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Does Unconventional Monetary Policy Affect Inequality? Evidence from Japan

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ABSTRACT

Inequality has been largely ignored in the literature and practice of monetary policy, but is gaining more attention recently. Here, we exclusively focus on the impact of unconventional monetary policy (UMP) on inequality. We look at how the recent UMP in Japan affected inequality, using household survey data. Our vector auto regression results show that UMP widened income inequality after Q4 2008 as the Bank of Japan (BoJ) resumed its zero-interest rate policy and reinstated UMP. This is largely due to the portfolio channel. To the best of our knowledge, this is the first study to empirically analyze the distributional impact of UMP. Japan's extensive experience with UMP may hold important policy implications for other countries.

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The views expressed here are solely those of the authors and do not necessarily reflect the views of De Nederlandsche Bank.

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1 INTRODUCTION

Income inequality has been on the rise across developed countries in the past three decades, and in particular since the global financial crisis (OECD, 2013; Piketty, 2014). This trend – while important in its own right for normative reasons – also has important economic and financial stability implications. It has been a mantra among economists that there are trade-offs between equality and efficiency (Okun, 1975). However, a number of recent studies seems to indicate that this claim is not – or no longer – necessarily supported by fact. Several recent studies indicate that greater income inequality may hinder both the level and duration of long-term growth spells (Ostry *et al.*, 2014). Moreover, widening inequality can be associated with greater financial instability (Skott, 2013; Vandemoortele, 2009; Prasad, 2010). This effect may have been particularly relevant in the debt-driven housing boom in the pre-crisis period in the United States (Rajan, 2010; Van Treeck, 2013)[1].

Despite its importance, the distributional impact of monetary policy has until recently been largely ignored, by both academics and central bankers. To the best of our knowledge there has been no empirical study yet that analyzed the impact of unconventional monetary policies (UMP) on income distribution. The distributional impact of UMP is increasing in importance with the prolonged period of UMP in several major economies. If UMP increases inequality in income and wealth, it may sow the seeds for future financial instability. This study attempts to address this issue by looking at the impact of UMP in Japan – a country with a long history of UMP that has recently started taking more aggressive measures to combat deflation. Using household survey data, we study the impact of the policy of the Bank of Japan (BoJ) on income distribution between 2008Q4 to 2013Q3 (the Phase II of UMP, following an earlier phase in 2001-2006; see below). With a vector auto regression (VAR) model, we present evidence that UMP has increased inequality via capital gains from higher asset prices since the BoJ started Phase II of UMP in 2008Q4.

The distributional impact of UMP may be fundamentally different from the impact of conventional monetary policy. Under conventional monetary policy, most central banks set their policy based on a variant of the Taylor rule or inflation targeting. A popular view had been that central banks should take a counter-cyclical policy in general, including towards asset prices (leaning against the wind). However, after the eruption of the global financial crisis in 2008, the central banks' main objectives have shifted, with much more weight placed on financial stability and restoring the monetary

[1] The applicability of this link between inequality and credit booms has been found to be highly dependent on individual country factors and institutions (Bordo and Meissner, 2012). Moreover, estimations of the effect of inequality on growth may be very sensitive to methodological choices (Panizza, 2002). Yet Gu and Huang (2014) find that when taking proper account of cross-sectional heterogeneity, the link does hold, particularly for more "financialized" economies, i.e. those with more market-based financial systems. This fits with the theoretical model of endogenous leverage by Ranciere and Kumhof (2010).

transmission mechanism. As such, central banks have undertaken a wide variety of unconventional policies, with academic research often seeking to clearly understand the effects *a posteriori* (Krishnamurthy and Vissing-Jorgensen, 2012). On the top of that, the Bank of Japan (BoJ) was struggling to combat deflation, and its policy stance became much more aggressive soon after Mr. Abe became Prime Minister in December 2012. To beat persistent deflation and to minimize the negative impact from the global financial crisis, the BoJ returned to its zero-interest rate policy in 2008Q4, followed by large-scale purchases of various assets (comprehensive monetary easing, CME), including relatively risky asset classes since 2010.

While UMP's tools may differ among different central banks, the common goals are to stabilize the financial market and secure monetary policy transmission mechanisms (Borio and Disyatat, 2009; De Haan *et al.*, 2013). In order to achieve the latter goal, commercial banks' buffers (determined by the value of assets) play a crucial role. In the process, central banks try to keep financial markets afloat by putting more liquidity into the financial markets to support asset prices, sometimes directly purchasing private financial assets. Consequently, asset prices may become overvalued while UMP is in place. While research on UMP's impact on asset prices is still in its infancy, a recent study by Rogers *et al.* (2014) finds that the impact of monetary policy surprises on asset prices is larger when policy rates are stuck at the zero lower bound (and thus UMP is the only option left)[2]. The increase in asset prices when the overall economy is stagnant will disproportionally benefit those households with greater financial assets holdings, which typically have high income. As a result, households with high income will earn sizeable capital gains. On the other hand, lower-income households hold fewer financial assets, will not see an impact on wages, and may even be negatively impacted by lower interest rate earnings on saving accounts. This disparity can lead to higher inequality.

Of course, the lack of counterfactual evidence makes it impossible for us to examine how "successful" UMP has been. The general consensus is that central banks have prevented the worst-case scenario of a financial meltdown in many major economies. In the absence of political will and policy space for a fiscal response, monetary action may have increased the absolute size of economic output relative to the alternative of no response (Haldane, 2014). But UMP's impact at the microeconomic level – i.e. on income distribution – has not been examined yet, and may have important long-run consequences.

The paper is organized as follows. Section II briefly sketches the relevant literature, with special attention to Japan. Section III describes our data and some stylized facts. Section IV presents our vector autoregression (VAR) approach and empirical results.

[2] A potential explanation is that UMP at the zero lower bound reduces term premia, thus pushing down long-term interest rates and promoting investment in private assets.

Section V discusses sensitivity analysis. Finally, section VI concludes with policy implications.

2 LITERATURE

2.1 MONETARY POLICY AND INEQUALITY

While the impact of monetary policy (especially UMP) on inequality is new in the academic literature[3], it is becoming a high-profile topic of policy debate. For example, the Bank of England (2012) conceded that quantitative easing (QE) had particularly benefited the richest 5% of British households, who hold 40% of overall wealth outside pension funds. ECB Executive Board member Benoît Cœuré emphasized that inequality is relevant for central banks, "*as monetary policy may have an impact on inequalities, and* […] *stability is conducive to equity*"[4]. FRB Dallas President Richard Fisher recently argued that QE "*enabled the rich and the quick; it was a massive gift*", even while it was largely ineffective at stimulating job creation[5].

Among academic studies, Coibion *et al.* (2012) studied the role that monetary policy played in consumption and income inequality in the US since 1980. They find that *contractionary* shocks lead to greater inequality in the US in the pre-crisis period, especially before 1990, which is the opposite of our hypothesis. They argue that this is driven by the earnings heterogeneity channel, that is through the different responses of labor earnings to monetary policy shocks for high and low incomes, and the savings redistribution channel, that is the fact that savers gain and borrowers lose from the unexpectedly lower inflation after a contractionary shock. For the US, these effects are shown to dominate the portfolio channel, defined as the larger impact of higher asset prices on upper income households, who are the large holders of securities. This result is significant only in the period before 1990, in which monetary policy's main goal was to contain inflation. Importantly, their study does not include the period of UMP after 2008. More recently, Watkins' (2014) narrative paper presents some illustrations that income and wealth inequality has increased with the quantitative easing program of the Fed, which he compares to "trickle-down economics", although this is not tested formally.[6]

The idea that monetary policy may have a large impact on asset prices has recently become more prominent in the literature. For example, Borio and Lowe (2002) show that in times of low inflation, demand pressures may build up in credit and asset

[3] The literature on the impact of *inflation* on inequality and poverty is somewhat older. Romer and Romer (1998), based on cross-country research, find that low inflation and stable aggregate demand is beneficial for the poor in the long run. Subsequently, the literature has examined a number of channels by which monetary policy can impact income inequality in normal times, including through the impact of inflation on borrowers and savers (see Erosa and Ventura, 2002; Albanesi, 2007; Doepke and Schneider, 2006).

[4] Benoît Cœuré, "What can monetary policy do about inequality?", speech to the European Parliament, Brussels, 17 October 2012.

[5] Richard Fisher, remarks at London School of Economics, 24 March 2014.

[6] See also James Mackintosh, "Trickle-down monetary policy has failed to spread the riches", *Financial Times*, November 4, 2013: "*today we have trickle-down monetary policy, designed to increase the wealth of wealthy in the hope of some of their spending dripping down to the great unwashed*".

markets rather than in the prices of goods and services. For this reason, they suggest that monetary policy should be tightened to contain pressures in credit and asset markets as a means to preserve both financial and monetary stability. A large body of empirical work seems to bear out this view, showing that loose monetary policy can put upward pressure on asset prices relative to fundamental values, and that these effects are particularly strong during asset boom periods (see Bordo and Landon-Lane, 2013, for an overview and long-run evidence in the US). [7]

2.2 THE CASE OF JAPAN

As is well-known, Japan is a frontrunner of UMP – along with many other problems that advanced economies are likely to face going forward, especially population aging, deflationary risk, and increasing public debt. On UMP, Japan has followed several steps:

- The zero-interest rate policy between August 1999 and August 2000
- The first phase of quantitative easing (QE) between March 2001 and March 2006 (we call it Phase I of UMP)
- Reinstating the zero-interest rate policy in October 2008 and QE in December 2008[8], in response to the global financial crisis (Phase II of UMP). These measures were followed by various asset purchasing programs, including comprehensive monetary easing (CME) from October 2010, when the BoJ started purchasing higher risk assets[9]
- Much more aggressive easing: quantitative and qualitative easing (QQE) and much clearer forward guidance since April 2013 (Uchida, 2013)[10]

The QQE program, which is the first arrow of 'Abenomics' – the economic recovery program of Prime Minister Shinzo Abe – is ongoing and had so far seemed to deliver on its promise combat deflation; inflation is firmly in positive territory since mid-2013.[11] While the media tends to focus on QQE as a major monetary policy shift, we consider 2008Q4 as a starting point of UMP Phase II, as the overnight call rate was cut to virtually zero and the monetary base started growing rapidly around that time (Figure 1).

[7] A contrary view is taken by Galí (2013), who shows with a theoretical model and empirical evidence from the US that especially when asset prices diverge from their fundamental values (i.e. have a large "bubble component") contractionary monetary policy can even further inflate the bubble.

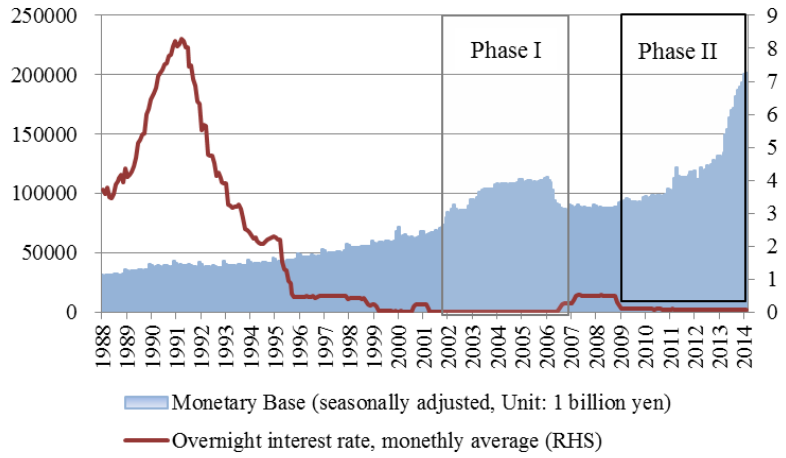
[8] The BoJ first cut the interest rate from 0.5% to 0.3% in October, and started paying interest rate on excess reserves. In December, the BoJ further slashed the interest rate to 0.1%, and started outright purchases of corporate bonds and commercial paper through an asset purchase program (Source: BoJ press releases).

[9] See the detailed explanation of the CME program and its effectiveness in Lam (2011).

[10] The rough idea of drastic accommodative measures by the BoJ was already announced by Mr. Abe in December 2012, although the actual implementation started in April 2013.

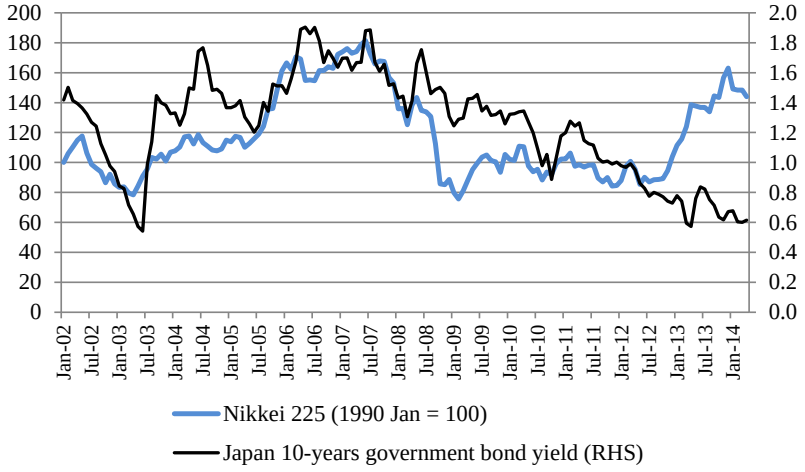
[11] On the other hand, the VAT rise in April 2014 turned out to be a major blow to output; real GDP shrank by 6.8% in GDP in Q2 in annualized terms, which was larger than expected.

FIGURE 1 – MONETARY BASE AND OVERNIGHT INTEREST RATE



Source: Bank of Japan

FIGURE 2 – STOCK AND 10-YEAR JAPANESE GOVERNMENT BOND YIELDS



Source: Datastream, Bank of Japan

Under Abenomics, even before QQE started in April 2013, the stock market rallied (30% gain in 2013 alone, 10% before QQE even took place – see Figure 2), while wages remained flat. Even in the public's eye, in view of the drastically changed consumption patterns of wealthy households (e.g. as reflected in increased sales of high-end condominiums and luxury products), it was clear that the first arrow of Abenomics benefited primarily wealthy households, who were able to convert the stock rally into immediate capital gains[12]. By contrast, average Japanese households' savings consist

[12] A recent analysis by Goldman Sachs (2014) reports that the bulk of domestic investors – including the household sector – sold equities in 2013, implying large capital gains, while buyers were primarily foreign.

chiefly of bank deposits, which earn little interest. In addition, there was no wage increase nor a substantial increase in the employment rate. The rise of the VAT rate (April 2014) hit the average households' consumption. Thus, the benefits of higher asset prices were limited to those who owned stocks and bonds, which are typically upper income households. Under the second half of Koizumi administration (2001-2006), stock prices more than doubled, thanks in part to Phase I of UMP and cuts in the capital gains taxes. Moreover, Mr. Koizumi's structural reforms – especially in the labor market – resulted in wider income inequality and a higher relative poverty ratio. Therefore, not only monetary policy, but also structural reforms are pivotal to determine the drivers of income inequality and the relative poverty ratio during the period of Phase I of UMP. This makes Phase I less suitable for empirical analysis of the impact of UMP on income inequality. This supports our choice to focus on Phase II.

3 DATA

3.1 HOUSEHOLD SURVEY DATA

In this study, we use household survey ("*Kakei Chosa*") data, made available by the Japanese Cabinet Office[13]. Unfortunately, the micro-level dataset is made available only to Japanese government (or government-funded) researchers, so we have to rely on various combinations of aggregated data, which implies a number of restrictions. Having said that, the micro-data also has one major downside: the data is not panel data because 1/6 of the households are replaced in each quarter. To the extent that the survey is not following the same households, the usefulness of micro-level data would be much less than normal panel data. In addition, despite the lack of micro-level data, the combination of various aggregated data enables us to extract some important stylized facts as well as statistics and estimates useful enough for our research.

For example, in order to calculate Gini coefficients, we have to rely on *income* (pre-tax) by decile. The definition of income includes both wages and, naturally, capital gains. Ideally, we would complement this with wealth by decile, but this data is only available in 5 quintiles at annual frequency from 2007 to 2013 (7 observations). However, there are two reasons why the Gini coefficient of *income* can be informative for our study. First, as we saw earlier, higher income groups tend to hold more wealth. Second, by definition, there should be a high correlation between high savings and high *capital gains* income. This is confirmed using prefecture-level data (sample size: 47) from the annual household survey during the sample period (2002 - 2012), where we find a strong (0.65) Pearson correlation between financial wealth and income[14]. Therefore, income disparity during the monetary accommodation period can be considered as a sufficient approximation of wealth disparity, and has the additional advantage of being the more widely accepted measure of overall inequality.

The household survey[15] consists of two subsets: (i) household income and expenditure survey (monthly frequency); and (ii) household savings and liabilities survey which includes "income in past 12 months" (quarterly frequency). For both subsets of surveys, the sample size is around 7,000. In order to maintain continuity, the authorities survey the same households with 1/6 of households replaced when they conduct the survey on the first day of every month. While the first dataset has higher frequency, the income survey covers only "typical" households where the head of the household is employed; the definition excludes the self-employed, company owners, managers, property

[13] Available at http://www.stat.go.jp/english/data/kakei/index.htm (accessed on June 18, 2014).

[14] Note that this definition of "income" includes only households where the head of household is employed - as described below. Therefore the sample coverage is much smaller than what we use for our VAR analysis.

[15] For details of this dataset, refer to Moriguchi and Saez (2008) and Lise et al. (2013).

owners, unemployed, most agricultural workers, fishermen, etc. Excluding these groups will grossly bias income inequality, as the household income and expenditure survey only covers 50% of the overall sample. Therefore, we use the second subset, which covers all types of households[16].

3.2 STYLIZED FACTS ON INEQUALITY IN JAPAN

Taking advantage of government research data access, Lise *et al*. (2013) summarize the descriptive statistics of the micro-level data of the household survey. They look at – among other things – household-level inequality from the household income and expenditure data from 1981 to 2008[17], to examine the main developments of inequality in wages, earnings, consumption and wealth. During the sample period, they find an increasing trend of inequality in wealth and income. They also find that, among households whose head is employed (thus excluding corporate owners, self-employed, unemployed, etc.), there has been a dramatic shift after 1996, since the households at and below the median experienced real declines in earnings. This is probably due to Japan's stagnant economic performance during that period, and the labor market reform of Mr. Koizumi. Mr. Koizumi's labor market deregulation led to a substantial increase in temporary workers (*haken-shain*) with much lower wages, no job security, and little or no fringe benefits.

The widening income disparity is also visible in the World Top Income Database, which is compiled by Facundo Alvaredo, Tony Atkinson, and Thomas Piketty[18] from various researchers' studies (available up to 2010 for Japan, 2012 for the US). From this data, there is an upward trend in the top 1% income share in the US: interestingly, there is a sharp increase *after* the Lehman shock. In comparison, Japan's top 1% income share is lower, but during the oil shocks and the 1980's real estate bubble, it spiked. Moreover, the top 1% income share is showing a rising trend since around 1999. However, during this period, Japan went through various structural changes, tax reforms, fiscal stimulus, income transfers, in its struggle to get out of Japan's 'lost (two) decade(s)', so various factors were at play. Therefore, in what follows, we focus on the data from 2008Q4, when the second phase of UMP started and fiscal and structural reforms were yet to be implemented (except for the aftermath effects of the earthquake, which we control for in our analysis).

[16] The reported annual (instead of monthly) income saves us from smoothing out the effects of bi-annual bonus payments and other seasonal income, which are a large component of regular workers' wage revenues in Japan.

[17] Note that there is a structural break in the surveying method in 2002 (i.e. including people engaging in agriculture and fishery), since when the data is available online.

[18] Available at http://topincomes.g-mond.parisschoolofeconomics.eu (retrieved on June 13, 2014).

4 EMPIRICAL ANALYSIS

4.1 SAMPLE

Roughly speaking, Japan has undertaken two periods of UMP in the past 15 years. The first period was from 2001 to 2006; the dating of the second period is subject to more judgment. Many commentators associate QE with Abenomics, but Abenomics merely made the already existing QE much more aggressive and combined it with clearer forward guidance. As we discussed earlier, we define 2008Q4 as the starting point of UMP Phase II. There are several reasons to confine our study to the second phase of UMP: (i) whereas various policy factors affected income disparity during Phase I of UMP, such as structural reforms and labor market reforms, comparable changes have not yet implemented during our sample period of Phase II; (ii) a large part of the fiscal stimulus under Abenomics was still in the planning stage during our sample period; the stimulus that had been enacted went to businesses (mostly to the construction sector) and not to households in the form of income re-distribution (except in the aftermath of the earthquake, which we control for in our analysis); (iii) wages and the unemployment rate remained more or less constant during the sample period[19]; and (iv) inflation has been stable and subdued. This means that Japan since 2008Q4 offers unique 'laboratory conditions' to examine the effect of UMP on income distribution.

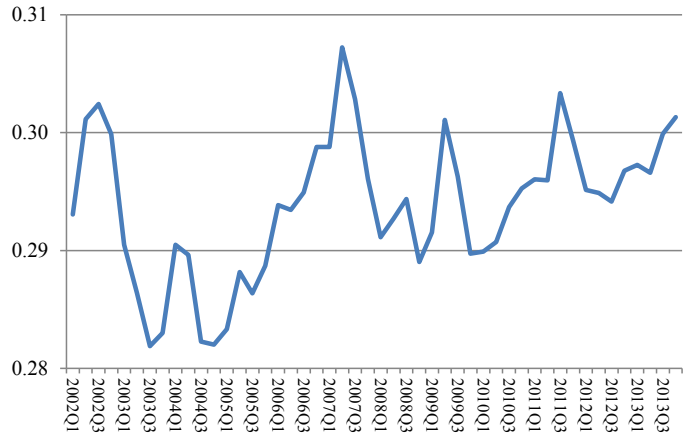
Figure 3 presents the Gini coefficient, which is one of the most standard indicators to measure income inequality. An alternative measure is introduced in section V. The surge in income inequality around Q1-Q2 2011 is due to the Great Earthquake when many households were dislocated or lost their income source (mainly agriculture and fishery industries). However, the disastrous effect of the earthquake was followed by generous fiscal transfers and donations, which is probably the reason that the Gini coefficient dropped sharply. More importantly for our analysis, , since the start of QQE (covering the last three quarters in our sample), income inequality seems to be increasing once again; expectations are that this trend is likely to continue. Figure 4 presents the Gini coefficient of net savings. While data availability is only annual, we can clearly observe net wealth inequality also increased in 2013 (the most recent data available).

To determine whether income and financial wealth followed the same pattern, it is natural to assess whether wealthier households will hold a higher percentage of their savings in securities. As of 2012 (the last year for which data is available by savings quintile), the top 20% of Japanese households held 15.4% of their assets in stocks and bonds, which is more than 5 times higher than the share of the second-top quintile

[19] The highest and lowest unemployment rate during the sample period is 5.0% and 4.0%, respectively, which is small compared to the US (10% and 5%), UK (8.3% to 5.2%), and the Eurozone (12% to 8%). One potential explanation is that Japan has already cut redundant labor force before the global financial crisis began.

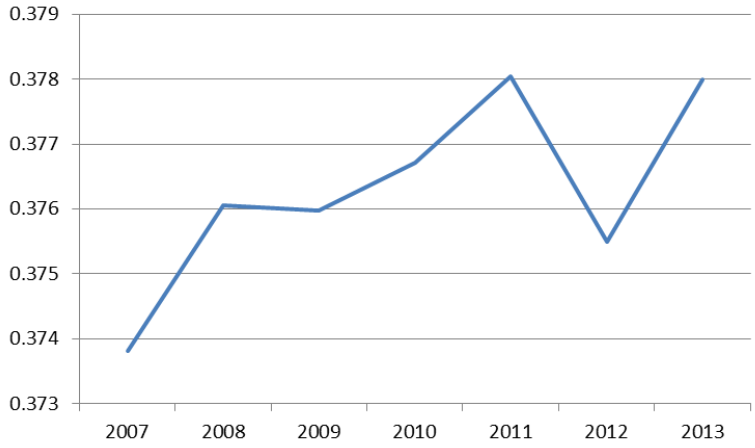
(Table 1). While inflation has been very low throughout our sample period, the disproportionally large holdings of equities and bonds by the top 20% of Japanese households suggests one potential channel for monetary policy – i.e. the portfolio channel – to impact income inequality going forward.

FIGURE 3 – DEVELOPMENT OF GINI COEFFICIENT OF INCOME



Source: Authors' calculation based on Japan Family Income and Expenditure Survey.

FIGURE 4 – GINI COEFFICIENT OF NET SAVINGS BETWEEN 2007 AND 2013



Source: Authors' calculation based on Japan Family Income and Expenditure Survey (Savings and Liabilities). Available only in annual frequency, between 2007 and 2013.

TABLE 1 – THE PROPORTION OF SECURITIES IN TOTAL GROSS SAVINGS BY INCOME QUINTILE: 2007-2012

	bottom 20%	20-40%	40-60%	60-80%	Top 20%
2007	0.04%	0.31%	1.17%	3.52%	21.21%
2008	0.06%	0.32%	1.11%	3.49%	21.85%
2009	0.04%	0.33%	1.06%	3.30%	17.93%
2010	0.04%	0.28%	1.15%	3.29%	16.71%
2011	0.04%	0.28%	0.98%	3.05%	16.47%
2012	0.02%	0.30%	0.96%	2.91%	15.40%

Source: Authors' calculation based on Japan Family Income and Expenditure Survey (Savings and Liabilities)

4.2 VAR FRAMEWORK

To test how monetary policy affects income inequality more formally, we make use of a vector auto regression (VAR) framework, which is pioneered by Sims (1972) and used broadly in empirical studies to examine transmission mechanisms of monetary policy.

Following Garlach and Smets (1995), we assume that monetary policy does not have instantaneous effects on real output or prices (one period = one quarter). At the same time, monetary policy's impact on asset prices is almost immediate, partly because stock and bond markets are forward-looking and usually react right after the BoJ's policy announcements. Based on the BoJ's announcements and minutes of its board meetings since 2005, we identify monetary base as the main monetary policy tool. The key assumptions of our VAR model are:

(i) Monetary shocks are identified as a change in monetary base, which is an official policy tool of the Bank of Japan during our sample period.
(ii) Monetary policy affects output and inflation with a lag.
(iii) Monetary policy has a contemporaneous impact on asset prices.

The third assumption is rather strong. With a Granger causality test during our sample period (2008Q4-2013Q4), we cannot reject the null hypothesis (at 5%) that asset prices do not Granger-cause monetary shocks. However, if we look at a longer period (2002Q1-2013Q4), we can reject the hypothesis at the 1% level. Two potential reasons are: (i) various monetary policy measures were pre-announced through forward guidance (especially under Abenomics); (ii) during the global financial crisis period, the BoJ was working to secure financial stability: i.e. it may have been more receptive to stock market developments than in normal times. Therefore, we also try a different specification where asset prices precede monetary policy in the Cholesky ordering, which is reported under the robustness checks in the next section. Importantly for our analysis, we can confirm that inequality does not affect the other variables contemporaneously.

In our baseline model, the list of endogenous variables is as follows:

$$Y_t = [\Delta \log(GDP_t), \Delta\pi_t, \Delta \log(MB_t), \Delta \log(S_t), Gini_t] \quad (1)$$

Where:

GDP_t Real GDP (Source: OECD)[20]

π_t YOY CPI headline inflation (Source: Statistics Bureau of Japan)

MB_t Monetary base as a percentage of GDP, seasonally adjusted (Source: Bank of Japan) [21]

S_t Stock prices, as measured by the Nikkei 225 Index (Source: DataStream)

$Gini_t$ Gini coefficient of income inequality, calculated based on the household survey as described in the previous section.

All variables except the Gini coefficient and inflation are the first difference of natural logs in order to make sure all variables are stationary. For the lag length, we choose 2 quarters based on the Likelihood Ratio (LR) test statistics and the Schwarz Information Criterion (SIC). For the Cholesky ordering, as described earlier, we assume that monetary policy (proxied by the monetary base) reacts to output growth and the year-on-year (YoY) CPI inflation rate. We then assume that the Nikkei index will react simultaneously to a change in the monetary base, and finally, we assume that the movement of the stock market affects income distribution (as measured by the Gini coefficient) via the portfolio channel.

Further, in order to take into account the exogenous nature of the earthquake episode, we use two exogenous dummy variables in our VAR analysis – 'earthquake' and 'earthquake response (income transfers from government, private donations, etc.)' – that take on a value of 1 in Q2 and Q3 2011, and in Q4 2011 and Q1 2012, respectively, and zero in all other quarters[22].

4.3 IMPULSE RESPONSE FUNCTIONS

The cumulated impulse response is presented in Figure 5. Our interest is how the Gini coefficient responded to the shock in monetary base. The results show that the increase in monetary base positively affects the Gini coefficient. The cumulative impact is positive and statistically significant in the first 6 quarters and remains positive in the quarters thereafter. After 10 quarters, a one-standard deviation shock

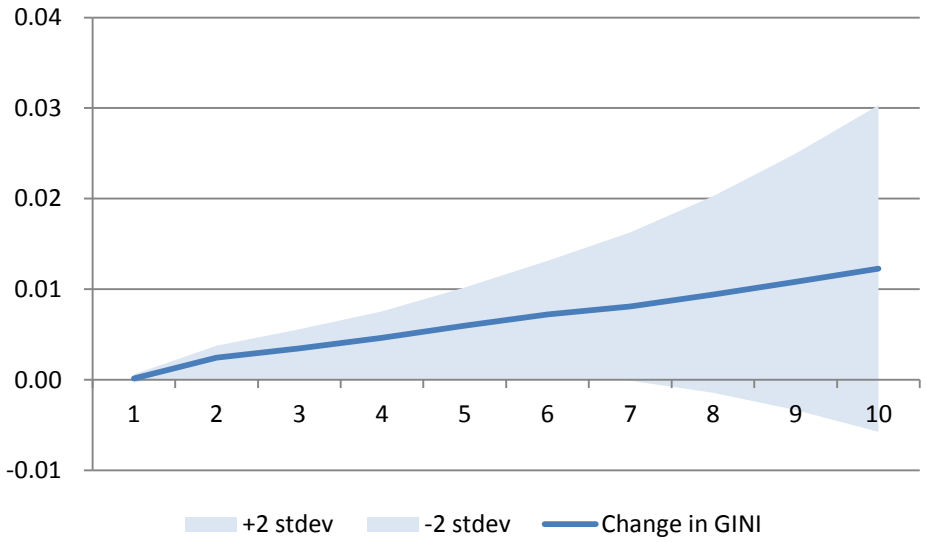
[20] As a robustness check, we also tried the cycle component filtered by HP filter and Baxter-King filter, but obtained similar results. In addition, the deflation during "lost decade" was largely due to structural, not cyclical, reason. For these reason, we use output growth instead.

[21] We consider YoY inflation to be a better variable to be used in our VAR analysis, since it has been used as a benchmark of the BoJ's policy target. Because of the unit root problem, we took the first difference.

[22] The earthquake occurred in March 11, the end of Q1 2011, but we considered a time-lag in taking surveys and impact on salary/income. Therefore earthquake dummy takes a value of 1 in Q2-Q3 2011.

to the monetary base to GDP has a cumulative upward impact of about 0.012 on the Gini coefficient, which is equivalent to two times the standard deviation of the Gini coefficient during our sample period. This means that income inequality increases as a result of monetary shocks to an economically meaningful extent. The statistical significance despite the short sample size indicates the strong impact of Japan's UMP during the sample period.

FIGURE 5 – IMPULSE RESPONSE OF THE GINI COEFFICIENT TO A MONETARY BASE SHOCK



Note: Cumulative Response. Sample Period: 2008Q4-2013Q3

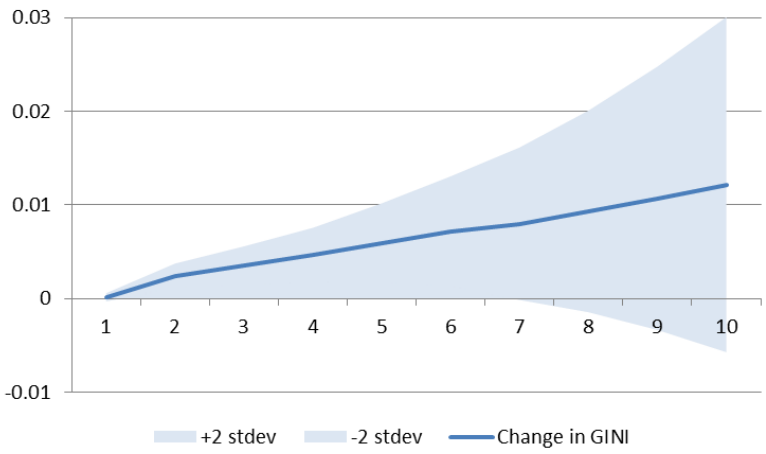
5 ROBUSTNESS CHECKS

One challenge of our estimation strategy is to pin down the direction of causation between monetary policy and asset prices. Our assumption in the baseline model is that monetary policy contemporaneously affect asset prices. But because we could not reject the null hypothesis that asset prices do not Granger-cause monetary policy shocks, we here change the ordering.

$$Y_t = [\Delta \log(GDP_t), \Delta\pi_t, \Delta \log(S_t), \Delta \log(MB_t), Gini_t] \quad (2)$$

In other words, we assume that stock prices affect monetary policy contemporaneously, whereas monetary policy affects stock prices with a lag. With this alternative assumption, the result (Figure 6) is similar to our baseline IRF. We obtain very similar results as the baseline (0.0122 in baseline vs. 0.01274 in alternative). We have also conducted a generalized impulse response function and find that our result is robust to the ordering of variables.

FIGURE 6 – IMPULSE RESPONSE OF THE GINI COEFFICIENT TO A MONETARY BASE SHOCK UNDER ALTERNATIVE SPECIFICATION



Note: Cumulative Response. Sample Period: 2008Q4-2013Q3

We also use alternative measures of income inequality. The first is the top-bottom quintile ratio, or the ratio of the income of the top 20 percent (the group with a large ratio of securities holdings in their total savings as discussed earlier) to the bottom 20 percent. This ratio (Figure 7) also seems to be pointing to the same message that income disparity has widened since 2008.

We use the baseline Cholesky ordering, in other words:

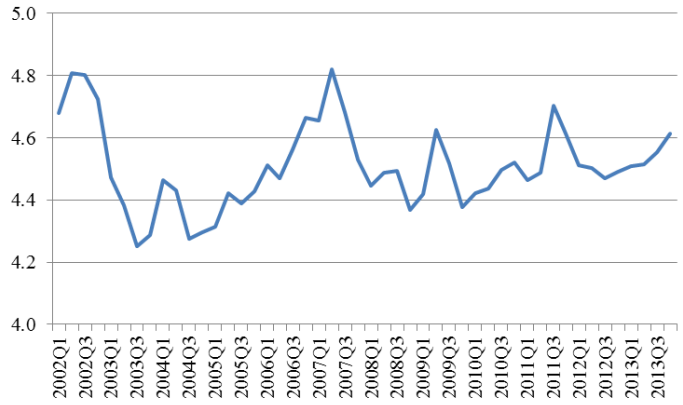
$$Y_t = [\Delta \log(GDP_t), \Delta\pi_t, \Delta \log(MB_t), \Delta \log(S_t), Ratio_t] \quad (3)$$

where $Ratio_t$ denotes the top-bottom quintile ratio. A unit-root test confirms the variable to be stationary over the sample period. The impulse response function is presented in Figure 8, which is in line with our earlier result – the monetary shock increases income inequality.

The second alternative measure is the Theil coefficient, which has some useful properties such as decomposability. The Theil coefficient (not reported) yields nearly identical results to the baseline with the Gini coefficient.

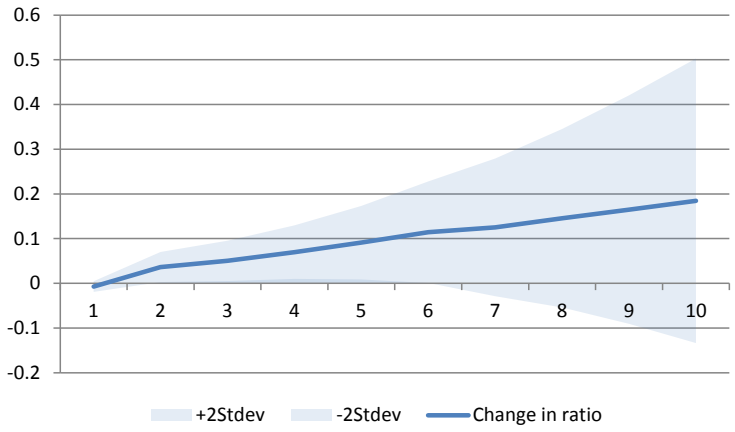
To the extent that each measure (top-bottom quintile ratio, Theil coefficient and Gini coefficient) have their strengths and weaknesses, this robustness check confirms that our result is not driven by the way we estimate income inequality.

FIGURE 7 – THE RATIO OF INCOME OF THE TOP 20% TO THE BOTTOM 20% INCOME GROUP



Note: Data is from the Household Survey.

FIGURE 8 – IMPULSE RESPONSE OF THE RATIO OF THE TOP 20% TO BOTTOM 20% TO A MONETARY BASE SHOCK



Note: Cumulative Response. Sample Period: 2008Q4-2013Q3

6 CONCLUSIONS AND POLICY IMPLICATIONS

Overall, our results provide evidence of the impact of the portfolio channel of UMP on income inequality. The underlying mechanism is that, in a period of severe economic and financial stress (like 2008-2009) where traditional monetary policy is judged ineffective and UMP is employed, asset prices rise disproportionally compared to economic fundamentals (notably wages and employment). Higher asset prices benefit primarily upper income households, who hold a larger amount and share of overall savings in securities, and thus benefit from greater capital income. Overall, despite the lack of micro-level data, we find strong evidence that the BoJ's UMP has increased income inequality during our sample period.

Taken together, our results imply that, while the aggressive monetary policy finally seems to be bearing fruit, this strong medicine may come with an unwanted side effect: income inequality. With already high levels of inequality and increasing relative poverty in Japan[23], further polarization of the income and wealth distribution may not be desirable for the Japanese economy, or the society as a whole. We are not advocating a particular level of income inequality – which may be a natural result of differences in human capital and labor effort and reflect favorable incentives to society (Mankiw, 2013). Yet we note that the inequality created by UMP, which works primarily through shocks to capital wealth rather than labor income, may have a negative social and economic impact. This should be a consideration for policy, which can consider complementary tax and structural reforms which offset the impact of UMP.

In addition to the relevance for Japan, our study also points to potential lessons for other countries undertaking UMP. While preventing deflation and repairing the monetary transmission mechanism at the zero lower bound is inherently a difficult undertaking, Japan's experience provides a cautionary tale on the side-effects of UMP. It is possible that the portfolio channel will be even larger in the US, UK, and many Eurozone economies, where households hold a larger portion of their savings in equities and bonds. This international comparison is an avenue for further research.

[23] Japan is in 4th place among the OECD countries on relative poverty, i.e. the proportion of the population with income less than half the median income, according to OECD data.

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