

Yoshino, Naoyuki; Taghizadeh-Hesary, Farhad; Shimizu, Sayoko

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## Impact of quantitative easing and tax policy on income inequality: Evidence from Japan

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## **ADB Working Paper Series**

### **IMPACT OF QUANTITATIVE EASING AND TAX POLICY ON INCOME INEQUALITY: EVIDENCE FROM JAPAN**

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Naoyuki Yoshino,  
Farhad Taghizadeh-Hesary,  
and Sayoko Shimizu

No. 891  
November 2018

**Asian Development Bank Institute**

Naoyuki Yoshino is Dean of the Asian Development Bank Institute and Professor Emeritus of Keio University. Farhad Taghizadeh-Hesary is an assistant professor of economics at the Faculty of Political Science and Economics of Waseda University. Sayoko Shimizu graduated from the Keio University, Faculty of Economics.

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Please contact the authors for information about this paper.

Email: [farhadth@gmail.com](mailto:farhadth@gmail.com), [farhad@aoni.waseda.jp](mailto:farhad@aoni.waseda.jp)

Asian Development Bank Institute  
Kasumigaseki Building, 8th Floor  
3-2-5 Kasumigaseki, Chiyoda-ku  
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500  
Fax: +81-3-3593-5571  
URL: [www.adbi.org](http://www.adbi.org)  
E-mail: [info@adbi.org](mailto:info@adbi.org)

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**Abstract**

From April 2013 until May 2016, Japan's monetary base rose from ¥155 trillion to ¥387 trillion as part of the Bank of Japan's (BOJ) quantitative and qualitative easing (QQE) monetary policy for achieving a price stability target of 2%. Although the main objective of the BOJ's quantitative easing (QE) and QQE policy is inflation targeting, this paper aims to shed light on the impact of the policy on income inequality. At the same time, this paper assesses the impact of Japanese tax policy on income inequality through the development of a vector error correction model for the period Q1 2002–Q4 2016 by including the five variables of income inequality, money stock, government income tax, the stock price index, and real gross domestic product. The empirical results reveal that the QE and QQE monetary policy of the Bank of Japan increased income inequality through a rise in the price of financial assets that benefited only richer income groups and resulted in a widening of the income gaps between different income groups. On the other hand, tax policy mitigated part of the adverse effect. The results indicate that monetary policy has both a short-run impact and long-run impact on income inequality, while tax policy has only long-run impact.

**Keywords:** income inequality, quantitative easing, monetary policy, tax policy, Japanese economy

**JEL Classification:** D63, E52, H24

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# 1. INTRODUCTION AND LITERATURE SURVEY

Growing inequality, especially in advanced economies, has attracted much attention from policymakers and academics (Yellen 2014; Bernanke 2015; Draghi 2016). Equality is considered to be significantly valuable in most societies, akin to fairness. Regardless of ideology, culture, and religion, individuals acknowledge inequality as unfavorable (Dabla-Norris et al. 2015). Not only can inequality cause instability within society, but studies have shown it can hinder economic growth.

Japan's economy is going through a prolonged period of recession or minimal growth with deflation. The Bank of Japan (BOJ) is continuously injecting liquidity in order to achieve its inflation target of 2%. The BOJ started its "unconventional monetary policy" (UMP) in the early 1990s, and the zero-interest rate policy continued throughout the following decade, followed by quantitative easing (QE) in the early 2000s, comprehensive monetary easing from 2010, and quantitative and qualitative easing (QQE) from 2013 until present. Japan's monetary base has increased from ¥112,513 billion as of January 2005 to ¥492,969 billion as of May 2018, a more than fourfold increase in liquidity. Although the accommodative monetary policy of the BOJ aims to target inflation, we believe it has a disruptive impact on income inequality. Most recently, the QE and QQE of the BOJ are widening the income gap through a rise in the price of financial assets that benefits only richer income groups, resulting in a widening of the income gaps between different income groups.

The widening income gap is making it tougher for the nation to deal with its demographic challenges as stagnant wages deter people from having children, and an aging workforce hampers the government's efforts to raise revenue to pay for the aging society. Residents of Tokyo have benefited the most from the BOJ's current monetary policy, with average taxable incomes rising almost 7% over the 5 years through FY2016—the highest increase of any prefecture. In comparison, the incomes of the 2.4 million people living in the prefectures of Nara and Kagawa dropped over the same period. Akita prefecture in the north is still the poorest of the 47 prefectures, with the average person earning just 59% of the average income in Tokyo. The people of Fukushima have seen their incomes rise on the back of compensation and reconstruction after the 2011 earthquake, tsunami, and nuclear meltdown that devastated large portions of the prefecture (Mayger and Dormido 2017).

Recent empirical works have found that high levels of inequality are harmful for the pace and sustainability of growth (Ostry, Berg, and Tsangarides 2014). Cingano (2014) strengthens these findings by through an econometric analysis of Organisation for Economic Co-operation and Development (OECD) countries and concludes that income inequality has a negative and statistically significant impact on subsequent growth. The study shows that the income distribution itself matters for gross domestic product (GDP) growth. Specifically, if the income share of the top 20% increases, then GDP growth declines over the medium term. In contrast, an increase in the income share of the bottom 20% is associated with higher GDP growth (Dabla-Norris et al. 2015). Others have argued that increasing inequality may have been a critical contributing factor to the global financial crisis (GFC). Rajan (2010) argues that increasing inequality led to political pressure for more housing credit, which intensified falsified lending in the financial sector. Ranciere and Kumhof (2011) present that in the United States, the Great Depression of 1929 and the GFC of 2008 were both anticipated by a rapid rise in income and wealth inequality and by a sharp rise in the debt-to-income ratios of low-income households.

Japan, along with some of other OECD countries, has also been susceptible to the gradual increase in inequality in recent years (Hoeller, Joumard, and Koske 2013). Concerns over income inequality have grown among the Japanese population, and the notion that “all Japanese are middle class” has become a concept of the past (Aoyagi, Ganelli, and Murayama 2015). In their study, Aoyagi, Ganelli, and Murayama (2015) find evidence of increasing income inequality in Japan, showing that the country’s Gini coefficient has continuously increased over the last 3 decades. Beginning from the lowest among Group of Seven (G7) countries in the 1980s, Japan’s Gini coefficient has recently converged to roughly the G7 average of 0.5. As such, Japan’s pace of rising inequality has been exceptionally high.

Scholars have deduced various reasons for the causes of income inequality, including (i) technology (Bound and Johnson 1992); (ii) demographics (Karahan and Ozkan 2013); (iii) globalization (Feenstra and Hanson 2008; Furceri, Loungani, and Zdzenicka 2016); (iv) and the structure of labor market (Jaumotte and Buitron 2015). Acemoglu and Johnson (2012) and Stiglitz (2015) raise expansionary monetary policy as a possible contributing factor for income inequality. However, the results of the effect of monetary policy on inequality have been ambiguous and sometimes even contradictory. Opinions are often divided among scholars, with results ranging from being insignificant to significant and expansionary monetary policy increasing inequality to reducing inequality.

In a recent study, O’Farrell, Rawdanowicz, and Inaba (2016) find the effect of monetary policy on inequality to be limited. They assess the impact of monetary policy on income and wealth in selected developed countries via changes in the returns on assets, debt interest payments, and asset prices rather than through the impact on employment and inflation. At the same time, they address whether high inequality has a negative impact on the effectiveness of monetary policy.

Similarly, Inui, Sudo, and Yamada (2017) assert that both conventional and unconventional monetary policy shocks do not have statistically significant impacts on inequality across Japanese households in a stable manner. Their results show the following. (i) Expansionary monetary policy shocks increased income inequality in a statistically significant manner, mainly through the responses of earnings inequality, when using data from Q1 1981–Q4 1998 on inequality for households with household heads that are employed. (ii) Monetary policy shocks scarcely affected income inequality, however, when extending the end point of the sample period to Q4 2008, or when studying earnings inequality for households including those with unemployed household heads. The distributional effects of the monetary policy shocks have weakened gradually from around the early 2000s. (iii) Compared with the response of income inequality, that of consumption inequality to monetary policy shocks is minor (Inui, Sudo, and Yamada 2017).

Various studies have demonstrated significant impacts of monetary policy on inequality. Fuceri, Loungani, and Zdzenicka (2016), for example, show that expansionary monetary policy reduces income inequality. They used data on top income shares (top 1%, 5%, and 10%) from the World Top Income Databases, the share of wage income in GDP from the OECD, and the Gini coefficients for 32 advanced and emerging countries. Their study is unique as it incorporates the forecast error of the policy rates. This is used to overcome the problem of “policy foresight” (Forni and Gambetti 2010) and to eliminate the chance of capturing the potentially endogenous response of monetary policy to the condition of the economy. Jorda (2005) examines monetary policy shock effects on inequality through impulse response functions directly from local projections. The study’s results show that an unexpected decline of 100 basis points in the policy rate reduces inequality by

approximately 1.25% in the short term and 2.25% in the medium term. According to the calculations, the effect of the policy rate is economically significant as there was a high persistence and limited variation in the Gini coefficient. The effect is larger for countries with a higher labor share of income and smaller redistribution policies. Likewise, Coibion et al. (2012) advocate the significance of the effect and that the expansionary (contractionary) monetary policy reduced (increases) inequality in the United States (US) from 1980 to 2008. According to their study, the contractionary monetary policy had significant long-term effects on inequality in consumption, income, expenditure, and labor earnings in a statistically significant manner. They also examine the transmission channels, and show that the earning heterogeneity channel and income composition channel were especially strong in their outcomes. They observe higher earnings for high-income earners after the contractionary monetary policy shocks but lower earnings for low-income earners, demonstrating the earning heterogeneity channel. The income composition channel also played a major role, as aggregate financial income rose sharply while business income declined after the contractionary monetary policy shocks, and the top 1% of the income distribution received approximately 30% of their income from financial income. The income composition of the low-income earners mostly consisted of labor income. Thus, there was a wider disparity between the income of the top and bottom layers of the income distribution. Another study proposing the significance of the monetary policy effect on inequality is by Saiki and Frost (2014). The study uses a vector auto regression framework and impulse response functions to identify empirically the response of monetary policy shocks to income inequality. The results conclude that an increase in monetary base positively affects the Gini coefficient.

In this paper, we shed light on the effect of UMP, in particular QE and QQE monetary policy, on income inequality across Japan from an empirical point of view. We also look at the effect of tax policy on income inequality. The effect of tax policy has been clear as it is used as “the primary tool for governments to affect income distribution” (Bastagli, Coady, and Gupta 2012). Both tax policies and spending policies have the power to alter the distribution of income over the short and medium term. However, the redistributive effects of fiscal policies have been shown less to be effective in recent years. Our findings show that an increase in monetary stock contributed to an increase in inequality in Japan, demonstrating that the implemented expansionary monetary policy contributed to increasing inequality and, as for the tax policy, reduced inequality in Japan.

## 2. RECENT MONETARY POLICY OF THE BANK OF JAPAN AND INCOME INEQUALITY TRENDS

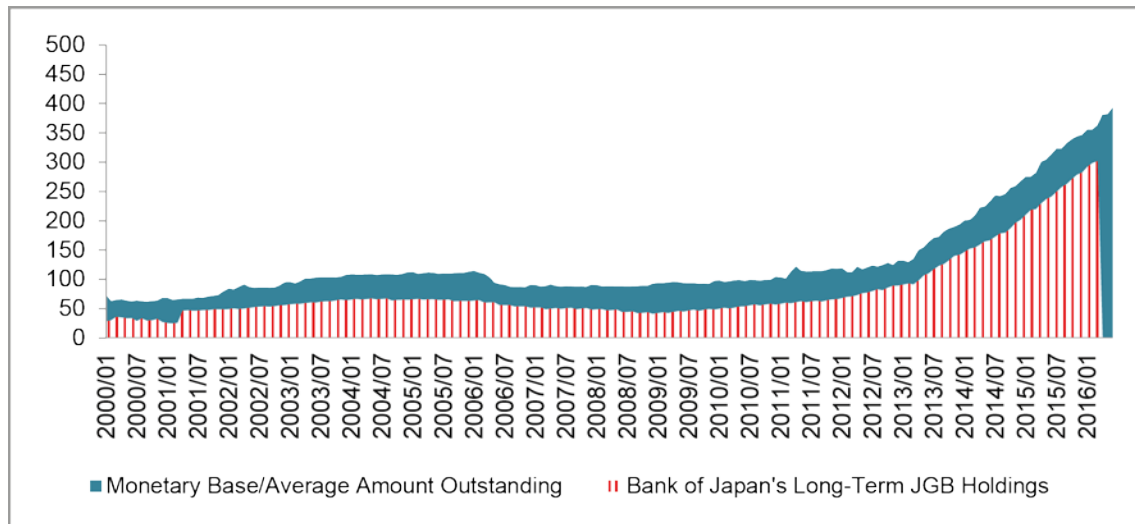
As the most recent monetary policy move the BOJ announced the purchase of Japanese government bonds (JGBs) on 4 April 2013. Haruhiko Kuroda made this decision when he first became governor of the BOJ (Yoshino, Taghizadeh-Hesary, and Miyamoto 2017). Figure 1 shows the expansion of the monetary base and JGB holdings by the BOJ. Since 2013, there has been a massive increase in the amount of monetary base through the implementation of QQE<sup>1</sup> as part of the three arrows introduced by Prime Minister Abe.

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<sup>1</sup> At the Monetary Policy Meeting held on 20–21 September 2016, the BOJ decided to introduce a new policy framework of QQE with yield curve control by strengthening the two previous policy frameworks of the QQE and QQE with a negative interest rate. The new policy framework consists of two major components: the first is yield curve control, in which the BOJ controls short-term and long-term interest



**Figure 1: Expansion in the Monetary Base and Japanese Government Bond Holdings, January 2000–June 2016**  
(¥ trillion)



JGB = Japanese government bond.

Notes: The monetary base is average amount outstanding in each month. The Bank of Japan's long-term JGB holding data were available up to March 2016.

Source: Bank of Japan. Time-series database. [https://www.stat-search.boj.or.jp/index\\_en.html](https://www.stat-search.boj.or.jp/index_en.html) (accessed 30 July 2016).

Japan. Time-series database. [https://www.stat-search.boj.or.jp/index\\_en.html](https://www.stat-search.boj.or.jp/index_en.html) (accessed 30 July 2016).

**Table 1: Comparison Using Monetary Base and Japanese Government Bond Purchase Data, April 2013 with May 2016**  
(¥ trillion)

	April 2013 (actual)	May 2016 (actual)	Average Annual Increase
Monetary base	155	387	About 80 trillion
Japanese government bonds	98	319	About 80 trillion
Commercial papers	1.4	2.3	Outstanding balance maintained
Corporate bonds	2.9	3.2	Outstanding balance maintained
Exchange-traded funds	1.7	8.0	About 3 trillion
Japan real estate investment trusts	0.13	0.31	About 90 billion
Bank of Japan total assets	175	426	–

Source: Bank of Japan. Time-series database. [https://www.stat-search.boj.or.jp/index\\_en.html](https://www.stat-search.boj.or.jp/index_en.html) (accessed 30 July 2016).

Table 1 compares the monetary base and government bond purchase data for April 2013 and May 2016. From April 2013 until May 2016, the monetary base of Japan rose from ¥155 trillion to ¥387 trillion, with an average annual increase of about ¥80 trillion. In the same period, in April 2013, BOJ assets amounted to ¥175 trillion and, by May 2016, they had increased to ¥426 trillion, an increase of almost 2.5 times in 3 years. In the same period, JGBs, which were the major purchase of the BOJ, rose from

rates through market operations; the second is an “inflation-overshooting commitment” in which the bank commits itself to expanding the monetary base until the year-on-year rate of increase in the observed consumer price index exceeds the price stability target of 2% and stays above the target in a stable manner (<https://www.boj.or.jp/en/announcements/education/oshiete/seisaku/b27.htm/>, accessed 23 January 2018).

¥98 trillion to ¥319 trillion. In other words, the purchase of long-term government bonds comprised a major part of the assets (Yoshino, Taghizadeh-Hesary, and Tawk 2017).

The extremity of Japan's recent monetary easing becomes distinct when comparing it with other countries and regions of the world. Table 2 compares the monetary base/GDP ratios for Japan with those for the US and the eurozone. In July 2016, the ratio was 80% in Japan, while it was 21% in the US and 20 % in the eurozone (Yoshino, Taghizadeh-Hesary, and Miyamoto 2017).

**Table 2: Monetary Base/GDP Ratios for Japan, United States, and the Eurozone (%)**

	Dec 2000		Dec 2012		Jul 2016
	Monetary Base/GDP	Monthly QE Volume/GDP	Monetary Base/GDP	Monthly QE Volume/GDP	Monetary Base/GDP
Japan	15	0.2	29	1.3	80
United States	6	0.5	16	–	21
Eurozone	7	–	17	0.8	20

GDP = gross domestic product, QE = quantitative easing.

Source: International Monetary Fund, International Financial Statistics (2016).

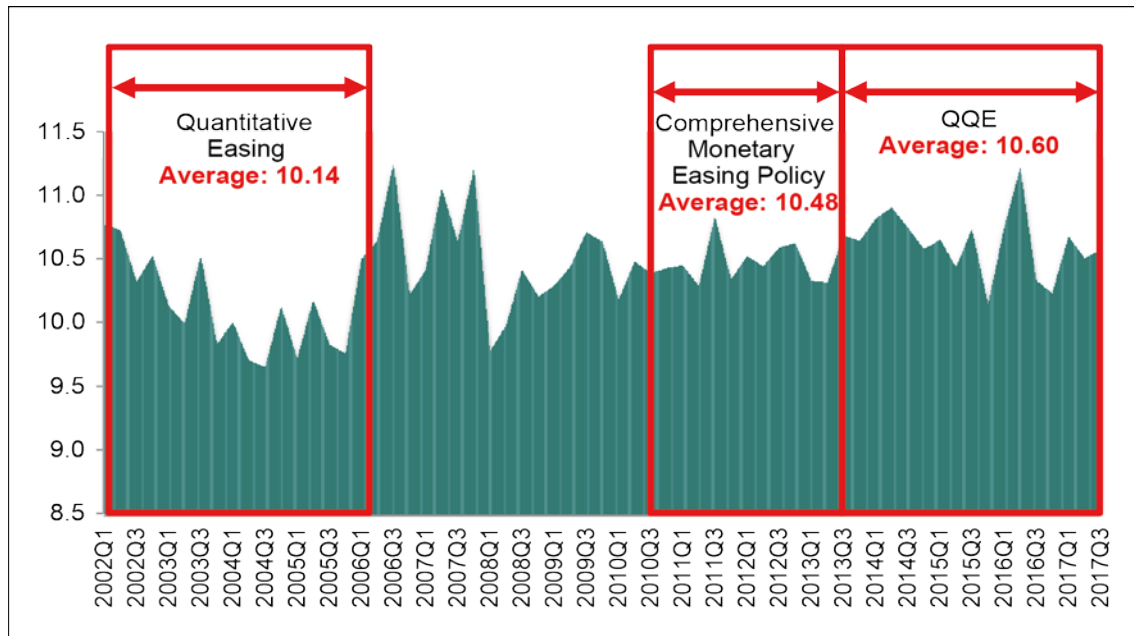
The goal of the aforementioned accommodative monetary policy was to overcome deflation and achieve sustainable economic growth. Therefore, the BOJ introduced the inflation target of 2%. Yoshino, Taghizadeh-Hesary, and Miyamoto (2017) show that due to the lower oil prices in the global market, this target could not be achieved long term. Although the interest rate became negative<sup>2</sup> and lending became cheaper, bank loans to the corporate sector did not grow due to the Japanese economy's vertical investment-saving (IS) curve. Yoshino, Taghizadeh-Hesary and Miyamoto (2017) argue that in the low oil price period, the BOJ should modify the inflation target of 2% and reduce it. Secondly, they argue that the role of monetary policy and the negative interest rate policy in Japan cannot recover from the current recession and deflation situation in the long term. What is important is to make the IS curve downward-sloping rather than vertical. That means the rate of return on investment must be positive and companies must be willing to invest when the interest rate is too low. The recession in Japan is coming from structural problems, such as the aging population, that cannot be solved by the current monetary policy.

For income inequality in Japan, the indicator we use in this survey is the average household income of the top 10% (rich) over the average household income of the bottom 10% (poor). Figure 2 illustrates the trend for this indicator during Q1 2002–Q3 2017. The index of inequality shows a drastic upward trend, especially during the last decade, meaning increasing income inequality. The ratio was 10.14 when the BOJ first implemented QE. QE was removed in March 2006 as the inflation rate turned positive and the economy seemed to be recovering. However, when the GFC hit in 2008 and the economy went into a tailspin, the BOJ lowered its interest rate to almost zero. In 2010, they executed the comprehensive monetary easing policy, and the ratio increased to 10.48. In 2013, as Prime Minister Abe took power for the second time and

<sup>2</sup> Although the monetary policy tool is the short-term interest rate or the money market rate, by reducing the short-term interest rate, the long-term interest rate is also affected. For example, when the BOJ published new monetary policy guidelines on 29 January 2016, the short-term rate became a negative interest rate, which also affected the long-term government bond interest rate, and the JGB yield curve started to fall and flattened.

released the “three arrows” of his strategy,<sup>3</sup> QQE was executed as a remedy to combat the prolonged deflation in Japan. Inequality during this period was at its highest – the inequality ratio from 2013Q3 until 2017Q3 in average was 10.60 – and this phase included the negative interest rate from 29 January 2016.<sup>4</sup>

**Figure 2: Average Household Income of Top 10% (Rich) over Average Household Income of Bottom 10% (Poor), Q1 2002–Q3 2017**



Source: Statistics Japan (<https://www.e-stat.go.jp>).

Figure 2 shows that following by the GFC in Q1 2008, income inequality fell. This took place partly because of drops in income gains from the rich’s financial assets. However, due to the recovery of the capital market caused by the economic recovery, and also due to the UMP, which inflated the stock price index in Japan, income inequality increased. The figure shows that the UMP of QE and QQE worked to increase income inequality in Japan.

### 3. THEORETICAL BACKGROUND AND THE MODEL

#### 3.1 Channels for the Transmission of Monetary Policy to Inequality

In order to capture the distributional effects of monetary policy on inequality, we will need to review the potential transmission channels. There are four major channels, introduced by Coibion et al. (2012), Nakajima (2015), and Inui, Sudo, and Yamada (2017), through which monetary policy affects income inequality.

<sup>3</sup> For more information on the three arrows of Abenomics, see: Yoshino and Taghizadeh-Hesary (2014, 2015a, 2017a).

<sup>4</sup> At its monetary policy meeting on 29 January 2016, the BOJ policy board introduced QQE with a negative interest rate to achieve the price stability target of 2% at the earliest possible time.

1. **The earnings heterogeneity channel** is used when the response of earnings to a monetary policy shock differs across different household income groups. This channel is affected by the level of labor unionization, the stickiness of nominal wages, or labor market flexibility. According to research done by Mumtaz and Theophilopoulou (2016), this channel works countercyclically to a monetary policy shock. However, this channel works procyclically among Japanese households, according to Inui, Sudo, and Yamada (2017). Under the assumption that the high-income households have more capital income and less wage income when the expansionary monetary policy is implemented, their capital income increases. However, because of the stickiness of nominal wages, the income of the poor, which is mostly wage income, will not change. Thus, this contributes to the widening of income inequality across households.
2. **The job creation channel** arises with job creation and job destruction resulting from the implementation of the monetary policy. This channel generates a countercyclical response of labor income inequality since contractionary a monetary policy shock creates jobs, reduces the unemployment rate, and decreases the number of households with no income (Bernanke 2015), therefore contributing to the narrowing of income inequality.
3. **The portfolio channel** becomes apparent when the size and composition of asset portfolios differ across households. Also, under the assumption of the rich holding most of their assets in financial assets and the poor in cash, income inequality widens as a result of monetary easing. This situation occurs due to the elevation in equity prices, resulting in an increase in income of the richer households. The result is inflation, which depreciates the purchasing power of money and contributes a widening in disparity between the rich and the poor.
4. **The savings redistribution channel** emerges from the fact that a decline in the policy rate set by the central bank and rising inflation lead to transfers from lenders to borrowers. According to quantity theory of money, when expansionary monetary policy is implemented, the price level increases. This means that inflation is present. Due to the Taylor Rule, the interest rate eventually increases, and, as a result, inequality increases as borrowers (low-income households) need to pay higher interests to lenders (high-income households).

In Japan, as the top 20% of the population hold 15.4% of their assets in stocks and bonds, which is 5 times as much as the second-top quintile, the prominence of the earnings heterogeneity channel and the portfolio channel is likely. During severe economic conditions, the UMP was put in place, which resulted in higher asset prices. Higher asset prices benefited the high-income households—which held a larger amount of overall savings in securities and, thus, benefited from greater capital income—hence, increasing income inequality among households overall. This paper focuses on the portfolio channel for the transmission of monetary policy to income inequality and provides a theoretical model as well as empirical analysis.

### 3.2 Impact of Tax Policy on Inequality

In this section, we look at the impacts of fiscal policy, with specific emphasis on tax policy, on inequality. In research by Bastagli, Coady, and Gupta (2012), fiscal policy is defined as “the primary tool for governments to affect income distribution”. Its three main objectives are described as being “to support macroeconomic stability, provide public goods and correct market failures, and redistribute income”. Both tax policies

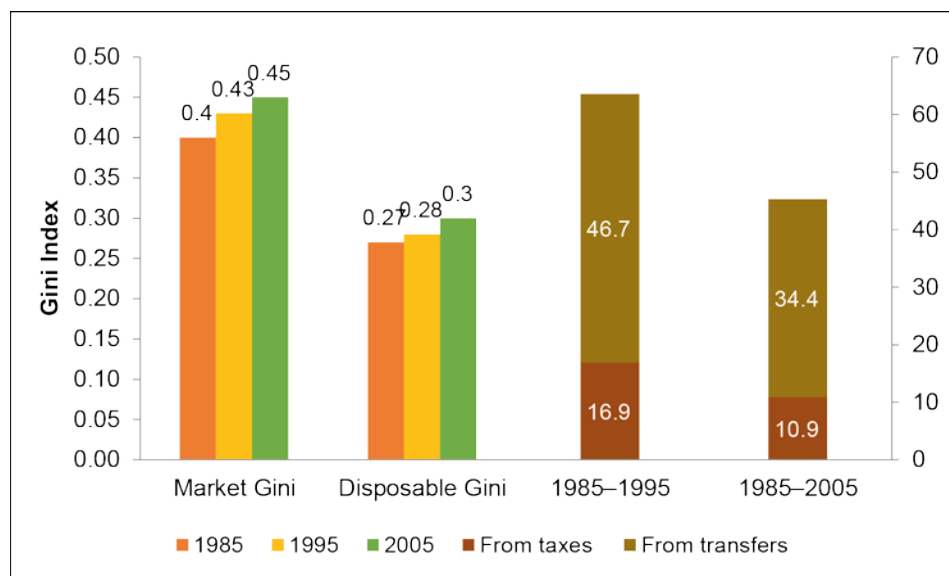
and spending policies have the power to modify the distribution of income over the short and medium term.

Various researchers have found the outcome through regression-based studies, that greater reliance on income taxes and higher spending on welfare reduces inequality (Niehues 2010; Martínez-Vázquez, Vulovic, and Moreno-Dodson 2012; Muinelo-Gallo and Roca-Sagalés 2013; Woo et al. 2013). The bulk of these studies provides evidence that direct taxes, such as income tax, corporate tax, and wealth tax, etc., are more redistributive than indirect taxes like sales tax and service tax, and social protection spending lowers inequality.

However, in OECD member countries, recently, a reduction in social benefits and less progressive taxation have resulted in a decrease in the redistributive impact of fiscal policy. Over the successive period, the mid-1990s to the mid-2000s, market income inequality was boosted, while disposable income inequality rose by less (Figure 3). Thus, while market income inequality increased by less than over the previous decade, income inequality after taxes and transfers actually increased by more. Therefore, during the 2 decades from the mid-1980s to the mid-2000s, fiscal policy offset less than half of the increase. Fiscal reforms in many economies since the mid-1990s are accountable for the decline in the redistributive power of fiscal policy (Gupta 2014). These reforms have reduced the generosity of unemployment and social assistance benefits, as well as income tax rates, particularly for high-income earners (OECD 2011a).

Without the policy changes, the absolute distributive impact of fiscal policy would have been higher than observed in Figure 3 since progressive tax and benefit systems redistribute income even more when market inequality rises (as unemployment rises and government transfers are given, or the rising income of the top earners are taxed more by the progressive tax system).

**Figure 3: Diminishing Fiscal Redistribution, 1985–2005**



Source: Caminada, Goudswaard, and Wang (2012).

The main reasons for the reduction in the distributive impact of fiscal policy were cost and efficiency. As for the means-tested social benefits, it provided disincentives for low-skilled workers to look for job opportunities (OECD 2011b). Progressive income taxes can have disincentives for higher-income individuals. However, recent research has argued that the efficiency cost of progressive taxation may be much less than previously thought (Bastagli, Coady, and Gupta 2012). Instead of boosting productivity, increases in top incomes were achieved at the expense of lower income groups, with no correlation between the rising top incomes and per capita GDP growth (Stantcheva, Saez, and Piketty 2011). On the grounds of this, more progressive taxation on high-income groups was called for (Tanzi 2011).

As previously stated, tax policies intend to reduce inequality, and, generally, they have a diminishing effect on inequality. For example, the inheritance tax in Japan is very high, up to 55% (Table 3). Before the revision of the inheritance tax in January 2015, the total deduction was calculated by adding ¥10 million per heir to the basic deduction of ¥70 million. However, after being revised, the basic deduction declined to ¥42 million and only ¥7 million per heir. This can be seen as an attempt to mitigate Japan's widening income inequality, since a major cause of inequality in Japan can be explained by inheritance.

**Table 3: Bracket of Taxable Inheritance in Japan, January 2015**

Bracket of Taxable Inheritance (¥)	Tax Rate (%)
Up to 10 million	10
10 million–30 million	15
30 million–50 million	20
50 million–100 million	30
100 million–200 million	40
200 million–300 million	45
300 million–600 million	50
Over 300 million	55

Source: Ministry of Finance (2018).

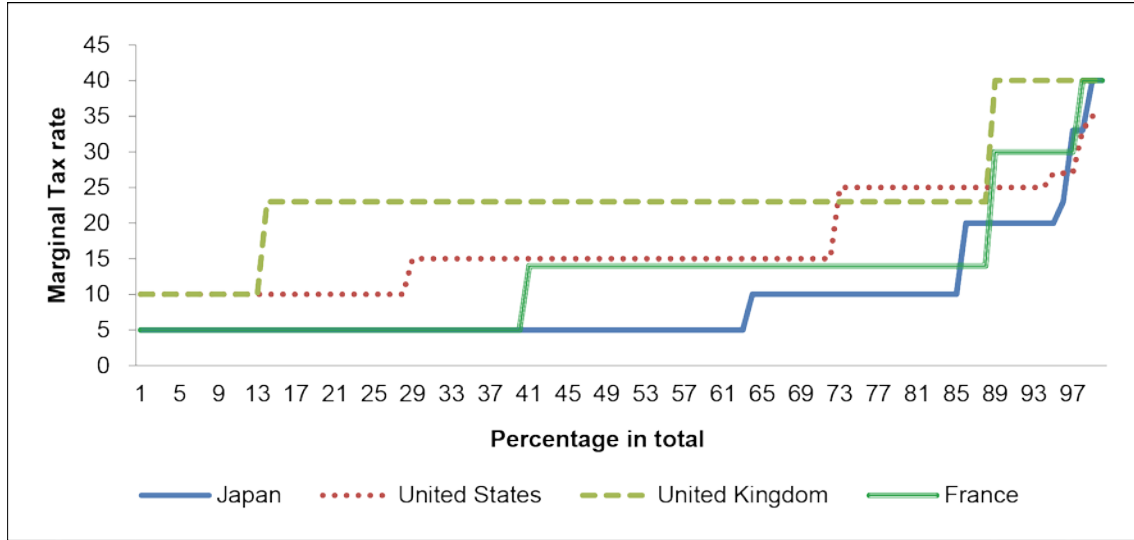
Japan's income tax is also effective in combating the growing inequality. As seen in Table 4, the income tax for low-income households is very low. It gradually rises as income rises and elevates quickly for high-income households. This is unique compared with other advanced countries, such as the US, the United Kingdom, and France (Figure 4). The well-established tax system in Japan is one of the major reasons why inequality has not increased as much as in other advanced countries.

**Table 4: Individual Income Tax Rates in Japan, January 2017**

Taxable Income Bracket (¥)		Tax Rate (%)
–	Or under 1,950,000	5
Over 1,950,000	Or under 3,300,000	10
Over 3,300,000	Or under 6,950,000	20
Over 6,950,000	Or under 9,000,000	23
Over 9,000,000	Or under 18,000,000	33
Over 18,000,000	Or under 40,000,000	40
Over 40,000,000	–	45

Source: JETRO (2018).

**Figure 4: International Comparison of Tax Percentages Based on the Final Tax Rate per Income Bracket (%)**



Source: Ministry of Finance of Japan. [https://www.mof.go.jp/tax\\_policy/summary/itn\\_comparison/j02.htm#a01](https://www.mof.go.jp/tax_policy/summary/itn_comparison/j02.htm#a01) (accessed 21 January 2018).

The tax policy's effectiveness in reducing the inequality in Japan will be examined empirically in Section 4.

### 3.3 Model Development

Here, we provide a simple theoretical model in order to show the impact of monetary policy and tax policy on income inequality. First, the two distinct income groups are presented in the form of their income and tax. Then, we depict the relationship between the macroeconomic factors and inequality.

$$E_H = w_H L_H + r_D D_H + \pi P_S S_H \quad (1)$$

$$E_L = w_L L_L + r_D D_L \quad (2)$$

In Equations 1 and 2, we consider the earnings of two income groups, the high-income group and the low-income group, denoted as  $E_H$  and  $E_L$ , respectively. The rich receive the wage income  $w_H L_H$ , where  $w_H$  is the wage rate per hour for the high-income group, and  $L_H$  shows how many hours they work. The second source of income for the high-income group is the interest income from their deposits,  $r_D D_H$ , where  $r_D$  denotes the deposit interest rate and  $D_H$  denotes amount of the deposits of the high-income group. The high-income group also invests in the capital market, so they receive dividends from the stock market as their third income source,  $\pi P_S S_H$ , where  $\pi$  shows the dividend (as a percentage),  $P_S$  shows the price of the stock, and  $S_H$  the number of shares the high-income group is holding. The low-income group receives labor income  $w_L L_L$  and also interest from their deposits,  $r_D D_L$ .  $w_L$ ,  $L_L$ , and  $D_L$  are, respectively, the wage rate per hour for the low-income group, how many hours the low-income group works, and the deposits of the low-income group. The difference in their income emanates from the wage income, deposit income, and also whether they can invest in the capital market or not.

$$P_S = \frac{\pi_1}{1+r} + \frac{\pi_2}{(1+r)^2} + \frac{\pi_3}{(1+r)^3} + \dots + \frac{P_S^{t+n}}{(1+r)^n} \quad (3)$$

Equation 3 shows the relationship between the stock price,  $P_S$ , and dividends,  $\pi_1, \pi_2, \pi_3, \dots$ . The present stock price depends on the present discount value of the dividend and future expected price of the stocks. We discount the dividend by  $1+r$ ,  $(1+r)^2$ ,  $(1+r)^3$  and  $(1+r)^n$ .

$$M \uparrow \rightarrow r \downarrow \text{ and } r_D \downarrow \rightarrow r_D D \downarrow \quad (4)$$

$$M \uparrow \rightarrow r \downarrow \text{ } P_S \uparrow \quad (5)$$

Equation 4 shows the impact of the money supply on deposits. If the money supply goes up,  $M \uparrow$ , the interest rate declines,  $r \downarrow$ , and this reduces the deposit interest rate,  $r_D \downarrow$ . For the asset return, as the deposit interest rate decreases, the money in deposit will be reduced,  $r_D D \downarrow$ . Also, if the monetary policy works well, the interest rate will fall, which leads stock prices to recover, and future prices of the stocks will increase because of monetary easing (Equation 5). Then, the total return from the capital market investment goes up for the higher-income group. However, for the lower-income group, since they only put their money in deposits, when the deposit interest rate goes down, their total assets do not increase. The rich are strongly affected by the easing of the monetary policy while the poor or those with lower incomes are not, leading to diversification in the income distribution.

Next, we add taxes to Equations 1 and 2. This gives Equations 6 and 7:

$$E_H = (1 - t_w^H) w_H L_H + (1 - t_C^H) (r_D D_H + \pi P_S S_H) \quad (6)$$

$$E_L = (1 - t_w^L) w_L L_L + (1 - t_C^L) r_D D_L \quad (7)$$

There are two kinds of tax, the wage income tax and the tax on capital.  $t_w^H$  denotes the wage income tax for the high-income group,  $t_w^L$  denotes the wage income tax for the low-income group, and  $t_C^H$  denotes the tax on capital.

Next, in order to capture the impact of monetary policy on each income group's income, we derive the first order conditions of  $E_H$  in Equation 6 and  $E_L$  in Equation 7 with respect to the money supply,  $M$ . The results of the first order conditions are shown in Equations 8 and 9:

$$\frac{\partial E_H}{\partial M} = (1 - t_w^H) \left( \frac{\partial w_H}{\partial M} L_H + w_H \frac{\partial L_H}{\partial M} \right) + (1 - t_C^H) \left\{ \frac{\partial r_D}{\partial M} D_H + r_D \frac{\partial D_H}{\partial M} + \pi P_S \frac{\partial S_H}{\partial M} + \frac{\partial \pi}{\partial M} P_S S_H + \pi \frac{\partial P_S}{\partial M} S_H \right\} \quad (6)$$

$$\frac{\partial E_L}{\partial M} = (1 - t_w^L) \left( \frac{\partial w_L}{\partial M} L_L + w_L \frac{\partial L_L}{\partial M} \right) + (1 - t_C^L) \left( \frac{\partial r_D}{\partial M} D_L + r_D \frac{\partial D_L}{\partial M} \right) \quad (7)$$

Therefore,  $\frac{\partial E_H}{\partial M} / \frac{\partial E_L}{\partial M} > 1$ , which means the money supply will increase the earnings of the high-income group more than for the low-income group, resulting in increasing income inequality among the different income groups. According to our model, good monetary policy has the power to widen the income distribution.



On the other hand, if the tax ratios are progressive, the higher-income group needs to pay much higher wage-taxes, while the poor only need to pay a small amount of tax, equalizing the income between the rich and the poor. The rich people will have to pay more capital income. This shows that, based on our model, the tax policy could be in favor of reducing income inequality.

In the next step, in order to find form the empirical model, we write  $\frac{E_H}{E_L}$  as in Equation 8:

$$\frac{E_H}{E_L} = \frac{(1-t_w^H)w_H l_H + (1-t_c^H)(r_D D_H + \pi P_S S_H)}{(1-t_w^L)w_L l_L + (1-t_c^L)r_D D_H} \quad (8)$$

Equations 9–15 show that each of the variables in Equation 8 are functions of certain variables:

$$w = p \frac{\partial Y}{\partial L} = f(P, Y) \quad (9)$$

$$P_S = g(r, M, Y) \quad (10)$$

$$r_D = r_D(r, M, Y) \quad (11)$$

$$L = L(r, M, Y) \quad (12)$$

$$\pi = \pi(r, M, Y) \quad (13)$$

$$D = D(r, M, Y) \quad (14)$$

$$S_H = S_H(P_S, r, M, Y) \quad (15)$$

Equation 9 shows that the wage rate is a function of the price level and GDP (income level). Equation 10 shows that the price of a stock is a function of the interest rate, money supply, and GDP (income level). As stated earlier in Equation 3, when the interest rate goes down, the present discount value of the stock increases, and the discounted present value of the dividends ( $\pi_1, \pi_2, \pi_3, \dots$ ) is a function of monetary policy and the economic conditions (GDP). This is the reason why as in Equation 10, the stock price is a function of the interest rate ( $r$ ), money supply ( $M$ ), and GDP ( $Y$ ). Equation 11 shows that the deposit interest rate is a function of the interest rate, money supply, and GDP (income level). The deposit interest rate depends on how banks manage their assets ( $r$ ) and how households change their deposit supply, which in turn depend on their income and monetary conditions. That is why as in Equation 11, the deposit interest rate is a function of the interest rate ( $r$ ), money supply ( $M$ ), and GDP ( $Y$ ). Equation 12 shows that the labor supply is a function of the interest rate, money supply, and GDP (output level). The production function depends on capital and labor. The capital stock depends on the level of the interest rate, which also affects employment and the demand supply of the labor market. On the supply side of the labor market, the labor supply depends on the wage rate and the economic conditions (GDP). From Equation 9, the wage rate depends on the price ( $P$ ) and economic conditions ( $Y$ ). Companies' dividends are shown in Equation 13 as a function of the interest rate of companies' bank borrowings, the money supply (monetary policy), and economic conditions (GDP). Deposits depend on the interest rate and income level. The interest rate on deposits as shown in Equation 11 is a function of  $r$ ,  $M$ , and  $Y$ . Therefore, In Equation 14, deposits are a function of the interest rate, money supply, and GDP (income level). As in Equation 15, the number of shares are a function of the

stock price, interest rate, money supply, and GDP (income level). If people are considering stocks and deposits as two types of assets, they compare the deposit interest rate and the stock price, and the deposit interest rate depends on the interest rate ( $r$ ) and economic conditions ( $Y$ ).

We write the linearized  $\frac{E_H}{E_L}$  as in Equation 10, according to Equations 9–15, by considering that each variable is a function of other variables:

$$\frac{E_H}{E_M} = \alpha_0 + \alpha_1 M + \alpha_2 T + \alpha_3 P_S + \alpha_4 Y \quad (16)$$

Equation 16 shows that  $\frac{E_H}{E_L}$ , which is the indicator of inequality in this survey, is a function of the money supply,  $m$ , the interest rate,  $r$ , income tax,  $T$ , the stock price index,  $P_S$ , and GDP,  $Y$ . The variables we used for the empirical survey and their definitions are summarized in Table 5.

**Table 5: Model Variables**

Variable	Description	Source
$M$	Average outstanding money stock amount (M1) of Japan, seasonally adjusted over GDP	Bank of Japan
$T$	Total income tax receipts of the Government of Japan, moving average	Ministry of Finance, Japan
$P_S$	Nikkei Stock Index average, Tokyo stock average	Japan Exchange Group
$Y$	Real GDP of Japan, expenditure approach, real term, seasonally adjusted, X-21 census	Nikkei Needs
$\frac{E_H}{E_L}$	Average household earnings of the top 10% (rich) over the average household earnings of the bottom 10% (poor) of Japan, moving average	Statistics Japan

GDP = gross domestic product.

Source: Authors.

## 4. EMPIRICAL ANALYSIS

Although the Gini index might be a better indicator for representing the level of inequality in a country, due to the lack of data for Japan, in this paper, the definition of inequality is the average household earnings of the top 10% (rich) over the average household earnings of the bottom 10% (poor). The original data were collected from Family Income and Expenditure Survey (FIES), conducted by Statistics Japan.

In this research, we use quarterly data from Q1 2002 to Q4 2016. For the reason that the two variables of “income inequality” and “income tax” do not change rapidly and change gradually, hence in order to consider their gradual changes we use their moving-average.

During most of our period of analysis for Japan, the short-term interest rate was almost zero, and its volatility was low. Therefore, we used the money stock (M1) as the monetary variable in our empirical analysis. We checked the empirical model using M2, but M1 gave a more significant relationship, so we retained the results using M1.

We also included the stock price index (market-wide portfolio from a macroeconomic perspective) as a proxy in our empirical analysis. The channel of transmission of monetary policy to stock prices and income inequality is that through the quantitative easing of money, access to cheaper finance will be easier, especially for the richer group of people. Part of the new liquidity will be transferred to the capital market, which will create new demand and increase the stock price index. This will inflate the financial asset values for the rich who hold shares in the stock market, leading to increasing income inequality.

## 4.1 Data Analysis

### 4.1.1 Unit Root Tests

In order to evaluate stationarity, we performed unit root tests on all variables at levels and first differences. The results are summarized in Table 6. Our results imply that all variables are non-stationary in levels, except for  $\frac{E_H}{E_L}$ . These variables include the money stock (M1), income tax, stock price index, and real GDP. These results demonstrate that the money stock, income tax, stock price index, and real GDP all contain a unit root. However, in the first differences, we were able to reject the null hypothesis of the presence of a unit root for these variables.

**Table 6: Unit Root Test**

Variable	Augmented Dickey-Fuller (ADF)	
	t-statistic (Levels)	t-statistic (First differences)
<i>M</i>	−0.07	−7.00**
<i>T</i>	−2.78	−3.08*
<i>P<sub>S</sub></i>	−1.22	−5.07**
<i>Y</i>	−1.18	−6.79**
$\frac{E_H}{E_L}$	−5.24**	−9.60**

Note: \* and \*\* indicate a rejection of the null hypothesis for the presence of unit root at the 5% and 1% levels, respectively. For income tax (*T*) and the household average earnings of the top 10% over the average earnings of the bottom 10%,  $\frac{E_H}{E_L}$ , we used the moving averages.

Source: Authors.

Since four of the variables were non-stationary in levels and stationary at first differences, they are integrated of order 1 or *I* (1). Due to the non-stationary series, the next step is to apply a cointegration analysis to examine whether the series are cointegrated, meaning whether long-run relationships are present among these variables or not.

### 4.1.2 Cointegration Analysis

One of the main issues in VAR and vector error correction (VEC) models is lag order selection. Ivanov and Kilian (2005) present six criteria for lag order selection: the Schwarz Information Criterion (SIC), the Hannan–Quinn Criterion (HQC), the Akaike Information Criterion (AIC), the general-to-specific sequential likelihood ratio (LR) test, a small-sample correction to LR (SLR), and the Lagrange multiplier (LM) test. In this research, we use AIC standards, which suggest four lags.

In the next step, in order to identify the cointegrating vectors among the money stock (M1) income tax, stock price index, real GDP, and  $\frac{E_H}{E_L}$ , we conduct a cointegration analysis using Johansen's cointegration test by assuming a linear deterministic trend and, in two cases, with intercept and with intercept and trend. The results of the cointegration rank test of trace are shown in Table 7.

**Table 7: Johansen Cointegration Test (Trace) No Trend**

Hypothesized No. of CE(s)	Intercept		
	Eigenvalue	Trace Statistic	Prob.
$r=0^*$	0.69	108.50	0.00
$r \leq 1^*$	0.41	54.07	0.01
$r \leq 2$	0.34	29.28	0.06
$r \leq 3$	0.19	10.04	0.28
$r \leq 4$	0.001	0.05	0.81

Johansen Cointegration Test (Trace) with Intercept			
Hypothesized No. of CE(s)	Intercept and Trend		
	Eigenvalue	Trace Statistic	Prob.
$r=0^*$	0.74	143.81	0.00
$r \leq 1^*$	0.48	81.22	0.00
$r \leq 2^*$	0.37	50.56	0.01
$r \leq 3^*$	0.33	28.63	0.02
$r \leq 4$	0.18	9.48	0.15

CE = Cointegration.

Note: \* denotes rejection of the hypothesis at the 0.05 level; p-values are based on the MacKinnon-Haug-Michelis (1999) order of variables:  $M, T, P_s, Y, \frac{E_H}{E_L}$ .

Source: Authors' compilation.

As we can see from Table 7, the results reject the null hypothesis of non-cointegrating variables with two cointegrating equations at the 5% significance level for intercept and four cointegrating equations at the 5% significance level for intercept and trend. This means that the variables are cointegrated, and there is a long-run association among them. Thus, the variables move together in the long term, suggesting we should run a VEC model.

## 4.2 Empirical Work

The Johansen cointegration results (Table 7) show that there is a long-run relationship among the variables.

### 4.2.1 Long-Run Relationship

The normalized Johansen long-run cointegration relationship with intercept and trend is shown in Equation 17. The values in parenthesis are the standard errors.

$$\frac{E_H}{E_L} = 2.004M + 0.92P_s - 1.13T - 7.02Y - 0.16(Trend) \quad (17)$$

(0.41)    (0.66)    (0.48)    (6.24)    (0.03)

The normalized long-run cointegration relationship is very revealing. The observed signs are as anticipated and consistent with our expectations. There is a statistically significant, negative long-run relationship between income tax and  $\frac{E_H}{E_L}$ . This means that the Japanese tax system is effective in reducing income inequality in the long run. On the other hand there is a statistically significant, positive long-run relationship between the monetary stock and  $\frac{E_H}{E_L}$ . This means that in the long run, the increase in the money stock will lead to an increase in income inequality,  $(\frac{E_H}{E_L})$ . The result for the GDP coefficient is negative but not statistically significant. The coefficient for the stock price index shows positive values but is not statistically significant. As is clear, the magnitude of the coefficient of  $M$  is larger than that of  $T$ . This means that tax policy mitigated a part of the adverse effect of monetary policy on income inequality but not the whole adverse effect.

#### 4.2.2 Vector Error Correction Model

Because of the presence of cointegration, we estimate Model (16) in a VEC model setting including the five variables: money stock ( $M$ ), stock price index, income tax, real GDP, and  $\frac{E_H}{E_L}$ . We define all variables in their logarithmic forms. The VEC model is defined as:

$$DV_t = A(L)V_t + \Pi V_{t-1} + \varepsilon_t \quad (16)$$

$$\text{where } V = \left( \frac{E_H}{E_L}, M, P_s, T, Y \right) \quad (17)$$

where  $D$  is the first differences,  $L$  is the lag operator, and  $\varepsilon$  is the error term.  $\Pi$  can be written as  $\Pi = \alpha\beta'$  where  $\alpha$  and  $\beta$  are  $p \times r$  matrices, and  $p$  is the number of variables in  $V$ .  $\beta$  is a vector of cointegration relationship and  $\alpha$  is a loading matrix defining the adjustment speed of the variables in  $V$  to the long-run equilibrium defined by the cointegrating relationship, and  $b$  is a vector of the cointegrating relationship (Yoshino et al. 2014). The rank of  $\Pi$  is expressed by  $r$ . As mentioned in the previous subsection, the AIC standard suggested four lags for these series. The results of the VEC model are summarized in Table 8.

**Table 8: Vector Error Correction Estimates**

	$\frac{E_H}{E_L}$	$M$	$P_s$	$T$	$Y$
ECT1	-0.34 [-3.54]	-0.18 [-2.96]	0.16 [3.67]	0.06 [1.88]	0.01 [2.30]
ECT2	-0.18 [-2.55]	-0.44 [-5.28]	0.19 [2.97]	0.07 [1.29]	0.04 [5.04]
$\frac{E_H}{E_L}(-1)$	0.51 [2.24]	0.14 [2.34]	0.11 [2.46]	-0.04 [-1.16]	-0.20 [-2.47]
$\frac{E_H}{E_L}(-2)$	0.12 [2.20]	0.08 [2.45]	0.03 [2.70]	-0.003 [-1.10]	-0.007 [-2.43]

ECT = error correction term.

Note: t-statistics are in brackets.

Source: Authors' compilation.

The presence of cointegration requires at least one of the coefficients of the error correction terms (ECT) to be statistically significant. This condition is observed throughout the VEC model. The ECT1 value of  $\frac{E_H}{E_L}$  is negative and statistically highly significant, as expected, signaling that the system is stable and converges to the equilibrium track after some disturbance in the system. In addition, when looking at values of the  $\frac{E_H}{E_L}(-1)$  row, for  $M$ , the coefficient value is 0.14 and statistically significant, showing the short-run positive impact of an increase in the money supply of an increase in income inequality. On the other hand, for  $Y$ , the coefficient is  $-0.20$  and statistically significant. This is further evidence that higher economic growth will reduce income inequality in the short run. For income tax,  $T$ , the results in Table 8 do not find any significant association with income inequality, however the sign of the tax coefficient is negative, showing the negative but insignificant short-run association between government tax income and income inequality. In other words, tax policies have a longer-term impact on income inequality, as shown in previous section. However monetary policy has both a short-run and long-run impact on expanding the income gap. The coefficient of the stock price index ( $P_S$ ) shows positive and significant values. This means that an increase in the stock price index in the short run will make the richer group richer as they are holding financial assets in the form of stock market shares. The value of these assets increases through the Bank of Japan's QE and QQE monetary policies, which increases income inequality.

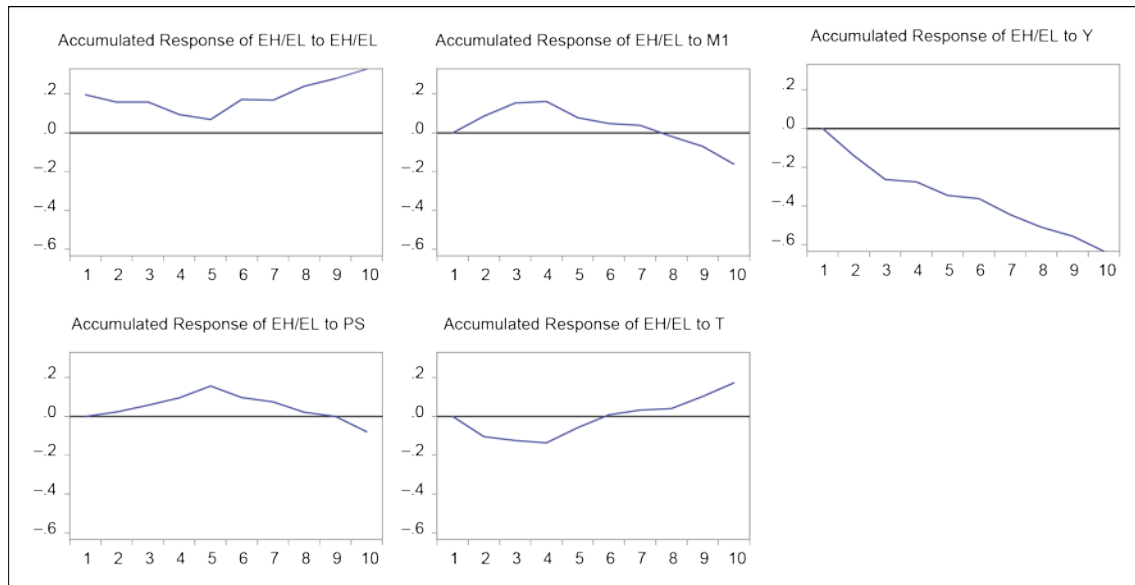
Next, in order to see the dynamics of the impact of different variables on the income inequality variable, we run an impulse response function (IRF).

#### 4.2.3 Impulse Response Function

Figure 5 shows the accumulated response of  $\frac{E_H}{E_L}$  to impulses or exogenous shocks to the money stock, stock price index, income tax receipts of government, and real GDP. The accumulated response of  $\frac{E_H}{E_L}$  to exogenous shocks to  $M1$  is positive and significant for eight periods and after that becomes insignificant. The accumulated response of  $\frac{E_H}{E_L}$  to exogenous shocks to the stock price index is positive and significant for nine periods but insignificant after that. The impulse response results are in favor of our hypothesis that the money supply or monetary policy in Japan increased income inequality, while the tax policy was in favor of reducing income inequality. The accumulated response of  $\frac{E_H}{E_L}$  to tax income is negative and significant for six periods but insignificant after that. An exogenous shock to GDP will reduce income inequality and is significant for 10 periods.

Our results for the monetary policy are in line with the findings of Saiki and Frost (2014) who find that UMP widened income inequality in Japan after Q3 2008 as the BOJ resumed its zero-interest rate policy and reinstated UMP. They mention that this was largely due to the portfolio channel. However, in our paper, due to the existence of cointegration among the series, we ran a VEC model and variance decomposition in Subsection 4.2.4., which showed the numeric share of monetary policy and other variables in the total variance of income inequality.

**Figure 5: Accumulated Response to Cholesky One-Standard-Deviation Innovations**



Note: Impulse response standard errors are not available for the VEC model. The Cholesky ordering is:  $\frac{E_H}{E_L}$ , M, P, S, T, Y.

Source: Authors' compilation.

#### 4.2.4 Variance Decomposition Analysis

In the VAR/VEC framework, variance decomposition is interpreted as the portion of the total variance of an observed variable that is due to various structural shocks (Yoshino et al. 2014). Variance decomposition clarifies which one of the macroeconomic factors provides explanatory power for a variation in our inequality measure over different periods (Lutkepohl 2005).

The result of the forecast error variance decomposition (FEVD) for  $\frac{E_H}{E_L}$  using Cholesky is shown in Table 9. Monte Carlo error (MCE) is implemented using 100 repetitions. The variance decomposition makes it possible to determine the magnitude of each variable in creating fluctuations in other variables. The results show that after 10 periods, firstly, almost 30.70% of the forecast error variance of  $\frac{E_H}{E_L}$  is accounted for by its own innovations. In other words, the lagged inequality made the current inequality and will make the future inequality. Secondly, 28.25% of the forecast error variance can be explained by GDP. That is, as the economic situation improves, the poor will also benefit, and income inequality in Japan will decrease through higher economic growth. For the forecast error variance of inequality, 16.30% is explained by the monetary policy, the money stock (M1). The government income tax contributed to reducing the inequality measure by 14.98% after 10 periods, and, finally, 9.76% of the forecast error variance can be explained by the stock price index.

**Table 9: Forecast Error Variance Decomposition of Inequality**

Period	S.E.	$\frac{E_H}{E_L}$	M	Ps	T	Y
1	0.195	100	0.00	0.00	0.00	0.00
2	0.279	50.97	9.37	0.66	13.93	25.06
3	0.316	39.98	11.93	1.76	11.33	35.00
4	0.325	41.66	11.33	3.04	10.82	33.16
5	0.358	34.99	14.82	5.36	13.66	31.16
6	0.384	37.51	13.42	7.05	14.90	27.12
7	0.394	35.57	12.79	6.98	14.47	30.20
8	0.414	35.35	13.55	8.03	13.21	29.87
9	0.427	34.10	14.17	7.80	14.64	29.28
10	0.458	30.70	16.30	9.76	14.98	28.25

Notes: S.E. is the standard error; the Cholesky ordering is:  $\frac{E_H}{E_L}$ , M, Ps, T, Y.

Source: Authors' compilation.

## 5. CONCLUSION

In this paper, we used our original calculation of an inequality measure from Statistics Japan to study how monetary policy shocks and tax policy affected inequality in Japan. We constructed a quarterly series of inequality measures of income by calculating the average household earnings of the top 10% over the average household earnings of the bottom 10% from Q1 2002 to Q4 2016 and estimated their responses to monetary shocks and the tax policy implemented. In order to find out the impact of monetary policy and tax policy on income inequality, we developed a VEC model. VAR of quarterly data is more appropriate for capturing relationships among fast-moving variables. On the other hand, the income inequality and income tax variables do not change frequently, change very gradually, and have slow variation. Therefore, for these two variables, their moving averages were used in order to capture their gradual changes.

The empirical results revealed that the QE and QQE monetary policies of the Bank of Japan increased income inequality through a rise in the price of financial assets that benefited only rich income groups, which resulted in a widening the income gap among different income groups. On the other hand, the results show that the tax policy of the government of Japan mitigated the adverse effect on income inequality in the short run.

Further breaking down our results, the largest factor affecting inequality was inequality itself (lagged inequality), accounting for 30.70% of the forecast error variance of our inequality measure. Our outcome shows that inequality creates inequality and that there is a low level of social mobility present. An additional factor that played a role in increasing inequality was the money supply (M1). On the contrary, tax policy and real GDP were effective in reducing inequality.

The empirical results revealed that monetary policy has both short-run and long-run impacts on income inequality. However, tax policy had only a long-run impact on income inequality. Our empirical results could not find any significant association between government income tax receipts and income inequality in the short run. This is further evidence that changes in income inequality are gradual.



The Japanese economy has been stagnant, often described as the “lost decade,” and monetary policy has not been able to promote economic growth or create jobs. Only those households holding financial assets and investing in the capital market, mainly high-income households, benefit, contributing to an increase in inequality (Yoshino and Taghizadeh-Hesary 2017b).

One theory to explain the ineffectiveness of the monetary policy is mentioned by Yoshino and Taghizadeh-Hesary (2015b) and Yoshino, Taghizadeh-Hesary, and Miyamoto (2017). The investment-saving curve (IS) is vertical; therefore, even when a lower interest rate is implemented by monetary policy (LM), private investment does not grow despite very low interest rates. As a consequence of the low return, not many new technologies appear in Japan. Depressed investment in Japan means that the economy is not able to recover (Yoshino and Taghizadeh-Hesary 2016). Corporate restructuring to reduce idle capacity and input new investments were not pursued, with greater importance placed on monetary policy instead of accelerating corporate restructuring (Yoshino and Taghizadeh-Hesary 2014).

Under UMP, while high-income households gain from the appreciating price of financial assets, low-income households, who do not hold significant financial assets, are unable to see the rise in their income. Although UMP in Japan has been taken as the last measure to combat the long-lasting stagnation, it may bring about unwanted side effects. As inequality is already rising, following this policy will bring desirable results to the Japanese economy or to the nation itself.

On the positive side, the tax policy implemented was successful in reducing inequality as there is a progressive income tax system in Japan, as shown in Figure 4, besides other types of taxes (inheritance tax, sales tax, capital tax, etc.). Beyond its pertinence for Japan, this study paves a way for other countries tackling economic turmoil and initiating unconventional measures. Its extensive history of UMP has the potential to enlighten other regions of the world in terms of the future of monetary policy and, hence, future growth.

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