

Income Inequality in Hong Kong and Singapore

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Abstract

This paper studies the evolution of labour income inequality in Hong Kong in the period 1996 to 2015, and the evolution of income inequality in Singapore in the period 2004 to 2016. Using tabulated income tax data together with the Generalised Pareto Interpolation method, the top income shares series are presented. The results show that both Hong Kong and Singapore exhibited a high level of income inequality. In Hong Kong, 12% of total labour income was accrued to the top 1% of the adult population in 1998 and increased to 22% in 2007. Similarly, top 10% of the population owns 39% of labour income in 1997 and its share rose to 54% in 2007. They dropped from the peak in 2007 to 50% and 18% in 2015 respectively. On the other hand, Singapore's top 1% of the population owns 16% of the total income in 2004 and increased to 20% in 2009. Although it fell slightly from the peak in 2009, the series started to increase since 2010 from 16% to 19% in 2016. Top 10% of the population own 47% of the total income in 2004, and this share rose to a peak level of 57% in 2009. Similar to the top 1% shares, the top 10% shares increased between 2010 and 2016, from 48% to 56%. The possible explanations for these observed trends are explored. Possible reasons for the difference in trends in the two economies are also investigated.

JEL Codes: D20, N30

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1 Introduction

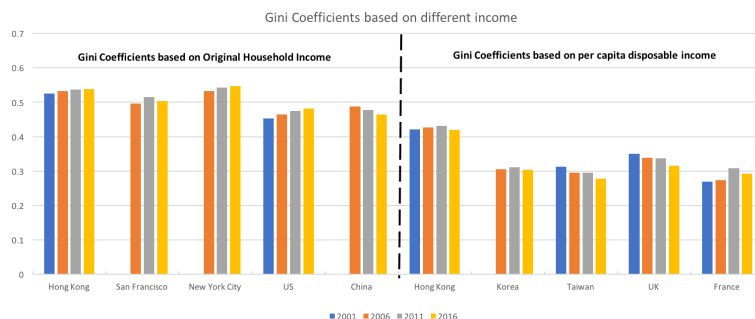
As noted in [Atkinson, Piketty, and Saez \(2011\)](#), there has been a renewed interests in the study of the distribution of top income using income tax data in the economic discipline, which started with the work by [Piketty \(2001\)](#) and [Piketty \(2003\)](#) to analyse the long-run distribution of top incomes in France. This research method can be traced back to the pioneering study for the United States by Kuznets (1953). Kuznets (1955) proposed that inequality in developing countries tended to exhibit an inverted U-shape, rising substantially for a time as the economy move from agriculture to industrialisation, then diminish as output grew and gains from increased productivity become more distributed. However, [Piketty and Saez \(2003\)](#) demonstrate that the U has turned right side up in developed economies, inequality has been rising steadily since the 1970s in the United States instead of falling. Since then, there has been a growing amount of study of top incomes using income tax data covering a wide variety of countries. [Atkinson and Piketty \(2007\)](#) and [Atkinson and Piketty \(2010\)](#) bring together two volumes of studies of the top income shares for twenty-two countries from five continents. This body of research has developed into a comprehensive online database, the World Inequality Database (WID.world).

It is important to study distribution of income, specifically the evolution of top income shares due to several reasons. First, research show that high inequality may lead to slower and less sustained economic growth ([Jonathan D. Ostry and Tsangarides \(2014\)](#)). The negative impact on growth could take place via difference channels including lower consumption, less investment by low-income households in education and skills, less government revenue (World Bank, 2006). Second, people, at least to a certain extent, have a preference for fairness and care about the distribution of economic resources across individuals. Third, study of the top income shares could tell us how economic growth is shared across the income distribution. For example, [Piketty, Saez, and Zucman \(2018\)](#) shows that the rising income inequality in the US since 1970s was due to stagnated income growth in the bottom 50% of the income distribution while income rose by 121% for the top 10%, 205% for the top 1% and 636% for the top 0.001%. Forth, top shares in a country can have a material impact in a global scale. The World Inequality Report 2017 shows that the rise of global inequality has not been steady. While the global top 1% income share rose from 16% in 1980 to 22% in 2000, it declined slightly thereafter to 20%. The decrease after 2000 is due to reduction in between-country average income inequality as within-country inequality continued to increase. On the other

hand, [Atkinson and Piketty \(2007\)](#) shows that the number of globally rich doubled in the United States during 1970-1992, which accounts for half of the global surge in the number of globally rich, making a perceptible difference to the world income distribution.

The interests to study Hong Kong and Singapore are due to several reasons. First, as in other developed economies, these two cities have experienced growing economies. Hong Kong has emerged as one of the developed economies with the highest Gini coefficients, as illustrated in [Figure 1](#). Singapore also exhibits growing income inequality as measured by Gini coefficients. As Singaporeans are expressing concerns over income inequality, the Singaporean government said they would give top priority to tackling income inequality. Researchers and policy makers have taken to address the topic, but there are few comprehensive analysis. Existing analysis relies mostly on household income survey data and uses Gini Coefficient as the main indicator of income inequality. However, household survey data is not ideal for studying top income shares, as the top income are usually underestimated, due to reasons including under-reporting and sampling bias. As these issues are less significant in tax statistics, tax data are preferred over household surveys in studying income at the top, while household surveys are used to estimate the bottom income shares. Moreover, use of Gini coefficients to measure income inequality can be misleading. Countries with different income distribution can give the same Gini coefficients. For instance, if there is a country in which the bottom 50% of the population has no income and the upper 50% has the same income. Gini coefficient would be equal to 0.5. On the other hand, if there is another country in which the poorest 75% of the population has 25% of income and the richest 25% has 75% income, the Gini coefficient would also be 0.5. Therefore, Gini coefficients should be complemented with top income shares in order to examine evolution of income distribution.

Figure 1: Gini Coefficient based on Original Household Income in Hong Kong



Source: Hong Kong Census and Statistics Department

Second, Hong Kong has undergone significant economic and political transformations over the past few decades, as explored in detail in Section 2. Economically, it transformed from an exporter in the 1970s to an international financial hub today, but growth slowed after the Asian financial crisis in 1997. Politically, 155 years of British colonial rule ended in 1997 and Hong Kong was returned to China. This provides an interesting case study to analyse the territory's evolution of income distributions.

Similarly in Singapore, the country has grown rapidly since their independence in 1965. This work goes further by providing a comparative study in the trends in income inequality with Singapore. Given their demographic, historical and economic similarities and differences, it is worth analysing the contrast in income trends, which can provide insights into the economic mechanism that led to the evolution of income inequality observed.

This paper aims to contribute to the literature by 1) constructing top labour income shares series of Hong Kong and top income shares series of Singapore using tax data 2) addressing the factors that explain the observed trends, and 3) providing a comparative study of the trends in top income shares between Hong Kong and Singapore.

The rest of the paper is organised as follows: Section 2 gives an overview of the economic situation and the historical context of Hong Kong and Singapore. Section 3 illustrates the data, sources and methodology employed in the analysis. Section 4 presents and interprets the results for the top income shares in Hong Kong, and compare it with Singapore. Section 5 discusses future research possibilities and we conclude in Section 6.

2 Overview of the Development in Hong Kong

2.1 History and GDP Growth

2.1.1 Hong Kong

Located on the southeast coast of China with a mere total land area of 1,104 square kilometres, Hong Kong started out as a farming fishing village and salt production site. After losing to Britain the First Opium War, China agreed to cede Hong Kong Island to Britain in 1941. This marked the beginning of the 155 years of British colonial rule in Hong Kong. Within 60 years, Kowloon the New Territories and 235 Outlying Islands were also leased to Britain. By the end of the Second Opium War in 1860, Hong Kong had turned into a major entrepot.

Under British rule, Hong Kong transformed into an international commercial and financial hub. However, there were not much development in Hong Kong before the Second World War, the territory was mainly used as a strategic hub to protect the British power and interests in the East Asian region. Most transformations took place after the Second World War.

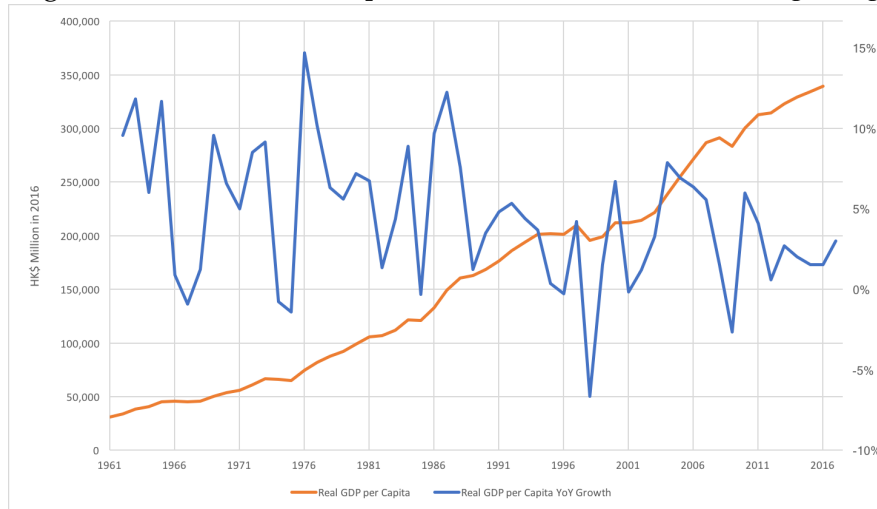
Since the end of World War II, there was a huge inflow of refugees, entrepreneurs and capital fleeing the civil war and cultural revolution in Mainland China. Moreover, the tragic events of the riots in 1967 sparked by anti-colonial sentiments prompted two decades of reforms by the colonial rulers that brought about an opening of the economy, industrialisation and policies to provide education, public housing, social welfare and better law and order. As a result, Hong Kong experienced rapid industrialisation during this period, and it rose to become a major textile and garment exporter by the 1970s, with average real GDP per capita growth of 6.1% in 1962-1976..

In 1978, the announcement of Open Door Policy of the PRC marked a new era for Hong Kong's economy. With the growing engagement of China in international trade and investment, Hong Kong's integration with the mainland accelerate as it regained its role as the country's main provider of commercial and financial services. While manufacturing businesses began to move out of Hong Kong into the mainland to take advantage of the cheap labour during the 1980s and 1990s, Hong Kong rapidly transformed into a major international financial hub. By 2015, Hong Kong's stock market was the fifth largest in the world by market capitalisation. Between 1977 and 1997, real GDP per capita

grew at an average annual rate of 5.1%.

In July 1997, Hong Kong was returned to China after 155 years of British rule. The Chinese government agrees to implement "One country, two systems" policy which left Hong Kong monetarily, economically and politically separate from the mainland. Hong Kong was hit hard by the Asian Financial Crisis in 1997 and SARS threat in 2003, leading to recession and rise in unemployment. These crises have led to increased trades and investment links with the mainland China. Most notably is the implementation of CEPA in 2003, which aimed to boost Hong Kong's economy after the SARS threat. It is the first free trade agreement ever concluded by Hong Kong and mainland China covering trade in goods and services, investment and allows mainland Chinese residents to visit Hong Kong in their individual capacity for the first time. In the period of 1997-2017, annual real GDP per capita growth slowed to an average of 2.6%.

Figure 2: Real GDP Per Capita at 2016 Market Prices of Hong Kong



Source: Hong Kong Census and Statistics Department

2.1.2 Singapore

Singapore is an island situated at the end of the Malayan Peninsula between Malaysia and Indonesia, with a total land area of 72.5 square kilometres. It was originally inhabited by fishermen and pirates and served as an outpost for the Sumatran empire of Srivijaya. Modern Singapore was founded in 1819, when the East India Company of the British Empire established Singapore as a trading station. In 1824 Singapore officially became a British colony and was

grouped together with Penang and Malacca into a single administrative unit named Straits Settlements. Similar to Hong Kong, the city grew quickly into an entrepot trade hub, attracting immigrants from China, India, the Malay Archipelago and beyond.

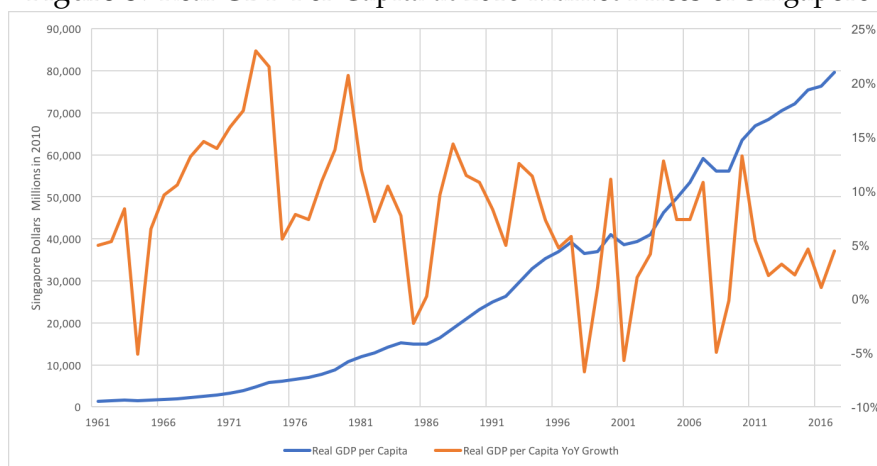
After the Japanese military rule between 1942 and 1945, Singapore was handed back to the British forces. In 1946, Singapore became a separate British Crown Colony from the Federation of Malaya, mainly due to Singapore's predominantly Chinese population. In 1959, growing nationalism led to self-government in Singapore, although Britain still retained control of its defence and foreign policy until 1971. Under the first prime minister Lee Kuan Yew, Singapore joined the Federation of Malaysia in 1963. However, Singapore seceded from the Federation due to political frictions between the state and central governments. Few expected Singapore to prosper given its small land area and lack of natural resources.

Beginning in the 1970s, still under the leadership of Lee Kuan Yew, Singapore pursued an aggressive policy of economic growth based on export manufacturing and trade. The government implemented two important strategies - to shift away from import-substitution in favour of export-led industrialisation, and to attract global multinational corporations as vehicles to achieve industrial growth. These industrialisation policies led to the take-off of the Singaporean economy. By 1975, Singapore had built a substantial industrial base, with manufacturing's share in GDP climbing to 22% from 14% in 1965. Industrialisation began in the 1960s focusing on products like matches and fish hooks, and moved to higher value-added electronics and petrochemicals by the early 1980s. Between 1962 and 1976, Singapore real GDP per capita grew at an annual average rate of 11.2%, higher than Hong Kong's 6.1% during the same period.

In 1985, Singapore went into recession, due to diminishing returns and the narrowing cost advantage Singapore enjoyed in the manufacturing sector. As a result, Singapore increased investment in the services sector, especially financial services, business services and info-communication services, adding services as an engine of growth alongside manufacturing. The share of services in GDP increased from 16% in 1965 to 24% in 1985 and then to 28% in 2010. Between 1977 and 1997, Singapore real GDP per capita grew at an average rate of 9.0% per annum, again higher than Hong Kong's average growth rate of 5.5% per annum.

Singapore has weathered the Asian financial crisis in 1997-8 better than most Asian economies. During 1998-2016, the average real GDP per capita growth rate in Singapore was 3.7% per annum, higher than Hong Kong's 2.6%.

Figure 3: Real GDP Per Capita at 2016 Market Prices of Singapore



Source: Singapore Department of Statistics

2.1.3 Comparison

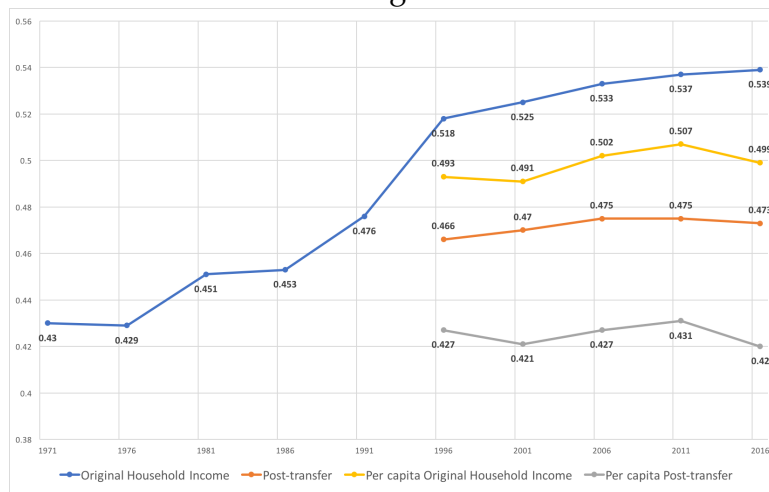
Overall, it is worth comparing Hong Kong with Singapore due to their similar historical background, population size, geographic areas and level of economic development. In 2015, the populations in Hong Kong and Singapore were 7.336 millions and 5.535 millions respective; GDP per capita were US\$ 42,351 and US\$53,630; total land area is 1,104 and 720 square kilometres.

2.2 Gini Coefficients

Since the 1990s, economic inequality has emerged as a serious social issue in Hong Kong. Household income inequality increased rapidly especially in mid-1990s. Household income inequality as measured by Gini coefficients based on original household income rose continuously from 0.453 in 1986 to 0.539 in 2016 as shown in Figure 2.2. Gini Coefficients based on post-social transfer post-tax household income give a sense of the magnitude of the government's taxation and social benefits in mitigating household income disparity. During 1996-2016, this series is lower and flatter than the Gini coefficients based on original household income, indicating the government's programmes is somehow effective in reducing Gini coefficients.

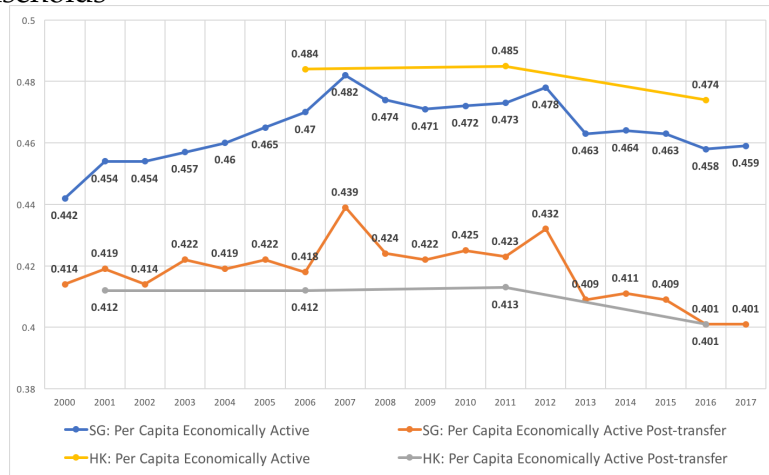
Figure 2.2 compares Gini coefficients of Hong Kong and Singapore based on per capita income for economically active households (which are the only series of Gini coefficients the Department of Statistics of Singapore publish). Looking at Singapore, the gini coefficients based on per capita income for economically active households exhibited a continuous upward trend between 2000 and 2007, but began to decrease since then. This indicator is higher in Hong Kong as compared to Singapore during 2006-2016, but the position reverses when taxation and transfers are taken into account.

Figure 4: Gini Coefficient based on Original Household Income in Hong Kong



Source: Hong Kong Census and Statistics Department

Figure 5: Hong Kong versus Singapore: Gini Coefficient based on Economically Active Households



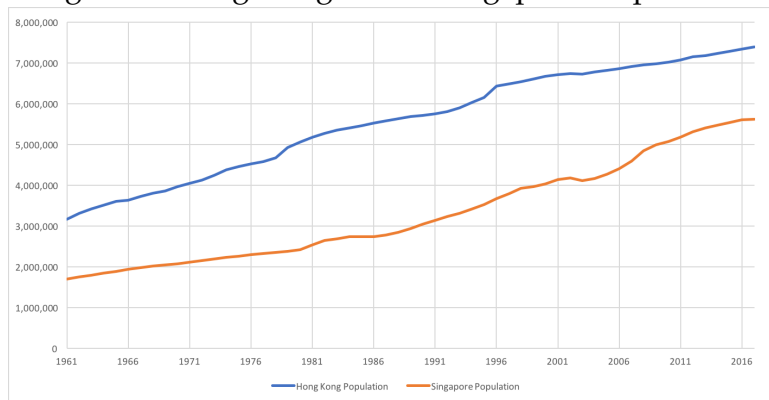
Source: Hong Kong Census and Statistics Department, Singapore Department of Statistics

While this paper does not cover wealth distribution due to limited data availability, it is noteworthy that surging property prices has become a major concern in the Hong Kong society. The rise is attributable to the creation of wealth

2.3 Demography

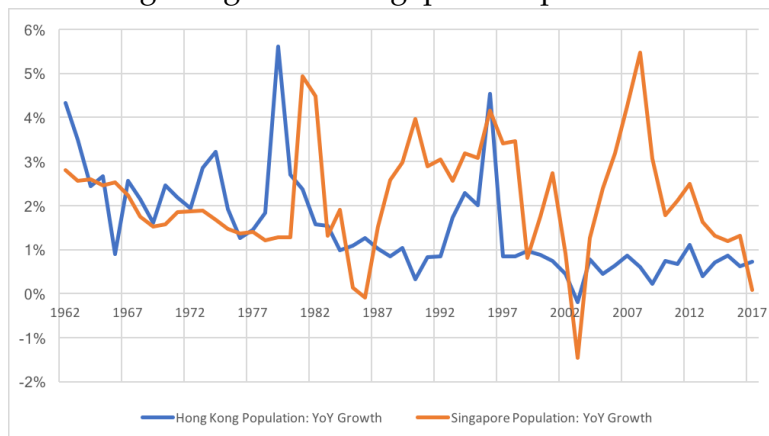
Both cities also face demographic shifts, but the challenges for Hong Kong is greater. Like many developed economies, Hong Kong and Singapore also facing a declining workforce owing to the ageing of their postwar baby boom generation. Due to the massive immigration wave from mainland China that occurred in the 1940s to 1970s, Hong Kong population grew at an average 3.2% p.a. in the 1950s, 2.4% p.a. in the 1960s and 2.5% p.a. in the 1970s, but fell to an annual growth rate of 1.1% in 1980-2017. Based on UN Population Projection, Hong Kong's population is projected to peak at around 8 million in 2030s. In contrast, Singapore's population was 52% that of Hong Kong in 1960 but it increased to 75% in 2017. Until the 1970s, Singapore population growth rate was lower than Hong Kong in the 1960-1979 but then the growth rate overtook Hong Kong's since the 1980s, which averaged at 2.3% p.a. between 1980-2017. Singapore's population is predicted to peak at over 7 million in the 2050s, which means Hong Kong's population will stagnate almost 20 years before Singapore's.

Figure 6: Hong Kong versus Singapore: Population



Source: Hong Kong Census and Statistics Department, Singapore Department of Statistics

Figure 7: Hong Kong versus Singapore: Population Growth Rate

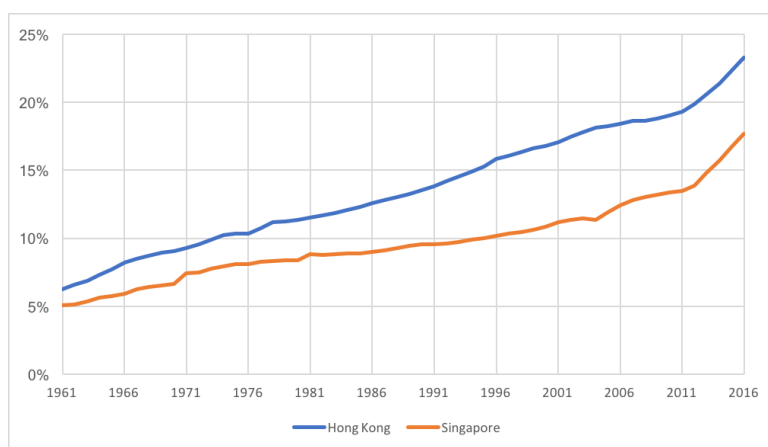


Source: Hong Kong Census and Statistics Department, Singapore Department of Statistics

In Hong Kong, as a result of the first massive immigration wave in 1945-1951, when population grew from 600,000 to 2.1 million, combined with high fertility rates, this created a huge postwar baby boom generation that became the main driver of the economic development in the 1960s and 1970s. However, as this group of baby boomers enter their retirement years in the 2010s, together with lower fertility rates of the subsequent generations, in which fertility rate decreased from 3.45 children per woman in 1971 to 1.20 in 2015, population starts to age. As a result, average household size declined from 3.9 in 1982 to 2.9 in 2015. As seen in Figure 2.3, the ratio of elderly (i.e.

those aged above 65) to working-age population (i.e. those aged 20-64) of Hong Kong is higher than that of Singapore, and it is growing at a faster rate as well. Based on UN Population Projection, the ratio of elderly to working age population is projected to rise from 20% in 2010 to a peak of 80% in the 2050s, while Singapore's ratio is projected to peak at a much lower rate of 50%.

Figure 8: Hong Kong versus Singapore: Ratio of Elderly to Working-age Population



Source: Hong Kong Census and Statistics Department, Singapore Department of Statistics

On the other hand, overall labour force participation rate is declining, dropped from 64.7% in 1982 to 61.1% in 2016, owing to a fall in male's labour force participation rate, which fell from 81.3% to 68.6% in the same period. Yet, Singapore's labour force participation rate has exhibited a sustained upward trend during the period, increased from 63.7% in 1991 to 68.3% in 2016. Human capital of the Hong Kong residents are also growing at a falling rate. Although average years of schooling rose from 6.7 years in 1980 to 8.5 years in 1990 then 8.7 in 2000 and to 10.0 years in 2010¹, Singapore has caught up during the same period, where average years of schooling increased from 3.7 years in 1980 to 10.1 years in 2010.

One of the major reasons for these demographic differences is probably the different immigration policies adopted. Singapore government has implemented policies to attract immigrants who are either young, highly skilled, or low-wage workers in sectors with labour shortages. By contrast,

¹UN Human Development Report 2013 Country Profile: <http://hdr.undp.org/sites/default/files/Country-Profiles/HKG.pdf>

Hong Kong's major source of population growth has been mainland Chinese spouses and accompanying children of Hong Kong residents through scheme designed for family union. These immigrants are often low-skilled female from the mainland China.

3 Data and Methodology

3.1 Data

3.1.1 Hong Kong

To construct the top income shares, income tax data published annually by the tax administration is used. Unfortunately, the Hong Kong Inland Revenue Department publishes tabulated tax data only for salary income tax, but not total individual income tax including other sources of income such as capital income like other countries. Therefore, we are only able to compute the top labour income share series in this paper. While labour income shares alone cannot give us a full picture of the evolution income inequality, it is still a useful starting point in investigating the trends in income inequality in Hong Kong, as employment income constituted 86% of total domestic household income in 2006, 2011 and 2016².

The main data used to construct the top income series is the tabulate salaries tax data published in the annual reports of the Hong Kong Inland Revenue Department, which provides figures on the total number of tax payers and the total income per brackets, available from 1998 to 2015. Appendix A provides an example of the raw tax data. A year of tax assessment runs from 1 April to 31 March of the following year, hence income tax data for the year n corresponds to income from 1 April in year n to 31 March in year $n + 1$. An example of the raw data is provided in Appendix

3.1.2 Singapore

Singapore levies an individual income tax, which taxes different sources of income including employment income, business income, rents, dividends, royalties and interests. Therefore, for Singapore, we are able to compute the top income shares as supposed to top labour income shares for Hong Kong. The

²Source: 2016 Hong Kong Population By-Census

Inland Revenue Authority of Singapore publishes tabulated total individual income tax data for 2004-2016, as well as the overall breakdown of assessable income by income type. Appendix A provides the detail of the sources and an example of the raw tax data.

Same as Hong Kong, a year of tax assessment runs from 1 April to 31 March of the following year.

3.2 Methodology

3.2.1 Generalised Pareto Interpolation

As data in the form of tabulations, the given thresholds do not usually coincide with the percentile of the population of interest (such as top 0.1%, 1%, 10%), it is necessary to interpolate to obtain top income shares of interest. It has been well documented that the upper tail of the distribution of income can be approximated by a Pareto distribution. Hence, Pareto interpolation methods have been widely used in the literature (such as Kuznets (1953), Piketty and Saez (2003)) to construct long-run series on income and wealth series. The Pareto law follows the following cumulative distribution function:

$$1 - F(y) = \left(\frac{k}{y}\right)^\alpha$$

where α is the Pareto parameter. with corresponding density function $f(y)$ of the form:

$$f(y) = \frac{\alpha k^\alpha}{y^{(1 + \alpha)}}$$

The distribution has the property that the ratio of average income $y^*(y)$ of individuals with income above y to y does not depend on the income threshold y :

$$\begin{aligned} y^*(y) &= E(z|z \geq y) \\ &= \left[\int_{z>y} z f(z) dz \right] / \left[\int_{z>y} f(z) dz \right] \\ &= \alpha y / (\alpha - 1) \end{aligned}$$

From the above equation, we can define a parameter β as follows:

$$\beta = y^*(y) / y = \alpha / (\alpha - 1)$$

where β is referred to as the inverted Pareto coefficient, which describes the shape of the distribution. Intuitively, a higher β implies a fatter upper tail of the

distribution. For example, if $\beta = 3$, the average income of individuals with income above \$100,000 is \$300,000. According to [Atkinson et al. \(2011\)](#), β typically varies between 1.5 and 3, values around 1.5-1.8 indicate low inequality by historical standards (with top 1 percent income shares between 5-10 percent), while values above 2.5 indicate very high inequality (with top 1 percent income shares between 15-20 percent or higher).

While this standard Pareto method is a reasonable interpolation, it is not entirely correct. Hence, [Blanchet, Fournier, and Piketty \(2017\)](#) has developed the generalised Pareto interpolation technique which nonparametrically characterise the entire distribution based on tabulated data. This allows for greater flexibility in contrast to the standard Pareto law, as the Inverted Pareto coefficient does not need to be held constant and the distribution need not to be in a specific shape. Comparing against other interpolation methods using micro income files, [Blanchet et al. \(2017\)](#) show that the generalised Pareto interpolation method produces precise results as well as guarantees the smoothness of the estimated distribution, while other methods introduce kinks around the thresholds used as inputs for tabulation. This paper adopts the generalised Pareto interpolation method to estimate the full distribution of income applied to tabulated tax data, combined with population and income data.

The generalised Pareto interpolation method generates 127 generalised percentiles including $p_0, p_1, p_2, \dots, p_{99}, p_{100}$ corresponding to the 100 fractiles of the distribution. The top fractile is split to 10 deciles ($p_{99.0}, p_{99.1}, \dots, p_{99.9}, p_{100}$) and the top decile is split further to ten deciles ($p_{99.9}, p_{99.91}, \dots, p_{99.99}, p_{100}$), the tenth decile is again split to ten deciles ($p_{99.990}, p_{99.991}, \dots, p_{99.999}, p_{100}$).

3.2.2 Control Total for Population

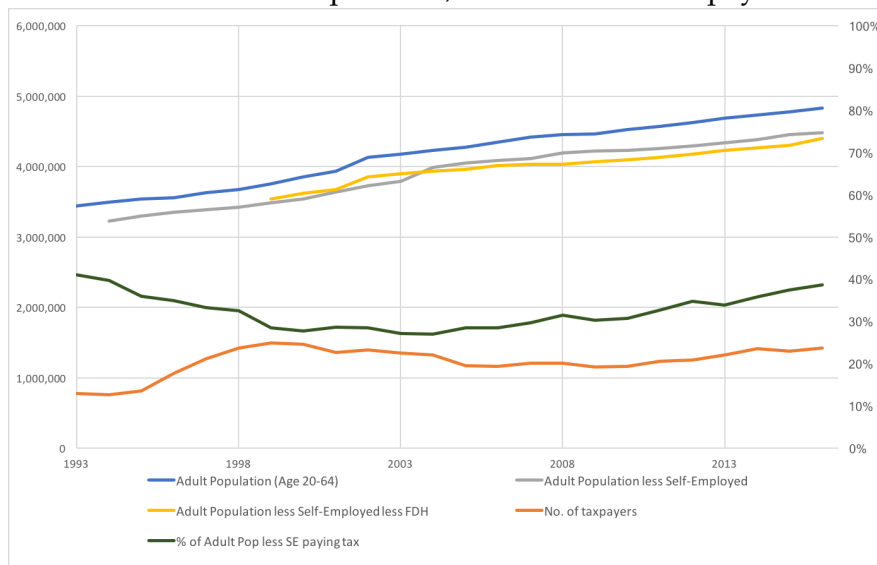
To estimate top income shares, we have to relate the number of persons to a control total that define how many tax filers represent a given fractile. The total number of tax filers is defined as the number of tax units which would have been observed had everyone been required to file a tax form.

Hong Kong

Hong Kong salaries tax is largely individually based, but married couples can also elect for joint assessment. Joint assessment account for around 5% of all tax filings. Here I haven't adjusted for this joint assessment. the resulting

estimates may overstate the top income shares among tax units. On the other hand, self-employed should be omitted as they file profit tax returns rather than salary tax return. Consequently, a natural approximation is the population aged between 20 and 64 less the self-employed population. In Appendix D, result in which foreign domestic helpers are removed are also presented for comparison. These statistics are published in the Quarterly Report on General Household Survey compiled by the Census and Statistics Department.

Figure 9: Evolution of Adult Population, Tax Units and Taxpayers in Hong Kong



Source: Hong Kong Census and Statistics Department

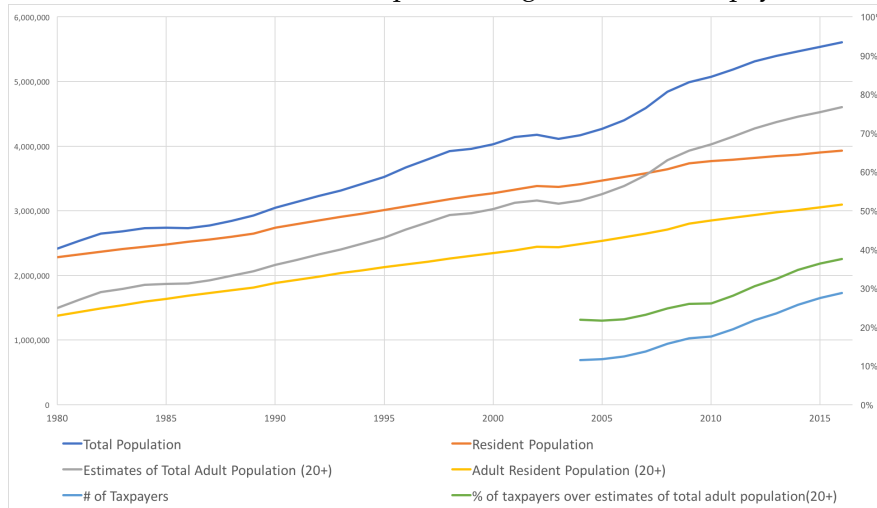
Singapore

The tax unit is individual as since Year of Assessment 2005, separate assessment becomes the default mode of assessment for husband and wife to replace the previous combined assessment for married couples. Hence, a natural candidate is the population aged 20 years old or above. Statistics on population are published in the Yearbook of Statistics Singapore. Two series of population estimates are published - (1) Singapore residents which comprises Singapore citizens and permanent residents with local addresses, (2) total population which comprises Singapore residents, and non-residents. Non-resident population comprises foreigners who were working, studying, or living in Singapore but not granted permanent residence. This is a significant share of the population, which made up 30% of total population in 2016. In this analysis, the control total for population should be based on total population

rather than resident population, as non-residents working in Singapore also pay individual income tax. However, Singapore Department of Statistics do not publish the breakdown of total population by age. Therefore, we have to estimate the total population aged 20 years old or above. Details for the estimation is explained in Appendix C.1.

As can be seen in Figure 10, the proportion of total population paying tax increased from 16% in 2004 to 31% in 2016. The control total for population, estimates of adult population, increases from 3.1 million in 2004 to 4.6 million in 2016.

Figure 10: Evolution of Residents Population aged 20+ and Taxpayers in Singapore



Source: Singapore Department of Statistics

3.2.3 Control Total for Income

To estimate income shares, it is also necessary to relate the amounts of income recorded in the tax data (numerator of top share) to a comparable control total of income for the full population (denominator of the top share). This control total for income is the total income which would have been reported if all the tax units were required to fill a tax form. [Atkinson et al. \(2011\)](#) documents two common methods to estimate this control total for income. One approach starts from the income tax data and adds the income of those not covered (the "non-filers"), which was adopted for the United States in [Piketty and Saez \(2003\)](#). This approach estimates the total income reported had all tax units been required to declare their income. The second approach involves an external control total, typically derived from the national accounts, corrected for missing

income and differences in timings to obtain the taxable income. In this approach, the income of non-filers appears as a residual. This was used for France in (Piketty, 2003).

Control Total for Income of Hong Kong

Note that as stated above, as we only have Hong Kong salaries tax data, the control total for income will consist of labour income only. Nonetheless, we adopt the second approach for estimating the total control labour income. The basis is the series of Compensation of Employees obtained from United Nations System of National Accounts (UNSNA) for years 1980 to 2015. Adjustments are made to Compensation of Employees in order to make it comparable to the tax data. The details of the adjustment are specified in Appendix B.

Control Total for Income of Singapore

As breakdown of National Accounts is not published, we will follow Atkinson and Piketty (2010) to construct the control total for income for Singapore. Instead of using Indigenous Gross National Income (GNI), which is the GNI less the share of resident foreign and resident foreign companies plus net factor receipts of Singaporeans from the rest of the world, here we use the GNI as a basis because the tabulated tax data include non-residents working/living in Singapore. The formula is to multiply GNI by an estimated ratio of total household income over GNI. Details are explained in Appendix C.2. Total household income is estimated based on the average monthly household income reported in the Household Expenditure Survey (HES) 2012/3. Additional results which use Indigenous GNI as a basis for the control total income is also presented in Appendix E.

3.3 Limitations of tax data

While the use of tax data has been widely adopted in the body of research on top income shares, it is not without drawbacks. First, as only a fraction of the population files tax return, tax data can only help to measure top shares, but it is not a good representative for measuring middle and bottom shares. Second, estimations may be biased due to tax avoidance and tax evasion. Estimations might understate the top shares to the extent that part of their income are not declared as the rich have higher incentives to under-declare their incomes. In our case, the rich may transfer their salary income to other forms of income to reduce tax liabilities. Third, the analysis on pre-tax and pre-transfer income

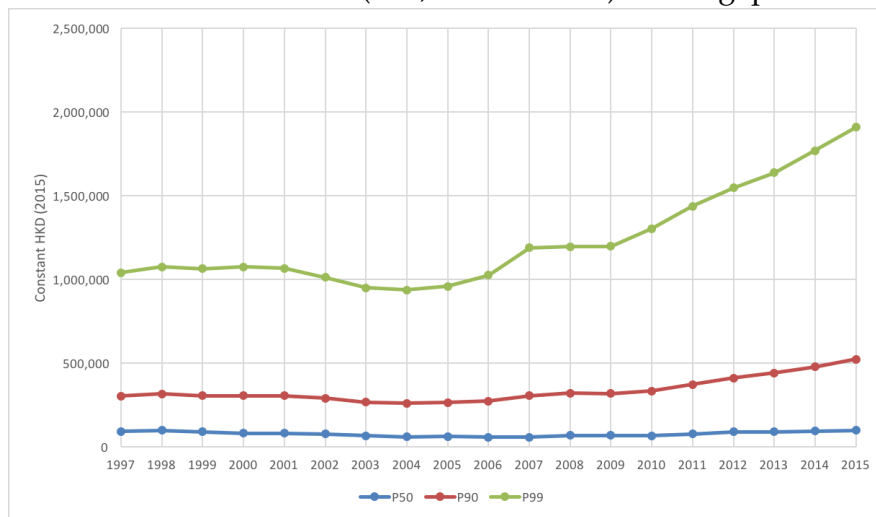
inequality do not take into account the potential redistributive impact of fiscal policies.

4 Results

4.1 Hong Kong

First, the different income thresholds for Hong Kong is presented. Figure 11 illustrates the minimum amount required to be part of the top 1% of the income distribution (P99), top 10% (P90) and top 50% (P50). The thresholds for P99 accelerated since 2009, which rose more rapidly than thresholds for P50 and P90.

Figure 11: Thresholds of income (P50, P90 and P99) for Singapore in 2004-2016



Source: Own Estimations

Figure 12 presents the evolution of different top labour shares in Hong Kong during 1997 and 2015. There are several noticeable trends. First, the top 10% and top 1% exhibited a clear upward trend between 1997 and 2007, and reached their peaks in 2007. Top 10% was at 39% in 1997 amid the Asian financial crisis, and it increased quickly by 6% to 45% in 2000, which might be attributable to the Dotcom Bubble in 2000. It then fell a bit to 44% in the following 2 years, but then started to rise since 2002, which rose from 44% in 2002 to 51% in 2006. Then from 2006 to 2007, at the peak of the global financial bubble, the top 10% shares jumped by 3% to 54%. Similarly for top 1% shares, it increased continuously from 12% in 1997 to 98% in 2006, which then jumped

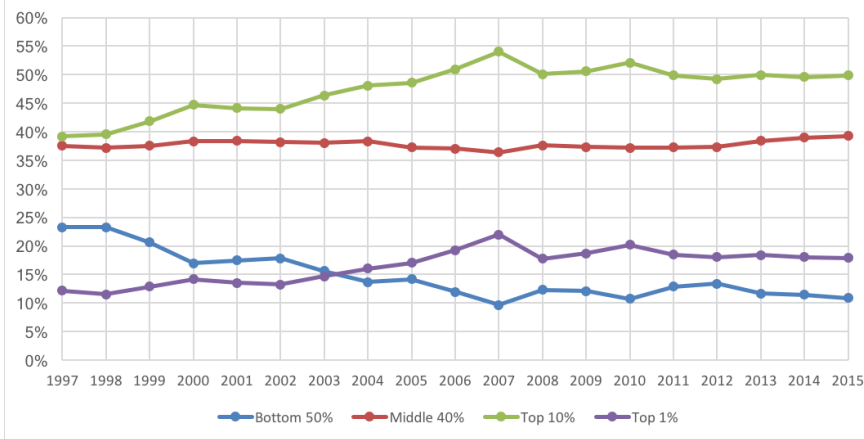
by 3% to 22% in 2007.

Second, after the 2008 global financial crisis, top 10% and top 1% shares decreased sharply from their peaks. Top 10% dropped by 4% to 50% in 2008. Top 1% also fell by 4% to 18% in 2008. But the two series recovered and rose by 2% to 52% and 20% respectively in 2010. Subsequently, the two top shares series stabilised during 2011 and 2015. Top 10% and top 1% hovered at around 50% and 18% respectively. Despite falling from its 2008 peak levels, the top 10% and 1% shares in the post-2008 financial crisis era were higher than pre-crisis levels.

Third, as the generalised Pareto interpolation technique also allows us to estimate the share of income going to the middle 40% and bottom 50%, it can be seen that middle 40% has been relatively stable at high 30% levels. The middle 40% share was flat at 38% between 1997 and 2004, then decreased slightly to 36% in 2007. After the global financial crisis, the shares has increased slightly from 36% in 2007 to 39% in 2015.

Fourth, the bottom 50% shares had a clear downward trend between 1997 and 2014. It dropped from 23% in 1997 to a trough of 10% in 2007. The bottom 50% shares then recovered subsequently as it increased steadily to 13% in 2012, but then the decreasing trend continues and dropped to 11% in 2015. This is despite of the introduction of minimum wage law in 2011 of HK\$28 per hour, which then increased slightly to HK\$ 34.5 per hour in 2017.

Figure 12: Evolution of different top labour income shares in Hong Kong in 1997-2015



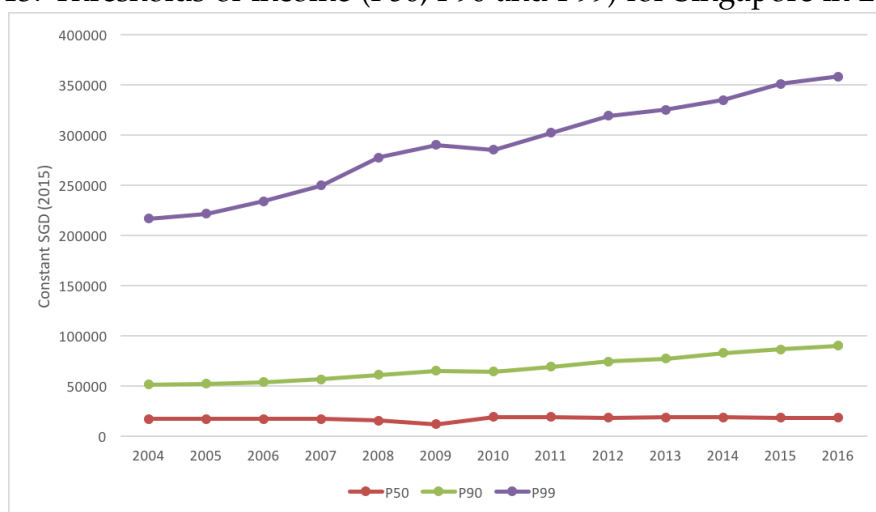
Source: Own Estimations

The results indicate that Hong Kong's labour inequality are highly exposed to external events, such as Dotcom bubble and the global financial crisis in 2008. The bottom 50% shares show that the minimum wage policies fail to alleviate the rising labour income inequality.

4.2 Singapore

First, the different income thresholds for Singapore is presented. Figure ?? illustrates the minimum amount required to be part of the top 1% of the income distribution (P99), top 10% (P90) and top 50% (P50). The increase of the thresholds for P99 accelerated since 2009, which rose more rapidly than thresholds for P50 and P90.

Figure 13: Thresholds of income (P50, P90 and P99) for Singapore in 2004-2016



Source: Own Estimations

Figure 14 presents the evolution of top income shares in Singapore during the period 2004 to 2016. Several points can be highlighted. First, top 10% income shares were relatively flat between 2004 and 2007, which increased slightly from 44% to 47%. Top 1% shares also increased from 15% to 17%.

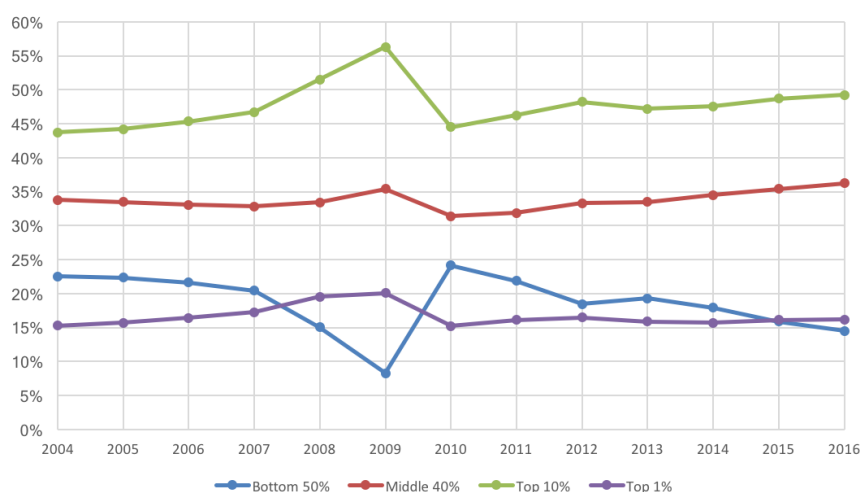
Second, since reaching the peaks in 2009, top 10% and top 1% shares then dipped in 2010, but then recovered and stabilized until the end of the observation. Top 10% shares increase dropped from 56% in 2009 to 45% in 2010, and increased slightly to 49% in 2016. Top 1% shares also dropped from the peak of 20% to 15% in 2010, and stabilized at 16% afterwards. Both series

was higher in the post-global financial era.

Third, the bottom 50% shares decreased from 22% in 2004 to 8% in 2009.. It then rebounded to 24% in a year in 2010. Between 2010 and 2016, the bottom 50% shares exhibited a clear downward trend. Note that the estimation of the bottom 50% shares are probably not as accurate as the top 10% shares. But the overall trend gives us an indication that the bottom 50% is declining.

Middle 40% shares follow a similar trend as the top 10% shares, but of lower magnitude of change. It dropped from 34% in 2004 to 33% in 2007. It then increased back to 35% in 2009. Similar to the top 10% shares, it exhibited an upward trend between 2010 and 2016, which increased from 32% to 36%.

Figure 14: Evolution of different top income shares in Singapore in 2004-2016



Source: Own Estimations

4.3 Comparison between Hong Kong and Singapore

The results for Hong Kong and Singapore cannot be compared directly as Hong Kong's series are based on labour income while Singapore's series are based on total individual income. Nevertheless, comparisons of the results between the 2 economies could provide some new insights.

First, both economies exhibit very high level of income concentration. Singapore's top 10% and top 1% income shares are at magnitudes of 50% -55% and 16%-20% respectively in the sample period, which is high compared with

other developed economies. The US's top 10% and top 1% income shares since the 2000s is in the mid 40% range and below 15% respectively. On the other hand, Hong Kong's labour income inequality alone already reaches the magnitude of 50%. Taking into account other sources of income especially capital income, we would expect Hong Kong's top 10% and top 1% income shares to be even higher, as capital income is usually a greater share of income source as we go up the income distribution and capital returns outpace employment income growth.

Also, the evolution of top income shares in Singapore can give an indication of the expected trends of top income shares in Hong Kong. I believe that Singapore and Hong Kong's top income shares are likely to be following similar upward trend given the similarities in the two economies. Singapore's top 10% and top 1% income shares are gradually increasing from their dip in 2010, from 49% in 2010 to 59% in 2016, while Hong Kong's top 10% labour income shares is stabilising at the level of 50% in the post-global financial era. Using Singapore as an indication, adding other sources of income are likely to exacerbate the income inequality in Hong Kong, thus Hong Kong's top income shares is likely to exhibit an upward trend in recent years.

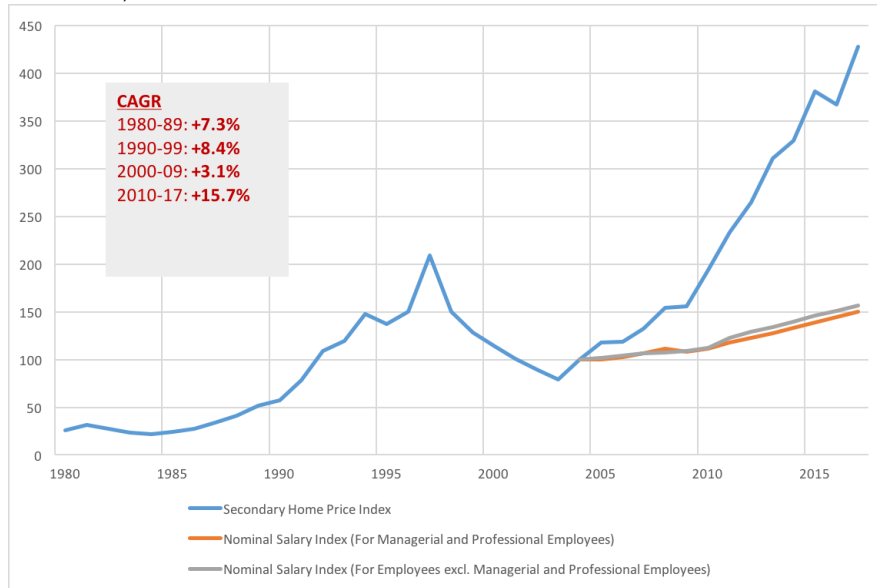
In the longer run, we might expect Hong Kong's income inequality to be worse than Singapore's. A possible fundamental reason is the difference in demographic features. The Singaporean government is actively attracting skilled immigrants to boost its population growth and slow its ageing population. Yet, Hong Kong's immigrants mainly come from mainland China through the family reunion scheme, and they are usually low-skilled female spouses. As explored in Section 2.3, Hong Kong's population is growing slower and ageing faster than Singapore and its labour force participation rate is also lower. Moreover, Singapore also invests more heavily in human capital than in Hong Kong. Moreover, as explained in Section 2.3, human capital in terms of years of schooling in Singapore has caught up Hong Kong. Going forward, we can expect this diverging trend to continue, not only due to the difference in demographic shifts but also difference in government policies. In recent year, Singapore's ruling PAP party has been losing support with income inequality emerging as one of the key issues. In May 2018, the President of Singapore has listed inequality as one of the five key priorities for the government. Yet, Hong Kong's government is relatively slow in tackling income inequality. The government is content with the traditional minimum interventionist stance. It has not introduced major economic or welfare reforms that might mitigate income inequality.

5 Future Work

This paper provides a starting point for studying the evolution of income inequality in Hong Kong by studying the labour income component and Singapore by studying the total individual income. For the case of Hong Kong, due to data constraint, it is impossible in this paper to investigate other sources of income such as business income and capital income. When data becomes available, the analysis should extend to analyse the top shares of total individual income. As estimated in Piketty, capital income becomes the dominant source of income for top 0.1% in the United States, which made up of at least 50% of their income. With capital returns growing faster than labour returns, overall income inequality is expected to be even higher when accounted for business and capital income.

Second, wealth inequality is not considered here, which should be examined in order to get a better understanding of the overall inequality. Wealth inequality is expected to be high in Hong Kong as its liberal economic policies, low tax rate and sound legal framework attract wealthy investors especially from China. In particular, hot money from the mainland China has pushed up local property prices especially since the end of 2008 global financial crisis. As seen in Figure 15, secondary private home prices increased by 15.7% per annum between 2010 and 2017, which outpaced nominal wage growth of 4.5% p.a. and 5.5% p.a. for managerial and professional employees and employees excluding managerial and professional employees respectively. Yet, home ownership rate in Hong Kong was only 49.2% in 2017, compared with 90% in Singapore. This means the rise in housing prices likely only benefit the upper part of the wealth distribution, widening wealth inequality. Hence, a comprehensive analysis of wealth inequality could give us a more complete understanding of the inequality in Hong Kong, especially how the liquidity from China has shaped the evolution of wealth inequality.

Figure 15: Hong Kong Secondary Private Home Markets Price Index and Wage Index (2014=100)



Source: Hong Kong Rating and Valuation Department, Hong Kong Census and Statistics Department

6 Conclusion

This paper examines the top labour income shares in Hong Kong and the top income shares in Singapore. The paper contributes by constructing the top labour incomes in Hong Kong in 1997-2015 and top incomes in Singapore in 2004-2016 using tabulated income tax data. The result suggests that both economies exhibit a high level of income inequality, which has been growing since the trough after the financial crisis in 2009.

However, this study has several limitations. First, the income concept used here is taxable income, instead of fiscal income, which is the income that should have been reported in tax returns prior to any deductions. Second, the control total for income, especially for Singapore, is subject to huge margin of error. Results are sensitive to the different control total for income used. Third, the number of years available for analysis is short (1997-2015 for Hong Kong and 2004-2016 for Singapore).

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Appendix A Tabulated Income Tax Example

For Hong Kong, the salaries tax data for 1998 to 2015 is obtained from the Annual Reports of Hong Kong Inland Revenue of Department. Figure 16 provides an example of the raw tax data for the year of assessment 2015.

Figure 16: Hong Kong Tabulated Individual Income Tax for 2015

Annual Income	No. of Taxpayers	Percent age of Taxpayers	No. of Elections for Joint Assessment	Total Income (After Deductions other than Self Education Expenses and Concessionary Deductions)
(\$)		(%)		(\$'000)
120,001 -	29,532	1.65	0	3,744,056
130,001 -	54,354	3.03	0	7,336,041
140,001 -	55,577	3.10	0	8,061,035
150,001 -	164,461	9.18	0	27,168,746
180,001 -	141,991	7.93	0	27,617,019
210,001 -	136,643	7.63	0	30,770,389
240,001 -	122,348	6.83	5,757	31,155,398
270,001 -	109,514	6.11	7,040	31,183,984
300,001 -	301,201	16.82	30,451	104,376,533
400,001 -	205,148	11.45	29,674	91,555,159
500,001 -	130,665	7.29	17,593	71,634,784
600,001 -	75,999	4.24	9,107	48,992,016
700,001 -	59,835	3.34	5,121	44,355,956
800,001 -	39,060	2.18	3,014	33,129,535
900,001 -	26,486	1.48	1,908	25,052,904
1,000,001 -	71,025	3.97	4,125	85,307,690
1,500,001 -	26,341	1.47	1,337	45,211,105
2,000,001 -	21,262	1.19	870	50,964,610
3,000,001 -	11,641	0.65	216	43,704,605
5,000,001 -	4,095	0.23	7	24,637,275
7,500,001 -	1,577	0.09	2	13,543,510
10,000,001 &	2,435	0.14	4	51,073,263
Total	1,791,190	100.00	116,226	900,575,613

Source: Hong Kong Inland Revenue Department

For Singapore, the individual income tax data for 2004 to 2015 is obtained from the Inland Revenue Authority of Singapore. Figure 17 provides an example of the raw tax data for the year of assessment 2016. As explained in Section 3.1.2, non-Tax Resident are excluded from the calculation of top shares.

Figure 17: Singapore Tabulated Individual Income Tax for 2016

Assessed Income Group S\$	Number of Taxpayers		Assessable Income ¹	
	Tax Resident	Non-Tax Resident ⁴	Tax Resident S\$'000	Non-Tax Resident ⁴ S\$'000
20,000 & below	-	22,798	-	173,127
20,001 - 25,000	69,328	2,186	1,610,735	49,003
25,001 - 30,000	141,817	1,679	3,943,990	45,972
30,001 - 40,000	322,052	2,214	11,213,368	76,261
40,001 - 50,000	243,206	1,327	10,887,626	59,076
50,001 - 60,000	185,427	939	10,171,474	51,474
60,001 - 70,000	130,977	648	8,483,207	41,995
70,001 - 80,000	99,045	501	7,406,447	37,384
80,001 - 100,000	138,151	631	12,338,535	56,260
100,001 - 150,000	181,790	665	22,113,864	79,993
150,001 - 200,000	82,226	263	14,155,151	45,151
200,001 - 300,000	69,633	219	16,845,514	51,929
300,001 - 400,000	28,074	74	9,644,768	25,612
400,001 - 500,000	13,525	30	6,010,792	13,293
500,001 - 1,000,000	17,753	49	11,773,402	32,212
1,000,001 & above	5,495	29	10,431,175	153,390
Total	1,728,499	34,252	157,030,049	992,132

Source: Inland Revenue Authority of Singapore

Appendix B Adjustment to Control Total for Income for Hong Kong

Compensation of Employees are used as the basis for the control total for income. UNSNA defines Compensation of Employees as the total remuneration payable by an enterprise to an employee in return for work done by the latter. It consists of two components - (1) wage and salaries in cash or in kind and (2) social insurance contributions payable by employers, which include contributions to social security schemes; actual social contributions to other employment-related social insurance schemes and imputed social contributions to other employment-related social insurance schemes.

According to UNSNA, employers' social contributions (series D12) are "social contributions payable by employers to social security funds or other employment-related social insurance schemes to secure social benefits for their employees". UNSNA categorises employers' social contributions to actual (series D121) and imputed contributions (series D122), separated by pension and non-pension benefits, as shown in Figure 18.

Figure 18: Breakdown of Employers' Social Contribution

$$\begin{aligned} &\mathbf{\text{Employers' social contribution (D12)}} \\ &= \text{Employers' actual social contributions (D121)} \\ &\quad \text{Employers' actual pension contributions (D1211)} \\ &\quad \text{Employers' actual non-pension contributions (D1212)} \\ &+ \text{Employers' imputed social contributions (D122)} \\ &\quad \text{Employers' imputed pension contributions (D1221)} \\ &\quad \text{Employers' imputed non-pension contributions (D1222)} \end{aligned}$$

The equation for the control total of income is as below, which will be explained further in the following subsections:

Figure 19: Estimates of Control Total for Income

$$\begin{aligned} &\mathbf{\text{Control Total of Income}} \\ &= \text{Compensation of Employees} \\ &- \text{Estimates of Employers' Actual Pension Contribution} \end{aligned}$$

B.1 Estimations of employers' actual pension contributions

In Hong Kong, there are no social security schemes, instead there are two retirement schemes - Mandatory Provident Fund (MPF)³ and Occupational Retirement Schemes Ordinance (ORSO)⁴. All employees and self-employed persons are legally required to participate in one of the retirement schemes. As of March 2017, MPF covers and ORSO cover 2.6 million and 0.37 million employees respectively.⁵

Employers' actual pension contributions (series D1211), here refers to employers' contribution to the MPF or ORSO schemes, are not considered as salary income in the tax file. Thus, it has to be deducted from Compensation of Employees for our control of total income. Employers' actual pension contributions can be divided to contributions from ORSO and MPF schemes respectively.

³MPF is a mandatory, defined contribution retirement scheme introduced by the government in 2000.

⁴ORSO is a voluntary retirement scheme enacted in 1993, which these existing firms can still opt for

⁵http://www.mpfa.org.hk/eng/information_centre/publications/annual_reports/files_20162017/12-Stat-e.pdf

Employers' contributions to ORSO schemes are specified in Part (D) of the Statistics Section of the MPFA Annual Report for 2000-2015. On the other hand, employers' contributions to MPF schemes have to be estimated manually as it is not directly reported in the Annual Report. Estimations is based on the total mandatory and voluntary contributions reported in the annual report. The total contributions are divided by 2 as it is assumed that employers and employees contributes equally to the MPF scheme. The formula for the estimations of Employers' Contribution to MPF schemes are as follow:

$$\begin{aligned} & \text{Estimated Employers' actual contributions to MPF schemes} \\ & = \frac{\text{Total Mandatory Contributions} + \text{Total Voluntary Contributions}}{2} \\ & *(\% \text{ of Enrollment who are employees}) \end{aligned}$$

Table 1 shows the estimated total employers' contributions to MPF and ORSO schemes. The total amount (last column) is then deducted from Compensation of Employees for the estimation of control total income.

Table 1: Estimations of Employers' actual pension contributions

Year	ORSO	MPF					Total	
	Employers' Ctn (HK\$ Million)	Total Mandatory Ctn (HK\$Million)	Total Voluntary Ctn (HK\$Million)	Estimated Total Ctn (HK\$Million)	# of Employees Enrolled	# of Self-Employed Enrolled	Est. Employers' MPF Ctn (HK\$Million)	Est. Employers' Ctn (HK\$Million)
1997*	17,888	NA	NA	NA	NA	NA	NA	17,888
1998*	17,888	NA	NA	NA	NA	NA	NA	17,888
1999*	17,888	NA	NA	NA	NA	NA	NA	17,888
2000	17,888				0	0	0	17,888
2001**	15,969			10433	1,664,000	292,000	4,438	20,407
2002**	14,208			10607	1,727,000	300,000	4,519	18,727
2003**	15,016			10249	1,716,000	302,000	4,358	19,374
2004	11,900	21,648	2,116		1,819,000	370,000	9,874	21,774
2005	13,736	22,554	2,368		1,889,000	292,000	10,793	24,529
2006	12,394	24,219	2,702		1,993,000	287,000	11,766	24,160
2007	11,986	25,919	3,141		2,052,000	284,000	12,764	24,750
2008	11,923	28,087	3,715		2,129,000	267,000	14,129	26,052
2009	11,846	38,566	4,346		2,202,000	266,000	19,143	30,989
2010	12,559	30,932	4,430		2,207,000	263,000	15,798	28,357
2011	13,855	32,581	5,201		2,272,000	241,000	17,079	30,934
2012	13,139	35,257	6,193		2,347,000	229,000	18,883	32,022
2013	14,075	40,098	6,731		2,376,000	219,000	21,438	35,513
2014	14,686	43,622	7,469		2,494,000	212,000	23,544	38,230
2015	14,316	48,500	7,944		2,564,000	207,000	26,114	40,430

Source: Hong Kong Mandatory Provident Fund Schemes Authority. "Ctn" stands for "Contributions". *MPF schemes was introduced in 2000. ORSO contributions are not published for 1997-99, so it is assumed to be equal to 2000's contribution. **For 2001-2004, contributions figures are not published. Hence total contributions are backwardly estimated by assuming it grows at the same rate as GNI growth rate.

B.2 Other series of employers' social contributions

On the other hand, certain employers' actual non-pension contributions (series D1212), including cash allowance for education benefits for dependants, allowance for housing, are taxable, but other non-pension benefits such as medical care expenditure are not taxable. In theory, the non-taxable non-pension contributions should be deducted from control of total income. However, in practice, such data is not available and it is difficult to make an estimation. It might be safe to assume that the size of non-taxable employers'

non-pension contributions are negligible.

For defined contribution pension scheme, there are no imputed employers' pension contributions (series D1221) unless the employer operates the scheme himself. For a defined benefit pension scheme, there is an imputed contribution by the employer calculated as a residual, which is such that the sum of the employer's actual contribution plus the sum of any contribution by the employee plus the imputed contribution by the employer is equal to the increase in benefit due to current period employment plus the costs of operating the scheme.

Employers' imputed non-pension contributions (series D.1222) refer to the benefits employers provide themselves directly to their employees without involving an insurance enterprise or autonomous pension fund and without creating a special fund or segregated reserve for the purpose. In practice, it is difficult to decide how large such imputed contributions should be.

Appendix C Adjustment to Control Total for Population and Income for Singapore

C.1 Adjustment to Control Total for Total Population

As explained above, Singapore publishes two series of population data - (1) Singapore residents which comprises Singapore citizens and permanent residents, (2) total population which comprises Singapore residents and non-residents. As Singapore Department of Statistics do not publish the breakdown total population by age, an estimation has to be made for our control total for population, i.e. the total population that aged 20 years old or above.

The formula for control total population is as below:

$$\begin{aligned} &\textbf{Control Total of Population} \\ &= \text{Singapore Residents aged 20+} \\ &+ \text{Estimates of Non-Residents aged 20+} \end{aligned}$$

Figure 20: Estimates of Control Total for Population for Singapore

Singapore residents breakdown by age groups is published annually in the Yearbook of Statistics Singapore. Estimates of Non-Residents aged 20+ will be calculated as below:

Estimates of Non-Residents aged 20+

= Total No. of Non-Residents * Estimates % of Non-Residents aged 20+

Figure 21: Estimates of Non-residents aged 20+

Estimates of % of Non-residents aged 20+ is based on the breakdown of non-residents provided by the publication "Population in Brief" published by the Singapore government⁶. Non-residents are categorized as work permit holders, foreign domestic helpers, dependants of citizens/residents/work permit holders and students. As of June 2016, non-residents totalled 1.67 million, 66% hold a work permit, 14% are foreign domestic helpers, 17% are dependants of citizens, residents or work permit holders, and 4% are students. The estimates is based on the assumption that all foreign domestic helpers and non-resident workers aged 20 years old or above, and half of the student and dependants population aged 20 or below. The estimates of % of non-residents aged 20+ is therefore $1 - (\% \text{ of dependants or students})/2$. As an example, for 2016, the estimates of % of non-residents aged 20+ is $1 - (0.04 + 0.17)/2 = 0.85$.

The estimates are presented here:

⁶<https://www.strategygroup.gov.sg/docs/default-source/Population/population-in-brief-2016.pdf>

Table 2: Estimations of Control Total for Population of Singapore

	(A)	(B)	(C)	(D)= 1-(C)/2	=(A)+(B)*(D)
Year	Singapore Residents aged 20+	Non-resident population	% of Non-residents being Dependants and Students*	Est. % of Non-residents aged 20+ (D)	Est. of Total Population aged 20+
2004	2,483,230	753,398	20.0%	90.0%	3,085,948
2005	2,537,574	797,948	20.0%	90.0%	3,175,932
2006	2,593,182	875,471	20.0%	90.0%	3,293,559
2007	2,647,325	1,005,517	20.0%	90.0%	3,451,739
2008	2,708,496	1,196,737	20.0%	90.0%	3,665,886
2009	2,803,250	1,253,697	20.0%	90.0%	3,806,208
2010	2,853,562	1,305,011	20.0%	90.0%	3,897,571
2011	2,891,609	1,394,437	20.0%	90.0%	4,007,159
2012	2,933,027	1,494,232	21.0%	89.5%	4,113,470
2013	2,974,442	1,554,411	20.0%	90.0%	4,217,971
2014	3,015,447	1,598,985	20.0%	90.0%	4,294,635
2015	3,057,373	1,632,312	20.0%	90.0%	4,363,223
2016	3,097,624	1,673,724	21.0%	89.5%	4,419,866

Source: Singapore Department of Statistics. * Population in Brief only published breakdown of non-residents in 2012-2016. For 2004-2011, % of dependants and students are assumed to be at 20%.

C.2 Adjustment to Control for Total Income

In [Atkinson and Piketty \(2010\)](#), a chapter by Anthony Atkinson is dedicated to Singapore to compute the top income shares series. As breakdown of national account series are not available, the author constructs the control total for household income by multiplying the Indigenous Gross National Income (GNI) with an estimate of the ratio of total household income over national income. In the chapter, estimates of the ratio of total household income over national income is based on the average monthly household income surveyed in the Household Expenditure Survey. Monthly household income consists of employment income, business income, non-work income including rental income, investment income, other sources including contributions from relatives and friends, pensions, social welfare grants, bursary, government transfers, regular payment from insurance protection policies and payouts from annuities and CPF schemes. Imputed rental of owner-occupied accommodation is excluded. Based on Household Expenditure Survey (HES) 2003 and [Khee](#)

and [Liong \(2005\)](#), the author estimated that the household income made up 61% of the indigenous GNI. However, he notes that the survey amount may be too low on account of under-reporting and differential non-response by upper income groups. According to [Rao \(2000\)](#), "it must be accepted that there is considerable under-coverage (up to 15% of GNP or 30% of likely actual household income) in the income data obtained by the HES.) Thus, the author takes a figure of 75% of the indigenous GNI as the control total for household income.

Following the same methodology, here the control total for income is estimated as GNI multiply by the estimated ratio of total taxable household income over GNI. GNI is used instead of indigenous GNI, as non-residents living/working in Singapore is also taken into account, and they are a considerable proportion of the population.

To compute the total taxable household income, the main data is the average monthly household income by income sources surveyed for 2003, 2007 and 2012 in the Household Expenditure Survey for 2012/13. First, the average monthly household income is adjusted to remove the non-taxable components. Employment income is adjusted by excluding compulsory employers' CPF contributions which is not reported in the tax form. This amount is estimated by multiplying employment income by 17%, the compulsory employers' contribution rate. Non-work income data is broken down by rental income, investment income, government transfers, and other sources such as contributions from friends. Assuming the whole other sources of income is not reported in the tax form, non-work income is adjusted by including investment income and rental income only, which is reported as 2.8% and 4.3% of monthly household income respectively in HES 2012/3. Since HES 2003 and 2007 did not reveal the non-work income by breakdown, ratio of rental and investment income to non-work income for 2016 is used to estimate the total rental and investment income for 2003 and 2007. The result is shown presented in [Table 9](#).

Then, as shown in [Table 11](#), the average monthly taxable household income is multiplied by 12 and the number of households to construct the total annual household taxable income in column (C). The ratio of household income to national accounts in Column (D) is then obtained by dividing (C) by GNI. The ratios for 2003, 2007 and 2012 are 52%, 50% and 47% respectively. Following the suggestions in [Atkinson and Piketty \(2010\)](#), I will add 10% to these ratios. To smooth the series, the ratios are assumed to fall linearly between 2002 and 2013. 2014 and 2015's ratios are calculated by assuming the ratio fall at the same

linear rate as in between 2007-2013. The resulting series is presented in the last column. As noted in [Atkinson and Piketty \(2010\)](#), there is clearly a wide margin of error arising from the assumed percentage.

Table 3: Surveyed Average Monthly Household Income by sources

Year	Employment Income	Business Income	Non-Work Income	Average Monthly Household Income
2002	5,288	608	282	6,178
2007	6,805	892	408	8,105
2013	8,251	1,151	1,101	10,503

Source: Singapore Household Expenditure Survey 2012/3

Table 4: Adjustment to Average Monthly Household Income by sources

	Remove Employer CPF (17%)	No Adjustment.	(Investment and Rental Income only)	(A)
Year	Employment Income	Business Income	Non-Work Income	Average Monthly Taxable Household Income
2002	4,389	608	191	5,188
2007	5,648	892	276	6,816
2013	6,848	1,151	746	8,745

Source: Singapore Household Expenditure Survey 2012/3

Table 5: Adjustment to Average Monthly Household Income by sources

	(B)	(C)=(A)*12*(B)	(D)	(C)/(D)
Year	No. of Hseholds	Est. Total Annual Hsehold Taxable Income	GNI (SGD Million)	Ratio of Hsehold Taxable Income / GNI
2002	989,000	61,571,659,431	153,983	0.40
2007	1,074,800	87,916,368,031	256,117	0.34
2013	1,174,500	123,252,636,042	366,053	0.34

Source: Singapore Household Expenditure Survey 2012/3

Table 6: Estimations of Control Total for Income for Singapore

	(E)	(F)	(G)	(F)*(G)
Year	GNI (SGD Million)	Indigenous GNI (SGD Million)	Ratio of Hsehd Taxable Income / GNI	Control Total for Income
2004	176,584	133,233	0.48	84,270
2005	194,250	144,127	0.47	90,502
2006	219,383	168,249	0.45	99,728
2007	256,117	204,795	0.44	113,528
2008	271,562	187,697	0.44	120,078
2009	260,605	195,655	0.44	114,948
2010	320,527	226,094	0.44	141,027
2011	337,394	231,592	0.44	148,080
2012	348,076	248,227	0.44	152,388
2013	366,053	260,010	0.44	159,858
2014	380,423	275,802	0.44	165,718
2015	389,941	289,449	0.43	169,437
2016	397,153	294,802	0.43	172,137

Source: Singapore Household Expenditure Survey 2012/3, Singapore Department of Statistics

Appendix D Additional Results for Hong Kong, excluding Foreign Domestic Helpers

Here presents the results in which foreign domestic helpers are removed from the population. Foreign domestic helpers (FDH), which made up 5.8% of the adult (aged 20-64) population in 2016, is removed from the control total for population in order to focus on the situation in the local Hong Kong population. Including foreign domestic helpers will likely overestimate the labour income inequality as they usually receive their legal minimum allowable monthly wage rate of HK\$ 4,310 in 2016, versus the median monthly employment income of HK\$16,000.

D.1 Control Total for Population

The control total for population is the adult population defined as residents aged between 20 and 64 less self-employed population less number of foreign domestic helpers. Statistics on the number of foreign domestic helpers are issued by the Hong Kong Census and Statistics Department.

D.2 Control Total for Income

The formula for Control Total for Income is as below. Earnings by Foreign Domestic Helpers has to be removed.

Figure 22: Estimates of Control Total for Income

Control Total of Income

= Compensation of Employees

- Estimates of Total Foreign Domestic Helpers' Earnings

- Estimates of Employers' Actual Pension Contribution

D.3 Estimations of Total Foreign Domestic Helpers' Earnings

As official figures on the total income earned by foreign domestic helpers are not available, we will estimate the total income by the following equation:

Yearly Total Income of Foreign Domestic Helpers

= Minimum Allowable Monthly Wage * No. of Employed FDH * 12

This provides a lower bound of the total FDH earnings.

Table 7: Estimations of Total Foreign Domestic Helpers' Annual Earnings

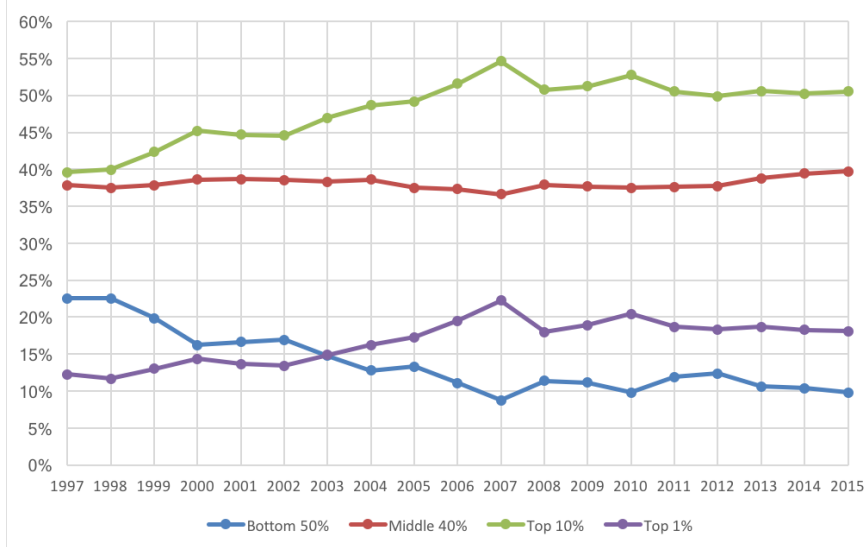
Year	# of Foreign Domestic Helpers	Minimum Monthly Allowable Wages (HK\$)	Est. Total FDH Earnings (HK\$ Million)
1993	77,600		
1994	98,800		
1995	106,900	3,750	4,811
1996	120,100	3,860	5,563
1997	131,500	3,860	6,091
1998	139,700	3,860	6,471
1999	157,300	3,670	6,927
2000	154,300	3,670	6,795
2001	179,400	3,670	7,901
2002	188,200	3,670	8,288
2003	199,200	3,270	7,817
2004	192,600	3,270	7,558
2005	202,900	3,320	8,084
2006	202,400	3,400	8,258
2007	213,100	3,480	8,899
2008	226,500	3,580	9,730
2009	230,200	3,580	9,889
2010	244,000	3,580	10,482
2011	252,500	3,740	11,332
2012	274,700	3,920	12,922
2013	280,400	4,010	13,493
2014	279,900	4,110	13,805
2015	291,200	4,210	14,711
2016	289,000	4,310	14,947
2017	312,700	4,410	16,548

Source: Hong Kong Census and Statistics Department

D.4 Results

Excluding FDH give very similar results to including FDH in the population.

Figure 23: Evolution of different top shares in Hong Kong in 1997-2015



Source: Own Estimations

Appendix E Additional Results for Singapore, with a Different Control Total for Income

E.1 Control Total for Income

Similar to the main result, but only that GNI is replaced with Indigenous GNI for comparison with [Atkinson and Piketty \(2010\)](#)'s results.

Table 8: Surveyed Average Monthly Household Income by sources

Year	Employment Income	Business Income	Non-Work Income	Average Monthly Household Income
2002	5,288	608	282	6,178
2007	6,805	892	408	8,105
2013	8,251	1,151	1,101	10,503

Source: Singapore Household Expenditure Survey 2012/3

Table 9: Adjustment to Average Monthly Household Income by sources

	Remove Employer CPF (17%)	No Adjustment.	(Investment and Rental Income only)	(A)
Year	Employment Income	Business Income	Non-Work Income	Average Monthly Taxable Household Income
2002	4,389	608	191	5,188
2007	5,648	892	276	6,816
2013	6,848	1,151	746	8,745

Source: Singapore Household Expenditure Survey 2012/3

Table 10: Adjustment to Average Monthly Household Income by sources

	(B)	(C)=(A)*12*(B)	(D)	(C)/(D)
Year	No. of Hseholds	Est. Total Annual Hsehold Taxable Income	Indigenous GNI (SGD Million)	Ratio of Hsehd Taxable Income / GNI
2002	989,000	61,571,659,431	119,171	0.52
2007	1,074,800	87,916,368,031	177,335	0.50
2013	1,174,500	123,252,636,042	260,010	0.47

Source: Singapore Household Expenditure Survey 2012/3

Table 11: Estimations of Control Total for Income for Singapore

	(E)	(F)	(G)	(F)*(G)
Year	GNI (SGD Million)	Indigenous GNI (SGD Million)	Ratio of Hsehd Taxable Income / Ind. GNI	Control Total for Income
2004	176,584	133,233	0.61	81,046
2005	194,250	144,127	0.60	87,071
2006	219,383	168,249	0.60	100,940
2007	256,117	204,795	0.60	122,009
2008	271,562	187,697	0.59	111,143
2009	260,605	195,655	0.59	115,146
2010	320,527	226,094	0.58	132,241
2011	337,394	231,592	0.58	134,618
2012	348,076	248,227	0.58	143,389
2013	366,053	260,010	0.57	149,254
2014	380,423	275,802	0.57	157,319
2015	389,941	289,449	0.57	164,055
2016	397,153	294,802	0.56	166,021

Source: Singapore Household Expenditure Survey 2012/3, Singapore Department of Statistics

E.2 Results

Figure 24 presents the evolution of top income shares in Singapore during the period 2004 to 2016. Several points can be highlighted. First, top 10% and top 1% income shares decreased between 2004 and 2007, which fell from 49% to 42% and 17% to 16% respectively. Top 10% shares then increased until reaching the peak of 55% in 2009, and top 1% increased by 5% between 2007 and 2008 to 21%.

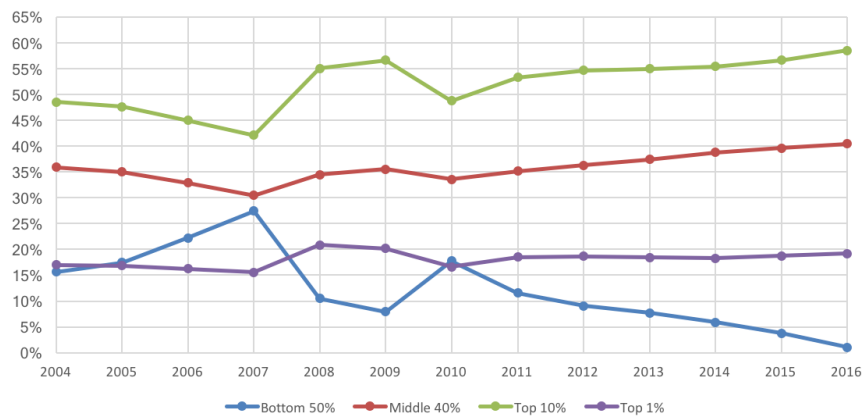
Second, in the post-global financial crisis era, top 10% and top 1% shares continue to increase from their troughs in 2010. Between 2010 and 2016, top 10% increased from 49% to 59%, while top 1% rose from 17% to 19%. This means the increase in income shares fall largely to the top 2nd-10th percent of the population. Both series was higher in the post-global financial era.

Third, the bottom 50% shares increased from 16% in 2004 to 27% in 2007. It then decreased sharply going into the global financial crisis, which dropped to 8% in 2009. It then rebounded to 22% in a year in 2010. Between 2010 and 2016, the bottom 50% shares exhibited a clear downward trend. Note that the

estimation of the bottom 50% shares are probably not as accurate as the top 10% shares. But the overall trend gives us an indication that the bottom 50% is declining.

Middle 40% shares follow a similar trend as the top 10% shares, but of lower magnitude of change. It dropped from 36% in 2004 to 30% in 2007. It then increased back to 35% in 2009. Similar to the top 10% shares, it exhibited an upward trend between 2010 and 2016, which increased from 34% to 40%.

Figure 24: Evolution of different top income shares in Singapore in 2004-2016



Source: Own Estimations

Appendix F Top Income Estimations

This section report the top income shares, corresponding income thresholds and average income.

F.1 Hong Kong

Table 12: Top Income Shares for P90, P95, P99, P99.9 and P99.99

Year	P90	P95	P99	P99.9	P99.99
1997	39.21%	27.93%	12.14%	3.67%	1.17%
1998	39.55%	27.80%	11.54%	3.10%	0.89%
1999	41.87%	29.78%	12.85%	3.81%	1.20%
2000	44.71%	32.06%	14.19%	4.52%	1.50%
2001	44.13%	31.40%	13.51%	4.08%	1.39%
2002	43.97%	31.17%	13.22%	3.79%	1.15%
2003	46.34%	33.21%	14.66%	4.57%	1.51%
2004	48.05%	34.81%	16.02%	5.36%	1.71%
2005	48.58%	35.57%	17.05%	6.09%	2.03%
2006	50.97%	37.96%	19.25%	7.42%	2.61%
2007	53.99%	41.01%	21.99%	9.02%	3.37%
2008	50.09%	36.87%	17.76%	6.18%	2.00%
2009	50.56%	37.53%	18.69%	6.78%	2.19%
2010	52.08%	39.10%	20.18%	7.56%	2.54%
2011	49.88%	37.08%	18.48%	6.47%	1.96%
2012	49.25%	36.45%	18.08%	6.44%	2.08%
2013	49.92%	36.93%	18.42%	6.63%	2.18%
2014	49.59%	36.57%	18.03%	6.42%	2.10%
2015	49.86%	36.62%	17.88%	6.37%	2.18%

Table 13: Thresholds for P90, P95, P99, P99.9 and P99.99

Year	P90	P95	P99	P99.9	P99.99
1997	297,044	426,118	1,016,050	2,802,112	9,231,966
1998	305,944	443,221	1,035,934	2,628,417	7,470,331
1999	308,159	449,902	1,069,549	2,901,505	9,173,974
2000	318,746	466,447	1,120,025	3,184,509	10,902,404
2001	324,099	472,978	1,129,850	2,985,163	9,620,014
2002	319,594	467,483	1,111,696	2,907,048	8,905,957
2003	312,997	462,602	1,111,112	3,153,775	10,303,421
2004	316,653	467,440	1,135,834	3,617,942	12,811,401
2005	321,307	477,611	1,163,630	4,092,062	14,940,268
2006	335,174	502,107	1,251,845	4,967,492	18,973,226
2007	361,508	542,606	1,405,085	6,242,537	24,647,850
2008	375,431	563,357	1,397,026	4,986,342	17,508,500
2009	375,386	562,261	1,403,272	5,435,641	19,669,680
2010	390,082	586,206	1,522,539	6,134,898	23,055,128
2011	421,049	629,807	1,617,530	6,178,111	21,316,333
2012	448,436	667,060	1,680,006	6,349,275	22,220,049
2013	471,573	694,944	1,746,089	6,690,707	23,605,514
2014	497,024	730,738	1,835,613	6,795,857	24,152,071
2015	523,760	769,667	1,909,137	6,909,304	24,399,543

Table 14: Top Average Income for P90, P95, P99, P99.9 and P99.99

Year	P90	P95	P99	P99.9	P99.99
1997	607,832	865,881	1,881,932	5,692,369	18,182,917
1998	611,426	859,693	1,783,485	4,798,514	13,792,983
1999	635,454	903,890	1,950,449	5,786,380	18,272,127
2000	670,897	962,165	2,129,922	6,780,011	22,438,208
2001	669,462	952,608	2,049,078	6,183,624	21,105,709
2002	655,255	928,921	1,970,396	5,641,510	17,193,432
2003	662,518	949,580	2,096,202	6,534,251	21,532,789
2004	688,435	997,537	2,294,697	7,678,914	24,534,502
2005	721,136	1,056,024	2,531,826	9,047,168	30,190,374
2006	792,061	1,179,649	2,991,198	11,526,474	40,609,185
2007	907,913	1,379,151	3,698,119	15,164,159	56,689,327
2008	858,053	1,263,228	3,041,632	10,585,490	34,235,781
2009	877,014	1,301,906	3,240,846	11,765,491	38,016,388
2010	947,366	1,422,521	3,671,154	13,756,279	46,290,974
2011	991,620	1,474,276	3,673,392	12,863,385	38,893,405
2012	1,038,642	1,537,505	3,812,422	13,582,417	43,926,596
2013	1,087,726	1,609,327	4,013,172	14,448,169	47,548,196
2014	1,136,557	1,676,537	4,133,576	14,711,065	48,229,954
2015	1,184,086	1,739,485	4,246,478	15,132,352	51,806,343

F.2 Singapore

Table 15: Top Shares for P90, P95, P99, P99.9 and P99.99

Year	P90	P95	P99	P99.9	P99.99
2004	46.7%	34.7%	16.3%	5.2%	1.6%
2005	45.8%	34.2%	16.2%	5.2%	1.6%
2006	45.5%	34.2%	16.5%	5.4%	1.7%
2007	45.3%	34.2%	16.7%	5.6%	1.8%
2008	50.9%	38.8%	19.3%	6.8%	2.3%
2009	56.7%	42.6%	20.2%	6.6%	2.0%
2010	45.7%	34.1%	15.6%	4.7%	1.4%
2011	48.4%	36.2%	16.9%	5.3%	1.6%
2012	51.4%	38.2%	17.6%	5.4%	1.6%
2013	51.3%	37.9%	17.2%	5.2%	1.6%
2014	52.6%	38.6%	17.3%	5.2%	1.6%
2015	54.8%	40.2%	18.1%	5.5%	1.6%
2016	56.4%	41.3%	18.5%	5.6%	1.7%

Table 16: Thresholds for P90, P95, P99, P99.9 and P99.99

Year	P90	P95	P99	P99.9	P99.99
2004	51,443	81,021	216,776	678,869	2,183,216
2005	52,013	82,471	221,684	717,709	2,322,147
2006	53,620	85,583	233,995	780,357	2,527,753
2007	56,701	91,207	249,841	869,621	2,892,821
2008	61,229	99,800	277,859	1,007,800	3,492,030
2009	65,118	106,778	290,170	956,808	3,064,084
2010	64,172	105,820	285,247	861,645	2,557,739
2011	69,079	113,642	302,451	968,794	2,997,411
2012	74,200	122,068	319,401	997,261	3,039,400
2013	77,219	126,330	325,422	987,768	2,994,966
2014	82,753	134,041	334,907	1,013,622	3,052,083
2015	86,554	140,132	351,340	1,065,560	3,212,426
2016	90,259	144,802	358,430	1,091,249	3,281,888

Table 17: Top Average Income for P90, P95, P99, P99.9 and P99.99

Year	P90	P95	P99	P99.9	P99.99
2004	124,396	185,055	434,948	1,374,559	4,371,590
2005	127,301	189,935	451,443	1,447,617	4,481,960
2006	134,208	201,648	485,405	1,578,363	4,916,664
2007	144,653	218,407	533,584	1,796,676	5,720,115
2008	161,465	245,859	612,642	2,162,025	7,202,771
2009	165,742	249,243	591,713	1,920,294	5,975,536
2010	159,957	238,530	546,771	1,630,436	4,783,230
2011	172,854	258,267	601,915	1,889,280	5,693,279
2012	183,175	272,369	626,322	1,927,165	5,806,417
2013	187,379	277,171	629,296	1,905,848	5,777,862
2014	195,603	286,976	644,445	1,943,855	5,845,218
2015	205,173	301,319	678,344	2,046,367	6,171,116
2016	210,967	308,745	692,398	2,090,464	6,276,385