back to ninth place in 2010. Food & Non-alcoholic Beverages Ranking remained largely unchanged at the top throughout the first sub-period.

In the second sub-period, the rankings of all 10 categories went down between 2011 and 2013. In particular, Alcohol & Tobacco Ranking fell 22 places from 28th in 2011 to 50th in 2013, making it the lowest ranked category in 2013. Household Supplies & Domestic Help Ranking slipped 20 places from ninth position to 29th over the second sub-period. Transport Ranking dropped 17 spots from 15th to 32nd between 2011 and 2013. Education Ranking declined from 26th in 2011 to 40th in 2013. Health Ranking went down from 31st to 44th over the same sub-period. Food & Non-alcoholic Beverages and Housing Rents & Utilities Rankings both fell three places from first to fourth and eighth to 11th, respectively, over the second sub-period, making them the highest and second highest ranked category in 2013.

4.5 Zurich

Often referred to as Switzerland's cultural capital, Zurich is home to some of the country's finest museums, art galleries and theatres. The city's Cost of Living ranking for Ordinary Residents, as denoted by the grey bars, rose from second to first between 2005 and 2010, and declined from first to second between 2011 and 2013 (see Figure 6).

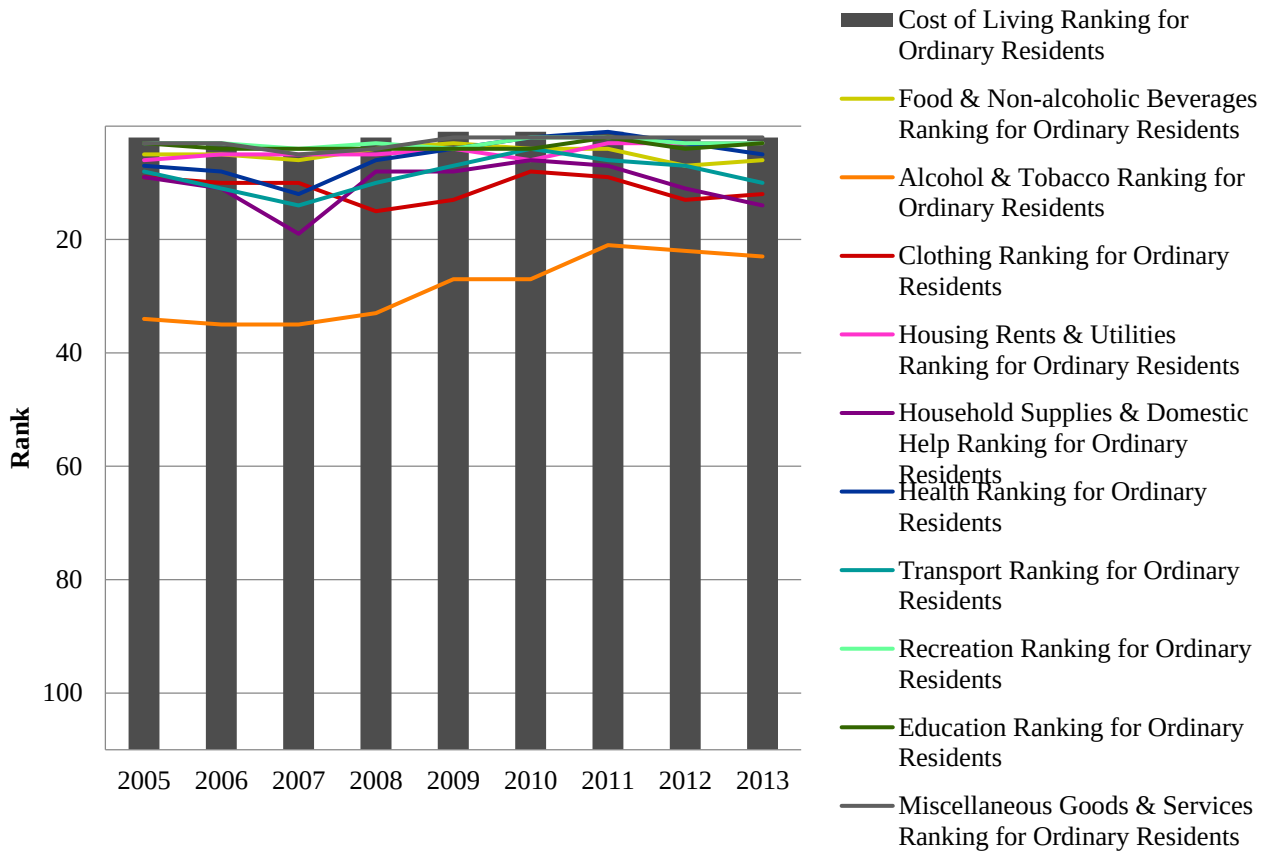

Figure 6. Cost of Living and 10 Consumption Categories Rankings for Ordinary Residents in Zurich, Switzerland

Source: Authors

In the first sub-period from 2005 to 2010, Health Ranking jumped five places from seventh to second position. Transport ranking moved up four spots from eighth in 2005 to fourth in 2010. Food & Non-alcoholic Beverages ranking rose from fifth to fourth between 2005 and 2010. In contrast, Education Ranking slipped one spot from third to fourth position over the same sub-period. Housing Rents & Utilities Ranking went up from sixth in 2005 to fourth spot in 2009 before falling back to sixth in 2010.

Between 2011 and 2013, Miscellaneous Goods & Services Ranking remained at second place, making it the highest ranked category throughout the second sub-period. Likewise, Housing Rents & Utilities Ranking stayed unchanged at third. In contrast, Household Supplies & Domestic Help Ranking slipped seven places from seventh in 2011 to 14th in 2013. Health and Transport Rankings both fell four spots from first to fifth and sixth to 10th, respectively, over the second sub-period. Food & Non-alcoholic Beverages ranking moved down two places from fourth in 2011 to sixth in 2013. Education Ranking declined from second to third place over the same sub-period. Alcohol & Tobacco was consistently the lowest ranked category in both sub-periods as its ranking rose from 34th in 2005 to 27th in 2010, and dropped from 21st in 2011 to 23rd in 2013.

5. Summary, Conclusion and Policy Implications

The pace of urbanization has risen rapidly across the globe in recent years. Considering that the overwhelming majority of economic activity now occurs in cities, the speed and scale of urbanization has significant implications for cost of living worldwide. International benchmarks for major cities become crucial in this context. This paper provides the means to analyze questions pertaining to differences in the cost of living in cities across the globe for ordinary residents in the city they are residing or cities they may intend to relocate to. In addition, it is useful for multinational corporations which deal with professionals who work abroad. It is also of paramount importance to public policy makers who try to render a better city for ordinary residents; it is thus crucial to understand factors or policies which contribute to these changes, especially on whether earnings and purchasing powers have been keeping up with cost of living, particularly in the case of ordinary residents across cities worldwide.

The Cost of Living Index for Ordinary Residents that we propose in this paper comprises three main components: the first providing a measure of the cost of living index which utilises ordinary residents' consumption patterns but prices of

the consumption items for expatriates as reported by EIU and UBS ($CP_{C,m}^{EIU}$), assuming such data for prices will generally correlate with the data for prices of the counterpart items in the consumption basket for ordinary residents in each city while ordinary residents' consumption patterns are country-specific. The second component (NP_C^{ICP}) provides a proxy for the national mean of the cost of living index in a country. The final component is the price level per unit real consumption for ordinary residents living in a country based on data from the ICP surveys (NP_C^{EIU}), standardised against the world level. As the ICP surveys capture data on expenditure of ordinary residents, the NP_C^{ICP} term itself represents ordinary residents' cost of living, but at the national level. Multiplying $CP_{C,m}^{EIU}$ with the ratio between NP_C^{ICP} and NP_C^{EIU} allows us to obtain a measure of ordinary residents' cost of living at the city level which reflects both prices faced by ordinary residents and consumption patterns of ordinary residents.

The Cost of Living Index for Ordinary Residents benchmarks ordinary residents' cost of living in a city against their counterparts' cost in the base city New York. A larger index value implies that the city has higher cost of living while a smaller Cost of Living Index value implies that the city has lower cost of living. In addition, cities with Cost of Living Index larger than 100 are more expensive than New York while cities with Cost of Living Index smaller than 100 are cheaper than New York for ordinary residents. By arranging the cities in descending order of their index values, we create a Cost of Living Ranking for Ordinary Residents.

An alternative interpretation would imply that our Cost of Living Index and Ranking for Ordinary Residents controls for utility levels of ordinary residents when comparing their costs of living. As the standardised price per unit real consumption of goods and services for ordinary residents in a country, the term NP_C^{ICP} controls for living standards and utility level across different countries. Meanwhile, the terms $CP_{C,m}^{EIU}$ and NP_C^{EIU} can be thought of as proxies for variations among cities within a country while maintaining such controlling for utility. As a result, the Cost of Living Index for Ordinary Residents also controls for utility. Thus the strength of the methodology used is the fact it makes an effort to control for utility, which in turn facilitates comparison in cost of living for ordinary residents across cities worldwide. There is a distinct need to control utility when conceptualising a framework and designing a methodology for drawing cost of living comparisons; this is driven by the notion that the cost of living should directly relate to the amount of financial expenditure needed to generate a certain utility level for the person incurring this expense.

Finally, an additional advantage of our methodology is that the Cost of Living Ranking for Ordinary Residents is insensitive to the choice of the base city. This is because according to our formulation, the ratios of the index values between any two cities will always be the same even if we change the base city. In other words, the relative difference in costs for ordinary residents between the cities, which is what the Cost of Living Ranking for Ordinary Residents captures, is always preserved regardless of the choice of the base city. This single property cements the objectivity of the research, as one does not know beforehand the order of the ranking prior to performing the calculations needed to derive the results.

Although this study generates the Cost of Living Rankings for Ordinary Residents for 103 cities worldwide, this paper focuses on five key cities (i.e. London, Hong Kong, Singapore, Tokyo and Zurich), as they are global financial centers. New York is used as a base city in this study. In the period 2011-2013, Zurich is considerably more expensive than the other major financial centers. In 2011, it had originally occupied the top position in the Cost of Living Ranking for Ordinary Residents but placed second by 2013. From 2011-2013, Zurich's high living costs for ordinary residents is attributable to exceptionally high costs in Miscellaneous Goods & Services, Housing Rents & Utilities and Education; for these three categories, it ranked within the top three positions for this sub-period. Nonetheless, Zurich's Cost of Ranking for Ordinary Residents declined marginally in the 2011-2013 period due to ranking declines in areas such as Housing Supplies & Domestic Help, Health and Transport, Food & Non-alcoholic Beverages and Education. Zurich is followed by London, Tokyo, Singapore and Hong Kong which came in at 21st, 22nd, 48th and 59th respectively. Tokyo's Cost of Living Ranking for Ordinary Residents also experienced a decline (10th to 22$^{nd)}$ for the 2011-2013 period, in contrast to its rise (10th to ninth place) for the earlier 2005-2010 period. This fall is due to significant ranking declines in all 10 cost of living categories. The remaining financial centers of London, Hong Kong and Singapore all recorded a rise in the Cost of Living Rankings for Ordinary Residents in the second sub-period of 2011-2013.

For the earlier 2005-2010 period, London, by falling from 12th to 38th place, witnessed the largest decline in the Cost of Living Ranking for Ordinary Residents across the five major financial centers. This precipitous decline was triggered by ranking declines across all ten categories. However, this situation was reversed in the later 2011-2013 sub-period, as London recorded a rise in rankings from 26th to 21st place; this rise was brought about by rising rankings in categories such as Transport, Household Supplies & Domestic Help, Health, Housing Rents & Utilities and Education. Singapore is the only city among the five major financial centers to have witnessed a back to back rise in its Cost of Living for Ordinary Residents rankings for both the 2005-2010 (58th to 53rd) and 2011-2013 (55th to 48th) periods. In the earlier 2005-2010 sub-period, Singapore recorded a significant rise in rankings for categories such as Food & Non-alcoholic Beverages, Household Supplies & Domestic Help and Housing Rents & Utilities; Singapore's ranking gains for

Transport and Health were relatively modest for that period. For the 2011-2013 sub-period, Singapore saw a significant rise in ranking for the Household Supplies & Domestic Help category but comparatively more modest ranking rises in the other remaining categories. This sustained ranking rise in virtually all categories invariably led to the back to back rise in Singapore's overall Cost of Living Ranking for Ordinary Residents in both sub-periods.

As for future research agenda, a number of underlying assumptions could be re-examined. One such area would be to incorporate some analysis on the net effect of the substitution effect and income effect of price changes, rather than any direct change in prices by the sellers or any goods and services tax. Future research could also analyze the changes in the composition of consumer baskets over time as longitudinal studies may be interesting, as indicated by the composition of retained imports for consumption by ordinary citizens.

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Appendix

Table A1. Yearly Average Exchange Rates in 103 World's Major Cities (Local Currency Units per US Dollar), 2005-2013

No.	City	Country	Currency	Currency Code	Year								
					2005	2006	2007	2008	2009	2010	2011	2012	2013
1	Adelaide	Australia	Dollar	AUD	1.3122	1.3277	1.1947	1.1972	1.2791	1.0891	0.9690	0.9659	0.9679
2	Amman	Jordan	Dinar	JOD	0.7089	0.7087	0.7084	0.7082	0.7081	0.7085	0.7088	0.7085	0.7082
3	Amsterdam	Netherlands	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
4	Asuncion	Paraguay	Guarani	PYG	6174.1039	5632.5646	5029.1432	4351.5055	4969.7309	4747.4964	4195.1567	4418.3704	4310.1687
5	Athens	Greece	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
6	Atlanta	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	Auckland	New Zealand	Dollar	NZD	1.4204	1.5421	1.3605	1.4255	1.5965	1.3870	1.2653	1.2352	1.2188
8	Baku	Azerbaijan	Manat	AZN	0.9458	0.8966	0.8604	0.8234	0.8051	0.8031	0.7900	0.7852	0.7840
9	Bangkok	Thailand	Baht	THB	40.2728	37.9205	32.3059	33.0042	34.3213	31.7035	30.4834	31.0686	30.7233
10	Barcelona	Spain	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
11	Beijing	China	Yuan	CNY	8.1924	7.9731	7.6079	6.9502	6.8315	6.7680	6.4634	6.3093	6.1485
12	Berlin	Germany	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
13	Bogota	Colombia	Peso	COP	2321.5521	2360.5401	2076.0322	1967.6820	2153.1986	1897.5554	1848.1236	1797.2341	1868.9212
14	Boston	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
15	Bratislava	Slovakia	Euro	SKK/EUR	31.0651	29.6483	24.6791	21.3545	0.7189	0.7553	0.7189	0.7781	0.7528
16	Brisbane	Australia	Dollar	AUD	1.3122	1.3277	1.1947	1.1972	1.2791	1.0891	0.9690	0.9659	0.9679
17	Brussels	Belgium	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
18	Bucharest	Romania	Leu	RON	2.9135	2.8083	2.4355	2.5200	3.0459	3.1829	3.0480	3.4692	3.3269
19	Budapest	Hungary	Forint	HUF	199.6883	210.3270	183.5897	172.2992	201.8224	208.0735	201.1137	225.0008	223.5381
20	Buenos Aires	Argentina	Peso	ARS	2.9229	3.0745	3.1153	3.1625	3.7279	3.9118	4.1281	4.5503	5.4797
21	Cairo	Egypt	Pound	EGP	5.7948	5.7426	5.6453	5.4378	5.5525	5.6423	5.9442	6.0707	6.8730
22	Calgary	Canada	Dollar	CAD	1.2113	1.1341	1.0740	1.0670	1.1405	1.0301	0.9891	0.9996	1.0299
23	Caracas	Venezuela	Bolivar	VEB/VEF	2108.7918	2147.2888	2147.3000	2.1473	2.1473	4.2542	4.2955	4.2955	6.0635
24	Chicago	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25	Cleveland	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
26	Colombo	Sri Lanka	Rupee	LKR	100.5102	103.9748	110.6490	108.3351	114.9658	113.0177	110.5756	127.7046	129.1382
27	Copenhagen	Denmark	Krone	DKK	5.9982	5.9414	5.4426	5.0940	5.3528	5.6268	5.3561	5.7921	5.6164
28	Dalian	China	Yuan	CNY	8.1924	7.9731	7.6079	6.9502	6.8315	6.7680	6.4634	6.3093	6.1485
29	Detroit	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
30	Doha	Qatar	Riyal	QAR	3.6399	3.6406	3.6395	3.6403	3.6404	3.6405	3.6415	3.6412	3.6409
31	Dubai	United Arab Emirates	Arab Emirate Dirham	AED	3.6733	3.6735	3.6725	3.6728	3.6725	3.6724	3.6726	3.6726	3.6730
32	Dublin	Ireland	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
33	Frankfurt	Germany	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
34	Geneva	Switzerland	Franc	CHF	1.2463	1.2529	1.2000	1.0824	1.0849	1.0424	0.8866	0.9377	0.9267
35	Guangzhou	China	Yuan	CNY	8.1924	7.9731	7.6079	6.9502	6.8315	6.7680	6.4634	6.3093	6.1485
36	Helsinki	Finland	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
37	Hong Kong	Hong Kong, China	Dollar	HKD	7.7775	7.7684	7.8020	7.7863	7.7517	7.7689	7.7844	7.7570	7.7566
38	Honolulu	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
39	Houston	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
40	Istanbul	Turkey	Lira	TRY	1.3474	1.4380	1.3063	1.3053	1.5537	1.5074	1.6813	1.8002	1.9053
41	Jakarta	Indonesia	Rupiah	IDR	9716.4020	9170.5495	9144.1914	9684.7911	10390.1787	9084.3993	8778.0869	9377.1178	10437.1308
42	Johannesburg	South Africa	Rand	ZAR	6.3664	6.7703	7.0495	8.2705	8.4068	7.3156	7.2641	8.2098	9.6460
43	Kiev	Ukraine	Hryvnia	UAH	5.0996	5.0419	5.0351	5.2556	8.0698	7.9492	7.9856	8.0821	8.1544
44	Kuala Lumpur	Malaysia	Ringgit	MYR	3.7860	3.6671	3.4367	3.3337	3.5226	3.2185	3.0597	3.0876	3.1498
45	Kuwait	Kuwait	Dinar	KWD	0.2920	0.2902	0.2843	0.2689	0.2882	0.2869	0.2763	0.2801	0.2839
46	Lexington	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
47	Lima	Peru	Nuevo sol	PEN	3.2965	3.2746	3.1286	2.9231	3.0094	2.8245	2.7535	2.6371	2.7032
48	Lisbon	Portugal	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
49	London	Great Britain	Pound	GBP	0.5502	0.5432	0.4997	0.5457	0.6405	0.6475	0.6236	0.6310	0.6389
50	Los Angeles	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
51	Luxembourg	Luxembourg	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
52	Lyon	France	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
53	Madrid	Spain	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
54	Manila	Philippines	Peso	PHP	55.0534	51.2844	46.1159	44.4386	47.5491	45.0655	43.2974	42.1874	42.4621
55	Melbourne	Australia	Dollar	AUD	1.3122	1.3277	1.1947	1.1972	1.2791	1.0891	0.9690	0.9659	0.9679
56	Mexico City	Mexico	Nuevo peso	MXN	10.8915	10.9068	10.9280	11.1625	13.5003	12.6303	12.4431	13.1560	12.7619
57	Miami	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
58	Milan	Italy	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
59	Minneapolis	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
60	Montevideo	Uruguay	Peso	UYU	24.4868	24.0979	23.4472	20.8553	22.5195	20.0171	19.2783	20.2550	20.4343
61	Montreal	Canada	Dollar	CAD	1.2113	1.1341	1.0740	1.0670	1.1405	1.0301	0.9891	0.9996	1.0299
62	Moscow	Russia	Rouble	RUB	28.3012	27.1762	25.5725	24.8779	31.7402	30.3740	29.4031	31.0608	31.8588
63	Mumbai	India	Rupee	INR	44.1129	45.3237	41.3495	43.4680	48.3415	45.7245	46.6633	53.5106	58.5864
64	Munich	Germany	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
65	Nairobi	Kenya	Shilling	KES	75.6261	72.2219	67.3399	69.2563	77.2830	79.2875	88.8696	84.4000	86.0950
66	New Delhi	India	Rupee	INR	44.1129	45.3237	41.3495	43.4680	48.3415	45.7245	46.6633	53.5106	58.5864
67	New York	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
68	Osaka / Kobe	Japan	Yen	JPY	110.1786	116.3429	117.7851	103.3671	93.6009	87.7330	79.7010	79.8371	97.5882
69	Oslo	Norway	Krone	NOK	6.4452	6.4106	5.8584	5.6485	6.2859	6.0457	5.6059	5.8184	5.8770
70	Paris	France	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
71	Perth	Australia	Dollar	AUD	1.3122	1.3277	1.1947	1.1972	1.2791	1.0891	0.9690	0.9659	0.9679
72	Pittsburgh	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
73	Prague	Czech Republic	Koruna	CZK	23.9635	22.5738	20.2900	17.0679	19.0324	19.0973	17.6839	19.5618	19.5557

74	Pretoria	South Africa	Rand	ZAR	6.3664	6.7703	7.0495	8.2705	8.4068	7.3156	7.2641	8.2098	9.6460
75	Qingdao	China	Yuan	CNY	8.1924	7.9731	7.6079	6.9502	6.8315	6.7680	6.4634	6.3093	6.1485
76	Quito	Ecuador	US Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
77	Reykjavik	Iceland	Krona	ISK	62.8837	69.9340	64.0555	88.0507	123.7447	122.1333	116.0774	125.1254	122.1445
78	Rio De Janeiro	Brazil	Real	BRL	2.4342	2.1761	1.9466	1.8372	1.9986	1.7592	1.6743	1.9554	2.1612
79	Rome	Italy	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
80	San Francisco	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
81	Santiago	Chile	Peso	CLP	559.5110	530.5965	522.2462	523.6846	558.4423	510.0647	483.7583	486.3012	495.2821
82	Sao Paulo	Brazil	Real	BRL	2.4342	2.1761	1.9466	1.8372	1.9986	1.7592	1.6743	1.9554	2.1612
83	Seattle	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
84	Seoul	South Korea	Won	KRW	1024.3810	954.9017	929.5920	1101.6718	1275.6766	1156.5593	1107.7575	1126.2875	1094.4689
85	Shanghai	China	Yuan	CNY	8.1924	7.9731	7.6079	6.9502	6.8315	6.7680	6.4634	6.3093	6.1485
86	Shenzhen	China	Yuan	CNY	8.1924	7.9731	7.6079	6.9502	6.8315	6.7680	6.4634	6.3093	6.1485
87	Singapore	Singapore	Dollar	SGD	1.6645	1.5887	1.5068	1.4147	1.4538	1.3627	1.2572	1.2494	1.2510
88	Sofia	Bulgaria	Leva	BGN	1.5755	1.5583	1.4303	1.3340	1.4055	1.4773	1.4061	1.5219	1.4729
89	St Petersburg	Russia	Rouble	RUB	28.3012	27.1762	25.5725	24.8779	31.7402	30.3740	29.4031	31.0608	31.8588
90	Stockholm	Sweden	Krona	SEK	7.4789	7.3719	6.7561	6.5968	7.6437	7.2037	6.4932	6.7723	6.5137
91	Suzhou	China	Yuan	CNY	8.1924	7.9731	7.6079	6.9502	6.8315	6.7680	6.4634	6.3093	6.1485
92	Sydney	Australia	Dollar	AUD	1.3122	1.3277	1.1947	1.1972	1.2791	1.0891	0.9690	0.9659	0.9679
93	Taipei	Taiwan, China	New dollar	TWD	32.1702	32.5251	32.8610	31.5430	33.0318	31.4916	29.4022	29.5732	29.6962
94	Tel Aviv	Israel	New shekel	ILS	4.4881	4.4565	4.1086	3.5843	3.9272	3.7326	3.5775	3.8542	3.6098
95	Tianjin	China	Yuan	CNY	8.1924	7.9731	7.6079	6.9502	6.8315	6.7680	6.4634	6.3093	6.1485
96	Tokyo	Japan	Yen	JPY	110.1786	116.3429	117.7851	103.3671	93.6009	87.7330	79.7010	79.8371	97.5882
97	Toronto	Canada	Dollar	CAD	1.2113	1.1341	1.0740	1.0670	1.1405	1.0301	0.9891	0.9996	1.0299
98	Vancouver	Canada	Dollar	CAD	1.2113	1.1341	1.0740	1.0670	1.1405	1.0301	0.9891	0.9996	1.0299
99	Vienna	Austria	Euro	EUR	0.8049	0.7965	0.7305	0.6832	0.7189	0.7553	0.7189	0.7781	0.7528
100	Warsaw	Poland	Zloty	PLN	3.2361	3.1025	2.7651	2.4095	3.1142	3.0174	2.9652	3.2545	3.1590
101	Washington DC	United States	Dollar	USD	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
102	Wellington	New Zealand	Dollar	NZD	1.4204	1.5421	1.3605	1.4255	1.5965	1.3870	1.2653	1.2352	1.2188
103	Zurich	Switzerland	Franc	CHF	1.2463	1.2529	1.2000	1.0824	1.0849	1.0424	0.8866	0.9377	0.9267

Source: Calculated from daily average exchange rates obtained from Bloomberg

Table A2. Cost of Living Rankings for Ordinary Residents in 103 World's Major Cities, 2005-2013

No.	**City**	**Country**	**Rankings**	**Year**								
				2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
1	Adelaide	Australia	Cost of Living Ranking for Ordinary Residents	40	42	37	38	40	21	15	12	11
2	Amman	Jordan	Cost of Living Ranking for Ordinary Residents	72	72	75	72	70	72	97	97	96
3	Amsterdam	Netherlands	Cost of Living Ranking for Ordinary Residents	27	30	24	21	19	30	24	31	25
4	Asuncion	Paraguay	Cost of Living Ranking for Ordinary Residents	94	90	85	77	83	80	79	81	81
5	Athens	Greece	Cost of Living Ranking for Ordinary Residents	46	46	41	34	33	36	43	45	45
6	Atlanta	United States	Cost of Living Ranking for Ordinary Residents	54	53	55	59	58	57	54	49	51
7	Auckland	New Zealand	Cost of Living Ranking for Ordinary Residents	25	40	28	40	48	32	34	28	27
8	Baku	Azerbaijan	Cost of Living Ranking for Ordinary Residents	101	101	96	96	93	93	100	99	98
9	Bangkok	Thailand	Cost of Living Ranking for Ordinary Residents	92	93	89	92	94	91	95	96	95
10	Barcelona	Spain	Cost of Living Ranking for Ordinary Residents	41	41	36	27	30	40	37	39	36
11	Beijing	China	Cost of Living Ranking for Ordinary Residents	82	86	92	91	89	90	78	76	74
12	Berlin	Germany	Cost of Living Ranking for Ordinary Residents	35	33	33	30	35	47	48	54	50
13	Bogota	Colombia	Cost of Living Ranking for Ordinary Residents	80	80	76	74	77	73	72	70	71
14	Boston	United States	Cost of Living Ranking for Ordinary Residents	29	29	35	39	34	41	42	42	43
15	Bratislava	Slovakia	Cost of Living Ranking for Ordinary Residents	77	75	71	68	64	70	66	69	69
16	Brisbane	Australia	Cost of Living Ranking for Ordinary Residents	38	34	29	28	26	15	7	7	7
17	Brussels	Belgium	Cost of Living Ranking for Ordinary Residents	21	22	18	15	14	26	22	29	24
18	Bucharest	Romania	Cost of Living Ranking for Ordinary Residents	76	74	72	73	78	81	80	90	86
19	Budapest	Hungary	Cost of Living Ranking for Ordinary Residents	67	71	66	67	68	71	74	77	76
20	Buenos Aires	Argentina	Cost of Living Ranking for Ordinary Residents	81	83	84	89	92	92	53	53	58
21	Cairo	Egypt	Cost of Living Ranking for Ordinary Residents	100	100	101	99	97	95	103	102	103
22	Calgary	Canada	Cost of Living Ranking for Ordinary Residents	33	27	25	29	28	24	16	17	18
23	Caracas	Venezuela	Cost of Living Ranking for Ordinary Residents	70	69	65	57	32	67	71	63	64
24	Chicago	United States	Cost of Living Ranking for Ordinary Residents	17	14	21	24	23	27	31	27	29
25	Cleveland	United States	Cost of Living Ranking for Ordinary Residents	53	54	58	58	57	59	57	52	52
26	Colombo	Sri Lanka	Cost of Living Ranking for Ordinary Residents	87	88	91	84	84	82	99	100	100
27	Copenhagen	Denmark	Cost of Living Ranking for Ordinary Residents	5	5	2	1	2	4	6	10	8
28	Dalian	China	Cost of Living Ranking for Ordinary Residents	95	95	95	94	91	94	86	84	85
29	Detroit	United States	Cost of Living Ranking for Ordinary Residents	50	50	50	53	56	60	58	55	56
30	Doha	Qatar	Cost of Living Ranking for Ordinary Residents	59	57	53	50	50	56	60	60	57
31	Dubai	United Arab Emirates	Cost of Living Ranking for Ordinary Residents	59	59	56	54	52	51	61	61	60
32	Dublin	Ireland	Cost of Living Ranking for Ordinary Residents	8	8	6	4	7	11	18	20	17
33	Frankfurt	Germany	Cost of Living Ranking for Ordinary Residents	14	12	10	9	8	10	20	21	19
34	Geneva	Switzerland	Cost of Living Ranking for Ordinary Residents	6	7	8	6	4	2	3	5	6
35	Guangzhou	China	Cost of Living Ranking for Ordinary Residents	86	92	93	93	95	96	83	83	84
36	Helsinki	Finland	Cost of Living Ranking for Ordinary Residents	9	9	9	8	9	12	17	19	16
37	Hong Kong	Hong Kong, China	Cost of Living Ranking for Ordinary Residents	56	58	60	62	60	62	63	62	59
38	Honolulu	United States	Cost of Living Ranking for Ordinary Residents	47	45	46	47	44	42	41	35	35
39	Houston	United States	Cost of Living Ranking for Ordinary Residents	36	35	43	46	42	45	45	44	44
40	Istanbul	Turkey	Cost of Living Ranking for Ordinary Residents	63	64	62	61	65	63	75	75	73
41	Jakarta	Indonesia	Cost of Living Ranking for Ordinary Residents	85	81	82	90	88	79	94	95	97
42	Johannesburg	South Africa	Cost of Living Ranking for Ordinary Residents	64	67	73	78	72	69	68	71	77
43	Kiev	Ukraine	Cost of Living Ranking for Ordinary Residents	103	103	103	102	103	103	101	101	101
44	Kuala Lumpur	Malaysia	Cost of Living Ranking for Ordinary Residents	79	78	77	81	81	78	88	89	91
45	Kuwait	Kuwait	Cost of Living Ranking for Ordinary Residents	52	52	51	44	45	43	67	67	68
46	Lexington	United States	Cost of Living Ranking for Ordinary Residents	45	47	49	52	54	50	49	51	53
47	Lima	Peru	Cost of Living Ranking for Ordinary Residents	75	77	78	79	76	75	77	73	72
48	Lisbon	Portugal	Cost of Living Ranking for Ordinary Residents	48	48	42	37	41	49	46	50	47
49	London	Great Britain	Cost of Living Ranking for Ordinary Residents	12	11	12	22	38	38	26	24	21
50	Los Angeles	United States	Cost of Living Ranking for Ordinary Residents	26	23	30	25	16	17	28	25	23
51	Luxembourg	Luxembourg	Cost of Living Ranking for Ordinary Residents	13	10	11	10	11	14	14	15	13
52	Lyon	France	Cost of Living Ranking for Ordinary Residents	51	51	48	51	55	61	51	56	55
53	Madrid	Spain	Cost of Living Ranking for Ordinary Residents	42	43	38	26	27	39	38	43	42
54	Manila	Philippines	Cost of Living Ranking for Ordinary Residents	88	85	86	87	86	86	91	88	89
55	Melbourne	Australia	Cost of Living Ranking for Ordinary Residents	20	20	16	20	22	8	5	4	4
56	Mexico City	Mexico	Cost of Living Ranking for Ordinary Residents	65	63	68	71	74	74	73	74	70
57	Miami	United States	Cost of Living Ranking for Ordinary Residents	31	31	39	42	36	35	40	38	39
58	Milan	Italy	Cost of Living Ranking for Ordinary Residents	15	16	15	14	13	19	32	33	34
59	Minneapolis	United States	Cost of Living Ranking for Ordinary Residents	43	44	45	49	47	44	44	41	41
60	Montevideo	Uruguay	Cost of Living Ranking for Ordinary Residents	68	68	67	64	62	55	59	57	54
61	Montreal	Canada	Cost of Living Ranking for Ordinary Residents	44	36	40	43	49	37	25	22	30

62	Moscow	Russia	Cost of Living Ranking for Ordinary Residents	83	82	79	80	87	83	81	82	82
63	Mumbai	India	Cost of Living Ranking for Ordinary Residents	98	99	97	101	101	100	98	98	99
64	Munich	Germany	Cost of Living Ranking for Ordinary Residents	19	26	22	18	20	31	36	40	37
65	Nairobi	Kenya	Cost of Living Ranking for Ordinary Residents	90	84	81	75	73	77	96	94	94
66	New Delhi	India	Cost of Living Ranking for Ordinary Residents	102	102	102	103	102	102	102	103	102
67	New York	United States	Cost of Living Ranking for Ordinary Residents	3	1	4	7	6	6	11	6	5
68	Osaka / Kobe	Japan	Cost of Living Ranking for Ordinary Residents	24	37	47	41	21	18	21	18	40
69	Oslo	Norway	Cost of Living Ranking for Ordinary Residents	4	4	3	3	5	3	2	3	3
70	Paris	France	Cost of Living Ranking for Ordinary Residents	7	6	7	5	3	5	8	11	10
71	Perth	Australia	Cost of Living Ranking for Ordinary Residents	39	39	27	31	31	13	9	8	9
72	Pittsburgh	United States	Cost of Living Ranking for Ordinary Residents	49	49	52	55	53	52	50	47	49
73	Prague	Czech Republic	Cost of Living Ranking for Ordinary Residents	71	70	69	63	66	68	62	66	66
74	Pretoria	South Africa	Cost of Living Ranking for Ordinary Residents	62	66	70	76	71	66	69	72	80
75	Qingdao	China	Cost of Living Ranking for Ordinary Residents	96	97	100	98	99	97	87	80	75
76	Quito	Ecuador	Cost of Living Ranking for Ordinary Residents	78	79	83	88	80	85	82	78	79
77	Reykjavik	Iceland	Cost of Living Ranking for Ordinary Residents	1	2	1	13	37	33	30	32	28
78	Rio De Janeiro	Brazil	Cost of Living Ranking for Ordinary Residents	66	62	61	60	61	54	52	59	63
79	Rome	Italy	Cost of Living Ranking for Ordinary Residents	22	18	17	12	12	23	33	34	31
80	San Francisco	United States	Cost of Living Ranking for Ordinary Residents	16	15	23	33	29	34	39	37	38
81	Santiago	Chile	Cost of Living Ranking for Ordinary Residents	61	61	63	66	67	64	65	65	65
82	Sao Paulo	Brazil	Cost of Living Ranking for Ordinary Residents	69	65	64	65	63	58	56	58	62
83	Seattle	United States	Cost of Living Ranking for Ordinary Residents	34	32	44	45	46	48	47	46	46
84	Seoul	South Korea	Cost of Living Ranking for Ordinary Residents	57	55	57	69	69	65	64	64	61
85	Shanghai	China	Cost of Living Ranking for Ordinary Residents	84	87	88	86	79	84	70	68	67
86	Shenzhen	China	Cost of Living Ranking for Ordinary Residents	99	98	98	97	98	99	92	86	83
87	Singapore	Singapore	Cost of Living Ranking for Ordinary Residents	58	60	59	56	59	53	55	48	48
88	Sofia	Bulgaria	Cost of Living Ranking for Ordinary Residents	89	89	87	83	82	89	89	93	93
89	St Petersburg	Russia	Cost of Living Ranking for Ordinary Residents	93	91	90	85	90	88	85	87	88
90	Stockholm	Sweden	Cost of Living Ranking for Ordinary Residents	11	13	13	11	24	20	13	14	12
91	Suzhou	China	Cost of Living Ranking for Ordinary Residents	97	96	99	100	100	101	93	92	92
92	Sydney	Australia	Cost of Living Ranking for Ordinary Residents	18	19	14	17	17	7	4	1	1
93	Taipei	Taiwan, China	Cost of Living Ranking for Ordinary Residents	73	76	80	82	85	87	84	85	87
94	Tel Aviv	Israel	Cost of Living Ranking for Ordinary Residents	55	56	54	48	51	46	35	36	33
95	Tianjin	China	Cost of Living Ranking for Ordinary Residents	91	94	94	95	96	98	90	91	90
96	Tokyo	Japan	Cost of Living Ranking for Ordinary Residents	10	17	34	19	10	9	10	9	22
97	Toronto	Canada	Cost of Living Ranking for Ordinary Residents	32	21	19	23	25	16	12	13	14
98	Vancouver	Canada	Cost of Living Ranking for Ordinary Residents	37	28	31	35	39	29	19	16	15
99	Vienna	Austria	Cost of Living Ranking for Ordinary Residents	23	24	20	16	15	28	23	30	26
100	Warsaw	Poland	Cost of Living Ranking for Ordinary Residents	74	73	74	70	75	76	76	79	78
101	Washington DC	United States	Cost of Living Ranking for Ordinary Residents	28	25	32	32	18	22	29	26	32
102	Wellington	New Zealand	Cost of Living Ranking for Ordinary Residents	30	38	26	36	43	25	27	23	20
103	Zurich	Switzerland	Cost of Living Ranking for Ordinary Residents	2	3	5	2	1	1	1	2	2

Source: Tan *et al*. (2015)