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The Pasinetti Index and the Rise of Inequality in the Age of Unconventional Monetary Policy in Japan

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Discussion Paper

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The Pasinetti Index and the Rise of Inequality in the Age of Unconventional Monetary Policy in Japan

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Abstract

There are increasing concerns in Japan that unconventional monetary policy (UMP) accelerates inequality by the asset price mechanism, allowing the higher income group to gain extra capital income. The UMP does have limited accounting in creating real wage growth as well as restoring demand and growth as the overall economy has been stagnant. We revisit the issue of income inequality in Japan by using Pasinetti's approach of measuring personal income distribution and also examine its effect on the effective demand and functional income distribution. We implement workers' debt-augmented Pasinetti Index (PI) as a proxy of personal income distribution, moving away from workers towards rentiers in their interpersonal lending and borrowing relations. Our empirical result with the VAR model for the case of Japan shows 1) higher PI restrains the effective demand. 2) Higher rentier income also affects the wage share negatively through a decrease in capacity utilization.

Keywords: Monetary Policy; Income Distribution; Post-Keynesian Economics; Pasinetti Index.

JEL codes: B50; E12; E52.

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1. Introduction:

This paper investigates whether the income flow towards high-income groups from low-income workers would restrain the effective demand and wage share in the aggregate under the age of conventional monetary policy in Japan. The country has observed higher income inequality in the last decades in addition to the stagnant real wage, and several recent empirical studies have found that unconventional monetary policy (UMP) might have accelerated inequality by the asset price mechanism, widening wealth and income inequality (Saiki and Frost 2014, Israel et al. 2023). In that sense, despite the fact that UMP might boost the income of the rich, UMP has limited accounting for creating higher income for the bottom as the real wage has stagnated, and there is a rise of people with few or no savings and indebtedness, especially among the low-income group of people.[1] We revisit this issue, focusing on the recent trend of income distribution and monetary policy and its effect on aggregate demand and functional income distribution.

While there has been an increasing amount of research to show the effect of UMP and the rise of inequality in Japan, there needs to be more studies on how inequality that emerged under the UMP has affected Japan's overall economic performance and wage share. Following the methodology of Kappes et al. (2023) and Seccareccia and Lavoie (2016), we use the Pasinetti Index (PI) as a proxy of personal income distribution to take into account the distributional change when workers repay their financial liabilities to the rentiers from the wage income. Pasinetti's (1981; 1993) fair interest rate rule allows us to measure personal income distribution by considering the disparity between the income of rentiers and borrowers. As a contribution from our side, we developed our version of PI by taking into account the rise of inequality between interest income groups and the labor income group in their interpersonal lending and borrowing relations. This measurement of income distribution boils down to the fact that income inequality has been rising not only due to the rise of rentiers' interest income but also due to the rise of low-income workers may become indebted from decreasing savings and real wages. Despite the fact that the UMP by Bank of Japan (BoJ) has been targeting the interest rate at the negative range to counter economic deflation through massive purchases of securities and yield curve control of the government 10 years bonds yield, the effect of such UMP is questionable as the real wage and the effective demand have decreased while allowing the income distribution favored to the high-income group and also we observed the decrease of wage share.

There are various channels for the distributional effects of monetary policy. The previous empirical study of the effect of UMP has paid attention to the portfolio channel, which explains that the central bank's asset purchase would cause an increase in the asset price. Expansionary monetary policy might affect inequality through the heterogeneity in portfolios, which affects both *wealth and income inequality*, benefiting financial asset holders more. For example, the empirical research by Saiki and Frost (2014; 2020) and Israel et al. (2023) reveals a rise in inequality, especially since Japan's second phase of UMP due to the rise in asset price. Although the portfolio channel is related to the rise in asset price and financial asset value which also affects wealth inequality, Saiki and Frost (2014; 2020) and Israel et al. (2023) measure such

[1] The landscape of contemporary income distribution in Japan has changed, especially after the implementation of UMP, while it was limited only to wage inequality, as the top 1% of income source is primarily wage income Moriguchi and Saez (2008).

inequality using specific *income* survey data to compute wage differential and the Gini coefficient. The rationale is that there is a positive correlation between the share of securities in savings, and the level of wealth and income level. Another channel is more focused solely to income inequality, while the previous channel concerns income and wealth inequality. As regards the impact of monetary policy, there is an *income* composition channel. As there is heterogeneity in the source of income, such as labor and capital income, the monetary policy benefits differently depending on the characteristics of the income composition of households. Taghizadeh-Hesary et al. (2018) argue that income inequality in Japan since the implementation of UMP in 2001 has widened inequality due to increased capital income related to wage income as the stock price has hiked, allowing the rich to have higher dividend income.

Nonetheless, we investigate the rise of inequality from the *normative* monetary policy rule using workers' debt-augmented Pasinetti Index (PI), which is a proxy of income distribution specifically from low-income workers as debtors to rentiers as creditors (see the details in sections 3 and 4). The PI asserts a normative principle of income distributional neutrality, which assumes that the long-term nominal interest rate ought to equal the growth rate of nominal wages to keep the distribution of purchasing power between creditors and debtors unaltered. The advantage of measuring income distribution in this fashion is that income disparity is embedded in the PI, which also has normative connotations on whether monetary policy favors rentiers (capital income earning group). Thus, we do not restrict our position only to investigate a specific channel of the transmission mechanism such as the asset price channel/portfolio channel in Saiki and Frost (2014; 2020) and Israel et al. (2023) but with the normative point of view which is a combination of income composition channel and portfolio channel.

The previous studies by Taghizadeh-Hesary et al. (2019), Saiki and Frost (2020), and Israel et al. (2023) only focus on the effect of monetary policy on the rise of inequality. As a contribution from our side, we investigate how higher inequality by UMP would affect growth and distribution in Japan. While there are many studies about the relationship between effective demand and functional income distribution, the relationship between the PI, effective demand, and functional income distribution is partially studied. There are few theoretical studies regarding how PI would affect the dynamic between growth and functional income distribution. One of the critical post-Keynesian theoretical contributions is the study of the Kaleckian economic growth and income distribution models (Bhaduri and Marglin 1990; Blecker 1989; Dutt 1984; Rowthorn 1981; Taylor 1985). Following that research, several authors have analyzed different economies empirically to identify whether their demand regime is wage- or profit-led. The aggregative approach uses the estimation of a Vector Autoregressive (VAR) model with capacity utilization and wage share, showing that these variables are endogenously related. This approach is a theoretical investigation of the neo-Goodwin model, and for the case of the US, the neo-Goodwin pattern is empirically confirmed by Barbosa-Filho and Taylor (2006), Carvalho and Rezai (2015), and Diallo et al. (2011). These studies find a profit-led demand regime and a profit-squeeze distribution schedule. In the case of Japan, empirical research by Nishi (2012) has also revealed that this profit-led and profit squeeze pattern exists in the Japanese economy, using data from 1985 to 2008.

How the PI would affect the dynamic of growth and distribution has yet to be investigated substantially. If we regard the PI as an indicator of personal income distribution, there is similar research that can aid us in understanding the relationship between the variables. Lavoie (2017) argues the effect of overhead labor and its feedback effects on capacity utilization and income distribution. Income distribution moving towards the overhead labor (higher income group),

which tends to be classified as managers and supervisors receiving not only wage income but also bonus and remuneration, from the direct labor (lower income group) who received only wage income, would reinforce the profit-led pattern.[2] For the empirical research of the US economy, Rolim (2019) confirms the effect of overhead cost on the profit-led pattern. Also, the profit-squeeze pattern as direct labor only can increase their wage share due to bargaining power. Also, the VAR model shows that higher income distribution towards overhead labor would reduce capacity utilization. Recently, there has been empirical research using the VAR model to show the negative effect of higher PI on capacity utilization and wage share for the case of the US and Canada (see Kappes et al., 2023).

We conduct a standard VAR model to analyze the questions:

- Would a higher income flow due to the UMP toward rentiers restrain the effective demand and functional income distribution toward workers in Japan?
- What is the relationship between personal income distribution and functional income distribution under the UMP in Japan?

The main variables we use for this study are the PI, wage share, and aggregate capacity utilization to see if they are related to each other. Our empirical result with the VAR model would show 1) Higher PI or income flow moving towards rentiers affects macroeconomic growth negatively. 2) Higher rentier income flow also affects the wage share negatively, which indicates that in Japan, under the UMP, the wage share has been indirectly negatively affected by the higher PI or personal income distribution through the decreasing effective demand.

This paper follows this order: in section 2, we present a brief history of monetary policy conducted by BoJ and discuss recent literature on the distributional effect of monetary policy and income inequality. Section 3 explains the basic concept of the Pasinetti Index by analyzing Pasinetti's (1981, 1993) interest rule. Section 4 shows the data description and our VAR approach. Section 5 describes the result of our VAR model. Section 6 is the conclusion.

2. Preliminary Consideration

In this section, we present a brief history of the monetary policy conducted by BoJ from 2001 to 2022 and provide a survey of the existing empirical literature on the distributional effect of monetary policy. The brief history description would be worthwhile since BoJ has been the forerunner of UMP. BoJ's UMP was not just Quantitative Easing: it evolved to be followed by the control of the long-term interest rate, the introduction of negative interest rate, and finally, the yield curve control.

2.1. The brief history of monetary policy by BoJ as the forerunner of UMP

UMP by BoJ has several phases.[3] The first phase started in March 2001. However, it has a pre-history: the 'zero interest rate policy.' BoJ encouraged the uncollateralized overnight call rate (call rate, hereafter) to move as low as possible at the monetary policy meeting on 12 February 1999. As a result of this decision, the call rate was stably kept at virtually zero percent. BoJ

[2] As higher personal inequality rises due to the higher income distribution towards the overhead labor, which tends to have a lower propensity to consume than that of direct labor, Palley (2017) shows there is a high likelihood of a profit-led regime since it would diminish the stimulus on the consumption of increasing the wage share.

[3] The subsection depends on the announcements released by BoJ on the date of the monetary policy meeting, all of which are available in Bank of Japan (1998-2024).

officially called the policy the 'zero interest rate policy' in the announcement on 21 September 1999.

The zero-interest rate policy was terminated at the monetary policy meeting on 11 August 2000, and the call rate was raised to around 0.25%. Montgomery and Volz (2021) argued that this decision was premature. The decision was reversed, and UMP started.

【First phase: Quantitative Easing from March 2001】

On 19 March 2001, BoJ announced the new procedure for money market operation and monetary easing. The main operating target for money market operation was changed from the call rate to the outstanding balance of current accounts at BoJ, and the amount of the outstanding balance was increased to around 5 trillion yen. Moreover, it was also decided that the amount of the outright purchase of long-term government bonds increased to 400 billion yen per month.[4]

The first phase of UMP was a bold monetary policy experiment, called the Quantitative Easing (QE1). In the history of central banking, supplying sufficient liquidity beyond the required reserves was an unprecedented policy. BoJ purchased large amounts of assets from commercial banks to make them more liquid, aiming to lower interest rates on loans for businesses and households, which in turn stimulates investment, and economic growth.[5]

QE1 was lifted in March 2006. Namely, the operating target was returned from the outstanding balance of current accounts to the call rate, and the call rate remained at effectively 0 %, although it had been increased to 0.25% at the monetary policy meeting on 15 June 2006. The monetary policy by BoJ had returned to conventional for the first time in about 5 years.

【Second phase: Quantitative Easing from December 2008】

To respond to the financial turmoil caused by the global financial crisis, at the monetary policy meeting on 31 October 2008, BoJ decided to decrease the call rate to around 0.3 %, although it had been increased from 0.25 % to 0.5 % on 21 February 2007. Furthermore, it was decided to introduce the Complementary Deposit Facility at the meeting on 31 October 2008. It was a measure to pay interest on excess reserve balances to further facilitate the provision of sufficient liquidity, and a rate of 0.1 % was applied.[6] The BoJ's initial reaction to the financial crisis was conventional since the main operating target was the call rate. However, the call rate was further reduced to 0.1 % at the monetary policy meeting on 19 December 2008. It was also decided at the meeting that BoJ would add 30-year bonds, floating-rate bonds, and inflation-indexed bonds to the list of eligible JGBs since the additional measures regarding money market operation were necessary for the effect of extremely low policy interest rates to prevail in financial markets and corporate financing.

At the monetary policy meeting on 5 October 2010, BoJ decided to implement the 'Comprehensive Monetary Easing (CME)' to further enhance monetary easing. It consisted of three components:

[4] The amount of the outstanding balance was finally increased to 30–35 trillion yen at the monetary policy meeting on 20 January 2004.

[5] See also Fiebiger and Lavoie (2021) with respect to the transmission mechanism of the QE.

[6] This was initially a temporal measure. However, it was gradually extended and maintained until 'QQE + NIR' was introduced in 2016, as we will see.

1. The reduction of the call rate to virtually zero percent;
2. The clarification of the policy time horizon, under which the zero-interest rate policy would be maintained until the price stability is in sight 'on the basis of the understanding of "medium- to long-term price stability"';[7]
3. The establishment of a program on the balance sheet to purchase various financial assets, such as government securities, commercial papers, exchange-traded funds (ETFs), and Japan real estate investment trusts (J-REITs). The size of the program was initially set at 35 trillion.

We term the monetary policy conducted from December 2008 to April 2013 by BoJ 'Quantitative Easing 2 (QE2)', since BoJ unprecedentedly purchased the financial assets, such as the long-term JGBs, ETSs, and J-REITs.

【Third phase: Quantitative and Qualitative Easing from April 2013】

At the monetary policy meeting on 4 April 2013, BoJ decided to introduce the 'Quantitative and Qualitative Monetary Easing (QQE)'. This decision was made to achieve the inflation target of 2% in the consumer price index (CPI) within about 2 years. In order to do so, monetary policy entered a new phase of monetary easing in terms of both quantity and quality. Under QQE, the main operating target was changed from the call rate to the monetary base. QQE was expected to double the monetary base and the amounts outstanding of Japanese government bonds (JGB) as well as ETFs in 2 years, and more than double the average remaining maturity of JGB purchases. More specifically, it was decided:

1. The monetary base increases at an annual pace of about 60–70 trillion yen.
2. In order to encourage a further decline in interest rates across the yield curve, BoJ purchases JGBs so that their amounts outstanding increase at an annual pace of about 50 trillion yen.
3. JGBs with all maturities including 40-year bonds are made eligible for purchase, and the average remaining maturity of the JGB purchased by BoJ is extended from slightly less than three years at present to about seven years.

The third point corresponds to the 'Qualitative Easing' in that the central bank massively purchased the longer-term government bonds.

At the monetary policy meeting on 31 October 2014, the expansion of the QQE was decided. In other words, the monetary base increased at an annual pace of about 80 trillion yen, and the average remaining maturity of the JGB purchased by BoJ was extended to about 7–10 years. In addition, it was decided that the outstanding amounts of ETFs and J-REITs increased at an annual pace tripled compared with the past.

【Fourth phase: QQE + Negative Interest Rate from Jan 2016】

At the monetary policy meeting on 29 January 2016, it was decided to introduce the 'QQE with a negative interest rate (NIR).' BoJ applied a negative interest rate of minus 0.1 percent to current

[7] This can be considered to be a sort of forward guidance. In addition, 'medium- to long-term price stability' meant that the inflation rate of the CPI has a positive range of 2 % or lower. See Shirai (2013) on these points in detail.

accounts that financial institutions hold at BoJ.[8] Furthermore, it was also announced that the average maturity of the JGBs purchased by BoJ was extended to 7–12 years.[9] This decision was made to pursue monetary easing by making full use of possible measures in terms of three dimensions, combining quantity, quality, and interest rate. First, 'QQE + NIR' will lower the short end of the yield curve by slashing its deposit rate on current accounts into negative territory. Second, it will exert further downward pressure on interest rates across the entire yield curve, in combination with large-scale purchases of JGBs.

【Fifth phase: QQE + Yield Curve Control from Sept 2016】

The new framework for strengthening monetary easing was decided at the monetary policy meeting on 21 September 2016: the introduction of the 'QQE with yield curve control (YCC).' The new framework consisted of two major components:

1. BoJ controls short-term and long-term interest rates (yield curve control);
2. BoJ commits itself to expanding the monetary base until the inflation rate of CPI exceeds the price stability target of 2 percent and stays above the target in a stable manner (inflation-overshooting commitment).

Under the framework, BoJ initiated to target the yield on 10-year JGB at 'around zero percent.' Although the inflation target of 2 %, announced in April 2013, should have been achieved until 2015 at the latest, it could not be achieved in 2016. The inflation-overshooting commitment was set to raise the inflation expectations.

At the monetary policy meeting on 31 July 2018, it was decided that the commitment to achieving the price stability target is strengthened by the explicit introduction of the forward guidance for policy rates. The forward guidance implies that BoJ will intend to maintain the current extremely low levels of short- and long-term interest rates for an extended period of time. No change in YCC was made.[10]

To enhance monetary easing in light of the impact of the outbreak of COVID-19, on 16 March 2020, BoJ decided to massively purchase JGBs, ETFs, and J-REITs and establish the special program to support financing, while YCC is maintained.[11] On 24 April 2020, it was announced that an upper limit of the amount of BoJ's purchase of JGBs was removed (80 trillion yen at the past) to control the long-term interest rate.

[8] Following some central banks that introduced a multiple-tier system (e.g., the Swiss national bank), on 29 January 2016, BoJ decided to adopt a three-tier system of the outstanding balance of current accounts that each financial institution held at BoJ, to each of which a positive interest rate, a zero-interest rate, or a negative interest rate was applied, respectively. Regarding the details. The negative interest rate was applied primarily to new excess reserves each bank hold (Montgomery and Volz 2021).

[9] Precisely speaking, this extension had been decided at the monetary policy meeting on 28 December 2015.

[10] At the monetary policy meeting on 25 April 2019, the commitment was clarified that the current extremely low levels of short- and long-term interest rates will be maintained, at least through around spring 2020. At the monetary policy meeting on 31 October 2019, new forward guidance was decided that BoJ expected short- and long-term interest rates to remain at the present or *lower* levels if necessary.

[11] The special program to support financing was extended to the end of March 2022 at the monetary policy meeting on 18 June 2021.

【Sixth Phase: Further Effective and Sustainable Monetary Easing from March 2021】
It was decided at the monetary policy meeting on 19 March 2021 that while YCC was maintained the fluctuation of the 10-year JGB yield within ± 0.25 % was allowed. It was the BoJ's policy stance to enhance further effective and sustainable monetary easing. It would be decided, partially because there had been an increasing number of business days when no bids were submitted in the 10-year JGB market.

At the monetary policy meeting on 20 December 2022, the conduct of YCC was modified to improve market functioning and encourage a smoother formation of the entire yield curve, while maintaining accommodative financial conditions. In other words, the range of fluctuation of 10-year JGB yield was expanded to ± 0.5 %.

2.2. Related literatures

The effect of monetary policy is one of the important subjects in macroeconomics. The consensus among economists is that monetary policy stabilizes the fluctuations in output, investment, prices, interest rates, and employment. Mainstream economists, except Romer and Romer (1999), had paid little attention to the distributional effect of monetary policy in the 20th Century. Meanwhile, post-Keynesian economists traditionally focused on the distributional effect, as Lavoie and Seccareccia (1988, 1999) and Rochon (2022) argued.

Although BoJ's initial reaction was conventional, the global financial crisis in 2008 had many central banks implement UMP promptly. The research on the effects of UMP on macroeconomic stability became popular. For example, Meinusch and Tillmann (2016) showed by using the US 2007–2013 data that UMP (the QE shock) led to a fall in interest rates, an increase in stock prices, and a rise in real economic activity and inflation. Gambacorta et al. (2014) demonstrated by using 2008–2011 data from several developed countries that UMP (an exogenous increase in central bank balance sheet at the zero lower bound) led to a temporal rise in economic activity and consumer prices. As Dell' Ariccia et al. (2018) confirmed, most studies on the macroeconomic effects of UMP indicated that UMP generally had stabilization effects on financial markets, prices, and real GDP growth. Hanisch (2017) investigated the effectiveness of the monetary policy from 1985 to 2014 implemented by BoJ by using a structural dynamic factor model and showed that an expansionary monetary policy shock significantly increased real and nominal economic activity. Moreover, he argued that the effectiveness differed depending on the policy instrument.

On the other hand, there has been a growing number of debates regarding the rise in inequality of distribution of income/wealth, since Piketty's (2014) influential book *Capital in the Twenty-First Century*. Some academic research revealed that inequality could destabilize growth (Berg et al., 2014; Rajan, 2010) and increase the occurrence of financial crises (Bordo and Meissner, 2012; van Treeck, 2014). Thus, the attention to the relationship between economic inequality and monetary policy has been growing recently in the economic profession. Furthermore, central bankers also began to mention the distributional effect of monetary policy. For example, Kuroda (2017, p. 19), who was the Governor of BoJ, said that monetary policy is not a policy tool for distributional purposes, but he subsequently stated, 'this does not mean that central banks are allowed to ignore the distributional effects of monetary policy, especially if the distributional effects have an effect on aggregate impact.'

The transmission mechanism of UMP to income distribution is twofold (e.g., Bonifacio et al., 2021). One is the *income composition* channel. As is pointed out in Section 1, UMP increases

asset prices and capital income (or capital gain), which is in general beneficial to households with higher income. Through this channel, income would be unequally distributed among households. The other channel is the *earnings distribution* channel. UMP stimulates economic activity, which leads to creating more employment and higher wages, which is in general beneficial to households with lower income. This channel would reduce income inequality. Which effect is greater affects the personal income distribution.

Mainstream empirical studies on the distributional effect of monetary policy have been actively published. For the US empirical research, for example, Coibion et al. (2017), Davtyan (2017, 2023), and Doepke et al. (2019) analyzed the impact of monetary policy on income inequality. The UK empirical research is given by Ballabriga and Davtyan (2022), Bunn et al. (2018), and Mumtaz and Theophilopoulou (2017). Casiraghi et al. (2018) analyzed the distributional effect of monetary policy in Italy. Guerello (2018), Lenza and Slacalek (2018), Rupprecht (2020), Creel and El Herradi (2022), and Samarina and Nguyen (2024) analyzed the distributional effect of monetary policy conducted by the European Central Bank in the selected countries of the Euro area. El Herradi and Leroy (2021) analyzed the effect in the 12 OECD countries and Furceri et al. (2018) examined the distributional effect in the case of 32 developed and developing countries. Hafemann et al. (2018) investigated the effect in the case of six developed countries. O'Farrell and Rawdanowicz (2017) analyzed the effect of the portfolio channel in Europe and North America in the 2010s.[12]

The sample in some of the above works includes the periods during which conventional monetary policy was conducted. As Colciago et al. (2019) and Kappes (2023) argued, the distributional effect of monetary policy, irrespective of whether it is conventional or unconventional, yields mixed results. This is because the empirical result depends on various conditions.[13] However, Kappes (2022, 2023) concluded that an expansionary (contractionary, resp.) conventional monetary policy tended to decrease (increase) income inequality, and the effect of UMP was country-specific: it reduced inequality in Europe and increased in Japan.

Post-Keynesian economists also examine the distributional effect of monetary policy. One of the characteristics of the post-Keynesian studies is to analyze income distribution from the *normative* point of view by using PI. PI, whose conceptual explanation is closely made in the next section, is the index to see whether lenders receive from borrowers a greater purchasing power compared with the lenders' contribution in terms of labor when the lenders receive the repayment. If the lenders receive the greater purchasing power, the income distribution turns out

[12] Some works, such as Coibion et al. (2017) and Mumtaz and Theophilopulou (2017), measured inequality in terms of consumption out of income. McKay and Wolf (2023) also argued the distributional effect of monetary policy in terms of consumption across different groups of households. This measure may ignore the increase in higher consumers due to higher inequality. Setterfield et al. (2016) showed that in Anglo-Saxon countries such as the US and UK, low-income households are taking higher loans (indebtedness), which contributes to the debt-led growth in the US; regardless of the income level, the debt-led consumption increases economic instability, which led the financial crisis.

[13] One of the examples of the conditions is the measure of UMP; some works (e.g., Lenza and Slacalek, 2018) used the quantitative easing or asset purchase program, while others (e.g., Saiki and Frost, 2014, 2020) used the monetary base or the size of the central bank's balance sheet. Second, although the Gini coefficient is often used to measure inequality, the empirical result may change depending on whether the coefficient is derived from gross or net income. Moreover, El Herradi and Leroy (2021) used the top 1% income share and Taghizadeh-Hesary et al. (2018) used the ratio between the incomes of the top decile and the lowest decile in measuring the inequality. Third, what kind of econometric technique is used also affects the result, although the vector autoregression or its variants is one of the representative techniques used to analyze the distributional effect of monetary policy.

to be unfair. Post-Keynesian economists have analyzed the fairness of income distribution using PI.

Lavoie and Seccareccia (1988) is the earlier work applying PI to the empirical study of income distribution. They analyzed the tendency of the movement of PI and the business cycle in Canada. Seccareccia and Lavoie (2016) used PI to analyze the income distribution in the US and Canada from 1926 to 2013 and found that the relations of the movement of PI with the growth rate and unemployment rate observed in the US were similar to those in Canada. Seccareccia (2019) analyzed the movement of PI of the selected G7 countries from 1971 to 2017 and demonstrated that the income was distributed in favor of rentiers from the end of the 1970s to 2008, which was called the era of rentier tranquility. Furthermore, it was argued that the average unemployment rate was relatively kept higher in the era. Lavoie and Sccareccia (2019) and Kappes et al. (2023) also examined the income distribution in Canada and the US, respectively, using PI. Levy-Orlik and Bustamante (2023) utilized PI for several Latin American countries from 1950 to 2018 and found the inverse relation between the change in the real interest rate and the real wage growth for the period 1980–2018 although such a relation was not observed from 1950 to 1980. Seccareccia and Matamoros (2023) analyzed the income distribution of several developed countries by using PI and demonstrated that the rentier losses during the post-global financial crisis decade were primarily reflected in the increased profits of business corporations. In general, post-Keynesian analyses tend to lead to the result that the net income transfer in favor of rentiers is associated with a negative macroeconomic performance.

Finally, the effect of the monetary policy conducted by BoJ deserves particular attention since it occupies a special position among those conducted by other central banks, as already mentioned in the previous subsection. Moreover, there has been a notable shift in income and wealth distribution in Japan in recent decades. During the period of high economic growth in the 1980s, the inequality in Japan was insignificant as it was the lowest level of inequality among G7 countries. Nonetheless, the recent statistic shows that the poverty rate in Japan is the 7th highest among the OECD countries, and it has become the highest among G7 (Komiya and Kihara, 2021).

Saiki and Frost (2014) is the early work on the effect of BoJ's UMP and argued that UMP from 2008 to 2014 conducted by BoJ widened inequality, mainly via the financial market channel. Saiki and Frost (2020) also analyzed the distributional effect of UMP by BoJ, with the sample periods extended from 2007 to 2017, and derived the same conclusion. Both used the VAR model. By using the local projections method, Inui et al. (2017) analyzed the distributional effect of the monetary policy conducted by BoJ from 1981 to 2008. They demonstrated that the monetary expansion shock had a statistically significant impact on inequality across Japanese households in a stable manner. By using the VAR model, Taghizadeh-Hesary et al. (2018) analyzed the distributional effect of UMP by BoJ from 2002 to 2017 and showed that the monetary policy increased inequality via the financial market channel. Taghizadeh-Hesary et al. (2022) also examined the distributional effect of UMP by BoJ from 2000 to 2018 by using the autoregressive distribution lag model and derived similar conclusions to Taghizadeh-Hesary et al. (2018). By using the local projections method, Israel et al. (2023) examined the distributional effect of UMP from 2007 to 2021 conducted by BoJ and demonstrated that both conventional and unconventional monetary policy increased income inequality, mainly via the financial

market channel.[14] Irrespective of the measure of inequality and the econometric method, many studies pointed out that UMP tended to increase income inequality in Japan.

All the above-mentioned studies regarding the Japanese economy are positive analyses. To the best of our knowledge, our study is the first one to *normatively* analyze the distributional effect of UMP implemented by BoJ using PI.

3. Theoretical understanding of the Pasinetti Index

This section presents the theoretical foundation of this study. First, we review Pasinetti's (1981, 1993) *natural* rate of interest and define the Pasinetti Index.

3.1 The *natural* or *fair* rate of interest

The Pasinetti Index is based on his *natural* rate of interest, which Lavoie and Seccareccia (1999, 2019) called the *fair* rate of interest to emphasize its normative property. The *natural* or *fair* rate of interest is derived from Pasinetti's (1981, 1993) structural economic dynamics.

Pasinetti's (1981, 1993) analyzed the economic system in which each sector has a specific growth rate of productivity and final demand. The sectoral proportions of outputs, prices, and employment are ever-evolving, and thus the balanced growth path does not exist in Pasinetti's (1981, 1993) structural economic dynamics.[15] The *natural* economic system defines the macroeconomic equilibrium with ever-lasting structural changes and full employment of capital and employment.

The sectoral differences in the labor productivity imply the emergence of interest. First, let us consider the property of the natural rate of interest in the simplest case: a pure labor economy explored by Pasinetti (1993). Although the possibility of saving does not exist in the overall economic system, it is open to single individuals. An individual can save by postponing consumption (lending consumption goods) and dissave by forwarding consumption (borrowing them), even though overall saving is impossible. Those who save are lenders, and those who dissave are borrowers.

Suppose that the economic system has m commodities, which are indexed in the order as follows:

$$\rho_1 > \rho_2 > \cdots > \rho_m,$$

where ρ_j denotes the growth rate of labor productivity of commodity j. The rate of interest logically consistent with the pure labor economy is a zero rate of interest in terms of labor. It means that the amount of purchasing power that the lender receives is exactly equal to the amount that was lent. The *natural* or *fair* rate of interest is defined as follows:

Definition: The *natural* or *fair* rate of interest (Pasinetti, 1993, p. 97)
The *natural* or *fair* rate of interest is "the rate of interest which realized through time a distribution of income among the participants to the production process, which is proportional to the physical quantities of labour they have contributed".

[14] Israel and Latsos (2020) argued that the expansionary monetary policy from 2003 to 2014 implemented by BoJ increased labor income inequality. In addition, they showed that the expansionary monetary policy increased the educational pay gap but diminished the gender pay gap.

[15] This is a striking difference between Pasinetti's and the mainstream analysis of structural change. See Kurose (2021) concerning this point.

We note that the amount of labor embodied in the same unit of a commodity is decreasing over time because of the growth of labor productivity. This implies that the interest necessarily emerges to keep the purchasing power in terms of labor unchanged, even though an actual rate of interest is zero. The zero rate of interest in terms of labor is a normative criterion of the *fair* distribution of income in the pure labor economy, since all contributions to benefits from the production process are regulated based on the amount of labor in the economy (Pasinetti, 1981, p. 166). Therefore, Pasinetti's *natural* rate of interest has a normative character.

The numeraire must be set to make a financial contract. Pasinetti (1993, pp. 60–63) indicated that the price equations have *two degrees of freedom* in a dynamic model: the absolute value of the numeraire at the initial point of time and its rate of change over time. Letting the evolutions of the labor coefficient of commodity j and the wage rate be $l_j(t) = l_j(0)e^{-\rho_j t}$ and $w(t) = w(0)e^{\mu_w t}$ respectively, the price equations are generally expressed as follows:

$$p_j(t) = l_j(t)w(t) = l_j(0)e^{-\rho_j t}w(0)e^{\mu_w t} = l_j(0)w(0)e^{(\mu_w - \rho_j)t}, \quad (1)$$

where $p_j(t)$ denotes the price of commodity $j = 1, \cdots, m$.

Since the labor productivity is assumed to grow, the amount of labor embodied in one unit of a commodity is decreasing at rate of its growth rate of labor productivity over time. It implies that the interest must emerge to keep the purchasing power in terms of labor unchanged. Therefore, the own rate of interest is ρ_1 in terms of commodity 1, ρ_2 in terms of commodity 2, … and ρ_m in terms of commodity m, following the above definition. These are the *natural* or *fair* structure of the rates of interest (Pasinetti, 1993, p. 88).

We must consider the numeraire that stipulates all credits and debts and represents the *natural* or *fair* structure of the rates of interest. Choosing the wage rate as the numeraire is equivalent to assuming $\mu_w = 0$ in (1). From its definition, the *natural* or *fair* rate of interest in this case, denoted by i_w^*, is given by:

$$i_w^* = \mu_w = 0. \quad (2)$$

If the specific commodity, say h, is chosen as the numeraire, $p_h(t) = 1$ holds over time. From (1), it implies that $p_h(t) = l_h(0)w(0)e^{(\mu_w - \rho_h)t} = 1$, which mean that $\mu_w = \rho_h$ holds over time. In other words, choosing commodity h as the numeraire is equivalent to assuming that the wage rate grows at rate of ρ_h. Therefore, the *natural* or *fair* rate of interest in this case, denoted by i_h^*, is given by:

$$i_h^* = \mu_w = \rho_h. \quad (3)$$

If the standard dynamic commodity is chosen as the numeraire, $p_D(t) = \sum_{i=1}^{m} p_i(t)\alpha_i^*(t) = 1$ holds, where $p_D(t), \alpha_i^*(t)$ denote the price of the dynamic standard commodity and the weight of commodity i in the commodity basket constituting the standard dynamic commodity at period t, respectively.[16] By the same token, this case is equivalent to assuming that $\mu_w = \rho^*$, where ρ^*

[16] Based on Sraffa's (1960) standard commodity, Pasinetti (1993, pp. 70–72) invented a special composite commodity, called the dynamic standard commodity. Its property is that the labor productivity grows at the weighted average growth rate of labor productivities of all commodities. Thus, the labor productivities of the half of commodities grow faster and the labor productivities of the other half grow slower than the labor productivity of the dynamic standard commodity. It means that the dynamic standard commodity can be the numeraire that keeps the general price level constant over time. In other words, the dynamic standard commodity serves as the Ricardian invariable measure of value in that the value is invariant to technical progress, leaving aside the possibility of a

is the weighted average growth rate of labor productivities of all commodities (i.e., the growth rate of labor productivity of the dynamic standard commodity). Therefore, the *natural* or *fair* rate of interest in this case, denoted by i_D^*, is given by:

$$i_D^* = \mu_w = \rho^*. \quad (4)$$

Note that (2) – (4) are the equivalent expressions in terms of labor.

In any case, the *natural* or *fair* rate of interest, denoted by i^*, is expressed by:

$$i^* = \mu_w. \quad (5)$$

This is the most general and the simplest expression of the *natural* or *fair* rate of interest independent of the choice of the numeraire.

Furthermore, Pasinetti (1981, pp. 171–173) considered the case in which production needs not only labor but also physical capital goods as its inputs. The *natural* economic system in Pasinetti (1981) defines a specific equilibrium with structural changes. In the system, each vertically integrated sector receives the amount of profits just equal to the amount of its equilibrium investments since the *natural* rates of profit are valid. Thus, no production agent needs to borrow or lend in the *natural* economic system, and thus total consumption is equal to total wage. As in the pure labor economy, therefore, single individuals can save by postponing consumption (lending consumption goods) and dissave by forwarding consumption (borrowing them) in Pasinetti's (1981) case. Therefore, there is no need to make an essential modification to (5) even in Pasinetti's (1981) case. In other words, the rate of interest that keeps the purchasing power unchanged in terms of labor exists irrespective of whether the economic system is the pure labor one.

We can derive the implication on income distribution from the concept of the *natural* or *fair* rate of interest. Recall that it is defined as the rate of interest which keeps purchasing power in terms of labor unchanged through time. Therefore, if the actual rate of interest is not equal to the *natural* or *fair* rate, the income is redistributed through time among debtors and creditors. More precisely, if the actual rate of interest is higher than the *natural* or *fair* rate, the income is redistributed from debtors to creditors. In this case, the creditors receive a purchasing power greater than that justified by the amount of labor that the creditors contributed.[17] Moreover, the debtors are deprived of a part of the purchasing power originally obtained by the amount of labor that the debtors contributed. The deprivation by the creditors can be regarded as "exploitation" (Pasinetti, 1993, pp. 98–99).

3.2 The Pasinetti index

In order to analyze the effects of monetary policy on income distribution, the post-Keynesian economists invented the *PI* using the implication on income distribution derived from the *natural* or *fair* rate of interest. It is the index to see whether income distribution is fair in terms of labor contribution to production processes.

In fact, it is difficult to directly apply Pasinetti's *natural* or *fair* rate of interest to analysis of the real economy. This is because the concept is based on the specific macroeconomic

change in factor income distribution. See Kurose and Yoshihara (2019) on the generalization of the Ricardian invariable measure of value.

[17] The purchasing power that the creditors receive in this case shall be called 'usury', not 'interest'. See Pasinetti (1993, p. 93) concerning this respect.

equilibrium, as is argued in Subsection 3.1. The functional income distribution changes through time. Therefore, we need the approximate methods to apply it to empirical research, as Lavoie and Seccareccia (2019) examined.

Lavoie and Seccareccia (1988, 2019), Seccareccia (2019), and Seccareccia and Lavoie (2016) defined the *PI* in the real terms as follows:

$$PI \equiv i_M - \sigma_M - \lambda, \quad (6)$$

where i_M, σ_M, λ denote the nominal rate of interest, the inflation rate, and the average growth rate of labor productivity, respectively. The *PI* is defined as the real rate of interest minus the average growth rate of labor productivity. If $i_M - \sigma_M > (<, \text{resp.})\ \lambda$, then income distribution is changing in favor of creditors (debtors).

In contrast, we define the *PI* in the real terms, denoted by PI_w, as follows:

$$PI_w \equiv i_M - \sigma_M - \sigma_w, \quad (7)$$

where σ_w denotes the growth rate of real wage. In other words, the PI_w is the real rate of interest minus the growth rate of the real wage. [18] If $i_M - \sigma_M > (<, \text{resp.})\ \sigma_w$, then income distribution is changing in favor of creditors (debtors). We choose the version with the growth of real wage instead of growth of labor productivity because PI_w would allow us to connect the issue of the recent rise in inequality in Japan during the unconventional monetary policy with the fact that there is a trend of increasing income inequality shown in the higher Gini coefficient, as Figure 1 indicates. Figure 2 shows that there has been an increase in the share of households with no financial assets since 2007 around the beginning of the second phase of UMP. Furthermore, Figure 3 shows that increasing debt to personal income has been noticeable for all *wage-earning* households compared with all households.

Insert Figures 1, 2, and 3 here.

Since those wage-earning households are likely to earn their income solely from wage, PI_w is suited to focus on the circumstance of such households, who can be categorized as debtors who repay to rentiers. In other words, the adoption of the PI_w gives us the possibility to focus on the state of lower-income households; thus, we use the PI_w as the proxy of the personal income distribution.

Insert Figure 4 here

Figure 4 shows the time series trend of the movements of the PI_w, the capacity utilization, and wage share from the second period of UMP. The PI_w during the period of 2008-2022 is located in the positive range except during the time of global financial crisis and the recent COVID-19 crisis when the government transfer might have allowed the higher wage growth. It implies that the UMP might lead to a massive transfer of income away from low-income workers and in favor of rentiers. Figure 4 also indicates the trend that the wage share has been declining during the period of UMP except for the global financial crisis and the COVID-19 crisis.

[18] Lavoie and Seccareccia (2019) used the "adjusted *PI*", defined as the real rate of interest minus the growth rate of real wage (the proxy of the growth rate of all-industry real total labor compensation), as well as the *PI*. They compared the former with the latter and showed that the two series had remarkably similar patterns from 1970 to 2017 in Canada.

Furthermore, we can observe the interesting trend of the capital utilization (the proxy of aggregate demand), which would decrease when the PI_w is in the positive range, meaning that the monetary policy would be favoring the rentiers. The possibility to analyze the relationship among the changes in personal income distribution, capital utilization, and aggregate demand is the advantage of the adoption of the PI_w.

In the next section, we conduct an econometric analysis with a standard VAR model methodology using the PI_w as proxy of change in personal income distribution to confirm this phenomenon. The main variables we use for this study are the PI_w, income distribution (wage share), and aggregate demand (capacity utilization rate) to see if they are connected, and the data we used is quarterly data from 2008 to 2022.

4. Data and Empirical Strategy

In this section, we explain the data source and present our econometric model.

4.1 Data

The data periods that we use in our model are the quarterly time series data from Q1 2008 through Q1 2022 (see the time series trend of the main variables in Figure 4). Recall that the main variables that we use in the empirical analyses are the following:

- Pasinetti Index: $PI_W = i_M - \sigma_M - \sigma_w$ where;
  i_M as the long-term interest rate for ten years government bond,[19]
  σ_M as the inflation rate, and
  σ_w as real wage growth.
- Capacity Utilization: CAP
- Wage Share: OMEGA

The QE2 started in 2008, and the time frame would include the BoJ's CME which started in December 2010 and its even larger-scale QQE which began in Q2 2013. Thus, our empirical analysis covers both CME and QQE. This allows us to conduct our study, which uses the PI_w as the proxy of personal income distribution in our study parallel to the study conducted by Saiki and Frost (2014; 2020) and Israel et al. (2023), which employ personal income ratio and Gini coefficient as a measurement of the personal income distribution.[20] As we use PI_w, our study implements the normative rule of monetary policy to see how the current long-term government bond rate targeted by the BoJ is fair for the wage earners in debt repayment and might allow income for moving towards the rentiers. While PI_w can be applied for any monetary policy evaluation, we use the data set specifically since the second phase of UMP to evaluate the trend of income distribution associated with such monetary policy.

[19] The appropriate choice of interest rate is also discussed by Lavoie and Seccareccia (2019). Despite the fact that mortgage loans are the appropriate target of a fair rate of interest when we think about the income distribution that arises from the debt/credit relation from workers (wage earners) to lenders (rentiers); however, it comes with some risk premier. Thus, we chose the 10-year government bonds rate as Lavoie and Seccareccia (2019) suggest being royal to the notion of Keynes' 'classical rentier asset'.

[20] Saiki and Frost (2014; 2020) used the data from Q4 2008 to Q1 2014 and from Q4 2010 to Q2 2018 while Israel et al. (2023) used the data from Q1 2007 to Q2 2021.

The definitions of the following variables and the manner in which they have been estimated are given:[21]

- The capacity utilization (CAP) is the output gap (GAP) as a percentage of potential output, and the source of the data is from BoJ.
- The wage share (OMEGA) is constructed by dividing the compensation of employees by the national income from National Account. The data was downloaded from the Economic and Social Research Institute website, and the data source is from the Cabinet Office of the Government of Japan.
- The Pasinetti index with real wage growth rate (PI_w) is composed of the following three variables: i_M as nominal interest rate; σ_M as the inflation rate, and σ_w as real wage growth (see eq. 4).
  - For the i_M, we use the data constructed by the Japanese Ministry of Finance for 10-Year Government Bond Yields.
  - For σ_M we downloaded the consumption price index (CPI) data from the Cabinet Office, Japanese Statistics Bureau.
  - For σ_w we use the data of real wage indices growth from the Japanese Ministry of Health, Labour, and Welfare. The data is originally downloadable as quarterly time series data, and thus we haven't modified other frequent data into quarterly. This data is for all types of industries; the size of the establishment is more than 30 employees. Also, this data does not contain the bonus.

4.2 VAR Model

To examine how income flow towards rentier would affect income distribution in terms of wage share and the growth and demand in an empirical manner, we use a VAR model. The main premise of the VAR model is its ability to provide a coherent and credible approach to data description, forecasting, structural inference, and policy analysis.[22] The VAR model has been used widely in the post-Keynesian literature, most notably to empirically investigate the relation between effective demand, income distribution, and unemployment for the USA, UK, and France (Stockhammer and Onaran, 2004). Also, the long debate of post-Keynesian literature regarding the wage-led or profit-led growth regime is empirically investigated by Barbosa-Filho and Taylor (2006) with the VAR model. Recently, the debt-led and debt-burdened demand analysis are investigated with VAR model for the case of Germany and the U.S. by Hein and Schoder (2011) and Japan by Nishi (2012).

For our study we conduct three variable VAR model:

3-variable VAR model:

$$\boldsymbol{y_t = \alpha + \sum_{j=1}^{p} \phi_j y_{t-j} + e_t}$$

[21] The Pasinetti Index and the choice of real wage growth instead of labor productivity growth can be explained by leaving the assumption that the profit rate and the capital-to-output ratio (inverse of the capacity utilization rate in a simplistic manner) are constants; we do not assume a condition of Harrod's neutral technical progress. This is the reason why Lavoie and Seccareccia (2019, p. 98) emphasize the alternative way to compute the Pasinetti index which does not rely on labor productivity growth.

[22] See the detail of VAR model in the paper: Stock and Watson (2001)

The VAR model above shows autoregressive, which means that the presence of the lagged values of the dependent variable on the right-hand side of the equation. In our model, we first specify the following order: the Pasinetti Index (PI_w), capacity utilization (CAP), wage share (OMEGA). $\boldsymbol{y_t} = [PI_t^w, CAP_t\ OMEGA_t]'$ represents a column vector (3×1). $\boldsymbol{\phi_j}$ is the coefficient matrix for lagged explanation variables. The parameter $\boldsymbol{\alpha} = [\alpha_1, \alpha_2, \alpha_3]'$ is a constant vector. The dash mark represents transposition of the vector. The parameters, $\boldsymbol{e_t}$ is an error vector for which we suppose that the variance-covariance matrix is constant, the mean is zero, and there is no serial correlation.

In the baseline model, we use Cholesky decomposition, which allows the decomposition of residuals in a triangular fashion in VAR (or the so-called recursive system, i.e.), and the order of the variables must be set based on the degree of exogeneity. Regarding the decision of the ordering of the variables, the Granger causality test described below posits that capacity utilization would precede wage share, and capacity utilization would precede wage share. Thus, it is not possible to determine the order uniquely using the exogeneity test. However, the focus is the PI_w shock to the rest of the variables, and we set the PI_w as the most exogenous variable. Then the result of the Granger causality test shows that the movement of capacity utilization can be predicted by the PI_w but the same result cannot be assumed when we apply the movement of wage share to see if it is affected by PI_w. Thus, regarding the order of profit share and capacity utilization, we set capacity utilization is the variable to be set the second exogenous. We set the wage share the in the third variables in the order meaning that the wage share could be affected indirectly by the Pasinetti index; PI_w affects capacity utilization, and then capacity utilization would affect functional income distribution. However, we use generalized order in the robustness check to see if the results would be the same in the impulse response function to see the consistency of the result if we change the order.

To define the lag structure of the model, we set eight quarters as the maximum length and computed Akaike (AIC) and Schwarz (SBIC) information criteria for all specifications. From the results in Table 1, we set the appropriate lag as 3.

Insert Table 1 here.

The inverse roots of the AR characteristic polynomial are used to check the stability of the VAR or stationarity. The estimated VAR is stable if all inverse roots of the characteristic AR polynomial have a modulus less than one and lie inside the unit circle. From Figure A.1 in the Appendix, all lie inside the unit circle; therefore, the VAR model is stationary.

5. Result

In this section, we show the results of Granger causality test and the impulse response. Subsequently, we derive the implications from results.

5.1 Granger causality test

First, we check the Granger-causality statistics to examine whether lagged values of one variable help to predict another variable in the VAR (3) model. Table 2 shows that when the dependent variable is capacity utilization (CAP), with a 10% significance level, we can reject the null

hypothesis that the Pasinetti index (PI_w) and wage share (OMEGA) would Granger cause the capacity utilization. When the dependent variable is wage share, the p-value of the capacity utilization rate is only significant, and the p-value of the Pasinetti Index is insignificant. Capacity utilization Granger causes the wage share showing the validity of ordering the variables in the VAR model specified in the previous section. When we have the Pasinetti Index as the dependent variable, only the p-value of the wage share is significant. Higher wage share Granger causes the PI_w. Taking these results into consideration, all variables must be included in the VAR analysis.

Insert Table 2 here.

5.2 IRF and AIRF

We investigate the effect of the Pasinetti index on the capacity utilization and functional income distribution in the Japanese economy using the VAR (3) with innovation accounting. First, we conduct the Impulse Response Function (IRF) with Cholesky ordering as our baseline model estimation in order to investigate the *dynamic characteristics* among the variables but not to search the equilibrium relation among the variables. Figures 5 and 6 illustrate IRF and Accumulated Impulse Response Functions (AIRF), respectively, derived from VAR (3), showing the first 10^{th} quarter.

Insert Figures 5 and 6 here.

First, from the IRF and the AIRF we can confirm that both capacity utilization and wage share are negatively affected by the Pasinetti index from Figures 5 and 6. On the other hand, from the Granger causality test in Table 2, we could not reject the hypothesis at the 10% significance level that the Pasinetti index Granger causes the wage share despite that IRF and AIRF confirming the negative influence of the Pasinetti index on wage share. Thus, we assume that the higher Pasinetti index would only affect the capacity utilization directly. Also, the IRF and the AIRF, with regard to the distribution schedule, suggest that the wage share is positively affected by a shock in capacity utilization, which indicates some profit-squeeze outcome. At the same time, the demand schedule suggests a negative impact of the wage share on capacity utilization, which shows profit-led demand corresponding to the previous empirical results by Nishi (2012). The IRF shows the nonlinear effect of higher capacity utilization on the Pasinetti index; in the first 2 quarters and between the 8th and 10th quarters, it would affect negatively, but from the 2nd and 7th quarters, it would affect positively. The AIRF shows that during the 10th quarter, higher capacity utilization would induce a higher Pasinetti index, but from the Granger causality test (Table 2), we could not reject the hypothesis at the 10% significance level that the capacity utilization Granger causes the Pasinetti index. Thus, there is an ambiguity in the feedback effect between PI_w and capacity utilization. The increase in the wage share shows a nonlinear effect on the Pasinetti index in the IRF; from the 1st and 5th quarters, it would decrease the Pasinetti index, but from the 6th to the 10th quarter, it affected positively. The Granger causality test (Table 2) also shows that wage share Granger causes the Pasinetti index.

As a robustness check, we conduct different ordering with generalized impulse response functions. This is because impulse response analysis comes with the price: the result can depend on the ordering of variables in VAR. To make our work robust, we see how our results are sensitive to the ordering, by using a generalized AIRF (Pesaran and Shin, 1998), which does not depend on the ordering. The results with generalized AIRF (see Figure 7) show that they are

consistent to our results with Cholesky ordering (in Figure 6). With the general IRF we can confirm that capacity utilization continuously decreases after an increase of 1 standard deviation in the Pasinetti index.

Insert Figure 7 here.

With regards to the direction of the shock, our results confirm that PI_w can be the initial shock of the dynamic between the three variables. From the Granger causality test, the movement of wage share is not predictable when the PI_w is an independent variable, but only capacity utilization can be predicted by PI_w. Thus, we set capacity utilization as the more directly affected by the shock of PI_w. The capacity utilization also Granger causes wage share, and from IRF, we also observe a profit squeeze. Thus, the identification of the causal ordering is captured as below:

PI_w → Capacity utilization → Wage share

We can discuss our findings from the theoretical perspective following our empirical results. The preexisting economic growth and income distribution model, such as the neo-Goodwin pattern (utilization/wage share cycles), can be observed in our findings; there is a profit squeeze and a profit-led demand pattern. In terms of the personal income distribution (PI_w) and how it affects the dynamics of capacity utilization and wage share, there are some new findings. First, from the Granger causality test, PI_w, only Granger causes capacity utilization. The dynamic of capacity utilization and wage share is driven by higher PI_w; higher PI_w first causes lower capacity utilization. Due to the profit squeeze, lower capacity utilization can cause a lower wage share. However, the story might continue, and there are nonlinear outcomes from the interactions of the three variables. As the Granger causality test shows, the wage share Granger causes capacity utilization and also PI_w. Lower wage shares due to the profit-led demand pattern cause capacity utilization to increase, and the AIRF, IRF, and PI_w also get increased by the higher wage share. The rest of the outcome depends on the dominance of the effect of wage share on PI_w and capacity utilization. Higher PI_w can diminish capacity utilization, but the higher capacity utilization due to the lower wage share can offset the overall reduction of capacity utilization. Thus, using our empirical findings, we need to formalize the dynamic of the three variables. The PK literature on how PI affects utilization (and growth) was modeled by Rochon and Setterfield (2012); however, they do not produce endogenous cycles.

5.3 UMP and income distribution

From the policy perspective, the more the monetary policy favors the rentier, making the income distribution moving from rentiers and workers, the more it would induce lower capacity utilization, and it follows the diminishing wage share. The results shown in the previous subsection postulate a question that attempts income flow towards workers (lower income earning group) compared to the financial asset holders/rentiers (higher income groups) would have been more effective in order to restore the effective demand and economic growth. As workers spend a more significant proportion of their income than wealthier ones, a policy that redistributes toward workers may encourage greater growth. In this sense, a permanent policy of low-nominal and even zero interest rates under the UMP has been, in fact, by the BoJ might have accelerated economic downturn despite zero interest rates QE was intended to induce the

demand and restore the growth stability. There is always a percussion of monetary policy that causes some distributional change when the monetary policy deviates from the normative position. Our result could also contribute an additional story in Japan's unconventional monetary policy age and higher income inequality. Higher inequality in comparison to rentiers and workers also contributes to the sluggish effective demand growth, higher income inequality has been detrimental to the macroeconomic performance in Japan.

6. Concluding Remarks:

This paper sheds light on Pasinetti's work on a distributional aspect of interest rate, later formalized as the Pasinetti index, the normative rule of monetary policy by Lavoie and Seccareccia (2019). The Pasinetti index allows us to measure the income flow movement either towards rentiers or workers. Thus, we investigate the fairness of the monetary policy using the Pasinetti index to measure the higher income flow toward rentiers for the Japanese economy under the UMP. We conduct the VAR model to investigate whether higher income inflow towards rentiers would restrain the effective demand and wage share toward works under UMP in Japan. The stylized fact is that the country has observed higher income inequality in the last decades, and it has been revealed that UMP accelerates inequality by the asset price mechanism, widening wealth and income inequality (Israel et al., 2023). Before the UMP in the early 2000s, the basic consensus was that the analysis of Japanese income inequality was insignificant, according to Moriguchi and Saez (2008), as the top 1% of income source is primarily wage income. However, after almost 20 years, new research results show rising inequality, especially between wage earners and rentiers. 1) Our empirical result confirms that the rise of rentier income at the age of UMP affects macroeconomic demand growth negatively. 2) Higher rentier income flow also affects the wage share negatively.

Such a policy of zero-nominal interest rates must be reconsidered when it comes to the distributional aspect: the last fifteen years since the BoJ accelerated the unconventional monetary policy with even control of the rate of the long-term government bond (since 2013) have shown the fragility of our economic system when monetary policy is not accommodative to workers. In other words, monetary policy has acted as an income policy that protected rentiers. The monetary policy does not protect workers who tend to hold fewer financial assets, will not see an impact on wages, and may even be negatively impacted by lower deposit interest rate earnings on saving accounts.

Another factor affecting income distribution is the real wage growth, given that our PI uses the growth rate of real wage. As is already shown, the real wage growth has been sluggish for many of the periods our study covers. It is attributable to the sluggish nominal wage growth, which is affected by Japanese firms' behavior. One of the characteristics of Japanese firms is that they overall hold a larger amount of cash equivalent (i.e., cash and deposit). The tendency of the Japanese firms to increase the cash equivalent holding after the global financial crisis and the tendency was reinforced after the COVID-19 pandemic, as Oku et al. (2018) shows. It also reveals that many of listing Japanese firms hold cash equivalent beyond the appropriate levels, and thus they cannot increase their corporate values. The productive spending of cash could increase employment and wage, and thus contribute to the reduction of income inequality.

Lastly, it is worth noting that the post-Keynesian literature has contributed historically to the study of growth and distribution: the relationship between wage/profit share and its implication on growth. However, there needs to be more clarity regarding the functional and personal income

distribution and its implication for growth. The former has accounted for growth and distribution with macroeconomic variable data, but the latter has employed microeconomics measurement (such as wage differential and Gini coefficient). The complementarity of the two methodologies can be reconciled and strengthened by the endorsement of the Pasinetti Index methodology, which employs the income flow between wage earners and rentiers (lenders) by decomposing the traditional capitalists and workers into smaller segments.

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Appendix

Insert Figure A.1 here

Lag	0	1	2	3	4	5	6	7	8
AIC	1.80	-2.18	-2.48	2.90*	-2.73	-2.9	-2.65	-2.87	-2.67
SBIC	1.91	-1.72	-1.67	1.75*	-1.33	-1.05	-0.45	-0.32	0.23

Table 1: Information Criteria

Notes: AIC and SBIC represent Akaike information criteria and Schwartz information criteria, respectively. * denotes the minimum information values.

Dependent variable: CAP			
Excluded	Chi-sq	df	Prob.
OMEGA	19.58123	3	0.0002
PI_w	7.218963	3	0.0552
All	22.74079	6	0.0009
Dependent variable: OMEGA			
Excluded	Chi-sq	df	Prob.
CAP	11.69818	3	0.0085
PI_w	3.695604	3	0.2963
All	14.56411	6	0.0239
Dependent variable: PI_w			
Excluded	Chi-sq	df	Prob.
CAP	2.923617	3	0.4036
OMEGA	10.23378	3	0.0167
All	18.82830	6	0.0045

Table 2: Granger Causality Test

Note: chi-sq and df represent chi-square statistic and the degree of freedom, respectively.

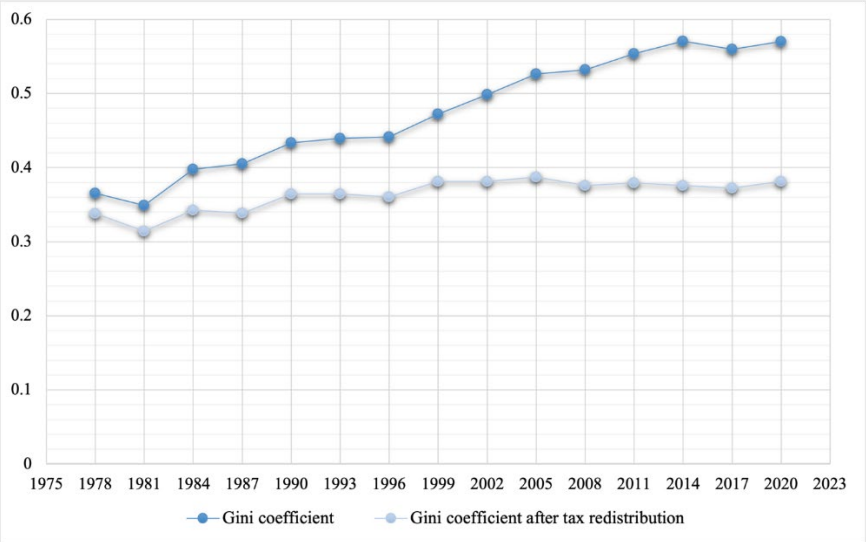

Figure 1: Gini coefficient for Japan

Data source: Japanese Ministry of Health, Labour and Welfare, Income redistribution survey (所得再分配調査)

Note: The Gini coefficient is computed using pre-tax income = (after tax) income + tax + social security fee.

The Gini coefficient after-tax redistribution is computed using after-tax and redistribution income = after-tax income – social security fee + social security benefit (such as pension, medical, etc.).

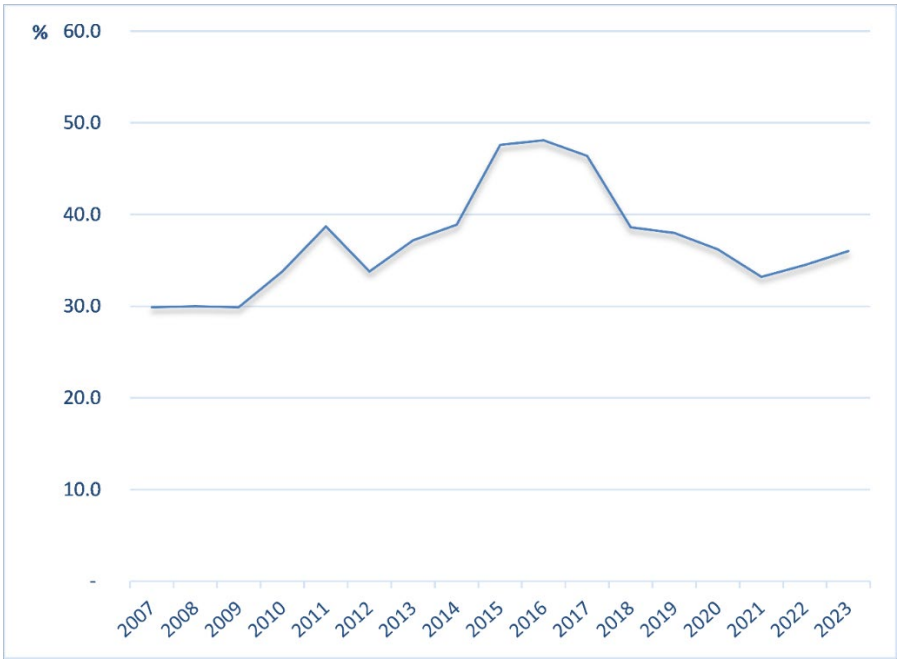

Figure 2: Share of Households with No Financial Assets from 2008 to 2022

Data source: 金融広報中央委員会

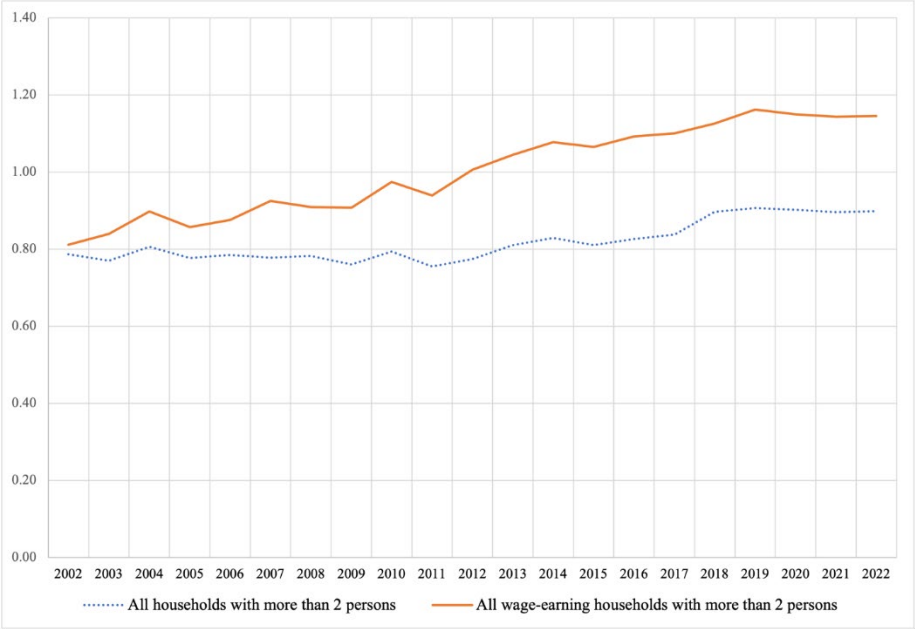

Figure 3: Household debt to personal income ratio for Japan

Data source: Statistic Bureau of Japan, Annual Household Survey Report: Savings-Debt Edition (家計調査年報: 貯蓄・負債編)

Note: All wage-earning households only include those who heard of households earning wage income. All wage-earning households are defined as the head of the household working at a company, government office, school, factory, store, etc. However, households where the head of the household is a member of the board/executive officer of a corporate organization, such as a company president, director, managing director, etc., are excluded from the definition.

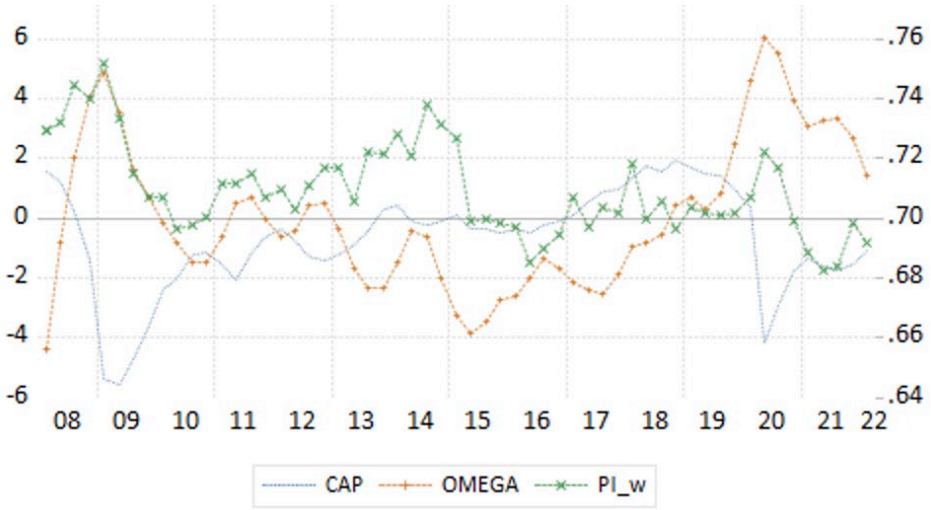

Figure 4: The capacity utilization (CAP); Wage share (OEMGA); and the Pasinetti Index (with real wage growth) using the Japanese macroeconomics data from Q1 2008 to Q1 2022 (horizontal axis).

*For the value of OMEGA, see the right-hand side axis.

*See the data description section for the source of data and details in subsection 4.1.

Figure 5: Impulse responses of VAR (3)

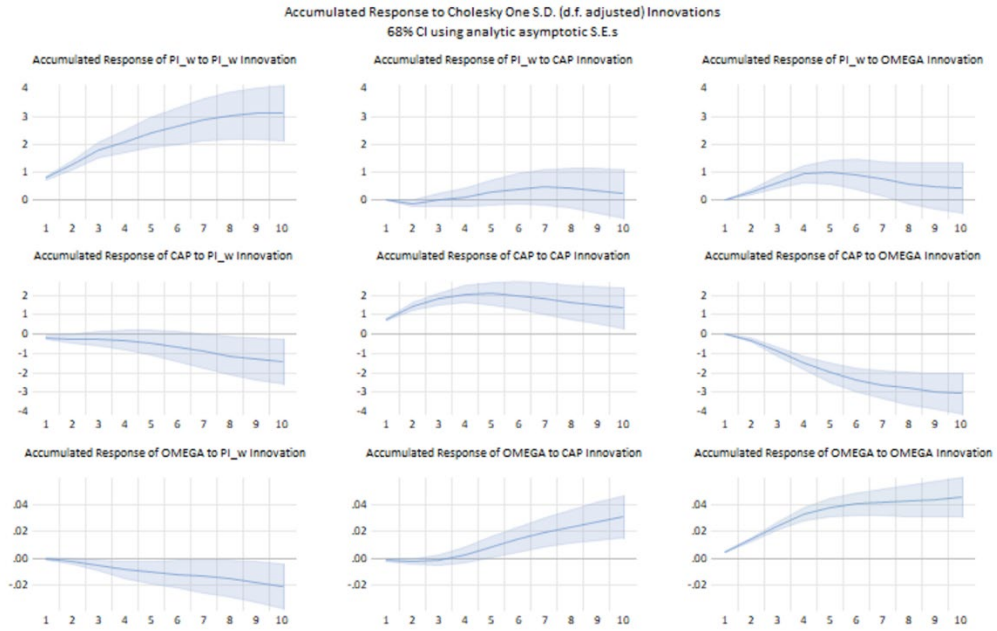

Figure 6: Accumulative impulse responses of VAR (3)

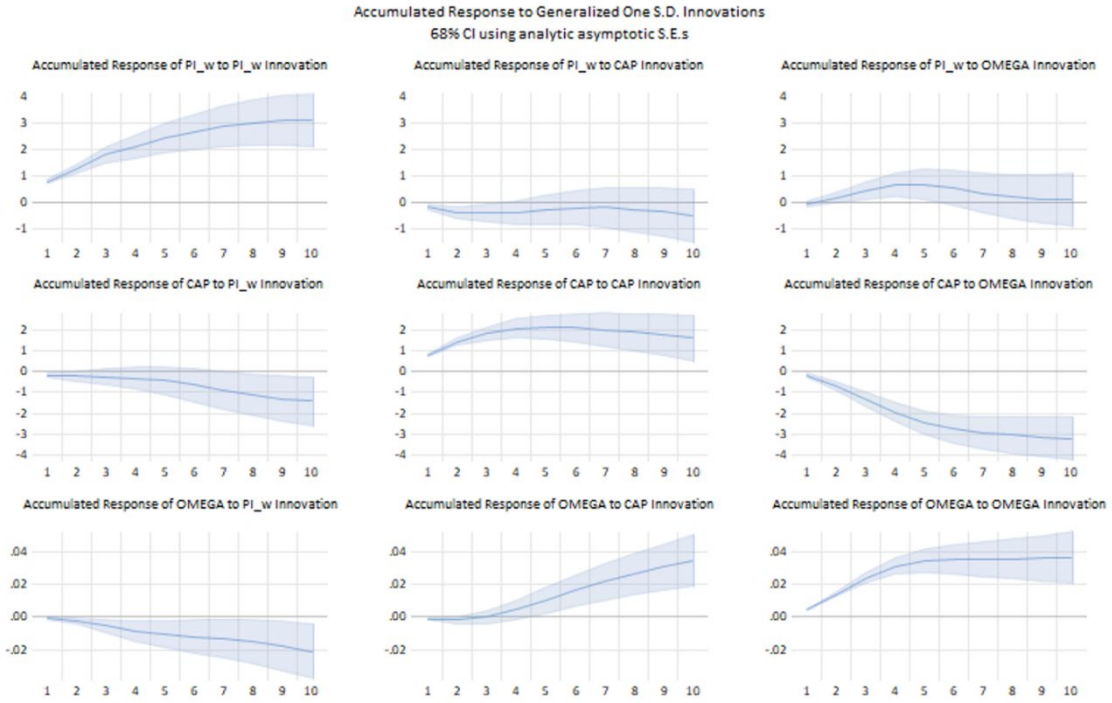

Figure 7: Accumulative generalized impulse responses of VAR (3)

Appendix

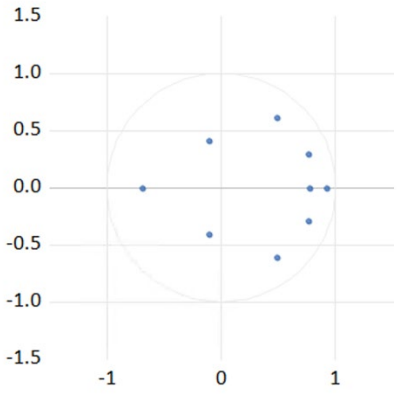

Figure A.1: The AR root graph of the baseline model, $Y_t = [PI_t^w, CAP_t, OMEGA_t]$ with 3 lags