# Income Inequality, Growth Inequality, and Redistribution in Taiwan, 2001-2015: Evidence from Distributional National Accounts *

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**Abstract**

This paper provides a comprehensive view of various inequality issues and evaluates the effects of redistribution by constructing new pre-tax and post-tax individual income series consistent with national income, as provided by the Distributional National Accounts of Taiwan. Compared to previous estimates, we find much higher income inequality levels, with magnitudes similar to the U.S. and rising over the period from 2001 to 2015. The top 10% income share in pre-tax income increased from 43% to 48%, mainly as a result of a surge in corporate retained earnings. The distribution of economic growth is even more unequal, with the top 10% growth share estimated to be 60%. More hopefully, the redistribution system in Taiwan is effective, and it reduces total income inequality by 39%, higher than both the U.S. (34%) and France (23%). Among all policies, the National Health Insurance system accounts for the greatest benefits to the bottom income groups. This offer of medical benefits has an unintended result: It helps to transfer income from the rich to the poor and reduces income inequality.

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# 1 Introduction

Income inequality has increased in nearly all countries over the past several decades. As a result, how to design appropriate redistribution policies has been a focus of attention for both researchers and policymakers. Taiwan's social welfare program has a unique design compared to programs globally: More than 70% of social expenditures are used on universal mandatory health care. Taiwan's National Health Insurance (NHI) system is now ranked first in the world.[1] While such policies aim to enhance health welfare, what is the effect of this redistribution system on alleviating income inequality? In this paper, we provide a comprehensive analysis of various inequality issues and evaluate the effects of redistribution in Taiwan to shed light on the determinants of income inequality and the effects of redistribution.

Taiwan was referred to as a *growth miracle* in the 1970s, a period during which the country saw rapid economic growth yet declining income inequality. Although Taiwan's economic growth rate has declined and hovered around 4% since then, the official Gini coefficient has remained around 0.3 over the past four decades. The social security program in Taiwan was designed and implemented during the democratization period from 1992 to 1996.[2] Today, Taiwan is regarded as a developed country with low income inequality and a strong universal health care system.

However, current measures of income inequality in Taiwan suffer from many shortcomings that put their accuracy into doubt. For example, official inequality measures in Taiwan only rely on survey data, which is well known for under-reporting top earners. Studies of top income shares seem to provide more accurate measures of income inequality, but they still face important limitations.[3] In particular, they are based on taxable income, a measure that is inconsistent with national income. For instance, fiscal income is only 48% of the national income of Taiwan, but a large proportion of national income is redistributed through tax,

1. The rank is according to the Health Care Index from Numbeo.

2. The democratization process started in 1987 when the 38-year martial law period ended. After 10 years, Taiwan achieved full enfranchisement in 1996. The first direct legislative election was in 1992, and the first direct presidential election was in 1996. The social subsidy program was implemented in 1992, and the NHI was established in 1995.

3. For studies of top fiscal income shares, please see Piketty (2003), Piketty and Saez (2003), Atkinson, Piketty, and Saez (2011), and particularly Chu, Chou, and Hu (2015), who specifically study Taiwan.

public expenditures, and social security transfers. Furthermore, there is not any complete pre-tax and post-tax income data. This inconsistency makes it hard to answer questions surrounding the distribution of income, economic growth, and redistribution.

To overcome the above challenges, we combine administrative individual income tax, governmental social security, household survey, and aggregate national accounts data to construct a homogenous series of pre-tax and post-tax micro income data in Taiwan. We follow the distributional national income (DINA) methodology proposed by Alvaredo et al. (2016) to redistribute national income across every individual adult in Taiwan from 2001 to 2015. To our knowledge, this is the first DINA study using detailed individual micro data in Asia, and Taiwan is the third country—after the U.S. and France—that can provide both complete pre-tax and post-tax personal national income series that enable researchers to study the effect of redistribution.[4]

We have several striking results, from the impact of pre-tax income and growth inequality to the effects of redistribution.

First, income inequality in Taiwan is much higher than previously documented, and it has increased rapidly over the past 15 years. For example, the Gini coefficient of our constructed pre-tax income is around 0.64, about two times larger than the official Gini coefficient. The top 10% (1%) pre-tax income share has increased from 43% (16%) in 2001 to 48% (19%) in 2015. By contrast, the top 10% fiscal income share (pre-tax) is less than 40% in the previous studies focused on Taiwan.[5]

This increase in income inequality over the past 15 years is the result of an upsurge in corporate retained earnings. In fact, this large discrepancy between the official Gini coefficient estimate and ours—and the rapid increase in top income shares—are because previous studies have not included corporate retained earnings as personal income, while DINA dis-

4. Currently, more than 100 countries are using the DINA approach in the World Inequality Database (WID). For example, there have been studies on the U.S. (Piketty, Saez, and Zucman 2018), France (Garbinti, Goupille-Lebret, and Piketty 2018), China (Piketty, Yang, and Zucman 2019), India (Chancel and Piketty 2019), Europe (Blanchet, Chancel, and Gethin 2019), and Brazil and the Middle East (Assouad, Chancel, and Morgan 2018). However, detailed individual income tax data is still not available in many countries, and these countries use a simplified approach (Piketty, Saez, and Zucman 2019).

5. For studies of Taiwan, Hong and Cheng (2013) use tax tabulation and Pareto estimation to estimate the top income shares in Taiwan from 1977 to 2010. Chu, Chou, and Hu (2015) use individual income tax to estimate top fiscal income shares. Both studies demonstrate lower top income shares than this paper.

tributes retained earnings to individual dividend earners. Over this period, the aggregate capital share increased from 40% to 45% due to the rapid growth of corporate income. The annualized real growth rate of national income is 2.46%, while that of corporate income is 7.19%. Although there has been a global rise in corporate savings (Chen, Karabarbounis, and Neiman 2017) as well as a global decline in labor share (Karabarbounis and Neiman 2014) since the 1980s, Taiwan's post-2001 upsurge in corporate retained earnings is stronger than the global trend. Compared to estimates for other countries using DINA, income inequality in Taiwan is at a similar magnitude to that of the U.S. This result stands in contrast to the previous understanding that income inequality in Taiwan is low. Indeed, we find that income inequality in Taiwan is a serious, underestimated issue.

Second, the distribution of economic growth is more unequal than income distribution. We analyze two types of distributions of economic growth: the distribution of total income growth and the distribution of the income growth rate. For pre-tax income, the top 10% and 1% income groups get 60.3% and 27.4% of total income growth from 2001 to 2015, while the bottom 50% only owns 5.8% of the economic growth. For the first time in the literature, we also provide the Gini coefficients for the share of economic growth, with estimated Gini coefficients of 0.72 for pre-tax income and 0.61 for post-tax income. All of these inequality measures are higher than those of the income distribution. Regarding the distribution of income growth rate, we find that the bottom 92% of the population has an income growth rate lower than the aggregate income growth rate. This is more unequal than in the U.S., in which the bottom 87% of the population has an income growth rate lower than the average growth rate.

Third, redistribution in Taiwan effectively reduces income inequality, both in level and in trend, and it successfully transfers income from the rich to the poor. We found that the redistribution system reduces total income inequality (measured by the ratio of average incomes of the top 10% and bottom 50% groups) by 39%. This is a significant improvement, larger than what social welfare redistribution programs achieve in the U.S. (34%) and France (23%). Furthermore, redistribution effectively transfers income from the top 10% group to the bottom 50% group, while the middle 40% group has little income change between pre-tax and post-tax income. The magnitude of fiscal redistribution is increasing: Total

income inequality was reduced by 32% in 2001 and by 40% in 2015. Not only are aggregate expenditures on social security transfers and health insurance increasing, but the government also transfers more to the bottom income group. Post-tax income of the bottom 1% group has increased from about 2.8 months of the minimum monthly wage in 2001 to 3.8 months of the minimum monthly wage in 2015. Additionally, the population who benefits from redistribution (people with a post-tax income larger than pre-tax income) becomes larger, in terms of both income percentile and income level.

Fourth, among all redistribution policies, the NHI contributes the most to the improvement in income inequality. This is an unintended result, since the NHI aims to provide affordable medical access to every individual, not to reduce income inequality. Indeed, we find that the amount of medical benefits transferred is similar across each income group, with benefits uniformly distributed across income percentile. When divided by individual disposable income to calculate the benefit rate, this medical transfer is strongly regressive. In fact, health care benefits account for more than 60% of post-tax disposable income for the bottom 10% group. This regressive medical redistribution, combined with progressive taxation, helps transfer income from the top to the bottom income group. In Taiwan, then, the majority of income redistribution occurs in the form of medical subsidies.

Finally, although the magnitude of redistribution increased during this period, it only created a slight improvement in the distribution of economic growth. From pre-tax to post-tax income, the income growth share of the top 10% group declines by 8.2% (from 60.3% to 52.1%). Among the 8.2% of the total income growth transferred, the bottom 50% group receives 6.7%, and the middle 40% group gets 1.5%. Although redistribution was mainly from the top 10% group to the bottom 50% group, the bottom 50% group only receives 12.5% of post-tax income growth, while the top 10% group still receives 52% of post-tax income growth.

In summary, pre-tax income inequality in Taiwan is high and rapidly increasing, resulting from the upsurge in corporate retained earnings. At the same time, the scale of redistribution is improving, and it results in stable post-tax income inequality, successfully reducing the rising trend in pre-tax income inequality. Among all redistribution policies, the NHI has the largest impact on transferring income from the rich to the poor and reducing income

inequality.

In addition to measures of income inequality, this paper also contributes to the literature on the evaluation of redistribution policies. While there is a huge literature that evaluates redistribution policies at the micro level (Bourguignon and Spadaro 2006), few scholars have compared complete pre-tax and post-tax income to evaluate the redistribution at the macro level. For studies of Taiwan, Cheng and Lee (2010) are the only researchers to evaluate redistribution at the macro level, but they rely on survey data only. Currently, two pioneering studies are Piketty, Saez, and Zucman (2018) for the U.S. and Bozio et al. (2019) for France. We use the same DINA methodology and report the same measures, allowing us to compare our results for Taiwan to those found for the U.S. and France. In the U.S., government redistribution only offsets a small fraction of increasing pre-tax inequality, and transfers are largely targeted at the middle class, while transfers to the bottom 50% have not been large enough to raise income significantly. We think this sharp contrast between the U.S. and Taiwan is due to the Taiwanese government's implementation of the universal mandatory health care system.

This paper is organized as follows. Section 2 explains the methodology and data resources we use and fills the gap between fiscal income and national income. Section 3 describes the distribution of national income and provides cross-country comparison. Section 4 presents the distribution of economic growth. Section 5 analyzes the effect of the redistribution on income and growth inequality. Section 6 concludes.

# 2 Concepts, Data Sources, and Methodology

This section describes the income concepts, data sources, and methodology of this paper. The income here refers to national income, which is defined as GDP minus capital depreciation plus net foreign income (following SNA 2008). This paper relies on six data sources: national accounts, government agency's aggregate data on pensions and social security, individual income tax data, non-filers' income data, individual wealth data, and the Family Income Survey. We follow the concepts and general methodology described in the Distributional National Accounts guidelines used for the World Inequality Database (Alvaredo et al. 2016).

However, due to the differences in tax and accounting rules, some imputation details differ from the DINA guidelines and the case in the U.S. (Piketty, Saez, and Zucman 2018). This section highlights the differences and empirical issues.

## 2.1 Income Concepts

Our income distribution series use four income concepts: pre-tax factor income, pre-tax national income, post-tax disposable income, and post-tax national income. Among them, only disposable income is smaller than national income, and the other three all add up to national income. Our benchmark data series are pre-tax and post-tax national income. Note all income series are real income, adjusted by the Consumer Price Index in Taiwan in 2010 dollars.

**Pre-tax factor income**

Pre-tax factor income is equal to the sum of all income flows going to labor and capital, before taking into account pensions, taxes, and all other wealth transfers.In other words, tt is income before any government intervention. One problem with this income concept is that retirees typically have little factor income. However, factor income can offer insights on income inequality between labor and capital, and factor income focuses mainly on income generated by working-age population.

**Pre-tax national income**

Pre-tax national income is our benchmark concept to study the income distribution. Pre-tax national income is factor income minus private and public pension contributions, plus all pension benefits, but before taking into account any tax, insurance, and other transfers. Unlike the U.S., social security benefits—labor insurance, health insurance, and disability insurance— are not taxable in Taiwan, while contributions are all tax deductible. Although pension benefits are taxable, the tax threshold is set so high that about 90% of pension income does not appear in tax data. Since social security benefits are tax-exempt, we treat these benefits as a type of government welfare program and exclude them from pre-tax national income. This procedure is different from the case of the U.S., where Piketty, Saez, and Zucman (2018) include taxable social security benefits in pre-tax national income.

**Post-tax disposable income**

Post-tax disposable income is the income concept we use to evaluate the effect of redistribution on income distribution. Post-tax disposable income is pre-tax income minus all forms of taxes and social security contributions, plus all forms of social security benefits and government transfers (cash transfers and in-kind transfers). Post-tax disposable income tells us how government interventions through tax and transfer systems affect income distribution. As a result, we follow Bozio et al. (2019) and choose to use post-tax disposable income as the main series to evaluate the effect of fiscal redistribution on the alleviation of income inequality. Since government transfers are only part of government spending, post-tax disposable income is less than national income.

**Post-tax national income**

Post-tax national income is our benchmark concept to study the redistributional effect on economic growth. Post-tax national income is post-tax disposable income plus back collective consumption expenditures and government deficits. It is the income after all forms of government interventions, and it also takes into account consumption on public goods. In total, it adds up to national income. The imputation follows the rule that it does not affect income shares at any income percentile. That is, when we compare the income shares among different income groups, such as the top 10% or the bottom 50% income shares, both post-tax disposable income and national income series offer the same number. However, the imputation does affect the level of income and, hence, the growth rate and the effect of redistribution. Since in aggregate, post-tax income is the only income concept that is equal to pre-tax income, we compare pre-tax and post-tax national income to study the redistributional effect on the distribution of economic growth.

## 2.2 Data Resources and Methodology

We now describe our data sources and methodology for constructing the distribution of national income. The main micro-files are income tax data collected by the Ministry of Finance for the period from 2001 to 2015. The tax tabulation statistics data starts in 1973, which is the main data source used to compute top income shares of Taiwan in the WID. However, the detailed and credible micro-files start in 2001 (according to the Ministry of Finance, individual income tax data before 2000 was deleted). These files include 10 income

categories and appproximately 6 million tax units and 11 million individual tax-filers.[6] We exclude lottery income and capital gain in our income series.[7] In addition to various income categories, these micro-files also include household information, such as the ages of tax filers, marital status, and the number of dependents. For married couples, we equally split income between spouses.

## 2.3 From Fiscal Income to Pre-Tax Factor and National Income

The total fiscal income reported in tax data is only about 50% of the national income of Taiwan. The majority of this missing fraction consists of tax-exempt income, production tax, and flows of retained earnings. Here we describe the methods and other data resources we use to supplement income tax data to match national income.

We use pension data from the Bureau of Labor Funds of the Ministry of Labor (MOL) to impute individual pension contributionx; labor insurance data from the Bureau of Labor Insurance of the MOL to impute individual labor insurance contributions, and health insurance data from the Ministry of Health and Welfare to impute individual health insurance contribution. For non-filers' income, we use the administrative micro-files of non-filers from the Ministry of Finance. Finally, we use the administrative data of individual real estate from the Ministry of Finance to distribute imputed housing rent.

**Non-filers**

In Taiwan, about 40% of adults are non-filers. The Ministry of Finance keeps track of evert individual's legal income. For example, employers are required to report paid employees' salaries; banks are required to report interest paid on each saving account, and renters and tenants are encouraged to report rents (tenants' rent is tax-deductible). The tax agency identifies non-filers based on all sources of reported income. This paper uses administrative data on non-filers from the Ministry of Finance. The advantage of this database is that we have exact income information of non-filers on 10 income categories. The disadvantage is that there is no household information. The unit in the non-filers' income database is

6. The 10 income categories are wages, dividends, interests, rents, professional practice, pension, agricultural income, capital gain, lottery, and other.

7. National income does not include capital gains from pure asset price changes, and taxable capital gain in Taiwan refers to gains from real estate trades. Capital gains from stock market trades are tax-exempt.

an individual adult. The total income of non-filers is about 9% of the national income of Taiwan.

**Tax-exempt labor income**

Tax-exempt labor income includes contributions of pension, labor insurance, and health insurance. It occupies about 6.5% of the national income of Taiwan in 2015. There are two pension systems in Taiwan: the public pension system and the labor pension system.[8] A particular feature of pensions in Taiwan is that the majority of retirees receive a one-time payout. We identify retirees from income tax data, match the number of pension receivers in the aggregate data from government pension funds (both public and labor pension), and impute the amount of the one-time payout to every retiree. For labor insurance, we impute contributions from both employees and employers by the specified insurance transfer rate according to their wages and professional practice income levels. We then match the total number of workers and aggregate premiums to the data from the Bureau of Labor Insurance of the MOL.

Taiwan's NHI system covers all citizens and has been in place since 1995. Similar to our labor insurance imputations, we impute contributions using the transfer rate according to wage and professional practice income levels. We then match the aggregate premiums to the data from the Ministry of Health and Welfare.

**Tax-exempt capital income**

The Ministry of Finance of Taiwan has records on individual dividends, deposit interests, and rents, which are all subject to income tax. Tax-exempt capital income includes individual pension funds and imputed housing rent. We impute individual pension funds by specified transfer rates since the 2005 labor pension reform. The main component of tax-exempt capital income is imputed housing rent. To distribute imputed housing rent from the National Account to individual real estate owners, we use the administrative data on the individual real estate from the Ministry of Finance and distribute imputed rent proportionate to the market value of the individual real estate. Imputed housing rent is about 10% of national income.

8. The public pension system serves government employees, public school teachers, and the military. It covers about 600,000 public workers. The labor pension system was reformed in 2005 and now serves 6 million workers.

**Retained earnings**

Another major component of income that does not appear in income tax data is undistributed corporate profits, or the flows of corporate accumulated retained earnings. Here, we use the word "retained earnings" as the annual undistributed corporate profits. Undistributed corporate profit is subject to a 10% tax rate in Taiwan.[9] Pre-tax undistributed corporate profits occupy about 17.5% of the national income. Following Piketty, Saez, and Zucman (2018), we distribute retained earnings proportionate to individual dividend income each year.

**Tax incidence assumptions**

Regarding the distribution of government production tax and corporate income tax, we make the following tax incidence assumptions that follow Piketty, Saez, and Zucman (2018). First, we assume that taxes do not affect income distribution and the distribution across labor and capital. Second, we allow the corporate tax to be shifted to all forms of capital other than corporate equity. For the property tax, we distribute it proportional to the market value of individual real estate.

**Decomposition of pre-tax factor income**

By combing all of the above data sources, we are able to decompose total national income into factor incomes with various components. Figure 1 describes the labor share (labor income to national income ratio) and four labor income components as percentages of national income.[10] These components include taxable labor income, non-filers' labor income, tax-exempt labor income, and the residual (tax evasions and others). Over the past 15 years, the labor share has declined from 59.5% to 55.2% of national income. The decrease in labor share is owed to the decline in taxable labor income and the residual, both of which fall by about 3% during this period. However, non-taxable labor income has increased by about 2%. This steady increase in non-taxable labor income reflects an improving social security system in Taiwan. For example, the new labor pension system reform was conducted in 2005, and the number of workers it serves has increased from 4 million in 2005 to 6 million

9. The 10% tax rate on retained earnings began in 1990 and remained in place until the 2017 tax reform. From 2018 on, this tax rate is 5%.

10. The definition of labor income is individual wages plus 70% of professional practice (self-employment) income.

in 2015. At the same time, the enforcement and implementation of labor insurance became stricter. More and more workers are now covered under labor insurance, from 7 million in 2001 to 10 million in 2015. The premiums for health insurance also increased during this period.

On the other hand, the capital share has increased from 40.4% to 44.7% as shown in the top panel of Figure 2. We decompose capital income into five components: taxable capital income, non-filers' capital income, imputed rent and property tax, corporate income tax, and retained earnings. Strikingly, all of the increases in aggregate capital share come from the upsurge in retained earnings alone. Figure 2 shows that almost all capital income components are relatively stable or even declining, except retained earnings. Retained earnings have increased from about 6% in 2001 to 14.7% in 2015. Indeed, taxable capital income has decreased from 13% to 10%, non-filers' capital income has decreased by 1%, and imputed rent and property tax has also decreased by 0.7%. Meanwhile, the corporate tax has slightly increased by 0.9%. These all point to the main component driving up capital income share being retained earnings.

When we distribute retained earnings to individuals proportionate to their dividend income, the upsurge in retained earnings should also lead to an increase in income inequality since dividend income is typically unequally distributed, and the distribution of retained earnings would further inflate dividend income. Indeed, we do find that the increase in retained earnings is the main driving force behind increasing top income shares in Taiwan from 2001 to 2015. This phenomenon is similar to the finding from Piketty, Saez, and Zucman (2018) that the key driver of the rise in capital income in the U.S. has been the rise in retained earnings since 2000.

## 2.4 From Pre-Tax Income to Post-Tax Income

Post-tax income is pre-tax income minus all forms of taxes and adding back all forms of government transfers and spending, including public goods consumption. We decompose all government spending into three categories: monetary social transfers, in-kind social transfers, and collective expenditure (public goods consumption). We then calculate the government deficit and distribute it back to all individuals such that post-tax national income is equal

to pre-tax national income.

The social security transfer data is taken from the National Statistics database constructed by the Directorate-General of Budget, Accounting, and Statistics (DGBAS). We then combine both data from DGBAS and the National Account to calculate government collective expenditure. We impute the distribution pattern of monetary social transfers and in-kind transfers by using the Family Income Survey, which is conducted by DGBAS every year, and it is the most widely used survey data in Taiwan.

**Monetary social transfers**

The main monetary social transfers are social insurance benefits such as labor insurance, unemployment insurance, farmers' insurance and subsidy, and government employees' insurance. Other monetary transfers include subsidies for low-income families and elderly. Together, monetary social transfer make up about 3% of national income.

**In-kind social transfers (health insurance transfers)**

In-kind social transfers are transfers that are not monetary but are individualized. In-kind transfers correspond to health insurance benefits (governed by NHI) in Taiwan. These transfers are mainly medical payments through the form of health insurance. Beneficiaries are imputed according to their age, number of dependents in a household, and income level. The distribution pattern of benefits is imputed from the Family Income Survey. Health insurance transfers make up about 7% of national income.

**Collective expenditure**

We calculate the aggregate amount of collective expenditure by taking the difference between government consumption and transfers in the national account and the overall social transfers in the National Statistics database from DGBAS. We then allocate collective expenditure proportionate to post-tax disposable income. In this way, we are assuming that the distribution of collective expenditure does not affect post-tax income distribution. This distribution-neutral assumption serves as a benchmark, as we know little about who benefits from public good spending in national defense, infrastructure, the education system, and other public goods.

**Government deficit**

To match national income, we also distribute imputed government deficit, the difference

between government revenues and spending, to individuals. We allocate 50% of the deficit proportionate to taxes paid and 50% proportionate to the amount of government spending received. This assumes that any government deficit will translate into higher taxes and reduced government spending at a 50-50 split.

# 3 The Distribution of National Income

We start from the summary statistics of our DINA income series and then go through the income distribution with inequality measures including Gini coefficients and the top income shares. We then do a cross-country comparison to understand the level and the position of Taiwan's inequality in the world. Our main message is that income inequality in Taiwan is much higher than previously documented, and it is at a similar, slightly higher magnitude to that of the U.S. In addition, income inequality has increased rapidly over the past 15 years, due to an upsurge in corporate retained earnings.

Table 1 presents the distribution of Taiwan's pre-tax and post-tax national income in 2015. Pre-tax and post-tax average national incomes for the full population is are, by definition, the same and equal to NT$788,031 (in 2010 dollars). The bottom 50% population's average pre-tax income is NT$148,605. That is, they earn about 18.8% of the average income of the full population before taxes and transfers. Table 1 further divides the bottom 50% into two groups, the bottom 20% and the next 30%. The bottom 20% gets only NT$22,682 pre-tax income, which is about 2.9% of the average income, and the next 30% earns NT$232,553 on average pre-tax, about 29% of the average income. This bottom pre-tax inequality (calculated both as the ratios of the bottom 20% and 50% average income to average nation income) is large, and the number is similar every year during the sample period. By comparison, the bottom 20% to average national income ratio is 8% and that of the bottom 50% is 36% in the U.S. in 2014.

The middle 40% (between the median and the 90th percentile) gets roughly the same average pre-tax income as the overall average and, therefore, has a pre-tax income share close to 40%. The top 10% earns about 4.8 times the average pre-tax income. Hence, The top 10% acquires about a half of total pre-tax income. The ratio of the average income

between the top 10% income group and the bottom 50% income group, which we denote as T10/B50, is a simple yet useful indicator we will use to evaluate the effect of redistribution. The pre-tax T10/B50 ratio is about 25 in Taiwan, which is exceptionally large. For context, this ratio in the U.S. is less than 20 and it in France is about 7. Moving up the distribution, the top 1% receives roughly 20% of the total pre-tax income, and the top 0.1% close to 10%, i.e., half of the income share of the top 1% group.

Table 1 also shows that post-tax national income is more equally distributed than pre-tax income overall. For the bottom 50%, average post-tax income is 47% higher than pre-tax income. The post-tax income of the bottom 20% is 4.5 times the pre-tax income on average. The median also increases by 13.5% after taxes and transfers. Nevertheless, significant inequality persists even when looking at post-tax income. The bottom 50% earns about one–fourth of the average post-tax income, while the top 10% earns more than 4 times the average.

## 3.1 Gini Coefficients

Now we look at a popular measure of income inequality: the Gini coefficient of income distribution, which our data series allows us to calculate for the entire population. The top panel of Figure 3 depicts the Gini coefficient of pre-tax and post-tax national income. The pre-tax Gini coefficient rises from 0.60 to 0.64 from 2001 to 2015, while the post-tax Gini coefficient rises more slowly, from 0.54 to 0.56. These numbers are two times larger than the official Gini coefficient, which is shown in the bottom panel of Figure 3. While the Taiwan government claims that income inequality is low, stable, and gradually decreasing, our DINA income series demonstrate the opposite: Income inequality in Taiwan is extremely high and has increased over the past 15 years.

Taiwan's official Gini coefficient is calculated using the Family Income Survey, where the unit is the disposable income of a household. We understand that survey data typically under–reports high-income earners, but this large difference—almost double the size—between the DINA and survey income is worth further explanation. To understand how the choice of the unit affects the Gini coefficients, we also draw the Gini coefficient of filers' fiscal income by two units: an individual adult and a tax unit at the bottom panel in Figure 3.

The blue dashed line in Figure 3 is the Gini coefficient calculated using the raw individual income data (for tax filers) recorded by the Ministry of Finance, before the distribution procedure of DINA. We can see that the distribution procedure of DINA—the distribution of production tax, tax-exempt income, and retained earnings—increases the Gini coefficients only by 1% to 2%. This is because the Gini coefficient is not sensitive to income changes at the tails, while the distribution of DINA (especially the distribution of retained earnings) mainly boosts the income at the top tail. The point is that the raw income data from the Ministry of Finance already exhibits a high level of inequality.

Figure 3 demonstrates a large reduction of the Gini coefficients by changing units: It decreased from about 0.6, the unit as an individual (the blue dashed line), to 0.48, the unit as a tax unit (the green two-dots-dashed line). Still, the Gini coefficients calculated from a tax unit is 10% to 15% higher than the official Gini coefficients. A second difference between the Family Income Survey and the tax data is the income concept. The family Income Survey uses after-tax disposable income, while the income tax data use the pre-tax income. Our DINA series demonstrates about 6% to 8% deduction of the Gini coefficients from pre-tax to post-tax income. If we apply this level of deduction, income tax data still demonstrates a higher Gini coefficients than the Family Income Survey, about 4% to 7% higher. Even though the DINA income series and the survey data are not directly comparable, we can still see how the official statistics underestimate income inequality.

## 3.2 The Top Income Shares and Cross-Country Comparison

Here we report the top income shares of Taiwan and compare them to the homogeneous income series of other countries that follow the same DINA procedure. Countries we compare with are the U.S. (Piketty, Saez, and Zucman 2018), France (Garbinti, Goupille-Lebret, and Piketty 2018), India (Chancel and Piketty 2019), and China (Piketty, Yang, and Zucman 2019). The unit of income series is the equal-split adult and the period we study is 2001 to 2014, during which the data is available for all five countries.

Figure 4 depicts the top 10% and 1% shares of pre-tax and post-tax income in Taiwan. There are several striking facts. First, the top income shares in Taiwan increased rapidly over the past 15 years. The top 10% pre-tax income share increases from 43.5% to 48.4%,

and the top 1% pre-tax income share increases from 15.8% to 19.1%. In 2014, the top 10% and 1% income shares reach their peaks.

To understand the meaning of these numbers, we draw top income shares of the U.S., France, India, and China in Figure 5. Among these five countries, India has the highest top income shares and also has the most rapid increase. If we rank India as the highest income inequality country in the world (also including the Middle East, Africa, and Brazil), the second highest-inequality group of countries then includes the U.S. and Taiwan.

What is more, Taiwan has a similar, and even higher, magnitude of income inequality than the U.S. From Figure 5, we can see that the scale of the increased top income shares (10% and 1%) in Taiwan is higher than that of the U.S in some years. In the U.S., the top 10% income share increased by 4% and the top 1% income share increased by about 3%. In contrast, these numbers in Taiwan are about 6% (increased top 10% share) and 7% (increased top 1% share). In 2014, the top 10% income earners own about 50% of pre-tax national income, and the top 1% income earners own about 22% of national income in Taiwan. These numbers are higher than that of the U.S., and comparable to India.

Furthermore, this high level of income inequality becomes even more significant when we look into higher percentiles. The top panel of Figure 6 depicts the top 0.1% and 0.01% pre-tax income shares of Taiwan and the U.S.; the bottom panel depicts the top post-tax income shares. Figure 6 shows that the top 0.1% and 0.01% income shares are at similar levels between the two countries during this period. In fact, in 2014, Taiwan even has higher top 0.1% and 0.01% income shares than those of the U.S. In the next subsection, we show that the increase of top income shares in Taiwan is due to the rapid growth of corporate income and retained earnings.

## 3.3 The Surge in Retained Earnings

The national income of Taiwan can be divided into three sectors: households, government, and corporations. The National Account of Taiwan started to record the sectoral income in 1996. From 1996 to 2015, the annual real growth rate of national income is 2.73%. During this period, the annual real growth rate of household sectoral income is 2.36%, that of the government sector is 0.96%, and that of the corporate sector is 6.36%. The rapid growth of

corporate income drives up the corporate income to national income ratio. Figure 7 depicts the evolution of this ratio. The corporate income to national income ratio declines to a trough in 2008, and then it increases rapidly from 10.5% to 17.6%. From 2008 to 2015, the annual growth rate of national income is 3.2%, while that of corporate income is 11.1%.

The surge in corporate income in the National Account is equivalent to the surge in retained earnings. Note that corporate income in the National Account does not include dividends, which is already counted in household income. One main purpose for corporations to keep some profits as retained earnings is to invest. However, total investment (domestic investment and foreign direct investment) to national income ratio does not increase during this period. Figure 8 depicts the total investment to national income ratio from 1996 to 2015. We can see that this ratio fluctuates around 29%. It declines to a low point of 26.4% in 2009, increases back to its high point in 2010, and has since gradually decreased. The increasing trend of corporate income and steady investment imply that corporations are keeping more and more earnings as savings. This phenomenon is consistent with the global rise in corporate saving reported in Chen, Karabarbounis, and Neiman (2017). When we distribute corporate income proportionately to individual dividend income, this drives up top income shares.[11]

Figure 9 depicts the top 10% and 1% shares of pre-tax income with and without the inclusion of individual retained earnings. Without counting individual retained earnings, the top 10% income share declines by about 0.6%, instead of increasing by 4.9%, while the top 1% income share remains stable, instead of increasing. A similar pattern also appears in the top 0.1% and 0.01% shares in Figure 10.

# 4 The Distribution of Economic Growth

This section analyzes the distribution of economic growth from two perspectives: the distribution of income that has grown from 2001 to 2015 and the distribution of income growth rates. For the first one, we aim to figure out which population group captures the majority of the fruits of economic growth. This can be answered by the share of total income growth of

11. Corporate income tax is distributed proportionate to the sum of all forms of capital income.

each income group. In looking at income growth rates, we aim to understand the changing trend of income inequality. Both help answer who benefits and who loses from economic growth. What is more, since our income series on pre-tax and post-tax national income are all consistent in aggregate, we are able to analyze how the redistribution system in Taiwan changes the distribution of economic growth.

Table 2 lists the share of economic growth and the income growth rate by each income group from 2001 to 2015. The first column lists the share of total pre-tax income growth. From here we can see that the distribution of the economic growth rate is highly unequal. The share of economic growth belonging to the bottom 50% group is merely 5.8%, with the bottom 20% group having only a 0.2% share. By contrast, the top 10% income group captures 60% of total pre-tax income growth, and the top 1% group gains 27.4%.

The post-tax national income in the second column shows a slight improvement in the distribution of economic growth. The share of the top 10% group declines by 8.2% (from 60.3% pre-tax to 52.1% post-tax). Among this 8% of the total income growth, the bottom 20% group receives 3%, the next 30% group receives 3.7% (from 5.7% to 9.4%), and the middle 40% group get 1.5%. Though redistribution successfully transfers income from the top10% to the bottom 50% (they receive 6.7% out of a total transfer of 8.2%), the amount does not seem to be significant, and the bottom 20% income group only obtains 3.1% of total income growth.

Figure 11 provides the granular view of the economic growth share by income percentile, with each bar representing the share of income growth.[12] We found that for both pre-tax and post-tax income, for most income percentile groups, the higher the income percentile, the higher the share of economic growth the group earns. This chart is similar to Jan Pen's Parade of Dwarfs. Since the Parade of Dwarfs is closely related to the Lorenz curve, we then use it to calculate the Gini coefficient of economic growth.[13] The Gini coefficient of economic growth for pre-tax income is 0.72, and for post-tax income, it is 0.61. Both are higher than the Gini coefficients of income distributions (about 0.62 for pre-tax and 0.55 for post-tax).

12. Income percentile is based on the income distribution in 2001.

13. For some income percentiles at the bottom, the share of economic growth can be negative. To deal with the negative elements in calculating the Gini coefficient, we use the approach proposed by Raffinetti, Siletti, and Vernizzi (2015).

Next, we discuss the distribution of the economic growth rates. The third column of Table 2 lists the total growth rate using pre-tax national income. Over this period, real national income per adult in Taiwan increases by 19.1%.[14] Column 3 reveals that the distribution of the economic growth rate is highly unequal. The income of the bottom 50% group only increases by 3.5%, almost stagnating; furthermore, the bottom 20% experiences negative income growth. The income of the middle 40% grows only 10.3%, lower than average. By contrast, the national income of the top 10% increases by 32.2% and that of the top 1% grows by 44%. However, the real income of the top 0.001% (representing the 180 richest people) experiences negative growth, -18%.

Going into more detail into the growth rate distribution in each income percentile, we depict the growth rate by income percentile. Figure 12 draws the annualized real growth rate of pre-tax and post-tax incomes for each income percentile from 2001 to 2015, with a zoom into the top 1%. During this period, the annualized real growth rate of national income per adult is 1.26%, which is drawn as the dashed line "Average Adult." For pre-tax national income, the bottom 92% of the population has an income growth rate lower than the aggregate income growth rate. This is more unequal than that of the U.S., in which the bottom 87% of the population has an income growth rate lower than the average growth rate. The pre-tax annualized income growth rates of the top 1%, 0.1%, and 0.01% are 2.53%, 3.5%, and 4.16% respectively.

Furthermore, the distribution of pre-tax income growth exhibits a worsening degree of income inequality over the entire population. That is, the lower the income percentile, the lower the growth rate, while the higher the income percentile, the higher the growth rate. More specifically, income inequality is increasing at almost every percentile for the pre-tax income series. The bottom 15% even experiences a negative pre-tax income growth rate.

On the other hand, the redistribution system seems to effectively improve the distribution of income growth rate. Let us take a look at the fourth column of Table 2. After redistribution, post-tax national income of the bottom 50% group—especially the bottom 20%—improves significantly. The bottom 20% now experiences a strong post-tax income

14. This number is smaller than the real income growth rate per capita (32%) in Taiwan during this period. This is due to the aging population: The population growth rate of adults is larger than the total population growth rate.

growth: 31.5%. The middle 40% growth changes little from pre-tax (10.3%) to post-tax (11.1%). The top 10% growth declines by 2.2% from pre-tax to post-tax. The decline from pre-tax to post-tax growth happens most within the top 0.1% income group. Income growth for the top 0.1%, 0.01%, and 0.001% groups declines about 5% to 6% from pre-tax to post-tax. This demonstrates that the redistribution system transfers income from the top 0.1% to the bottom 20% group, which effectively reduces the growth rate inequality.

From the granular view of Figure 12, the distribution of post-tax income growth shows that redistribution improves the growth rate distribution of the bottom 70%. That is, within the bottom 70%, the lower-income percentile experiences a higher post-tax income growth rate. This implies that the post-tax income inequality is decreasing within the bottom 70% of the population. For the bottom income group of the population, the difference between pre-tax and post-tax income is government transfers (which includes both social security transfers and health insurance benefits; more details in the next section), the surge in post-tax income growth rate indicates mainly the improvement in transfers.

However, the significant improvement of post-tax income growth rates seems to be at odds with the weak improvement of the post-tax income growth distribution. This phenomenon is due to the low income of the bottom group, which can be seen in the Rows 3 and 4 of Table 2. In Row 3, the bottom 20% income group see an improvement in economic growth from 0.2% (pre-tax) to 3.1% (post-tax), but this modest change in income growth demonstrates a much stronger improvement in terms of the growth rate, from -6.7% (pre-tax income growth rate) to 31.5% (post-tax income growth rate). Such a sharp contrast does not show up in the next 30% income group. The improvement of the growth share of this income group is at a similar magnitude to that of the bottom 20% income group—3.7% (from 5.7% pre-tax to 9.4% post-tax)—but the growth rate change for the next 30% group is from 4.1% (pre-tax) to 11.7% (post-tax). This indicates that the sharp increase in the post-tax income growth rate of the bottom 20% income group comes from their low income level. For this reason, we think the distribution of growth share is a better representation of the inequality of economic growth than the distribution of income growth rate.

To summarize, the distribution of economic growth in Taiwan is highly unequal. The Gini coefficients of the share of economic growth are 0.72 for pre-tax income and 0.61 for post-tax

income, and both are much higher than the Gini coefficients of the income distribution (0.62 pre-tax and 0.54 post-tax). About 92% of the population has an income growth rate below the average growth rate. The redistribution system has transferred the income mainly from the top 10% to the bottom 50%, and the amount of transfers has increased over the past 15 years. This improvement in government transfers is represented by the positive post-tax income growth rates for the bottom income group in Figure 12. However, when we look at the magnitude of the transfer by the share of economic growth, we find that the improvement of the distribution of economic growth is modest. Even after redistribution, the top 10% of the population captures 52% of total income growth, the bottom 50% of the population gets only 12.5% of total income growth, and the bottom 20% receives only 3.1%.

# 5 Redistribution

In this section, we first discuss how redistribution policy affects the aggregate level of income inequality in Taiwan. We then analyze how the tax system, social transfers, and health insurance system contribute to redistribution.

We choose to use post-tax disposable income, one of two available post-tax income series, as the main series in evaluating the redistribution effect. Post-tax disposable income targets transfers to individuals after paying all forms of taxes and social insurance premiums, while post-tax national income adds collective expenditure and government deficit to disposable income. Since collective expenditure is generally not targeted at a specific population, but all citizens, we choose to impute it proportionate to individual disposable income, such that the imputation does not change the income shares between the two post-tax income series.

To assess and quantify the overall magnitude of redistribution in alleviating income inequality, we choose two simple inequality indicators: income shares and the ratio of average income between different income groups. Both indicators show that the redistribution system improves the distribution of income significantly, mainly from the improvement of the bottom 50% income group. To give a sense of how large or small these changes are, we compare our results with two studies that also use the DINA post-tax income series in France (Bozio et al. 2019)) and the U.S. (Piketty, Saez, and Zucman 2018).

Table 3 presents the average changes in these two inequality indicators between pre-tax national income and post-tax disposable income in Taiwan from 2001 to 2015. In the top panel of Table 3, the first row shows that after redistribution, the top 10% income share declines by 10% (from 46.75% to 41.92%) on average over this period. This reduction of the top 10% income is transferred mainly to the bottom 50% income group. The second and the third row demonstrate this: The middle 40% (P51-P90) income share changes very little, while the bottom 50% income share strongly increases by 46.5% (from 9.66% to 14.15%). This increase in the bottom 50% income share is a similar magnitude to the U.S. (54%, from 12.5% to 19.3%) and much larger than France (19%, from 22.2% to 26.4%).

The bottom panel of Table 3 lists the ratio of average income between different income groups. The main indicator is the total inequality indicator: the average income ratio between the top 10% and the bottom 50% income groups. This total inequality indicator is intuitive and is also the product of the upper inequality (T10/M40) and the lower inequality (M40/B50), allowing for decomposition.

Our first conclusion is that the redistribution system in Taiwan improves total income inequality by 39%. This is based on Row 1 of the bottom panel in Table 3. The pre-tax income series shows that the top 10% income group earns 24 times more than the bottom 50% income group. This ratio is reduced to 14.8 in post-tax disposable income. The change rate of this total inequality income ratio is 39%. At the same time, the upper inequality (Table 3, bottom panel, Row 2) decreases by 11%, and the lower inequality (Table 3, bottom panel, Row 3) decreases by 31%. It means that the reduction in the income ratio is mainly from the improvement of the bottom 50% income group, not the middle 40% group. The redistribution system effectively redistributes income from the top 10% group to the bottom 50% group, and the improvement in income inequality is substantial.

To understand the magnitude of the 39% reduction, we compare it with the U.S. and France. In the U.S., from 1990 to 2014, the reduction of the T10/B50 average income ratio is 34%. In France, from 1990 to 2018, this reduction in total inequality is 23%. Compared to the U.S., Taiwan transfers more to the bottom 50% group: The reduction in the T10/M40 ratio is 11% in Taiwan (vs. 13% in the U.S.), and the reduction in the M40/B50 ratio is 31% in Taiwan (vs. 25% in the U.S.). We will later show that this is mainly due to the

NHI system that significantly improves the income of the bottom income group. Overall, this magnitude of fiscal redistribution is significantly large.

Looking at the time series of the total inequality indicator, Figure 13 shows that the magnitude of redistribution is gradually increasing, and it effectively annihilates the increasing trend of pre-tax total inequality. In Figure 13, total inequality in pre-tax national income (the blue circle line) is increasing during this period. In 2001, the average pre-tax income of the top 10% group is 20 times larger than that of the bottom 50% group; this ratio becomes 28 in 2014 and 25 in 2015. The total inequality indicator in post-tax disposable income (the green triangle line) is more stable, and this ratio increases from 13.5 in 2001 to 15.3 in 2015. The magnitude of fiscal redistribution is increasing, from 32% in 2001 to 40% in 2015.

In addition to the total inequality indicator, other inequality measures also demonstrate the same message: The magnitude of redistribution is increasing. For example, in Figure 3, the reduction of the Gini coefficients between the pre-tax national income and post-tax national income is 0.06 in 2001 and 0.08 in 2015. In Figure 4, the reduction of the top 10% income share has increased from 3.8% in 2001 (from 43.5% pre-tax to 39.7% post-tax) to 5.2% in 2015 (from 48.4% pre-tax to 43.2% post-tax). And the reduction of top 1% income share has increased from 2.1% (from 15.8% pre-tax to 13.7% post-tax) in 2001 to 3% in 2015 (from 19.1% pre-tax to 16.1% post-tax).

To see who exactly benefits from redistribution and the changing trend, Figure 14 provides the granular view at each income percentile of the bottom 55% in 2001 and 2015. In Figure 14, the lighter color represents 2001, and the darker color represents 2015. Two remarks are in order. First, the post-tax disposable income of the bottom group increases significantly from 2001 to 2015. For example, the real disposable income of the poorest 1% group in 2001 is NT$ 48,302 (about 2.8 months of the minimum monthly wage in 2001), and it increases to NT$ 79,729 in 2015 (about 3.8 months of the minimum monthly wage in 2015). Second, the population who benefits from redistribution becomes larger, in terms of income percentile and real income. In 2001, post-tax disposable income crosses pre-tax national income at the 47th income percentile, at NT$370,000; in 2015, the intersection happens at the 54th income percentile, at NT$477,000. Since the majority of people in the bottom 55% income group are non-filers, the positive difference between post-tax disposable income and pre-tax

national income is mainly from individualized social security transfer and health insurance benefits.

Our second conclusion is that health insurance transfer is strongly regressive, and it contributes the most of transfers to the bottom income group. Figure 15 decomposes post-tax disposable income into after-tax income, social security transfers, and health insurance transfers at each income percentile in 2015. It clearly shows that both social security transfers and health insurance transfers are regressive. For the bottom 20% income group, health insurance transfer is the major income source. For the bottom 10% income group, who earns little pre-tax income, health insurance benefits account for 66% of their disposable income, and social security transfers account for 33%. For the P11-P20 income group, the health insurance benefit is about 50% of their disposable income, while social security transfers and after-tax income equally account for the remaining 50%. This pattern is similar across each year. At the 50th income percentile, health insurance transfer still accounts for 14% of the P50-P60 income group's disposable income. This shows the NHI system in Taiwan plays an important role in alleviating income inequality by significantly subsidizing medical expenditures for low income individuals.

## 5.1 Tax

Here we discuss the tax system in Taiwan and its role in redistribution. As in most developed countries, individual income tax is progressive in Taiwan. For example, the marginal tax rate ranges from 5% to 45%. However, the marginal tax rate is a loose measure of the progressiveness of a tax system. We choose to use the exact individual tax payment directly from the tax administration to calculate the tax rate. In addition to the tax payment records, we also add up the distributed taxes to individuals. The tax rates we compute take into account all forms of taxes: individual income tax, individual housing tax, distributed production tax, and distributed corporate income tax. We also include labor insurance and health insurance premiums as payments to the redistribution system. The average tax rate is computed as all taxes and insurance premiums divided by total pre-tax national income of a specific income group.

Figure 16 depicts the average tax rate by income group from 2001 to 2015. Overall, the

average tax rate of the entire population is about 13%. The top 1% income group pays about 22% of their pre-tax income, and the top 10% pays 16%. The bottom 90% group pays about 11% of their pre-tax income. However, the bottom 50% income group pays a higher tax rate than the middle 40% (P51-P90) income group, and oddity that we found is due to the distributed corporate income tax. Figure 17 depicts the 2001 to 2015 average tax rates by tax categories across 10 income deciles. It clearly shows that the low-income group pays a higher corporate income tax rate than other income groups. The reason is that in the data, dividends comprise the majority of income for the low-income groups. We suspect that this is because people in low-income groups have other unreported/underground income. The reported dividend income is low, but it is the majority of reported income. Hence, the distributed corporate income tax rate is relatively high in these income groups. This U shape of income tax rates across income deciles also appears weakly in the individual income tax rate. The majority of paid income tax of the bottom income deciles is the interest income from deposits. For most of the bottom 30% income group, their payroll tax is zero after deductibles, and their main tax payment is on interest income.

For the top income earners, the higher the income percentile, the higher the average tax rate. This holds for most of the top income earners in Taiwan, except for the top 0.001%. Figure 18 depicts the average tax rate among the top 0.1% income group. It shows that the average tax rate (23%-26%) increases with the income percentile until we reach the highest income group, the top 0.001% (the 180 richest individuals).

## 5.2 Social Security Transfers and Health Insurance Benefits

Finally, let us look at social security transfers and health insurance benefits across income groups. Both types of transfers have a similar pattern: They transfer a similar magnitude of benefits across income groups. When these transfers are being divided by individual post-tax disposable income, they demonstrate a strong regressive feature.

**Social Security Transfers**

Figure 19 depicts the average social transfer rate among three income groups. This rate is calculated as the received social security transfers divided by the national average disposable income, adjusted for population differences in each income group.

Two remarks are in order. First, the bottom 50% and the middle 40% income groups receive a similar amount of social transfers. This is because the Taiwanese government does not impose strict income restrictions on receiving social transfers. A popular income threshold is the 20% marginal income tax rate. For example, the requirements to receive a childcare allowance or the senior citizens' annuity primarily center on age and the 20% marginal income tax rate. As a result, the social security transfer system mainly excludes people in the top 10% income group. When divided by individual disposable income, these social security transfers are regressive, as demonstrated in Figure 14.

Second, the amount of social security transfers increased over the past 15 years. This increase in social insurance transfers contributes to the positive post-tax income growth rate for the bottom income group in Figure 12.

**Health Insurance Transfers**

Figure 20 depicts the health insurance benefits rate across three income groups. The denominator is the average national disposable income, adjusted for population differences by income group. First, we can see that health insurance transfers are uniformly distributed across income percentiles. That is, the magnitude of medical benefits is similar across income groups.

Taiwan's NHI aims to provide health insurance coverage for all citizens, so it is a welfare program for every citizen and does not set any income restrictions. Although the health insurance premium is progressive according to each individual's wage, the premium only accounts for 1.5% to 3% of one's wage income and is capped. The health insurance premium is not designed for redistribution purposes, and it does not aim to reduce income inequality. In Figure 20, we can see that health insurance benefits rates (calculated with the same denominator) are similar across all income groups. This fact meets the welfare purpose of the NHI. However, when we calculate the benefit rate as transfers divided by individual disposable income, it is strongly regressive, as seen in Figure 14.

Second, health insurance benefits increased from 2001 to 2015 for all income groups. This increasing trend in health expenditures is common in many developed countries, which are often facing an aging population and higher medical costs from new medical technology (Hall and Jones 2007). The increase in health insurance benefits and social security transfers

explains the positive post-tax income growth in Figure 12.

To summarize, the magnitude of redistribution in Taiwan has increased over the past 15 years. Although pre-tax income inequality has increased, the redistribution system in Taiwan helps alleviate this increasing trend in income inequality. Overall, redistribution has improved total income inequality by 39%.

# 6 Concluding Remarks

The data from the Distributional National Accounts of Taiwan provide several new insights into issues of income inequality, the distribution of economic growth, and the effect of government redistribution. We found income inequality is much higher than previously reported. More hopefully, redistribution policies in Taiwan effectively reduce income inequality, and the magnitude of the impact of social transfers on income inequality has increased over the past 15 years. However, we would like to emphasize that the large reduction in total income inequality not only implies the effectiveness of fiscal redistribution but also reflects high pre-tax income inequality. That is, in addition to fiscal policies that focus on secondary redistribution (policies that improve the gap between pre-tax and post-tax income), Taiwan should also focus on primary redistribution policies that directly affect pre-tax income distribution, such as policies on public education, the labor environment, and wage structures.

Finally, among all redistribution policies, we found the NHI unintentionally serves as a social transfer mechanism that helps to alleviate income inequality between the rich and poor in Taiwan. It should be noted that all redistribution policies induce some degree of distortion, and some even face moral hazard issues, particularly in regards to the incentive to work. For example, unemployment insurance may reduce incentives to search for new jobs. On the other hand, with the aim of reducing health inequalities, universal mandatory health care is less likely to have moral hazard problems related to work incentives. This implies universal mandatory health care may be more beneficial than previously thought and have benefits that extend beyond improved health outcomes.

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Table 2: The Growth of National Income in Taiwan, 2001–2015

| | Share of Total Growth | | Income Growth Rate | |
|---|---|---|---|---|
| Income Group | Pre-tax | Post-tax | Pre-tax | Post-tax |
| Full population | 100.0% | 100.0% | 19.1% | 19.1% |
| Bottom 50% | 5.8% | 12.5% | 3.5% | 14.8% |
| Bottom 20% | 0.2% | 3.1% | -6.7% | 31.5% |
| Next 30% | 5.7% | 9.4% | 4.1% | 11.7% |
| Middle 40% | 33.8% | 35.3% | 10.3% | 11.1% |
| Top 10% | 60.3% | 52.1% | 32.2% | 30.0% |
| Top 1% | 27.4% | 22.0% | 44.0% | 41.1% |
| Top 0.1% | 11.8% | 8.8% | 35.0% | 30.7% |
| Top 0.01% | 4.2% | 2.7% | 13.5% | 7.4% |
| Top 0.001% | -0.3% | -0.8% | -18.0% | -24.0% |

Table 1: The Distribution of National Income in Taiwan, 2015

| | | Pre-tax National Income | | | Post-tax National Income | | |
|---|---|---|---|---|---|---|---|
| Income Group | Number of individuals | Income threshold | Average income | Income share | Income threshold | Average income | Income share |
| Full population | 18,804,459 | | 788,031 | 100% | | 788,031 | 100% |
| Bottom 50% | 9,402,229 | | 148,605 | 9.4% | | 218,584 | 13.9% |
| Bottom 20% | 3,760,891 | | 22,682 | 0.6% | | 101,875 | 2.6% |
| Next 30% | 5,641,337 | 71,261 | 232,553 | 8.9% | 147,537 | 296,391 | 11.3% |
| Middle 40% | 7,521,783 | 416,883 | 831,731 | 42.2% | 467,185 | 846,624 | 43.0% |
| Top 10% | 1,880,445 | 1,638,144 | 3,810,364 | 48.4% | 1,587,358 | 3,400,895 | 43.2% |
| Top 1% | 188,044 | 5,533,975 | 15,099,455 | 19.2% | 4,917,097 | 12,492,449 | 15.9% |
| Top 0.1% | 18,804 | 20,391,656 | 71,793,752 | 9.1% | 16,815,314 | 56,680,860 | 7.2% |
| Top 0.01% | 1,880 | 111,643,472 | 377,686,432 | 4.8% | 86,061,776 | 295,666,944 | 3.8% |
| Top 0.001% | 188 | 622,911,232 | 1,883,977,344 | 2.4% | 480,234,528 | 1,488,301,184 | 1.9% |

(a) Individual pre-tax and post-tax national income are shown in NT$.

(b) Pre-tax national income fractiles are ranked by pre-tax national income; post-tax national income fractiles are ranked by post-tax national income. The two sets of fractiles, therefore, are not the same groups of individuals.

Table 3: Redistribution of Income

| Average 2001-2015 | Income Share | | |
|---|---|---|---|
| Income Group | Pre-tax NI | Post-tax DI | Change after Redistribution |
| Top 10% | 46.75% | 41.92% | -10.33% |
| Middle 40% | 43.59% | 43.93% | 0.78% |
| Bottom 50% | 9.66% | 14.15% | 46.50% |
| | Ratio of Average Incomes | | |
| Inequality Measure | Pre-tax NI | Post-tax DI | Change after Redistribution |
| Total inequality, T10/B50 | 24.33 | 14.84 | -39.02% |
| Upper inequality, T10/M40 | 4.30 | 3.82 | -11.03% |
| Lower inequality, M40/B50 | 5.66 | 3.88 | -31.37% |

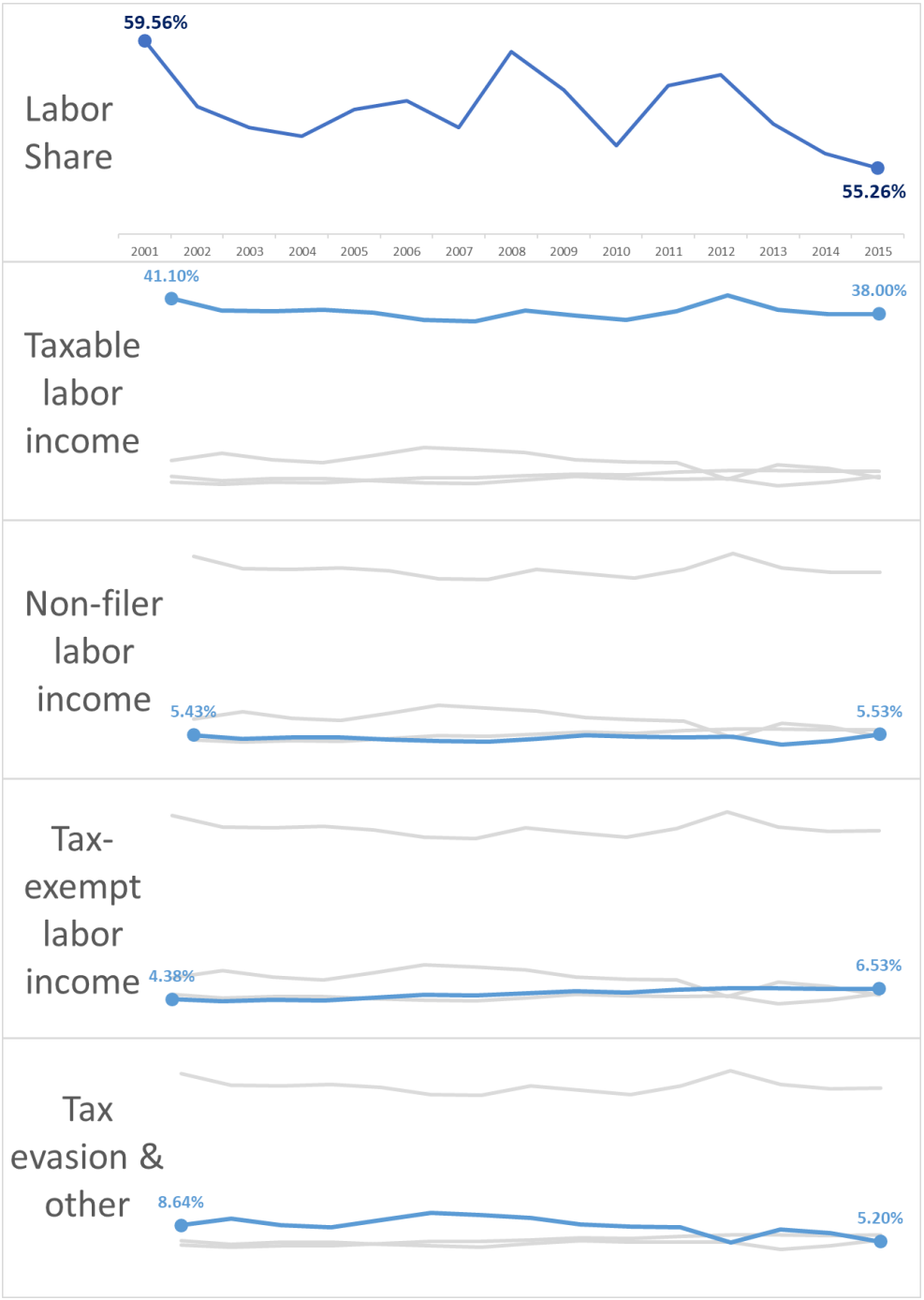



Figure 1: Labor Share and Its Components. The unit is percentage of national income.

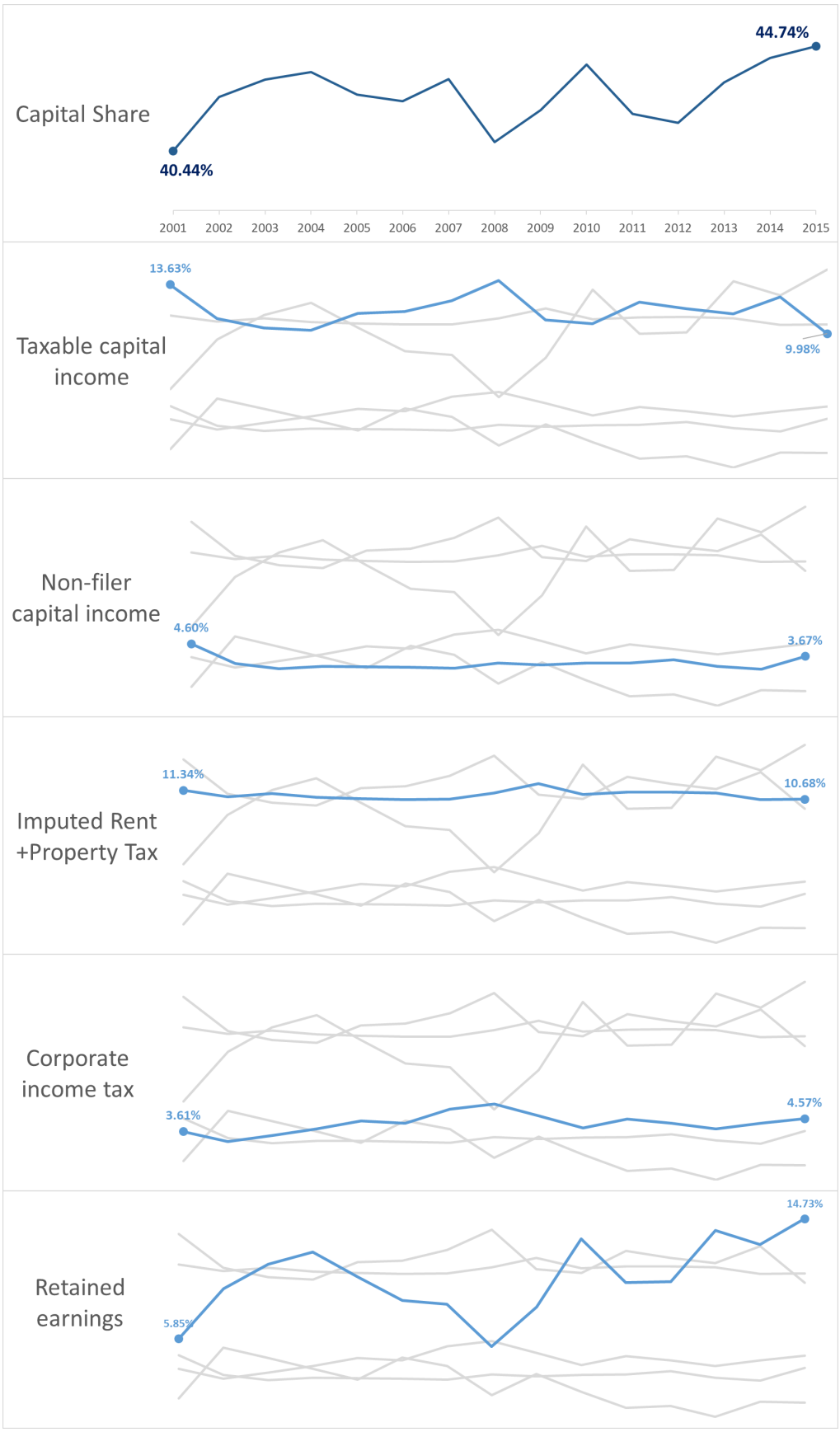
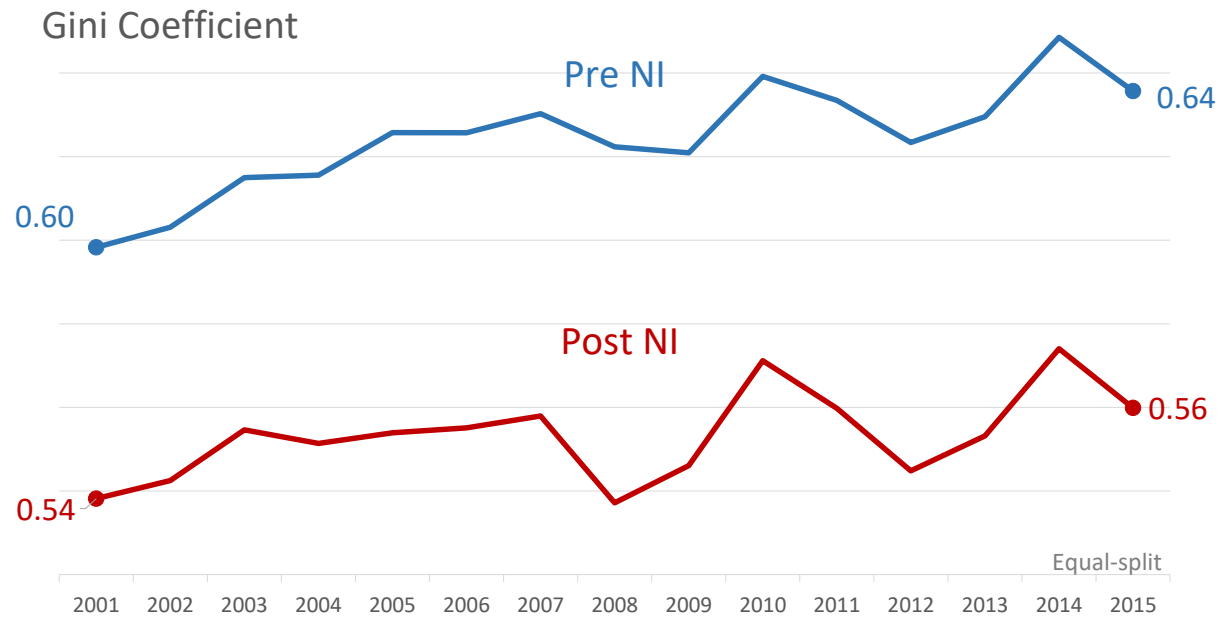
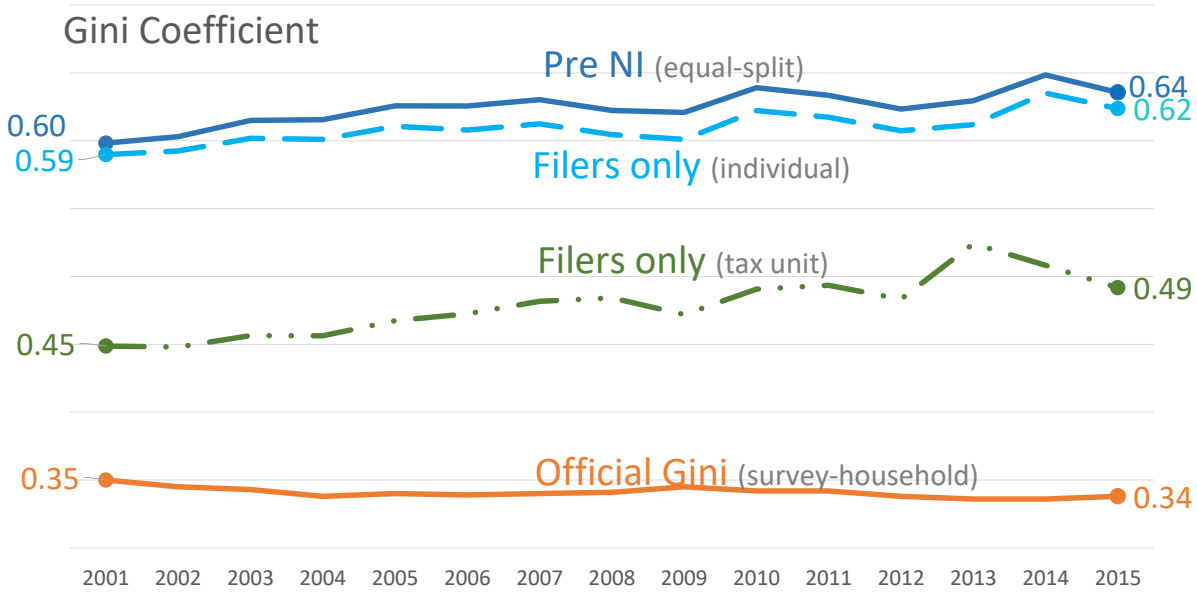



Figure 2: Capital Share and Its Components. The unit is percentage of national income.

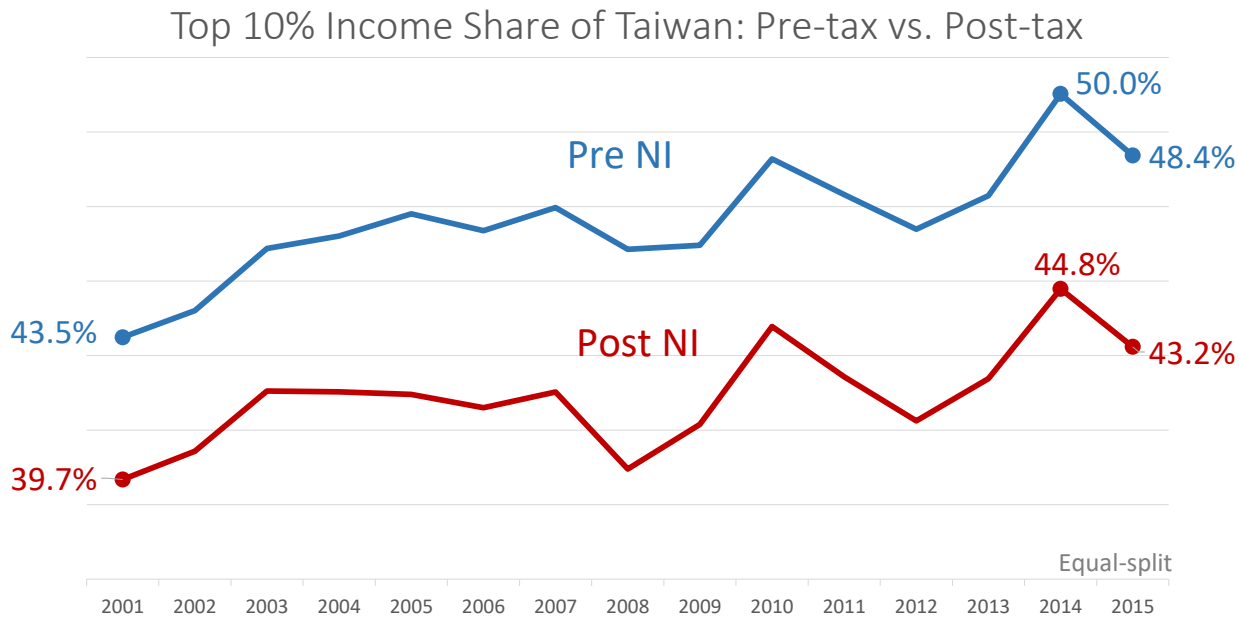



(a) Gini Coefficients are calculated for pre-tax and post-tax national income. The unit is an individual adult.

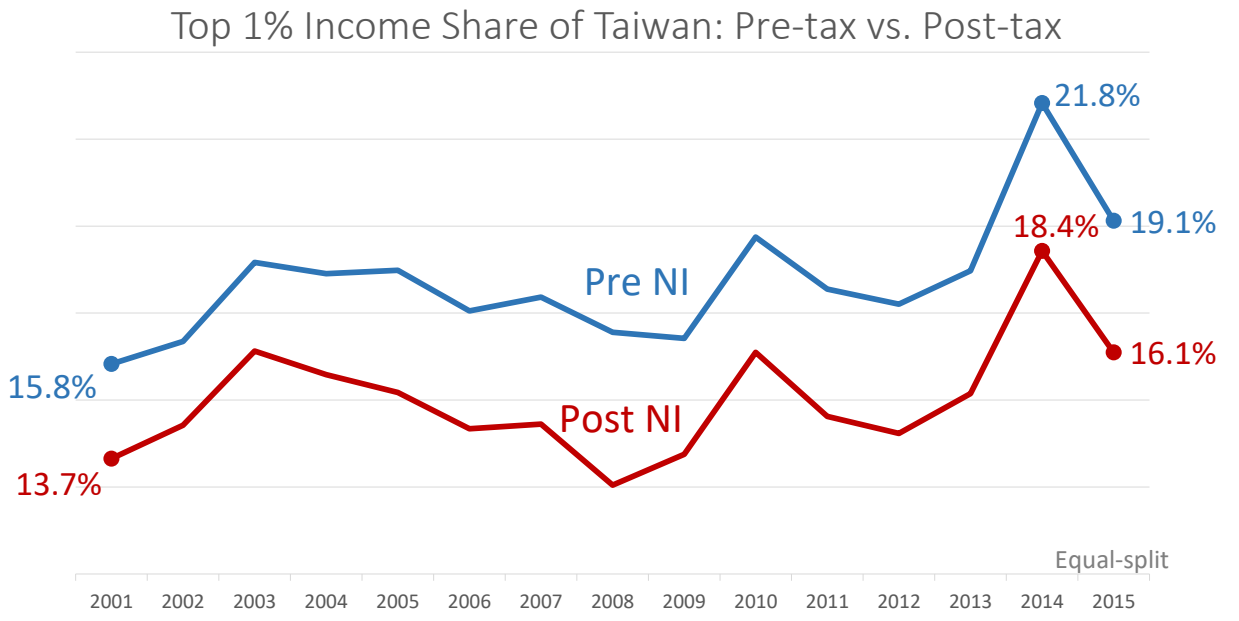



(b) Gini Coefficients are calculated for pre-tax national income, filers' income (both individuals and tax units), and are shown alongside Taiwan's official Gini Coefficients.

Figure 3: The Gini Coefficients of Various Income in Taiwan

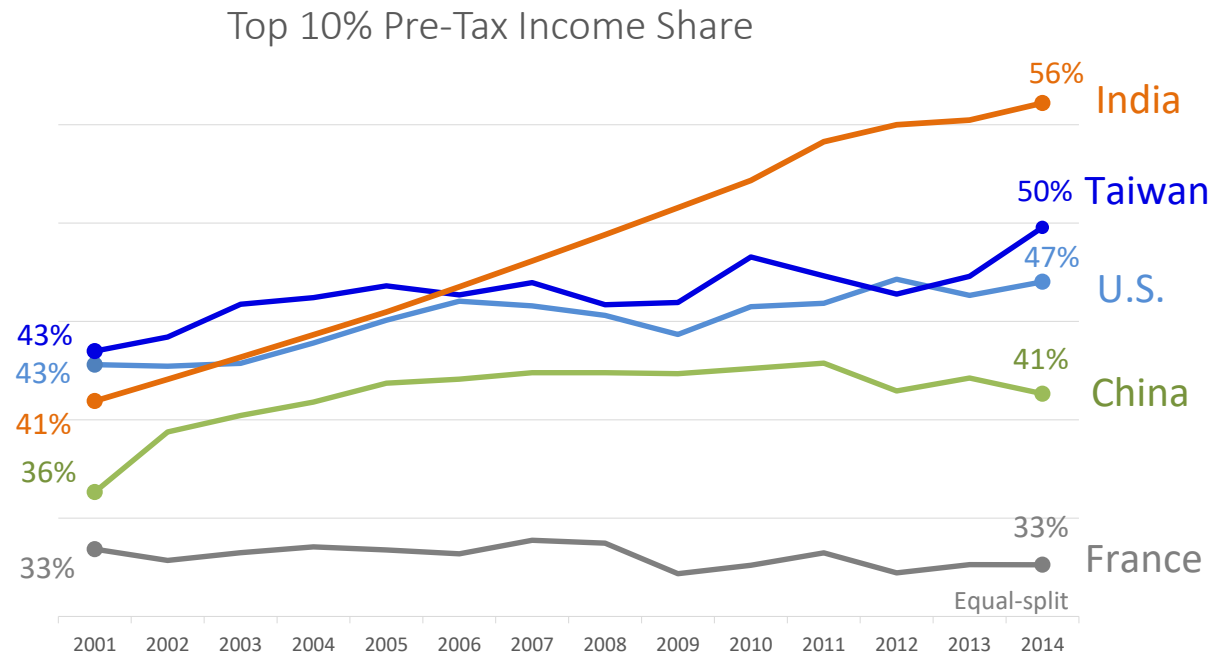



(a)

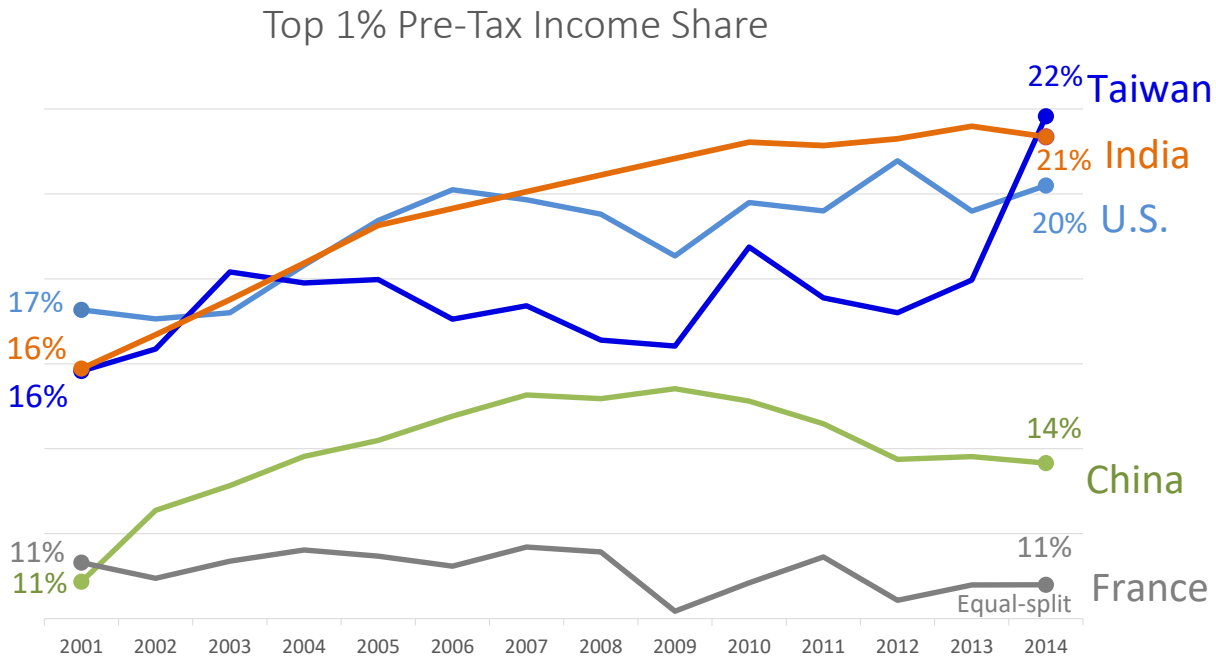



(b)

Figure 4: Top Income Shares of Taiwan

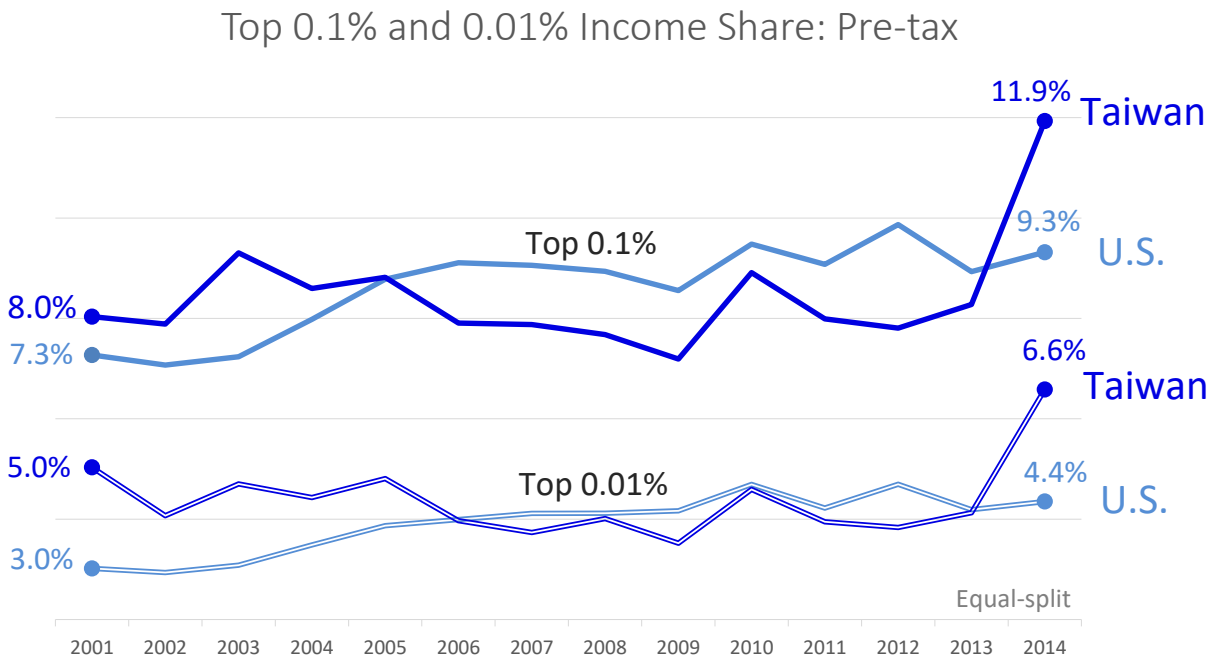



(a)

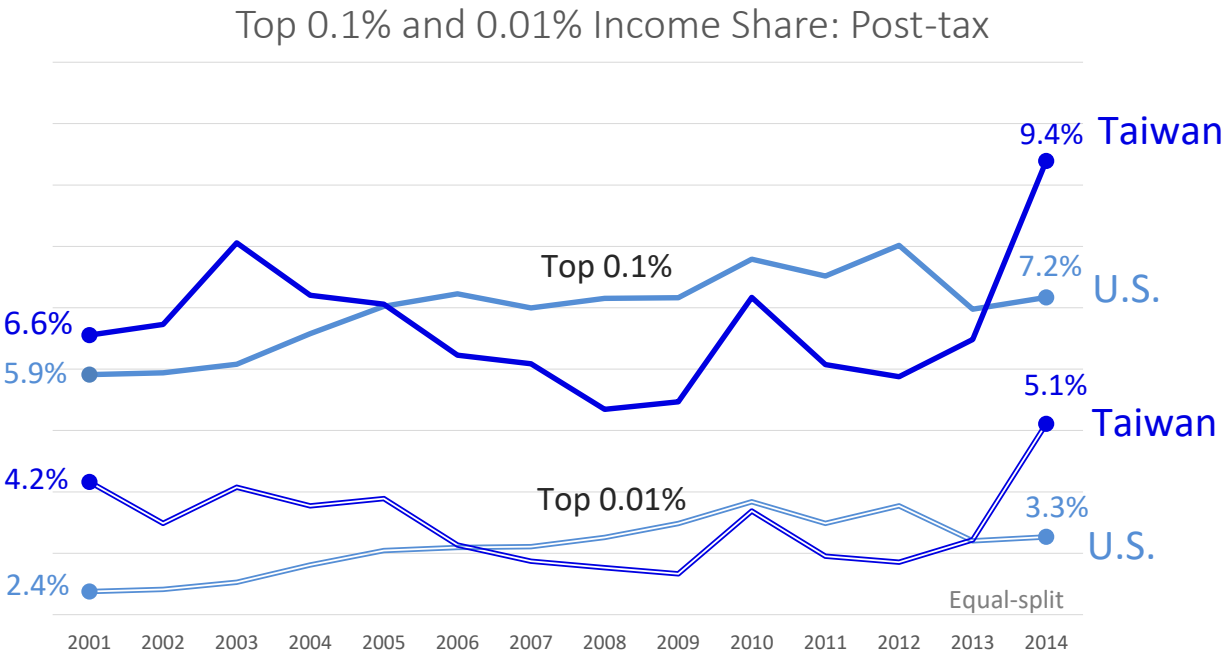



(b)

Figure 5: Top Income Shares Across Countries




(a)




(b)

Figure 6: Top Income Shares Between the U.S. and Taiwan: Pre-tax and Post-Tax Income

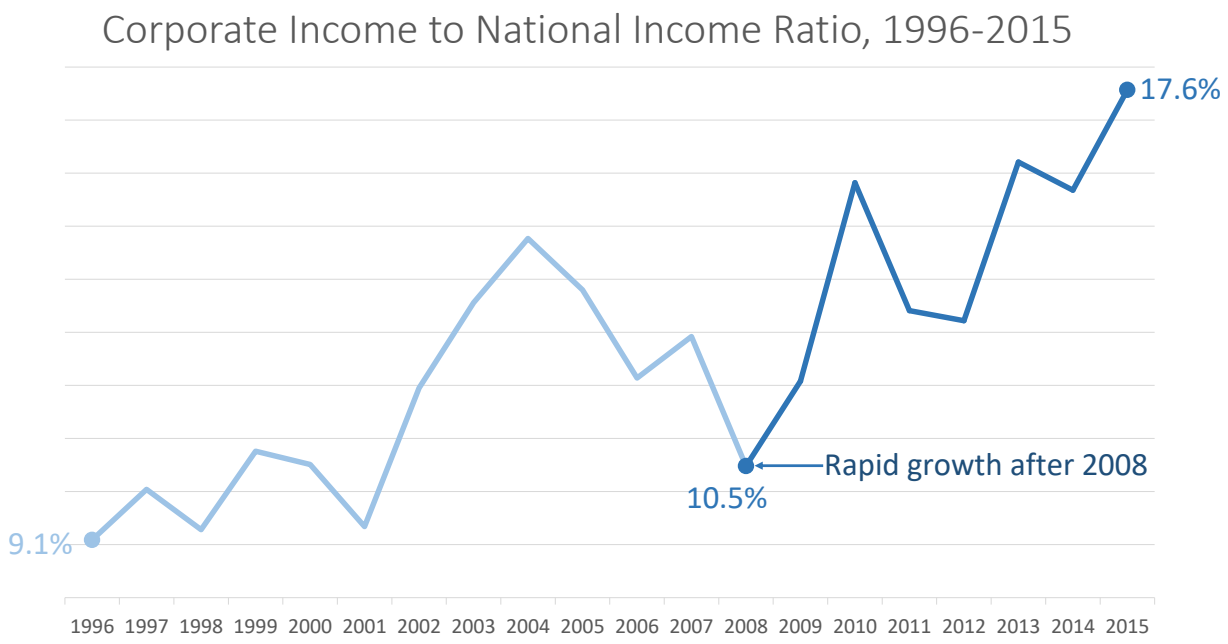



Figure 7: Corporate Income to National Income Ratio, 1996-2015

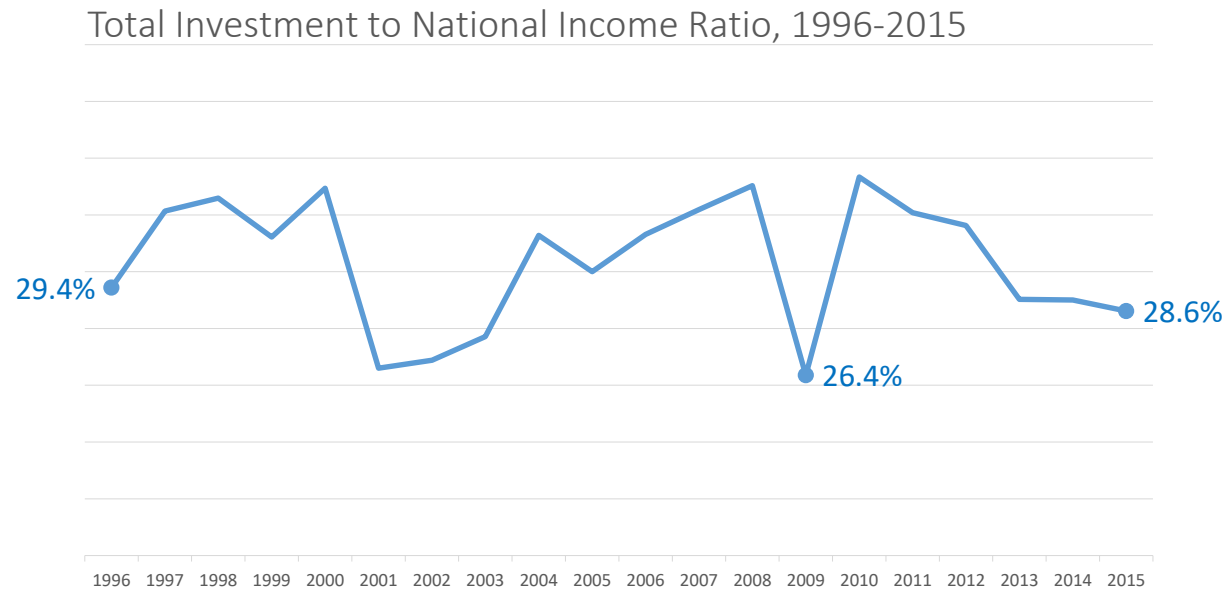
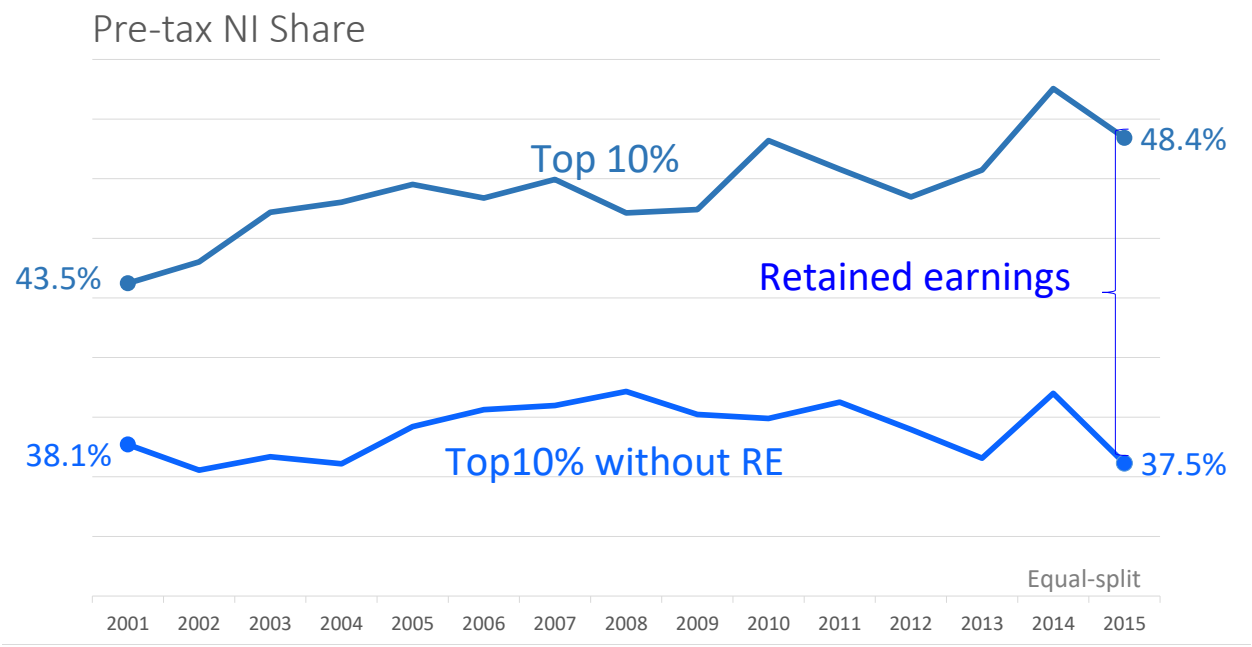
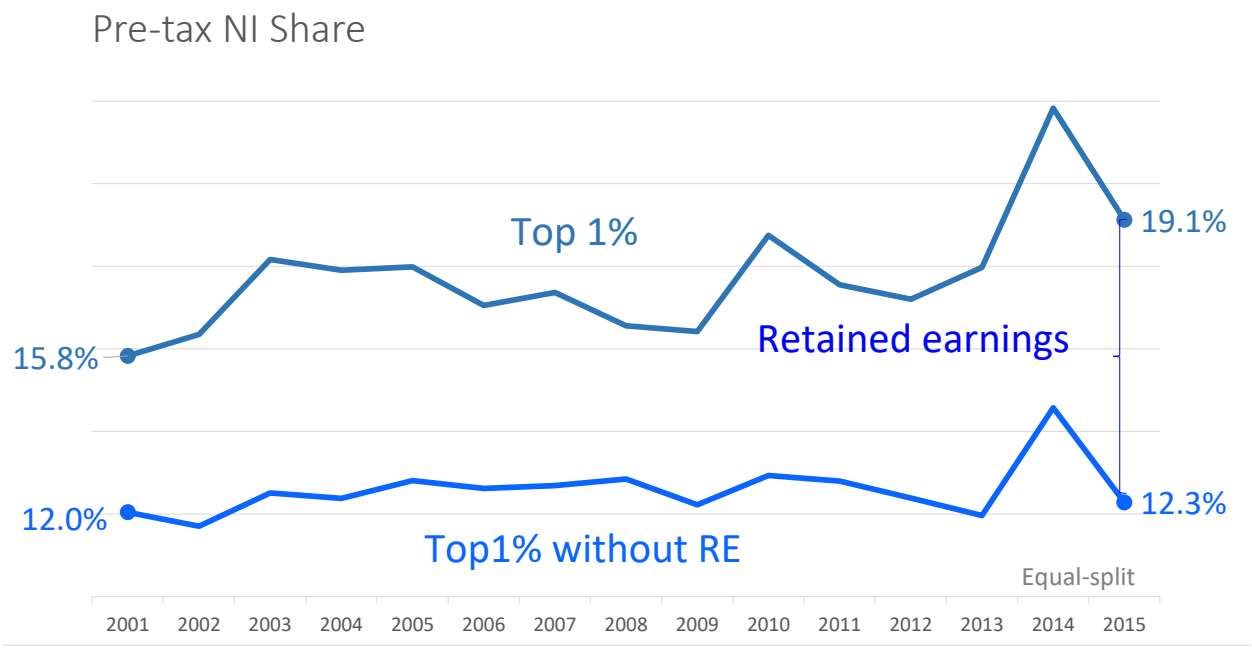



Figure 8: Total Investment to National Income Ratio, 1996-2015. Total investment includes domestic investment and foreign direct investment.

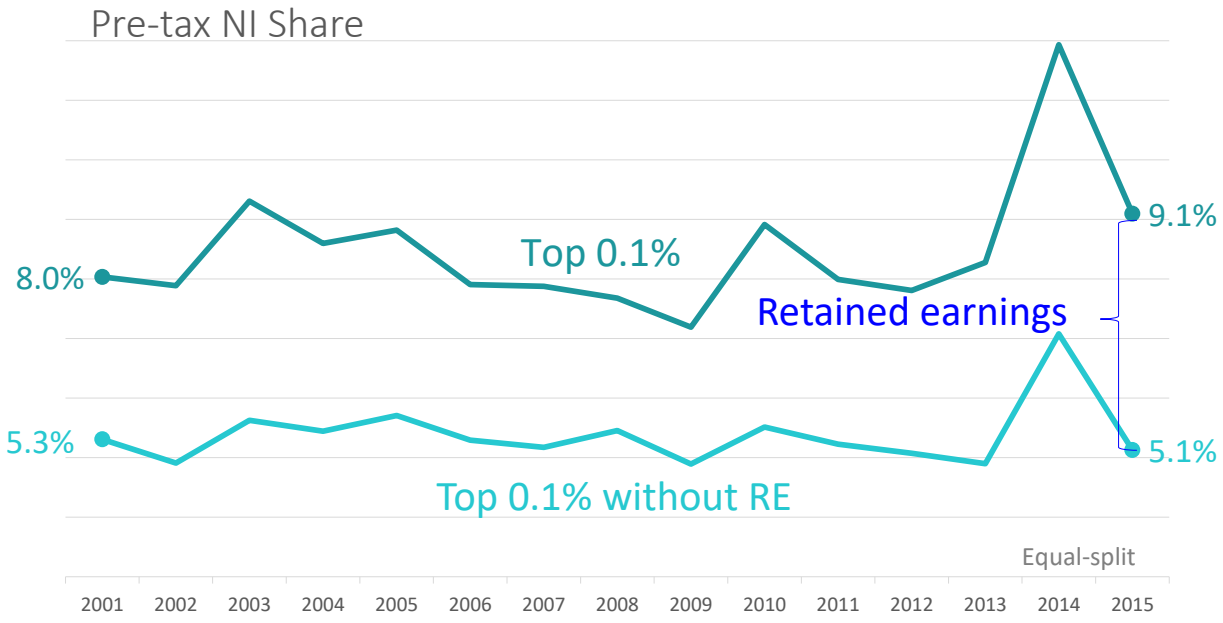



(a)

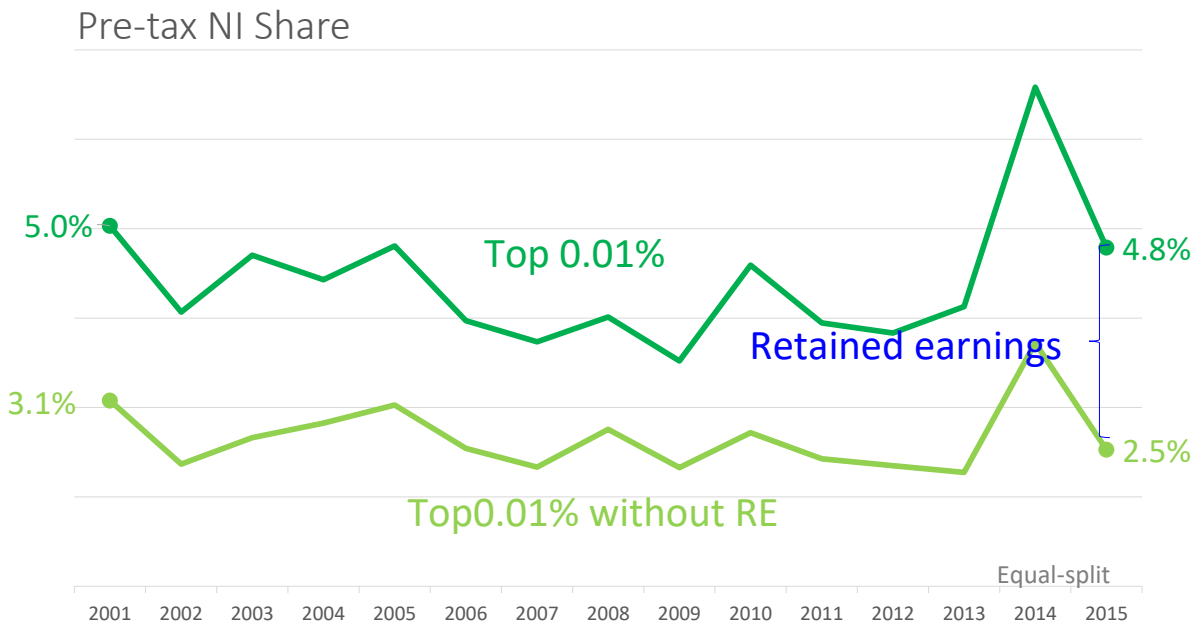



(b)

Figure 9: Top Income Shares with and without Retained Earning




(a)




(b)

Figure 10: Top Income Shares with and without Retained Earnings

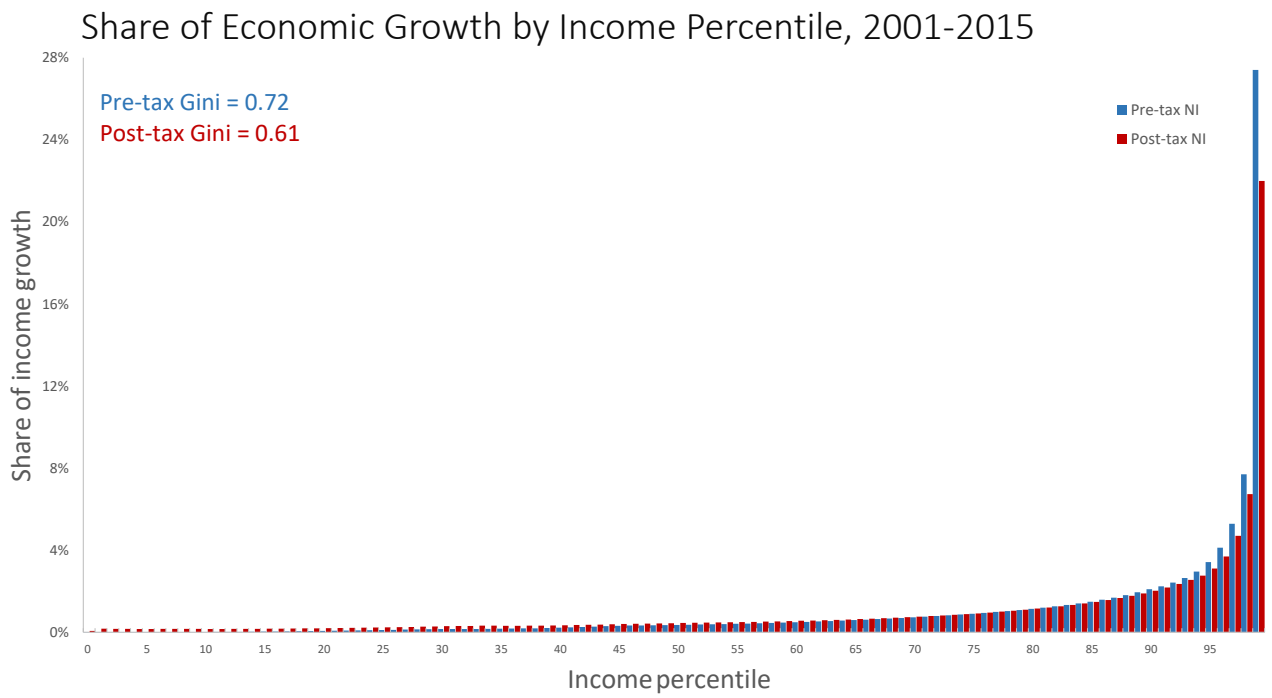



Figure 11: Share of Economic Growth by Income Percentile, 2001-2015

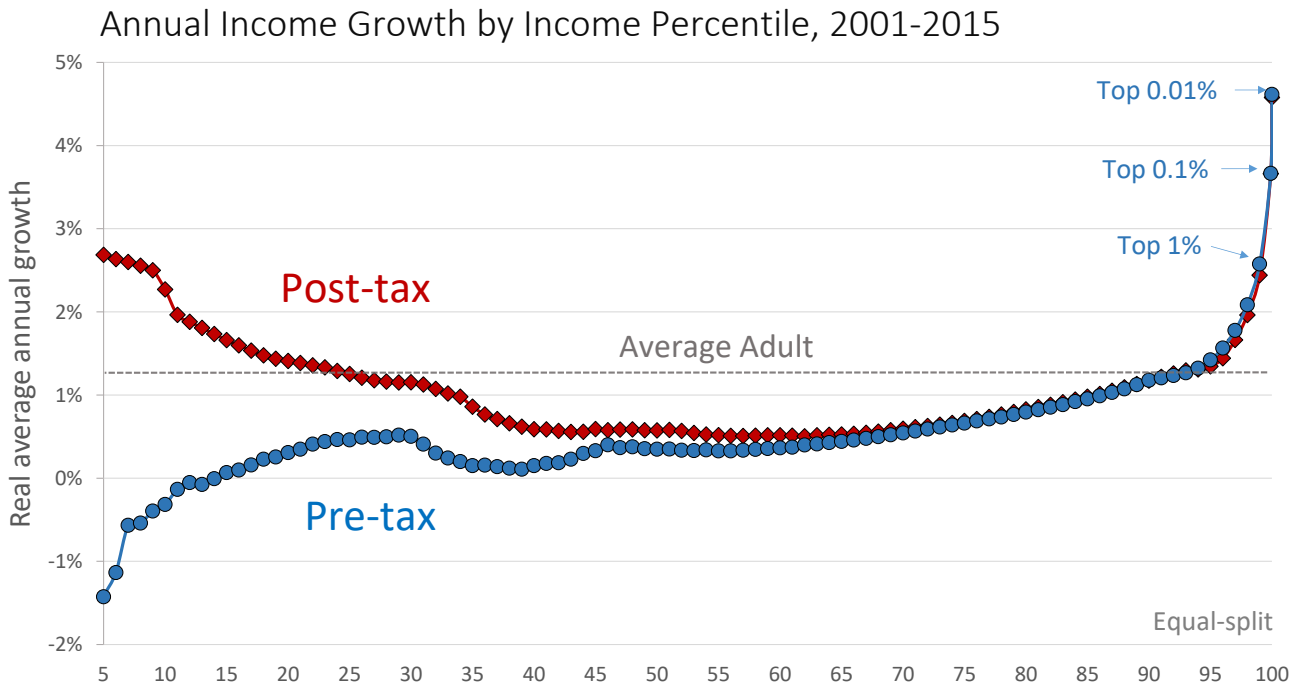



Figure 12: The Distribution of Income Growth Rate in Taiwan

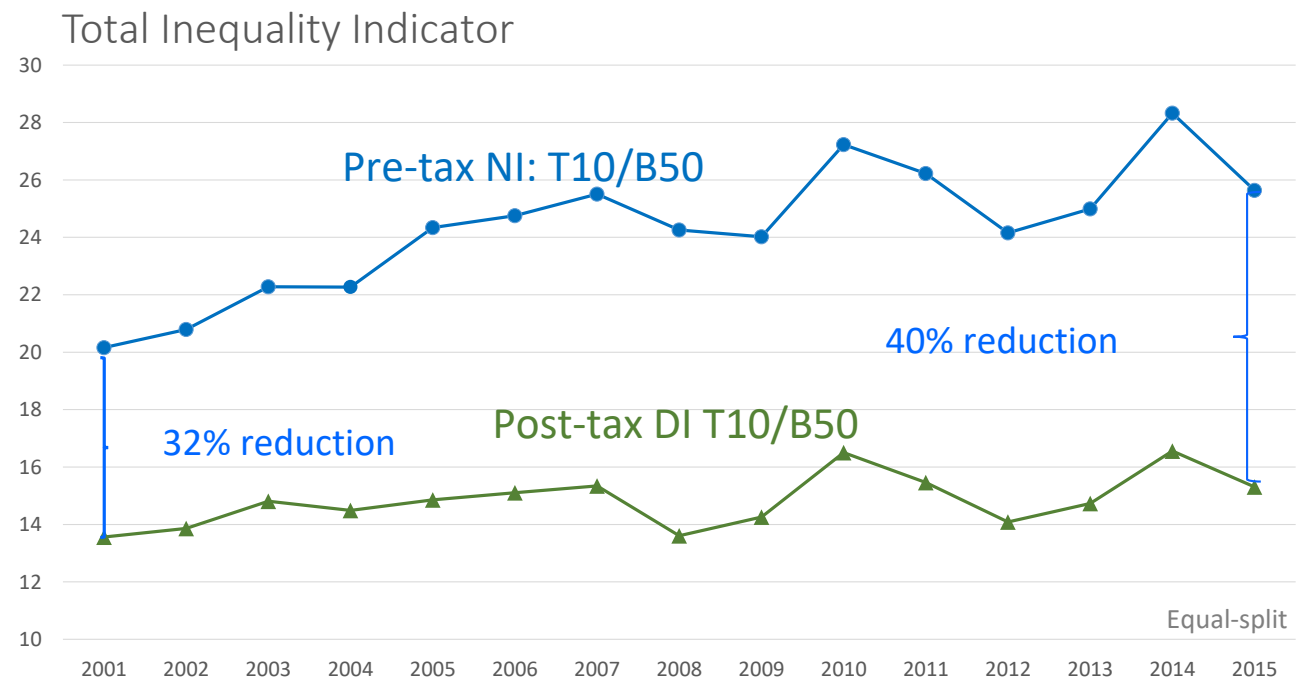



Figure 13: Total Inequality Indicator, 2001-2015

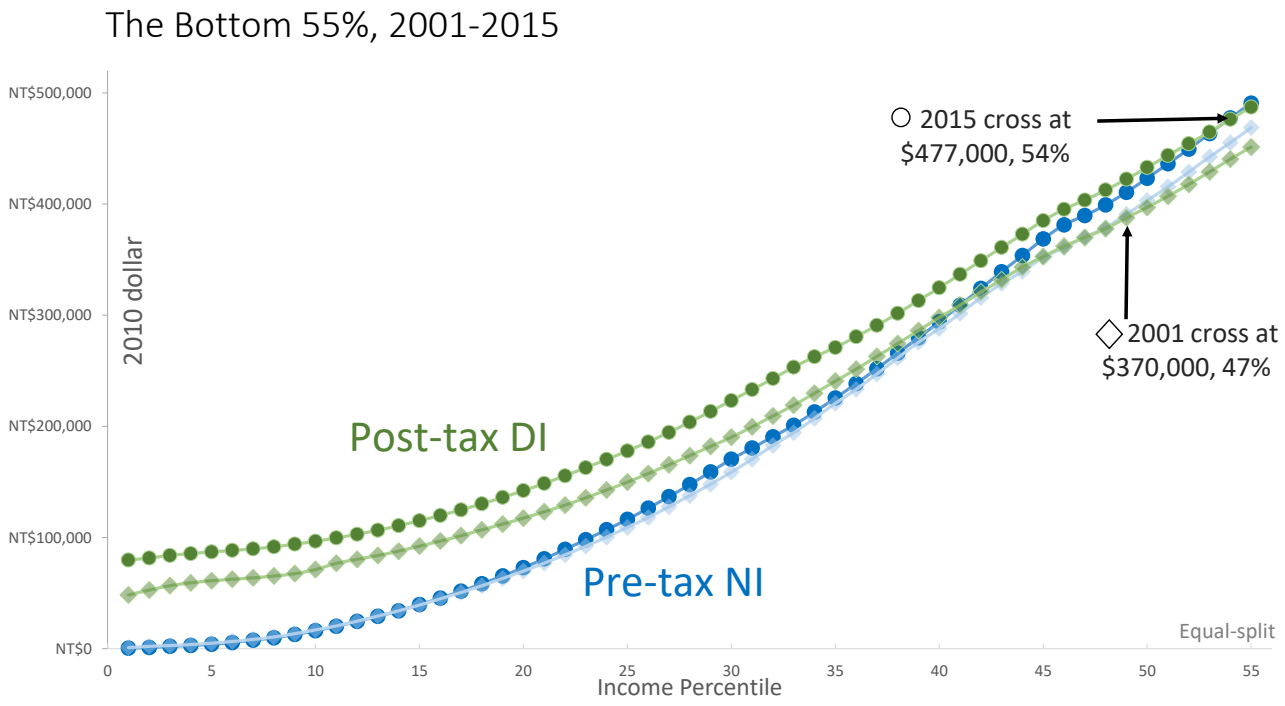



Figure 14: The Bottom 55% Income Distribution, 2001-2015

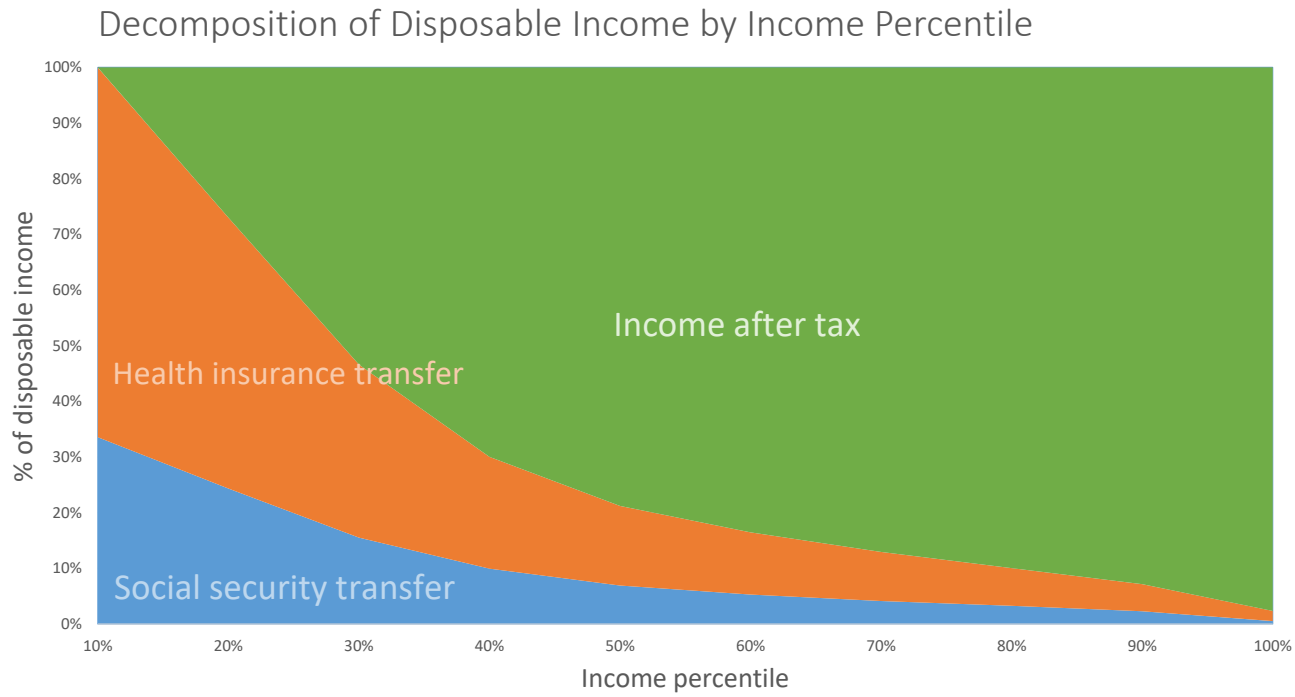



Figure 15: Decomposition of Disposable Income by Income Percentile in 2015.

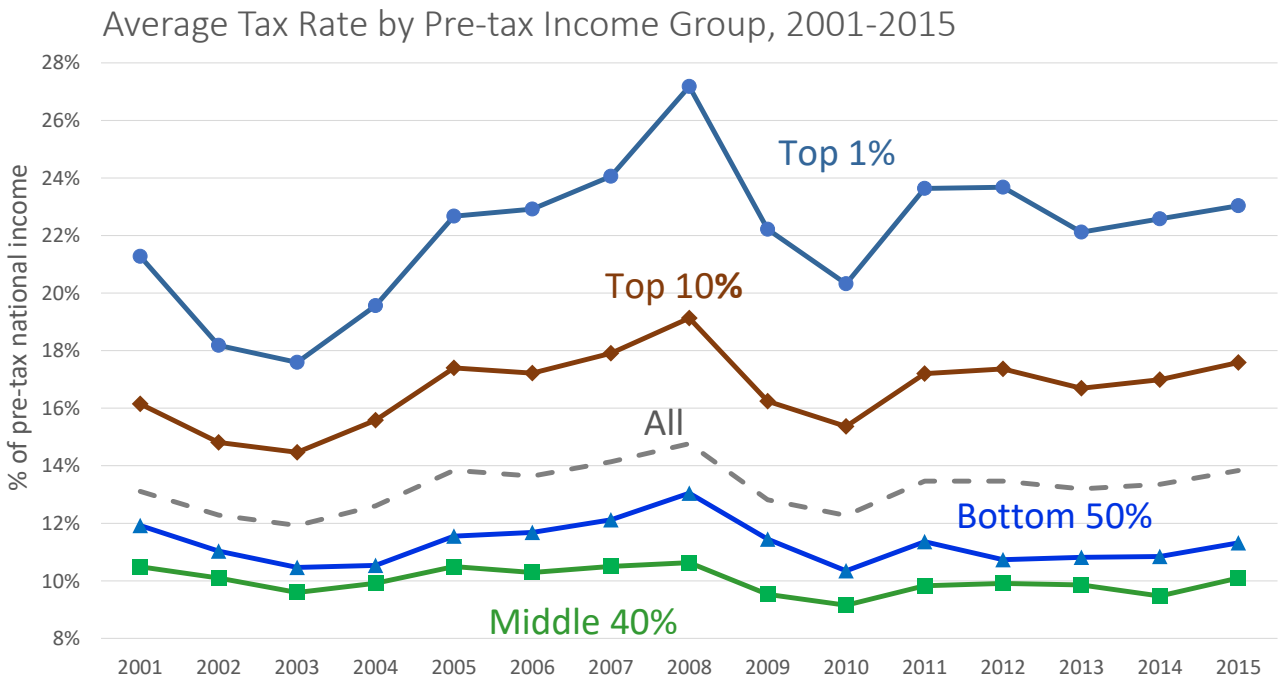



Figure 16: Average Tax Rate by Income Group, 2001-2015

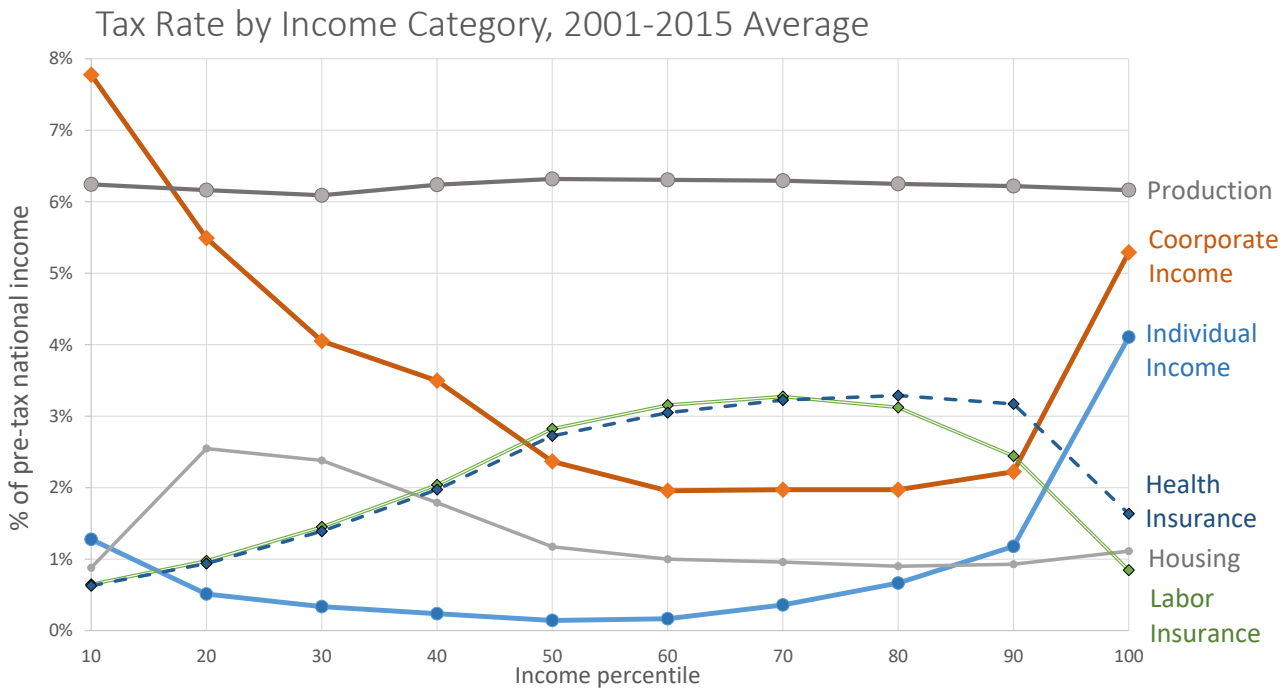



Figure 17: Average Tax Rate by Income Category and Income Percentile, 2001-2015

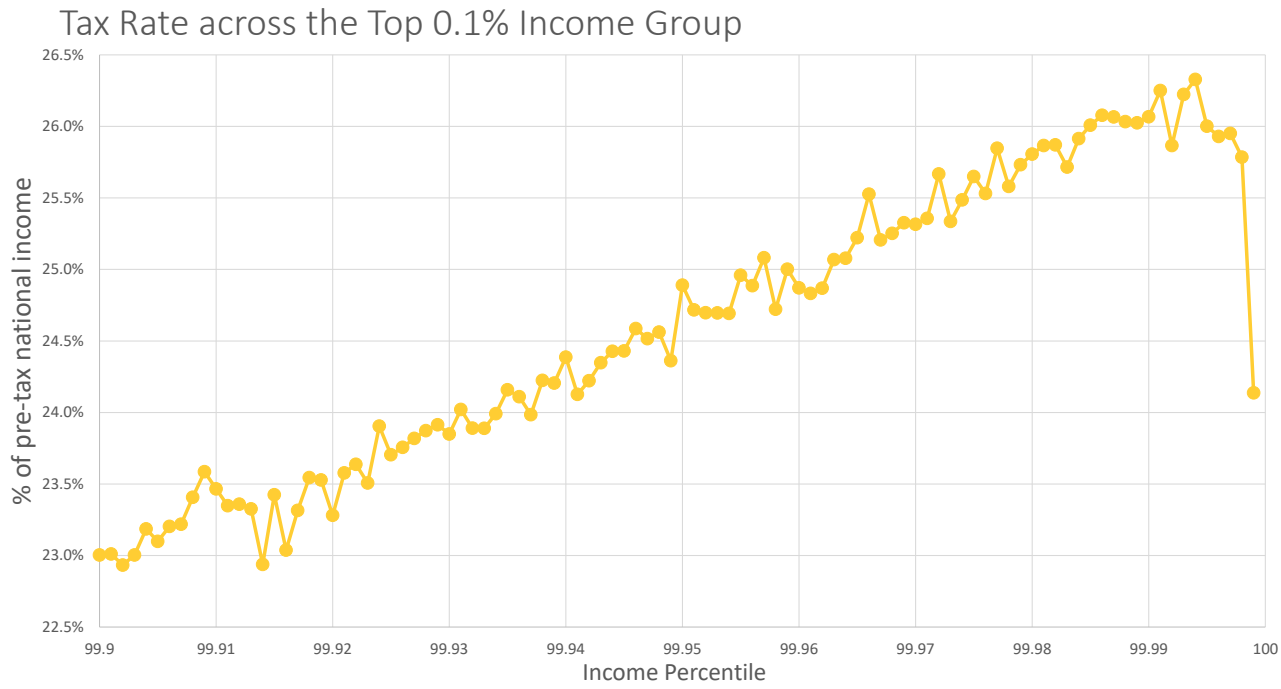



Figure 18: Average Tax Rate across the Top 0.1% Income Group in 2015

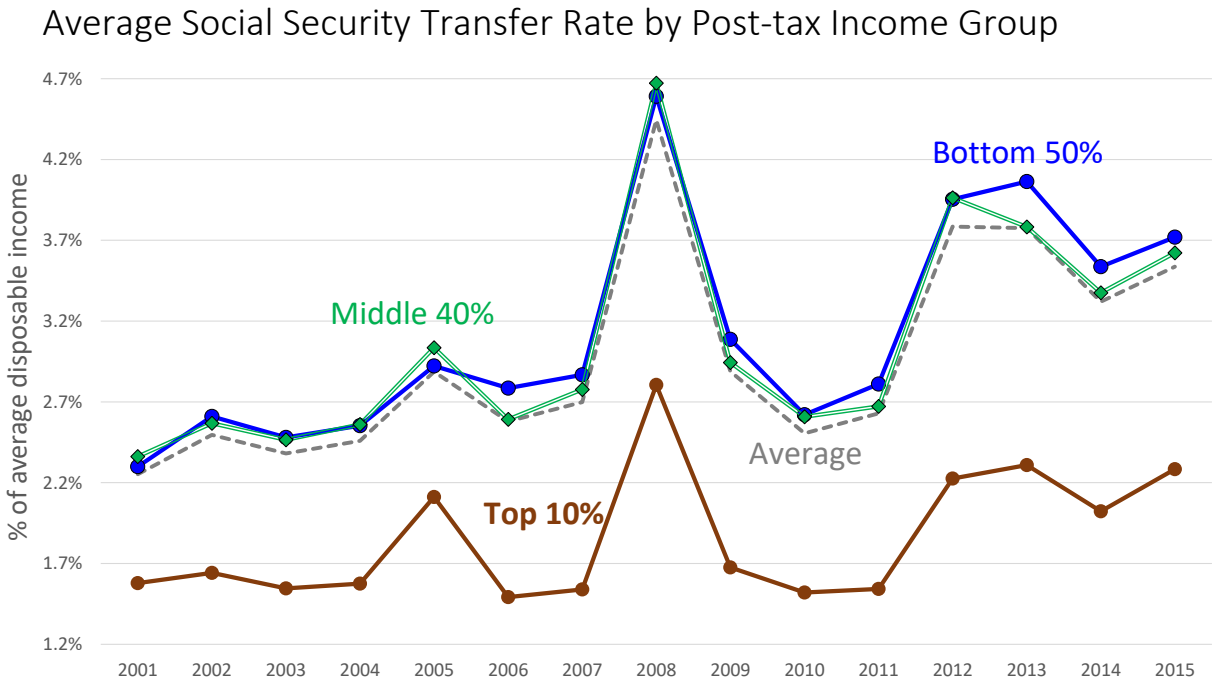



Figure 19: Social Security Transfer Rate by Income Group, 2001-2015

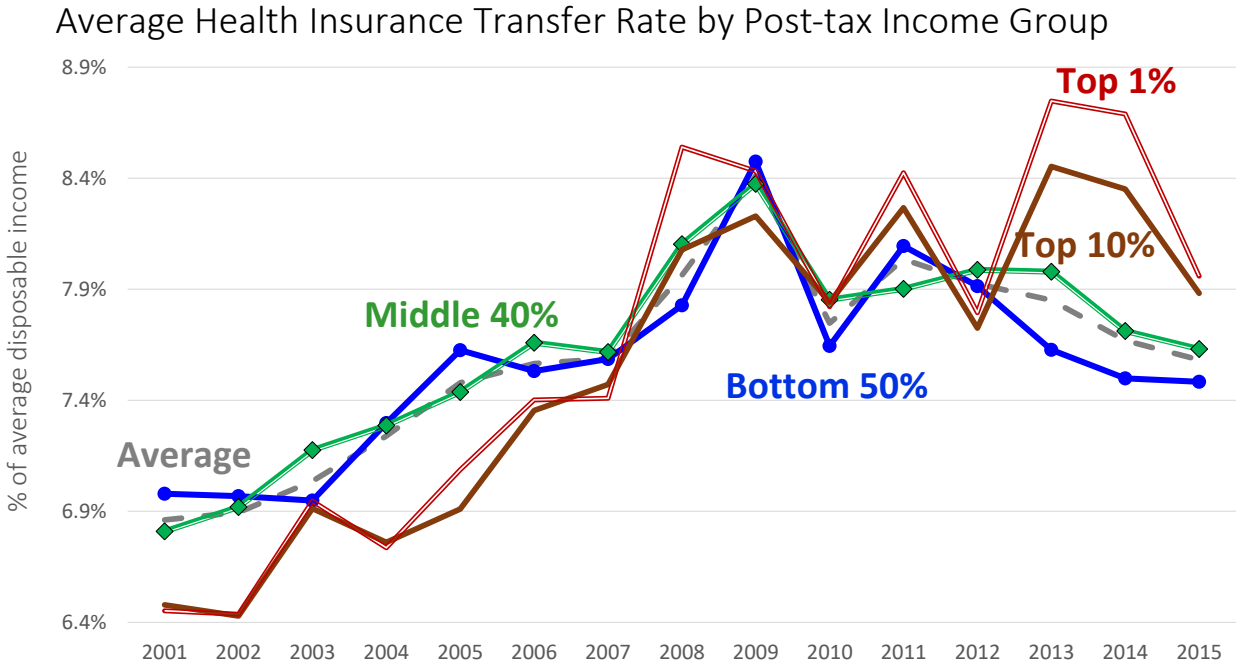



Figure 20: Health Insurance Transfer Rate by Income Group, 2001-2015