

Unconventional Monetary Policy and Inequality – Is Japan Unique?

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ABSTRACT

For over a decade, but especially since the start of Abenomics in 2013, the Bank of Japan (BoJ) has been increasing the monetary base rapidly by implementing an unconventional monetary policy (UMP). In a 2014 study, we found that Japan's UMP had increased income inequality. Yet emerging literature suggests that this impact of UMP on inequality is not universal and depends on structural factors, especially in the labor market. UMP influences inequality through two channels that work in opposite directions – a labor market channel (more employment, higher wages) and a financial market channel (higher asset returns). With data for Q4 2008 through Q2 2018, we build a new structural vector autoregression (SVAR) model to take these channels into account to explain how Japanese UMP's impact on inequality differs from other countries. We argue that Japanese structural problems, especially labor market rigidity, may explain the absence of wage growth. This means that the financial market channel (higher returns for financial assets, which are typically held by higher income households) overwhelms the labor market channel.

ACKNOWLEDGMENTS AND DISCLAIMER

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“The distributional effects of monetary policy are complex and uncertain.”

Ben Bernanke, at Brookings Institution, 2015.

1 INTRODUCTION

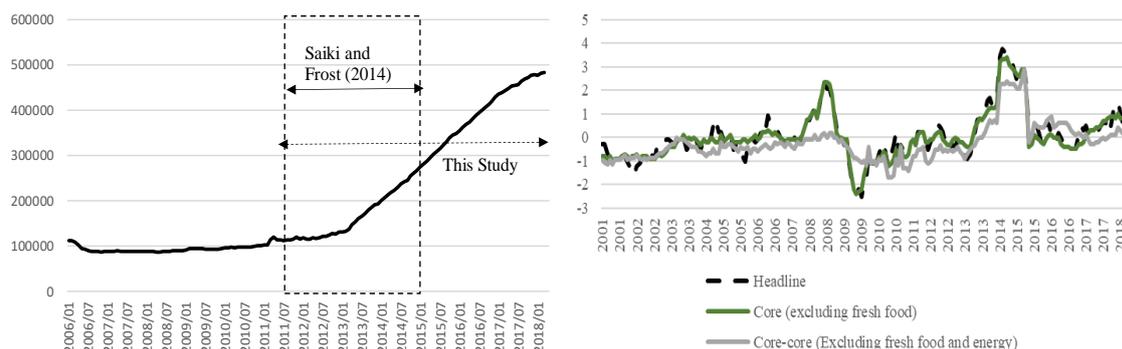
The pernicious effects of inequality on macroeconomic outcomes have been documented in numerous studies (for example, Ostry et al., 2014; Stiglitz, 2012; Rajan, 2010; Perugini et al. 2016). It has become increasingly evident that inequality of income and wealth can undermine economic performance and social cohesion. Since the global financial crisis, central banks have responded to low growth and inflation with aggressive accommodative monetary policy and unconventional measures. The intensive use of unconventional monetary policies (UMP) and their potential impact on inequality has put the role played by central banks in income and wealth distributions under the spotlight.

To measure the distributional effects of UMP in Japan, our earlier study (Saiki and Frost, 2014) used data between Q4 2008 to Q1 2014, the latest data available then. We found that the Bank of Japan’s comprehensive monetary easing (CME, started in December 2010) and quantitative and qualitative easing (QQE, which started in Q2 2013) had widened income inequality due to higher capital gains and dividends, which were captured by higher-income households.

In this paper, we use data from Q4 2008 through Q2 2018 (Figure 1) and improve our model. This extended period allows us to better highlight two channels by which UMP impacts income inequality: the labor market channel (more employment, higher wages) and the financial market channel (higher asset prices, higher dividends). First, during this extended period, Japan’s core inflation – the *de facto* target of the Bank of Japan (BoJ) – has remain low (it was 0.9% as of August 2018, see Figure 1, right-hand side panel). One reason for low core inflation rate despite the record-low unemployment rate of 2.4% is the lack of wage growth, a key determinant of the labor market channel. Second, QQE has had significant side effects on asset prices, which influence the financial market channel. QQE notably impacted on banks’ profits, on fiscal financing (approximately 40% of Japanese government bonds are held by the BoJ), and on the composition of the traditional bond market investor base. In addition, with abundant liquidity, banks have invested more heavily in securities (stocks and bonds) instead of lending, recognizing that the BoJ is also intervening in financial markets to underpin asset prices.¹

¹ According to Nikkei Newspaper, the BoJ is one of the top 10 shareholders of 40% of publicly listed companies. Source: <https://asia.nikkei.com/Economy/BOJ-is-top-10-shareholder-in-40-of-Japan-s-listed-companies> (Retrieved on August 29th, 2018). See also Barbon and Gianinazzi (2019) for a more thorough analysis.

Figure 1. Monetary Base (in Billions of Yen) and Inflation in Japan



Source: BoJ (Monetary base), Ministry of Internal Affairs and Communications (Headline and Core inflation), FRED database (Core-core inflation)

Note: Core inflation excludes fresh food; core-core inflation excludes fresh food and energy prices.

The enhancements from our earlier paper are: (i) we include a job creation / wage channel explicitly in the model (which may have reduced inequality as posited by Inui et al., 2017); we did not take this into account in the previous study as there was no significant change in the labor market conditions at that time, but in the last three years, the unemployment rate declined substantially (2.4% as of April 2019); (ii) we update our sample period to 2018Q2; and (iii) we use a structural vector autoregression (SVAR) model instead of the simple VAR used in Saiki and Frost (2014). Specifically, we impose the additional condition that income inequality does not affect other variables in the short run.

Overall, we continue to find the evidence that of UMP widens income inequality, despite the fact that we included job creation and wage channel, extended the dataset, and use SVAR instead of VAR. The size and persistence of effects differ from the pervious studies, likely due to the different method and model, but the presence of such an effect is robust to different estimation approaches and measures of inequality. Importantly, we do not find a positive effect of UMP on wages. We argue that this is likely due to structural factors, in particular, Japan’s labor market rigidity and duality.

The rest of the paper is structured as follows. Section 2 reviews the literature, especially with a focus on studies on other economies. Section 3 explains our data and empirical model. Section 4 shows the results. Section 5 describes the robustness checks. Section 6 compares our analysis of Japan to other countries. Section 7 extends our analysis to wealth distribution and variance decomposition, and Section 8 concludes.

2 LITERATURE AND COMPARISON WITH OTHER ECONOMIES

The literature on distributional effects of monetary policy is rather small compared to the literature on such effects for fiscal policy. However, the statement by Mark Carney, Governor of the Bank of England that “all monetary policy has distributional effects” (Carney 2016) illustrates well that the distributional impact of monetary policy is shared by central bankers. Uncertainty remains on the size and the direction of this effect in different monetary policy set-up. This section quickly reviews the main empirical findings on conventional monetary policy and inequality and then turns in more details to the evidence on unconventional monetary policies.

2.1 EFFECTS OF CONVENTIONAL MONETARY POLICY ON INEQUALITY

Monetary policy has effects on the distribution of income in the economy. Empirical evidence on conventional monetary policy tends to show that (unexpected) interest rate rises increase income inequality. Romer and Romer (1999) was the first study to examine the role conventional monetary policy on poverty. They find that expansionary monetary policy alleviates poverty only temporarily, and the best monetary policy can do is to achieve stable output and low inflation. In their seminal paper, Coibion et al. (2017) find that contractionary monetary policy shocks widened income inequality in the US over the period 1980-2008; the effect is mainly driven by the impact of monetary policy on the labor market. All else equal, easier monetary policy should strengthen labor markets – creating more jobs and pushing up wages – which decreases income inequality (Biven, 2015). Furceri et al. (2018) find a similar effect for a panel of 32 advanced and emerging markets. Mumtaz and Theophilopoulou (2017) find that contractionary monetary policy increased inequality in the UK over 1969 to 2012, but an opposite effect for unconventional policies like quantitative easing over the recent Great Recession (see below).

Some recent empirical evidence put these results in perspective. Doniger (2019), for example, finds that conventional monetary policy easing reduces employment inequality but increases wage inequality. El Herradi and Leroy (2019) find for a panel of 12 advanced economies between 1920 and 2015 that expansionary monetary policy increases the share of national income held by the top one percent – i.e. it widens inequality. There remain open questions on how to interpret these conflicting results.

2.2 EFFECTS OF UNCONVENTIONAL MONETARY POLICY ON INEQUALITY

The distribution mechanisms of unconventional monetary policy (UMP) are even less straightforward. UMP work through the size of central bank’s balance sheet rather than through interest rates. UMP often inflates the prices of financial assets, which tend to be held by the

wealthy rather than the poor and thus potentially increase inequality. Saiki and Frost (2014) was, to the best of our knowledge, the first study to look at the impact of UMP on income distribution, using semi-aggregated household survey data for Japan (discussed below). Compared to the quantitative easing in the US (2008-2014) and the euro area (2015-2018), Japan's QE has been in place for a longer time (since 2001) with no exit in sight, and the scope and depth of its QE – called comprehensive monetary easing and quantitative and qualitative easing – is by far larger than other major economies. While inequality is a slow-moving trend, the duration of Japan's QE means we cannot rule out that it played at least some part of widening inequality in Japan. Between 2013 (when Abenomics started) and 2017, the Gini coefficient of market income based on the household survey increased from 0.33 to 0.35, despite the stronger labor market.

Today, a large number of studies have examined the impact of UMP on income distribution in various economies. For Japan, Yoshino (2018) conclude using a sample dataset between 2002Q1 and 2017Q3 that contractionary monetary policy worsened income and consumption inequality due to a job destruction effect. At the same time, the larger government transfers, which offset the income distribution impact of monetary policy, made the net effect (monetary and fiscal policy) neutral. By contrast, Inui et al. (2017) find no support for the hypothesis that BoJ's QQE changed income distribution in Japan. This is also consistent with remarks by the BoJ that inequality has not increased in Japan.² Yet the main sample period of Inui et al. (2017) starts in 1981 ends in 2008, thus it does not include the QQE period. Another weakness of Inui et al. (2017) is that they use the shadow interest rate (which contains lots of uncertainty) to capture the impact of UMP.³ This price measure is likely to miss the change in the quantity of assets available to investors generated by BoJ's asset purchases. As such, we argue that it is desirable to use more straightforward measures such as the monetary base to identify UMP shocks.⁴

Looking at the world outside of Japan, the results are not clear-cut. For the euro area, Rupprecht (2018) finds a wide disparity in UMP's impact on household income and financial wealth across different euro area countries. This heterogeneity across the euro area is also documented by Guerello (2018). More recently, Lenza and Slacalek (2019) conclude that UMP did *not* increase inequality in the euro area due to job creation and wage increase effects. This is an important point, as a notable wage increase has not occurred in Japan. The importance of the wage channel in monetary policy's impact on income distribution is also documented by Ampudia et al. (2018). Casiraghi et al. (2018) examine micro data from Italy, and find that for Italy, the effects on labor markets were larger than the effects on financial markets, thus concluding that UMP did not increase income inequality in Italy. For the US, a study by Doepke et al. (2015) showed that UMP

² In June 2016, Governor Kuroda noted at Keio University "it is my understanding that inequality has *not* risen in Japan."

³ Feldkircher and Kakamu (2018) obtained a similar solution. However, we think using shadow interest rates, which require many assumptions to construct, is less preferable to using the monetary base, which does not require assumptions and is an actual tool of unconventional policy.

⁴ Inui et al. also replicate our study for the period Q4 2008 to Q2 2016 and find that the results are of a similar magnitude, but not (quite) statistically significant. Notably, this does not control for the consumption tax increase in April 2014 (see below).

by the Fed had benefited middle-class borrowers with mortgages while hurting wealthy retirees with nominal savings. Davityan (2018) find that UMP widened income inequality in the US.

Meanwhile, a simulation by Domanski et al. (2016) of six advanced economies finds an upward impact of UMP on wealth inequality, as the rise in equity prices has had a more significant impact on wealth distribution (benefiting the wealthy) than the increase in house prices (which benefits a broader segment of societies). Koedijk et al. (2018) review the literature and find that expansionary monetary policy, both conventional and unconventional, appears to reduce income inequality, mainly through its impact on the labor market, although they emphasize that empirical results for unconventional monetary policy are still subject to debate.⁵ Montecino and Epstein (2017) find that while employment changes and mortgage refinancing were highly equalizing, these impacts were nonetheless swamped by the large disequalizing effects of realized equity returns. Cui and Sterk (2018) use a heterogeneous agent model and conclude that active QE has “strong side effects” – including inequality, claiming that QE is a second-best policy to conventional monetary policy from a welfare perspective.

In sum, the results in the literature are mixed: among those that find that UMP amplifies income inequality are: Montecino and Epstein (2017) for the US, Mumtaz and Theophilopoulou (2017) for the UK, and Saiki and Frost (2014) for Japan. Meanwhile, Casiraghi et al. (2017), Guerello (2018) and Ampudia et al. (2018) for the euro area, and Bivens (2015) for the US find that UMP reduces income inequality.⁶ Bunn et al. (2018) use household survey data for the UK, and find that the impact of monetary policy between 2008-2014 on income and wealth inequality has been small, although there is a wide heterogeneity across different age groups (young vs. retired). Colciago et al. (2019) provide a recent survey, highlighting mixed empirical findings, and suggesting further research with general equilibrium models and heterogeneous agents.

One might wonder why the impact of UMP on income inequality may differ so starkly across countries and studies. A key factor seems to be the labor market: how employment and wages respond to a policy shock, relative to the response of value of financial assets. The Japanese labor market is notoriously rigid, and various forms of labor market duality (based on gender, nature of the contract, etc.) exist. At an aggregate level, Japan’s wage growth has been close to null until very recently. The large disparity of wage changes across industries, and by gender and the nature of the employment contract (regular vs. non-regular workers) may have suppressed recent wage increases. These reflect unique structural features of Japan. Also, in Japan, the interest rate had been near zero for a long time before UMP started, so there was little room to

⁵ At the same time, they find that expansionary monetary policy increases the wealth inequality.

⁶ Regarding wealth inequality, Adam and Tzamourani (2016) find that after UMP in the euro area, the capital gains from bond price and equity price increases turn out to be concentrated among relatively few households, while the median household strongly benefits from housing price increases. Guerello (2016) finds there is significant heterogeneity in the impact of monetary policy on distribution across countries. Finally, there is a new strand of literature on how macroprudential policy affects income inequality; Frost and van Stralen (2018) find a positive association between some macroprudential policies and market or net income inequality in a sample of 69 countries between 2000-2013.

cut interest rates. For other countries the interest rate was cut substantially before UMP was implemented. Demographic factors may also play a substantial role. Imam (2015) documents that aging dampens the effects of monetary policy. Specifically, among five different transmission channels of monetary policies (interest rates, credit, wealth effects, risk-taking, expectations), three channels (interest rates, credit and risk-taking) are less effective in aging societies, as older cohorts do not need to borrow, do not consume much, and are more risk-averse. Therefore, a central bank's effort to expand credit to stimulate demand is not likely to bring the desired result of increased consumption and investment, but only increases the savings or wealth of older asset holders, who are unlikely to spend out of their increased wealth (see Tobin, 1967, as well as many succeeding studies). To prepare for life after retirement, more people put their savings into investment trusts, equities, or personal pension plans. A household survey by Bank of Japan shows that approximately 80% of the households (all age groups) worry about their financial situation after they retire. In Japan, 27% of the population is older than 65, as opposed to 15% in the US and 20% in the EU.⁷ Therefore, the rapidly aging population in Japan may entail different effects of UMP as compared to other countries.

3 DATA AND EMPIRICAL STRATEGY

In this section, we describe the data we use for our analysis and explain our empirical model.

3.1 DATA

In Saiki and Frost (2014), we use a simple vector autoregression (VAR) analysis with a Cholesky decomposition to generate impulse response functions (IRF). We use the following ordering: quarterly GDP growth (seasonally adjusted), core year-on-year (YoY) inflation, % change of the monetary base, % change of the Nikkei 225 Index and the Gini coefficient of income inequality. Data on incomes are taken from the Cabinet Office's Household Survey ("Kakei Chosa"), and specifically the Family Income and Expenditure Survey (FIES).⁸

The FIES is taken by questionnaires every quarter by the Japan Ministry of Internal Affairs and Communications, using a three-stage stratified sampling method (municipality, survey unit area, and the household).⁹ The sample size is about 9,000 (out of which the number of single households is 750) and includes households from various categories – unemployed to self-employed. Half of the sample is replaced with new households every quarter, so in one year the entire sample changes. Thus, it is not possible to conduct a panel analysis of individual

⁷ The World Bank, World Development Indicators 2018.

⁸ For more detailed description of the survey, see <https://www.stat.go.jp/english/data/kakei/1560.html> (retrieved in June, 2019). The entire data can be downloaded from the website as well.

⁹ For households with two or more people, the survey is taken every month, with less granular contents.

households. Income fluctuates due to the twice-a-year bonus system, which (depending on an employer) can account for 6 months' worth of salary in Japan. However, when the bonus is handed out depends on the employer. Given that 40% of Japanese workers are contract/part-time workers, it is difficult to control for these seasonality factors. Thus, we take "the income of the last 12 months" as the key measurement of income. Unfortunately, for the full sample of households (which includes self-employed, investors, and company executives, which are typically far wealthier than an average employee), the break-down of wages and capital gains is not available – it is only available for the households where the head of household is employed. Our sample period is between Q4 2008 and Q2 2018.

3.2 METHODOLOGY

We use an SVAR model, with the following restrictions. The non-recursive restriction is that a central bank cannot observe and respond contemporaneously to the output gap, the unemployment rate, and inflation. This restriction follows Kim and Roubini (2000) and Bernanke and Mihov (1998) that a central bank cannot know the output gap, unemployment rate, wage and inflation in real time (even if it can try to estimate these, e.g. through nowcasting). One recursive restriction is that the Gini coefficient does not affect other variables in the short run.

It is worthwhile to mention that due to our small sample size, this more advanced model cannot be replicated using the same sample period as Saiki and Frost (2014), and the existence of a unit root in several variables is sensitive to the sample period. Especially due to the additional restrictions from the SVAR model, the results become unstable or cannot be estimated if the sample size becomes shorter. Nonetheless, for the full period, we feel that this takes relevant economic developments more fully into account. To test the sensitivity of the results to these assumptions, we also have a series of robustness checks.

Let \mathbf{X} be a vector of endogenous variables, defined as

$$\mathbf{X}_t = [\widehat{dY}_t, dr_t, dlW_t, \pi_t, dlMB_t, dlSP_t, Gini_t]'$$

$$\mathbf{D}_t = [D_t^{EQ}, D_t^{CS}]$$

where \widehat{dY} is the change in output gap, dr is the change in employment rate (100-unemployment rate), dlW is the percentage change in wages, π is core annual (YoY) inflation rate (the BoJ's target inflation rate), $dlMB$ is the first difference of the natural log (\approx % change) of monetary base, $dlSP$ is the first difference of the natural log (\approx % change) of daily average stock prices (Nikkei 225) and $Gini$ is the Gini coefficient, calculated from the FIES as described above.

Meanwhile, D_t is a vector of exogenous variables. Specifically, D_t^{EQ} is an earthquake dummy that takes a value of minus one in Q1 and Q2 2011.¹⁰ D_t^{CS} is consumption tax hike dummy that takes a value of one in Q1 2014 to capture the rush demand by Japanese consumers (*kakekomi-jyuyo*) before the tax increase came into effect, and minus one after the implementation of the tax hike (April, i.e. Q2 2014).

We restrict that the central bank does not observe the output gap in real time, thus:

$$B_0 X_t = B(L)X_{t-1} + A D_t + e_t$$

where $B(L)$ and A are matrices of estimated coefficients and

$$B_0 = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ x & 1 & 0 & 0 & 0 & 0 & 0 \\ x & x & 1 & 0 & 0 & 0 & 0 \\ x & x & x & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ x & x & x & x & x & 1 & 0 \\ x & x & x & x & x & x & 1 \end{bmatrix}$$

The triangular restriction creates a short-run restriction that the Gini coefficient does not affect the other endogenous variables in the short run. In the SVAR model, the number of lags is set to two quarters, following the final production error (FPE), the Akaike information criterion (AIC) and the Hannan-Quinn (HQ) criterion. Table 1 gives descriptive statistics.

TABLE 1: DESCRIPTIVE STATISTICS OF VARIABLES IN THE ANALYSIS

Sample period Q4 2008 – Q2 2018

	d(output gap)	d(employment rate)	% change in monetary base	d(% change in wage)	% change in Nikkei 225	Core inflation (annual)	Top-bottom 20 % ratio	Gini coefficient
Average	0.1034	0.0903	5.4298	0.0006	3.4261	0.4636	6.3630	34.2945
Median	0.1252	0.0875	5.1859	-0.0008	3.7946	0.0692	6.3927	34.3100
St. Dev	0.4397	0.0852	3.5499	0.0078	8.1517	1.0709	0.1367	0.4467

The top-bottom 20% ratio (the second left column) is the ratio of average income of the top 20% of households to the income of the lowest 20%. We use these data in a robustness check.

¹⁰ The Tohoku Earthquake occurred on March 11th, 2011.

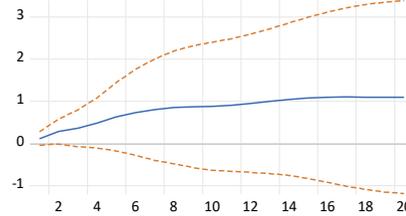
4 RESULTS

Figure 2 shows the impulse responses of our baseline model. With a small sample size as in our study, it is challenging to obtain statistically significant results, especially with additional restrictions on the SVAR. However, the upward impact of shocks to the monetary base on inequality as measured by the Gini coefficient is statistically significant at the 1% significance level in the first three quarters after a shock, and remains positive but insignificant after that (top panel). It is clear from the figure that the monetary base increase pushed up the Nikkei 225 index (middle right panel), but that the job-creating effect is not significant (middle left panel). That said, UMP seems to have had a marginally statistically significant positive effect on wages (middle second left panel). Thus, while there was no job creation effect, as Inui et al. (2017) posit, monetary policy shocks are associated to some extent with wage growth. The lower unemployment rate over the sample period does not seem to be linked to monetary policy shocks and thus may come from somewhere else, e.g. the economic recovery more generally. Note also that a shock in wage growth is associated with higher inequality (bottom middle panel). This implies that wage growth in Japan seems to be concentrated in the upper part of income distribution. Meanwhile, the portfolio rebalancing effect is much stronger: the monetary shock clearly had a positive effect on Nikkei index, with the accumulative shock last for three decades with statistical significance. Needless to say, the Nikkei index reflects the prices of only one of many classes of financial assets that higher-income households invest in; investors may have invested in selected stocks, bonds, or foreign assets, as well. While average wages responded positively to monetary shocks, the wage shock is also associated with higher inequality in the first 4 quarters. This would be consistent with labor market duality, by which higher wages may not be shared by contract workers and other households at the lower end of the income distribution.

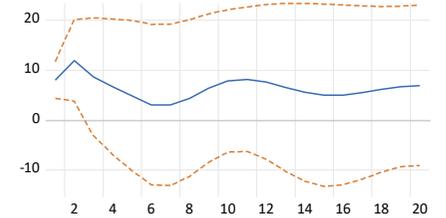
Figure 2: Impulse Response of Selected Variables, SVAR (Accumulated over 20 Quarters)

Accumulated Response to Structural VAR Innovations ± 2 S.E.

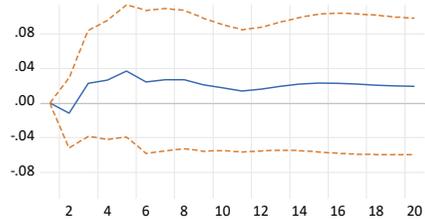
Accumulated Response of Gini to Monetary Shock



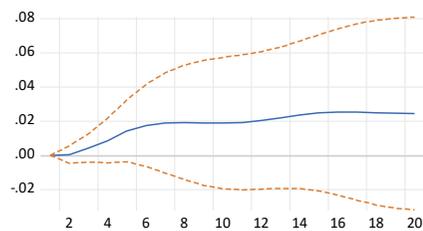
Accumulated Response of %Nikkei to monetary shock



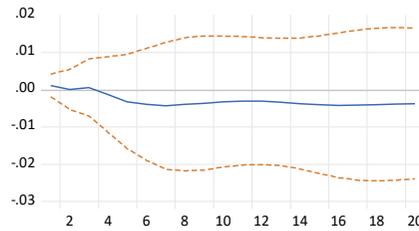
Accumulated Response of d(employment rate) to monetary shock



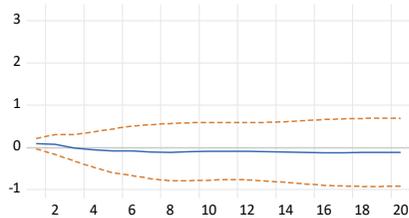
Accumulated Response of %wage to monetary shock



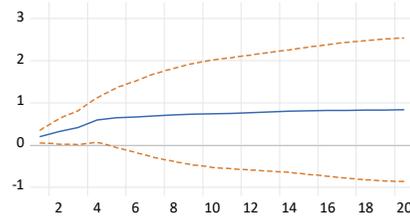
Accumulated Response of %wage to d(employment rate)



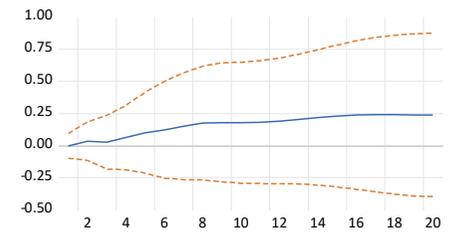
Accumulated Response of GINI to d(employment rate)



Accumulated Response of gini to wage



Accumulated Response of GINI to %Nikkei



To illustrate this further, while total wages moved up over 2013-2017 (Figure 3a), there is a large disparity in wage growth across industries. Unsurprisingly, on the back of a buoyant stock market, wages in the finance and real estate sectors went up while personal services (such as elderly care), mining and hospitality services experienced a significant decrease. Also, new jobs created were mainly part-time and non-regular, so the additional income gain was likely small. Wage dispersion increased as regular employees in the finance, real estate, and IT sectors captured a large portion of wage growth. Overall, labor force participation remained quite stable over the full period, even as participation of workers over 65 increased (figure 3b).

Figure 3a: Average Wage Change, 2013-2017

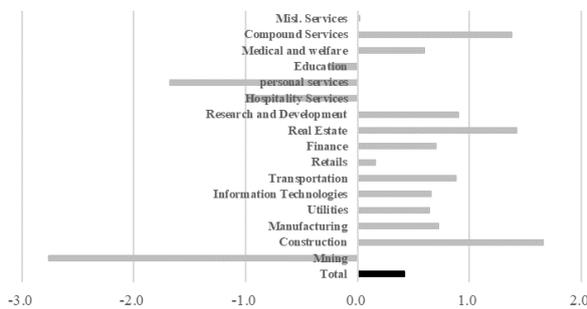
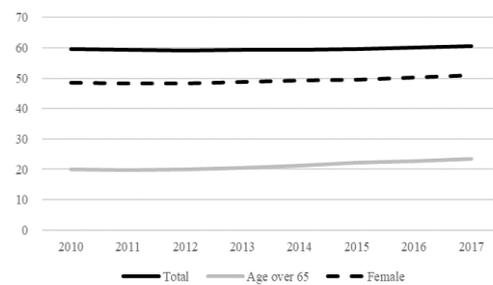


Figure 3b: Labor Force Participation



Source: Ministry of Health, Labor and Welfare. The industry-level wage change data is available only starting 2013.

5 ROBUSTNESS CHECKS

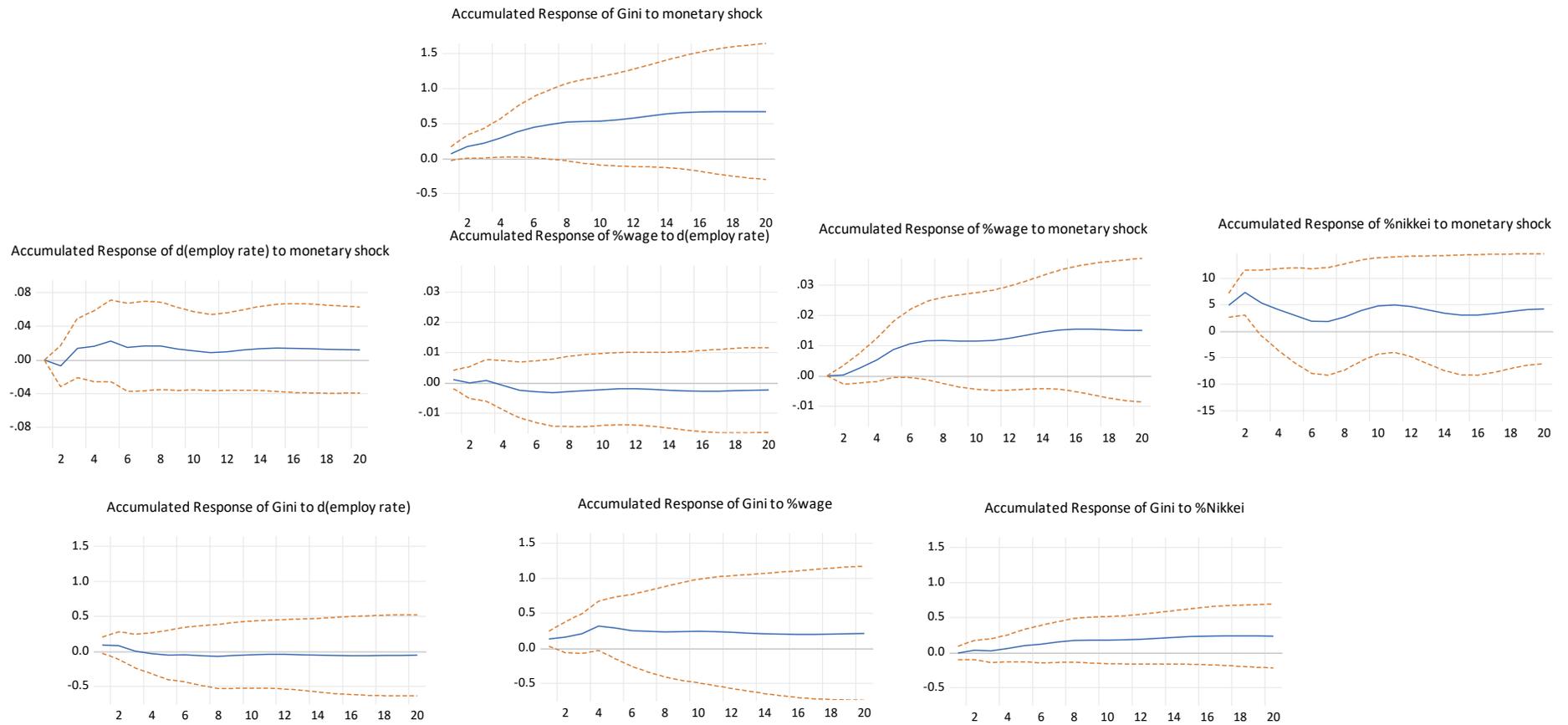
In this section, we check whether the IRF of the model are sensitive to: (i) the structure of the VAR model; (ii) different measures of income inequality; and (iii) the sample period.

5.1 CHOLESKY DECOMPOSITION

As a first test, we use a simple VAR with the Cholesky decomposition, with the same order of variables as the baseline model (Figure 4). We obtain similar results, with the impact of the monetary policy shock on the Gini being significant over the first eight quarters, with a somewhat smaller economic magnitude. This suggest that the basic results of our underlying analysis are robust to the constraints we placed on the SVAR specification.

Figures 4: Impulse Response Function from Cholesky Decomposition

Accumulated Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.



5.2 DIFFERENT ORDERING: GENERALIZED IMPULSE RESPONSE FUNCTIONS

Below we show the generalized IRF (Pesaran and Shin, 1998), with which the impulse response is irrelevant to order of variables. Again, we find a positive relationship between a shock to monetary base and the Nikkei, and between the Gini coefficient and wages. The link between monetary shocks and Gini is of a similar magnitude but is not statistically significant (Figure 5). This indicates that the ordering of the shock propagation process (i.e. the ordering of endogenous variables) does matter.

5.3 DIFFERENT INCOME INEQUALITY MEASUREMENT

As a further test, we use (i) the income ratio of the top 20% to the bottom 20%, and (ii) the ratios of income earned by top quintile and by top decile to total income.

For the top-bottom 20% ratio, the results are very similar to our initial estimation (Figure 6). The monetary shock did not affect the employment rate, but its effect on stock prices is positive and significant for the first three quarters, and the effect on the income disparity is statistically strong. The impact of monetary policy on inequality is significantly different from 0 for the first 8 quarters, after which it is positive but no longer significant. We also used the ratio of income earned by top quintile (20%) and top decile (10%) to total income.¹¹ We obtained similar results for the ratio of the top quintile to total income, but did not find any significant response of the top decile, indicating that the gains from UMP may have been concentrated among households high in the distribution but not necessarily the very highest earners.

¹¹ Not reported. Available upon request.

Figure 5: Generalized Impulse Response Function

Accumulated Response to Generalized One S.D. Innovations ± 2 S.E.

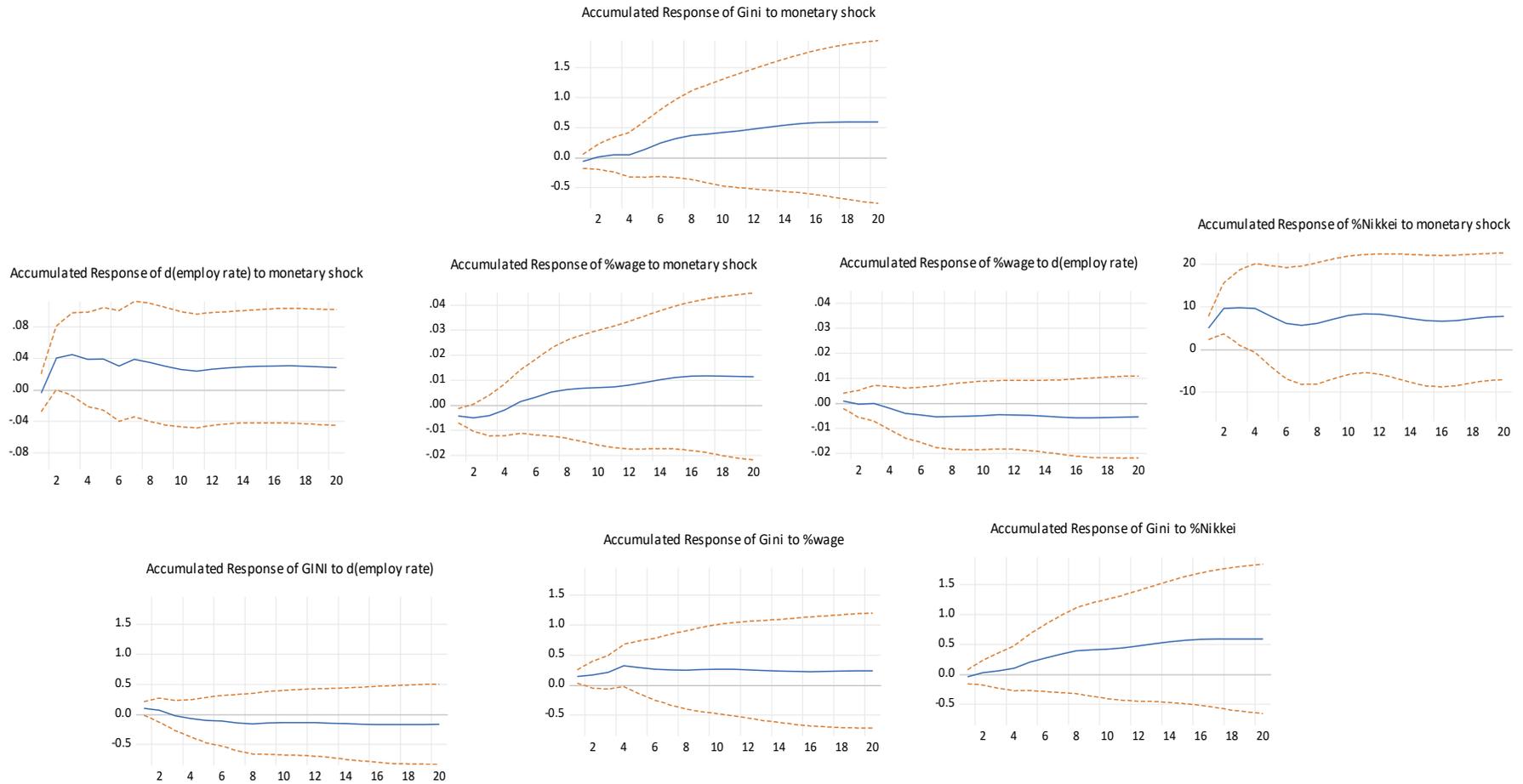
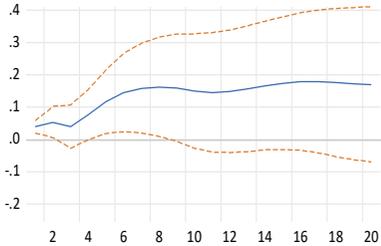


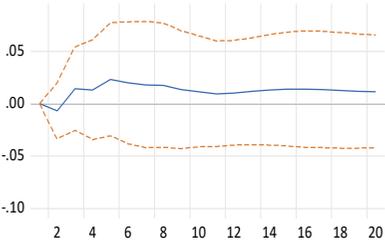
Figure 6: Top-Bottom 20% Ratio as Inequality Measure

Accumulated Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

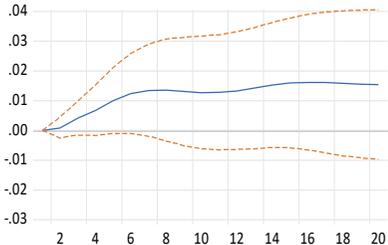
Accumulated Response of TB20PCT to monetary shock



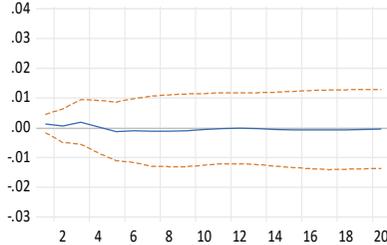
Accumulated Response of d(employ rate) to monetary shock



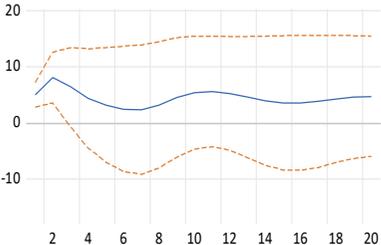
Accumulated Response of %wage to monetary shock



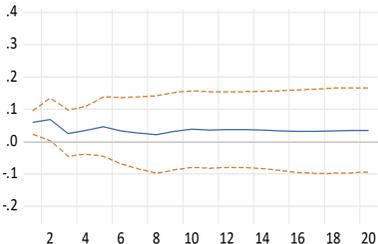
Accumulated Response of %wage to d(employ rate)



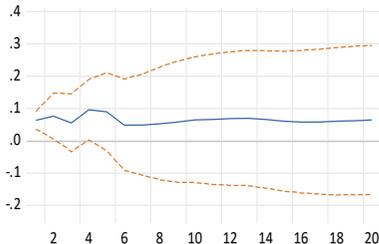
Accumulated Response of %nikkei to monetary shock



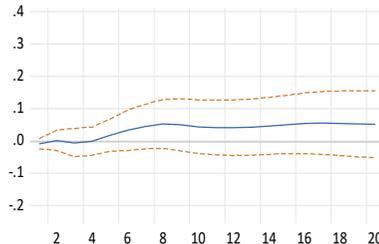
Accumulated Response of TB20PCT to d(employ rate)



Accumulated Response of TB20PCT to %wage



Accumulated Response of TB20PCT to PCHGNIKKEI



5.4 UPDATING THE SAIKI AND FROST (2014) MODEL WITH AN EXTENDED DATASET

In what follows, we simply update Saiki and Frost (2014) with the extended dataset. The specification of Saiki and Frost (2014) is as follows.

$$X = [dLGD P_t, d\pi_t, dLM_t, dLS_t, Ratio_t]'$$

where $dLGD P_t$ is the quarterly growth rate of GDP (seasonally adjusted), $d\pi_t$ is the first difference of annual core inflation rate,¹² dLM_t is the percentage increase in monetary base, dLS_t is the percentage increase in stock indices (Nikkei 225), and $Ratio_t$ is the ratio of income earned by the top 20% income group in total income.

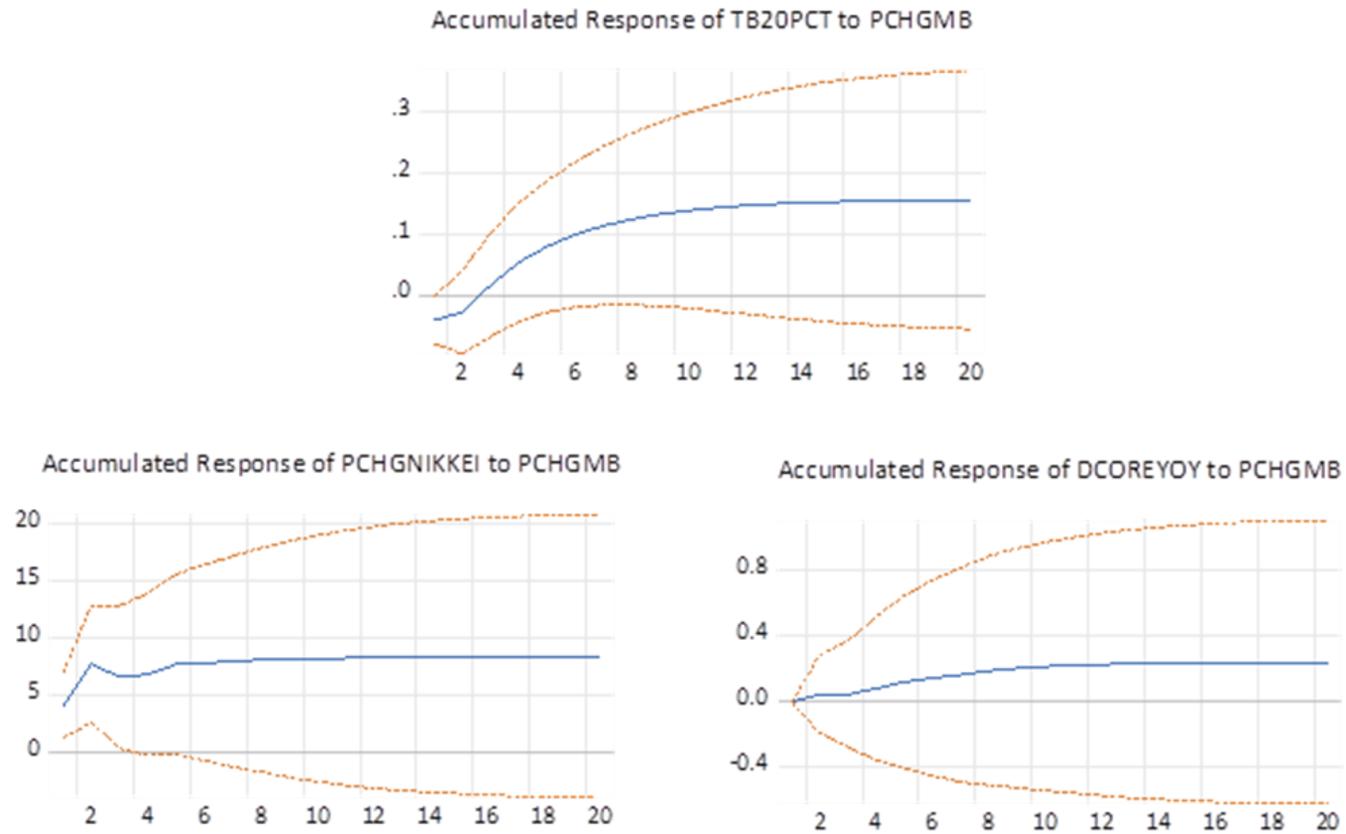
We replicate this model using the same data but a longer sample period. A key difference is that we took the first difference of core inflation due to the unit root problem, and included a consumption tax dummy, which is defined as one in Q1 2014 (for rush-demand before the consumption tax hike) and minus one in Q2 2014, as described above. The results are shown in Figure 7. With our extended dataset, we confirm that monetary shocks increased income inequality. The impact on income inequality is larger in our extended sample – around 0.12 at the 8th quarter versus 0.08 at the maximum in our earlier study. The estimate's two standard deviation band includes zero, but the lower bound of standard deviation is -0.02 in the 8th quarter after monetary shock. Thus, there is some impact of a monetary policy shock on the top/bottom 20% ratio (at the 90% confidence level). The Nikkei 225, once again, responds in a statistically significant way although its effect becomes insignificant after 6 quarters.

The bottom line is that our results are broadly robust to the different sample periods under the same monetary policy. Including wages and employment (job creation) in our specification does not change how monetary policy impacts inequality.

¹² In Saiki and Frost (2014), we did not take the first difference of core inflation because unit root hypothesis was rejected.

Figure 7: Saiki and Frost (2014) with Extended Dataset

Accumulated Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.



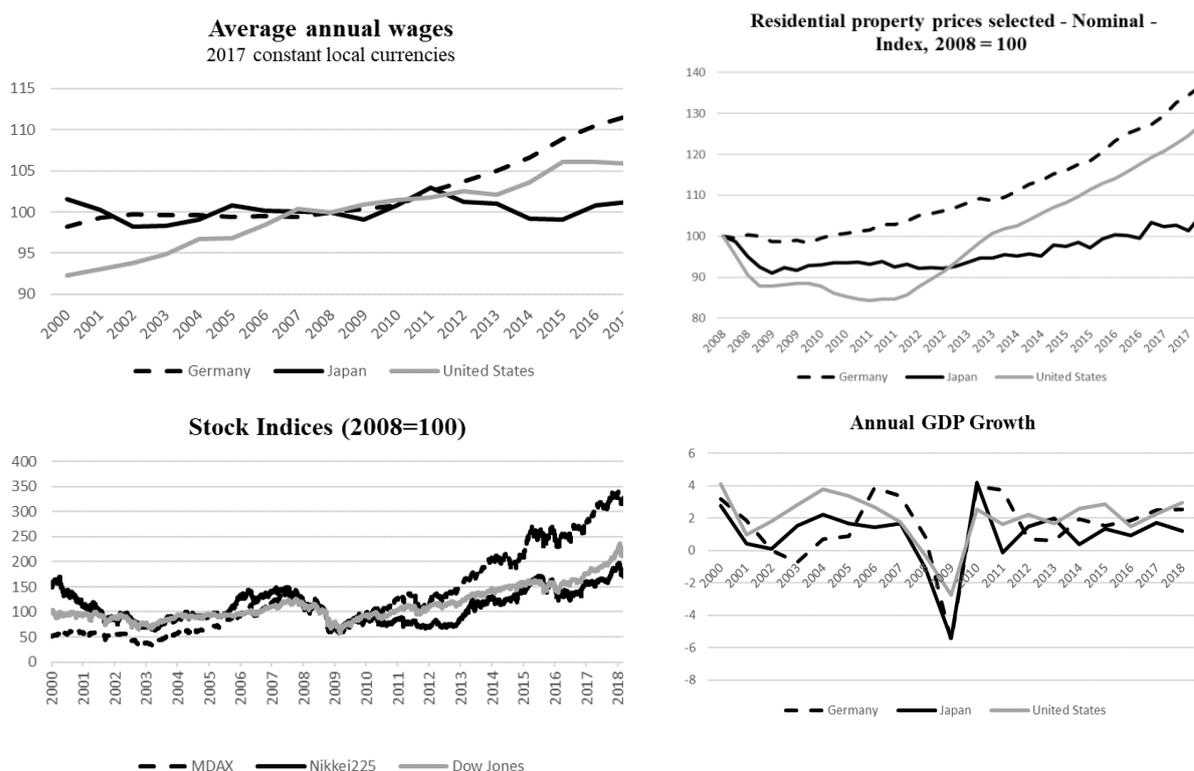
6 DIFFERENCES WITH OTHER COUNTRIES

As mentioned above, the distributional effects of UMP seem to differ across countries. Of course, this may relate to the large differences in the scale of asset purchases by central banks, and in the economic structure of each country. Purchases by the Bank of Japan have been much larger than in many other countries and have targeted a wider range of assets. Moreover, Japan has quite rigid labor markets and a bank-based financial system. Differences may also relate to the estimation method and the measurement of inequality that a researcher uses.

For Japan, there is evidence that UMP has widened income inequality. This result may relate to the lack of wage increases despite higher asset prices. As apparent from Figure 8 (first row, left panel), Japanese wages have hardly increased, while there has been about a 10% wage increase since the crisis in the US, the UK, and the euro area in the same period. Since wages are the largest component of income for the majority of households, wage increases in many advanced economies may have offset the increased income inequality from capital gains. Also, residential price growth in Japan has been the lowest among these selected economies (upper-right column), due largely to aging and a declining population. Subdued housing prices can lessen the rent that a real estate owner may collect and the collateral value of the wealth. The only variable that has moved in tandem with other major economies is equity prices (lower left panel).

Overall, these observations underscore the unique characteristics of Japan and the fact that the effects of UMP may not be fully comparable with effects in other advanced economies.

Figure 8: Key Macro Variables of Japan, US and Germany



Sources:

Residential Price BIS Residential Property Price database, <http://www.bis.org/statistics/pp.htm>

Average annual wage: OECD https://stats.oecd.org/Index.aspx?DataSetCode=AV_AN_WAGE#

Equity price: Japan Nikkei 225 (Japan), Dow Jones (US), MDAX (Germany); source: Yahoo Finance GDP Growth: IMF-WEO (the figure of 2018 is forecast)

7 EXTENSIONS

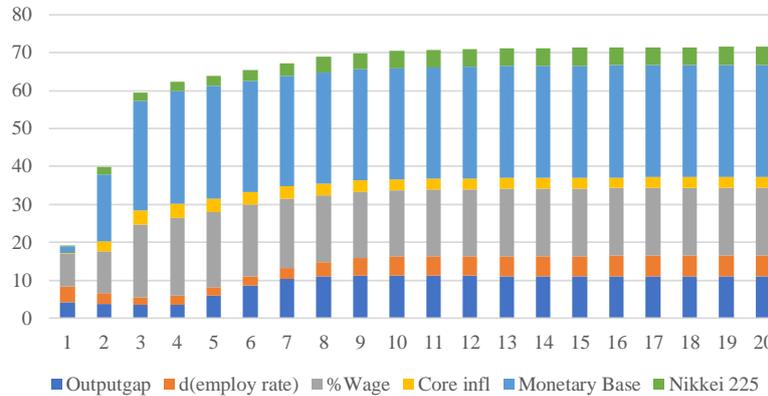
In this section, we conduct a variance decomposition analysis to analyze how much each factor played a role for inequality. We also compare income and wealth inequality.

7.1 VARIANCE DECOMPOSITION

To understand the relative importance of random innovation of individual variables in the SVAR model in the variation in inequality, we conduct a variance decomposition analysis. The results are reported in Figure 9. It is clear that monetary policy shocks are the most important component of the short-term variation in Gini during our sample period. Wages and output gap also play a role, but shocks to the Nikkei 225 index account for only 5% of the Gini's variance. If developments in other financial assets, such as bonds and foreign exchange positions, as well as dividend payments were taken into account, they may explain a further portion of the overall

variance. In the future, it may be worthwhile to look into other variables that capture buoyant financial asset prices during this period.

Figure 9: Variance Decomposition of the Gini Index



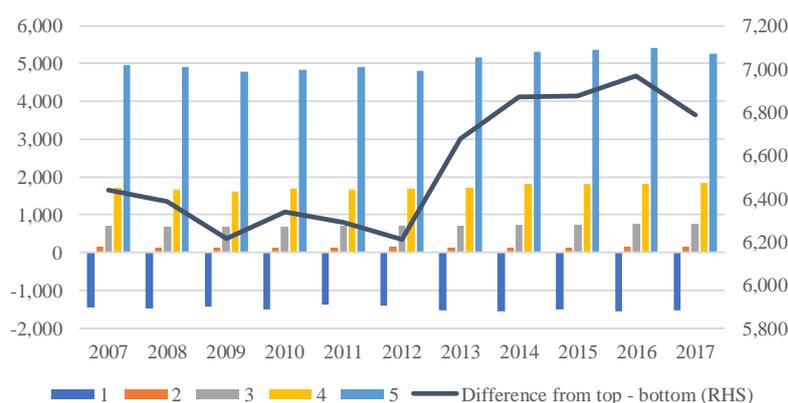
7.2 INCOME VS. WEALTH INEQUALITY

Monetary policy has an impact on income, which accumulates into wealth. Without a wage increase, accumulated differences in income derived from capital gains and dividends should result in wealth inequality. Figure 10 shows the structure of net assets by wealth quantile; the data are available only annually. The gap of net saving by quantile, which is shown by the grey line (the wealth difference between top and bottom wealth quantile) has risen since 2012. Where wealthier households have rebalanced their portfolios from safe assets to riskier assets including equities, they may retain the favorable effects of QQE. If a crash in equity markets happens, or bond prices fall during the exit from UMP (as a natural counterpart to higher interest rates), then both wealth and income inequality may shrink. Changes in labor markets (job loss) or fiscal policy may have further distributional effects.

Recently in Japan, anecdotal evidence suggests that higher income households, as well as Japanese companies, have moved assets abroad.¹³ As such, the wealth gained by UMP may have important cross-border effects, as well, without stimulating domestic demand.

¹³ <https://asia.nikkei.com/Business/Banking-Finance/Japanese-now-hold-1-000tn-yen-worth-of-foreign-assets>

Figure 10: Net Savings by Quintile



Calculation by the authors based on the household survey data from the Ministry of Internal Affairs and Communications' household saving and liability survey (two people or more households). The numbers are in 10,000 yen (about US\$100).

8 CONCLUSION

In this paper, we find that UMP has had a continued upward effect on income inequality in Japan. In 2014, we found that UMP had widened income inequality over the period 2008-2014. Since then, the BoJ has increased the monetary base further, and quite rapidly. We have updated our dataset through 2018 and made several improvements to the model, e.g. adding wages and employment, extending our dataset and introducing structural restrictions. We again find that income inequality increased after UMP shocks. These findings are generally robust to different measures of inequality, and to different specifications of a (structural) vector autoregression model. We emphasize that the result may relate to unique characteristics of the Japanese economy, especially labor market rigidity, and may not hold in other economies. We could not observe a job creation channel as posited by Inui et al. (2017). This suggests that whether greater inequality from asset price movements can be offset by changes in labor markets may crucially hinge on labor market structure and reform.

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