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A non-linear analysis of the macroeconomic impact of changes in the Pasinetti Index in the US

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Abstract

Policymakers and mainstream economists expressed concerns over the distributional impacts of monetary policy after the emergence of so-called Unconventional Monetary Policies (UMP) after the subprime and Eurozone crises (2007-2009). This topic, however, is not new for Post-Keynesian authors. At least since Keynes's 'euthanasia of the rentier', this school of tought have dedicated inumerous works to this issue. In this paper, the focus is in one of these works, the "fair" interest rate developed by Luigi Pasinetti, which came to be known later as the Pasinetti Index (PI). After an incursion into the history of this idea, the paper develops an econometric analysis of the connection between the PI, the functional income distribution, and the aggregate demand for the US from 1968 to 2022 using a threshold vector autoregressive model. The results indicate that the US economy has experienced different distributive regimes associated with changes in monetary policy. The economy has moved from the stable but volatile Keynesian era toward a less volatile but uncertain period in which monetary policy is employed to protect the income and wealth of rentiers. Moreover, the work also showed that switches to rentier-biased regimes are highly detrimental to aggregate demand and functional income distribution.

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

JEL codes: B50; E12; E52.

1. Introduction

The emergence of so-called Unconventional Monetary Policies (UMP) after the subprime and Eurozone crises (2007-2009) gave rise to concerns over their distributional impact. In short, these policies consisted of massive purchases of securities by major central banks aiming at the stabilization of their market price. Since these financial assets were mainly held by high-income individuals (or by investment funds where high income individuals placed part of their wealth), this price-stabilization policy can be regarded as a wealth-policy in disguise, or a rentier-first policy. With interest rates at their lower bound for some time, and with income streams on bonds also falling, monetary policy changed from an incomes policy, to a wealth policy. As Seccareccia

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(2017, p. 342) stated, "In times of crisis, monetary policy shifted from supporting rentier income to protecting rentier wealth."

Before the financial crisis, mainstream economists concerned themselves very little with income distributive issues surrounding the conduct of monetary policy. But with such a massive asset purchase, in many ways unprecedented, attention quickly focused around the possible impacts of such a policy, and concerns over the distributional effects of UMP did not take long to appear, as one would expect.

One example of this concern comes from the United Kingdom. In their 2012 report on Budget, the Treasury Committee of the British Parliament stated that "loose monetary policy, achieved through quantitative easing and low interest rates, has redistributional effects" (Treasury Committee, 2012, p. 54). They then demanded that "the Bank of England, and particularly MPC [Monetary Policy Committee] members, improve upon their efforts to explain the benefits of the current position of monetary policy" (ibid.). In reply, the Bank presented simulations supporting the claim that unemployment would have been higher if it had not implemented UMP (Bank of England, 2012).

Many financial institutions have since then dedicated considerable research efforts to study this issue. Examples of this effort comes from the Bundesbank (2016), the Bank for International Settlements (Domanski, Scatigna, and Zabai 2016), the Bank of England (Bunn, Pugh, and Yeates, 2018), the IMF (Furceri, Loungani, and Zdzienicka 2018) and the European Central Bank (Ampudia et al. 2018; Dossche, Slačálek, and Wolswijk 2021). The words "monetary policy" and "inequality" also appear in the titles of several policy-makers speeches, such as Mersch (2014), Bullard (2014), Bernanke (2015) and Carstens (2021).

Academics have joined the financial and policy-making institutions in the effort to understand these effects. To date, there are empirical analyses for the United States, (Davtyan, 2016; Coibion et al., 2017), United Kingdom (Mumtaz and Theophilopoulou, 2017), Japan (Saiki and Frost, 2014, 2018; Taghizadeh-Hesary et al., 2018), Italy (Casiraghi et al., 2018) and the Eurozone (Ampudia et al., 2018; Lenza and Slacalek, 2018; Guerello, 2018; Samarina and Nguyen, 2019). There are also panel data exercises, such as Furceri, Loungani, and Zdzienicka (2018), with a sample of 32 advanced and developing countries, and Herradi and Leroy (2019), considering 12 advanced economies. All these studies focus on the *personal* distribution of income. Most of them concludes that contractionary monetary policy shocks lead to increases in inequality, or that expansionary shocks lead to decreases in inequality. One notable exception is Japan, to which all studies find the opposite results.

By all accounts, mainstream interest in this topic began as a result of the financial crisis, and mainly from consequences of unconventional monetary policies. The earliest papers we found on this topic was a paper by the Bank of England (2012), a speech by Coeuré (2012), Coibion et. al (2012), and Brunnermeier, and Sannikov (2012). Here, we see an emerging interest, thought limited as it were at the time.

Post-Keynesian authors, by contrast, have been discussing this issue at least since Keynes's 'euthanasia of the rentier'. More specifically, contributions from the 1980's onwards have focused on the "fair" (or "just") interest rate, an approach that came to be know later as the Pasinetti Index

(PI). The “fairness” in this setting refers to an interest rate level that keeps unaltered the income distribution between creditors and debtors over time. Empirically, this interest rate is defined as the sum of labor productivity and inflation. Some authors have developed empirical works over the PI (for example, Seccareccia and Lavoie (2016) and Seccareccia and Romero (2022)), but, so far, no econometrical works have been pursued on this topic.

In this paper, our aim is to develop such econometric analysis of the PI. More specifically, we are going to study the connection between the Pasinetti Index, income distribution, and aggregate demand. In order to do so, we use a combination of modern time series tools to detect, date, and analyze distributional regimes of the United States' monetary policy. First, we investigate the presence of structural instabilities using a methodology that provides a comprehensive treatment to jointly test for multiple changes in the unconditional variance of the errors and the parameters of the conditional mean in a linear regression model. In a second stage, using a threshold vector autoregressive model, we investigate the time-varying structure and the transition between distributive regimes of the US economy.

The paper is organized as follows. Section 2 briefly explores the Post-Keynesian view of the relationship between interest rates and income distribution, focusing on the Pasinetti Index. Section 3 opens our empirical discussion by exploring the data in an univariate context. Section 4 presents our hreshold vector autoregressive model. Finally, section 5 concludes.

2. The Fair Interest Rate and the Pasinetti Index

Keynes and the Post-Keynesians

Despite the recent surge in empirical studies from a mainstream perspective, the analysis of the distributional impacts of monetary policy is not a new topic. Post-Keynesian authors have been discussing this issue at least since Keynes’s discussion of the ‘euthanasia of the rentier’, in chapter 24 of his *General Theory*. One could even refer to Keynes’s discussion in *A Tract on Monetary Reform*, published earlier, in 1930. Joan Robinson many times referred to this issue, let alone in the *Accumulation of Capital*, but much earlier still. The following quote, from 1937, is probably the most explicit: “when capitalism is rightly understood, the rate of interest will be set to zero, and the major evils of capitalism will disappear” (see Robinson, 1937, p. 251).

The analysis was revived in the late 1980s, in a series of papers by Niggle (1989), Moore (1989), and Lavoie and Seccareccia (1988). For Niggle (1989, p. 820), “monetary policy, through its effects on interest rates, debt to income ratios, and interest income, has contributed substantially to the observed increasing inequality in the personal distribution of income in the United States since the 1960s.” Specifically, he argues that “the processes connecting monetary policy to changes in the distribution of personal income through the transmission mechanism of the level of interest rates are complex, with at least three causal sequences operating: 1) changes in interest rates can affect the functional distribution of income, and thus the personal distribution; 2) changes in interest rates change the market values of financial assets, effecting capital gains or losses; 3)

interest rates influence investment, aggregate demand, employment and income" (see 1989, pp. 818-9).

Similarly, Lavoie and Seccareccia (1988, p. 151) have claimed that "changes in the rate of interest have both a direct and indirect impact on the distribution of income between rentiers and the 'active earning class' of workers and entrepreneurs" – an argument made once more in Rochon and Seccareccia (2021; 2023).

Moore (1989, pp. 25-26) argues that while central banks may indeed practice fine-tuning, such changes of the rate of interest will have an impact on firms' mark-up. According to the author, "From the viewpoint of the post-Keynesian theory of distribution, the *functional redistributional effect of changes in interest rates centres directly on the responsiveness of the mark-up to interest rates* … [which] will presumably depend both on the magnitude and expected permanence of interest rate changes."

A few years later, Michl (1991, p. 364) argues that "interest on the national debt redistributes income regressively. The clearest and most reliable indication of this comes from the high concentration of interest paid directly to households. The top 10 percent of households by income receive over 75 percent and the top one percent receive over 40 percent of the interest paid by the Treasury to the household sector. Yet out of every dollar in interest paid by the Treasury, little over a penny arrives in the hands of the poorest 30 percent of households".

A decade later, Argitis and Pitelis (2001, p. 620) argued that:

> Durable variation in the interest rate, ceteris paribus, may affect both the intracapitalist distribution of non-wage income between industrial profits and interest and the interclass income distribution between wages and non-wage income. More specifically, our perspective assumes that an increase in the interest rate, ceteris paribus, would cause an increase in the cost of production, resulting in a transfer of non-wage income from industrial to financial capital and result in a decline of the share of industrial profits to non-wage income.

More recently, as Lavoie (2014, p. 235) argues, "the current view of post-Keynesians seems to trend towards the income-distribution approach" of monetary policy. Indeed, today, there is a resurgence of interest in this topic from a number of post-Keynesians (see *inter alia*, Kappes, 2023; Kappes, Rochon and Vallet, 2023; forthcoming symposium in the *Review of Political Economy*, see ROPE, 2023).[4]

Pasinetti's fair interest rate

One of the first analytical explorations of the relationship between interest rates and income distribution can be found in the work of Luigi Pasinetti (1980-81; 1981; 1993). According to Pasinetti (1993), there are two broad paradigms in economics. One is the Walrasian (or neoclassical) paradigm, rooted in a 'pure exchange economy' model; the other is represented by the classical economics, the Keynesian and more recently by the Post-Keynesian economics,

[4] In a forthcoming paper, Antonino Lofaro, Guillermo Rufino Matamoros Romero and Louis-Philippe Rochon explore more thoroughly the post-Keynesian and Sraffian history of the relationship between interest rates and income distribution.

which is based on a 'pure labour economy' model. It is in the latter paradigm that he develops the so-called fair (or just) interest rate. Earlier, however, Lavoie and Seccareccia (1988, p. 151) claimed that "changes in the rate of interest have both a direct and indirect impact on the distribution of income between rentiers and the 'active earning class' of workers and entrepreneurs." It is in this paper that the authors began formulating, based on Pasinetti's work, what they would later call the Pasinetti Index.

Indeed, this index, of what Pasinetti called the "fair interest rate" is the interest rate "that maintains unaltered through time all purchasing power relations in terms of labour" (Pasinetti, 1993, p. 92). The 'purchasing power relations' is a reference to the distribution of income between creditors and debtors. In the pure labour economy that he uses as a reference, the only commodity produced is a perishable consumption good. Therefore, there is no aggregate savings nor capital accumulation, since all unconsumed goods perish at end of the period. However, there is room for personal savings: a producer can consume less than his/her current production, passing the excess to another producer. Alternatively, a producer can consume more than his/her current production, by borrowing goods from a "saver" producer. For that reason, this pure labor economy can have financial assets that represent claims on a future stream of production. The question that Pasinetti (1980-81) poses to himself is: which interest rate should be charged on those financial assets, if one wants to keep the income distribution between lenders and borrowers unchanged in terms of labor time?

Supposing that it is possible to vertically integrate each industry in this economy, the average labor productivity of each industry *i* will be:

$$a_{it} = a_0 e^{\lambda_i^t} \tag{1}$$

Where λ_i^t is the exponential growth rate of labor productivity for sector i. Assuming mark-up pricing, it is possible to write each sector product's prices as

$$p_{it} = \gamma_i w (a_{it})^{-1} \tag{2}$$

Where γ is the mark-up rate and w represents wages, assumed constant across all sectors. Assuming wages as a *numéraire* (w = 1) and analyzing the above equation in growth terms, we have that prices in each sector will be falling in exact proportion to the sectoral productivity growth rates:

$$\pi_i = -\lambda_i \tag{3}$$

Where π_i is the rate of change of prices of each *i* sector. This implies that each "credit" (that is, consumption goods) advanced to each sector has an "own" rate of interest λ_i, measured in terms of labor time. This is because a credit equivalent of *x* working hours given at time *t* will represent more consumption goods at a future time, since the productivity of the same *x* working hours will have increased. Conversely, all debts of each sector *i* have an "own" interest rate, at that same level.

If a given monetary unity is used as the *numéraire*, all credits and debts should also receive as interest the inflation measured in monetary units in order to maintain its purchasing power in terms of labor time. In order to see this, let us make a final simplifying assumption, integrating the whole economy in a single sector, in which case we will have:

$$\pi = -\lambda \tag{4}$$

Where π is the inflation rate and λ is average labor productivity growth. If prices and wages were varying in terms of the monetary unit, the interest rate that would keep the income distribution between lenders' and borrower's constant in terms of labor time would be:

$$i = \lambda + \pi \tag{5}$$

If the interest rate charged on loans is higher (smaller) than that, lenders will be receiving more (less) labor time than they have lent.

A numerical example may clarify the argument. For an hourly wage of $10, a loan of $1,000 will be able to purchase 100 hours of labor time. If productivity grows by 2% and inflation measured in money prices is 3%, wages will increase to $10.50 an hour. With an interest rate of 5%, the borrower must pay back $1,050, which is equivalent to 100 hours of labor time at the new wage rate.

This fair interest rate was latter used by post-Keynesian authors both as an empirical index (the Pasinetti Index) and as a policy rule (see discussion below).

For instance, Seccareccia and Lavoie (2016, p. 210) aimed to build "a simple empirical approximation that would allow an analyst to measure in a convenient way over long historical periods the evolution of rentier income".

To do so, they used i as the long-term interest rate for ten years government bond, π as inflation rate, and λ as measured productivity growth. The index thus constructed was labelled the "Pasinetti Index", which reads as:

$$PI = i - \pi - \lambda \tag{6}$$

When it is positive (negative), income is flowing to (away from) rentiers.

The authors argue that "whenever the Pasinetti index was *becoming* positive, it would be associated with a recessionary environment" (p. 213, emphasis in original). The authors also find a positive correlation between the Pasinetti Index and the unemployment rate, and a negative correlation with GDP growth rate.

The post-Keynesian Interest Rate Rules

Nearly a decade later, in a series of papers, Rochon and Setterfield (2007, 2008, 2012; although see also Gnos and Rochon, 2007) identified two approaches within the heterodox tradition when considering monetary policy, which they labelled the activist and the parking-it approaches. Whereas the first approach was largely based on the mainstream notion of fine tuning, the second approach links monetary policy directly to income distribution. In these articles, Rochon and Setterfield develop the Pasinetti Interest Rate Rule, based on the Pasinetti Index, largely proposed as an alternative to New Keynesian Taylor Rules.

Following Lavoie (1996), the Pasinetti Rule does not see rentiers as "parasites" but rather as a "necessary evil". In terms of income distribution, from a central bank perspective, this rule leaves "unchanged the distribution of income between interest and non-interest income groups, regardless of lending and borrowing activities" (Lavoie and Seccareccia, 1999, p. 543). Accordingly, and "under these conditions, an amount of money equivalent to one hour of labor time, if lent at that normal rate of interest, will still be worth one hour of labor time when recovered with its interest payments. The purchasing power of the rentier will increase if the productivity of the overall economy has increased. The relative situation of the rentiers in the social hierarchy stays the same, whatever economic conditions" (Lavoie, 1996, p. 537).

The emphasis on income distribution, however, carries obvious and important implications for monetary *policy*. Rochon (2022) has argued that given the 'general ineffectiveness' of monetary policy in delivering an inflation target except at very high costs for society, central banks should follow the Pasinetti Rule, which is a long-run rule. As Lavoie (1996, p. 537) has argued:

> It then becomes clear that monetary policy should not so much be designed to control the level of activity, but rather to find the level of interest rates that will be proper for the economy from a distribution point of view. The aim of such a policy should be to minimize conflict over the income shares, in the hope of simultaneously keeping inflation low and activity high.

3. Time series analysis

Motivated by the previous discussion, our aim is to examine the connections at the aggregate level between the PI, the general economic activity, and income distribution. However, before we analyze the macroeconomic effects of PI, we assess the dynamics of our variables separately to provide a comprehensive analysis of the series in a univariate and multivariate framework.

Our data are three US quarterly time-series variables spanning the period 1968:Q1 to 2022:Q3: the PI, capacity utilization (CU), and labor share (LS). Capacity utilization and labor share are expressed as year-over-year growth rates. The PI was built as the real interest rate minus labor productivity year-over-year growth rate. The real interest rate is the long-term interest rate minus core inflation, and the latter is the year-over-year growth rate of personal consumption expenditures (PCE), excluding food and energy. We used data from the OECD and Federal Reserve Bank of St. Louis's FRED databases.

Since the Covid-19 pandemic, several works have proposed different approaches to deal with the extraordinary change in mean and volatility of macro data (Lensa and Primiceri, 2022). They have

shown, however, that accounting for those observations is more relevant in cases in which the aim is forecasting. Nevertheless, we do not treat those observations since forecasting is not the goal of this document and because the pandemic triggered inflation and interest rate changes that caused alterations in the PI and labor share that interest this study.

As a first data exploratory analysis, we inspect the evolution of each of the three series, PI, CU, and LS, in isolation. In particular, we test whether structural breaks are present in the series' mean and variance. Following Perron et al. (2020), we provide a comprehensive treatment of testing jointly for structural breaks in both the mean and the variance of the errors, allowing the break dates to differ or overlap partly or entirely. The algorithm proposed by Perron et al. (2020) considers a general specification of the error term, which permits accommodating non-normal and heteroscedastic errors.

We explore the existence of structural breaks in the conditional mean and the error variance using an AR(4) model of the form:

$$y_t = \mu + \sum_{j=1}^{4} \delta_j y_{t-j} + e_t, \qquad t = T_{j-1}^c + 1, \dots, T_j^c, \tag{1}$$

with m potential breaks (producing $m + 1$ regimes) in the conditional mean and n potential breaks (or $n + 1$ regimes) in the variance of the errors e_t; and where y_t *is* the variable of interest. All the potential breaks either in the mean ($T_1^c, \dots, T_m^c$) or the variance ($T_1^v, \dots, T_n^v$) are treated as unknown and can happen at different times. e_t has zero mean and variance σ_i^2 for $T_{i-1}^v + 1 \leq t \leq T_i^v$.

Perron et al. (2020) propose three groups of testing problems. The first group (the supLR) tests a simple hypothesis for a given number of changes ($m = m_a$) in the regression coefficients and ($n = n_a$) changes in the variance of the errors, where m_a and n_a are some positive numbers selected a priori. The second group (the UDmax) tests for no structural break against an unknown number of breaks, given some pre-specified maximum. The third (the supSeq) uses sequential procedures to estimate the number of changes.

Motivated by Seccareccia's (2019) work and the literature on the Great Moderation, we select $m = 3$ and $n = 2$. The selection of $n = 2$ is based on the literature on the Great Moderation that states that the US economy experienced a period of relatively stable macroeconomic activity during the last decades of the 20th century (Blanchard and Simon 2001), which seems to have come to an end after the Great Financial Recession (Stock and Watson 2017). For its part, the selection of $m = 3$ relies upon the study of Seccareccia (2019), who observes that, in general, the PI in some developed countries, the US included, exhibits four different regimes. The regimes are the Keynesian era until the 1970s, the monetarist age until the 1990s, the inflation targeting regime that ends with the Great Financial Recession, and the flexible inflation targeting regime from the Recession onwards. Thus, we consider that $m = 3$ and $n = 2$ as upper bounds for potential breaks in mean and variance capture all the possible regimes our variables might have experienced.

Table I summarizes the results for jointly testing structural breaks in the mean of the variables and variance of the errors (detailed results in the Appendix).

Table I. Number and dates of breaks in mean and variance for the three selected variables

	Breaks in mean	Breaks in variance
PI	1979Q1; 1997Q3	1985Q2; 2009Q3
LS	2012Q3	2008Q3
CU	--	1982Q3; 2014Q3

The three testing groups can be more or less informative, lack power, and are sensitive to the choice of m and n. Therefore, the break dates must be selected in compliance with the three testing groups proposed by Perron et al. (2020) and in conjunction with the data to avoid a spurious selection.

The three variables experienced breaks in their variance and mean except CU for which only breaks in the variance were detected. The breaks around the mid-1980s in the variance of PI and CU appear consistent with the overall change in macroeconomic volatility that the literature on the Great Moderation stresses. PI and CU volatility also changed with the Great Financial Recession as expected due to its profound impact. For its part, LS has experienced more recent changes in its mean and variance. Both breaks are in line with what Rochon and Seccareccia (2021) have termed the wage moderation that has started since the adoption of the inflation targeting strategy. Interestingly, relating breaks in mean and variance to historical episodes of financial and economic distress lends further confidence in the empirical approach. But more interesting it is the fact that most of these breaks are associated with the transition from the Keynesian era to the age of rentier tranquility in the early 1980s, which confirms that "Volcker Shock" seems to have constituted by far the most severe rupture for the US economy.

The first breaks for PI correspond to the onset of the Great Moderation period, which has modified not only its volatility but also its mean value. The second break in its mean heralds the end of the neoliberal expansion, while its second break invariance coincides with the Great Financial Recession. The two breaks the procedure found for PI suggest the US economy has experienced three distributive regimes: the Keynesian era (1955Q2-1979Q1), the monetarist age of rentier tranquility (1979Q2-1997Q3), and the inflation targeting regime (1997Q4-2022Q3), using Seccareccia's (2019) labels. The exercise did not find evidence of Seccareccia's fourth regime, the hybrid or "flexible" inflation targeting regime.

The Keynesian era can be classified as a period of stability but with large volatility. During this period, the economic policy concentrated on unemployment and the connection between fiscal policy and economic performance. One might argue that inflation was not a preoccupation of economic policy but until the first oil price shock of the 1970s. During the Keynesian era, the real interest rate gravitated around approximately zero percent. Still, it was characterized by significantly high variance around the mean, signifying strong discretionary policy actions of the central bank, which was not wedded to any simple type of interest rate policy rule.

The shift toward the age of rentier tranquility rooted out the Keynesian activist policy because it supposedly was a source of macroeconomic instability. The reactionary reversion to monetarism

resurrected monetary policy as the only macroeconomic policy instrument with the single objective of eliminating inflationary pressures. Without direct intervention from the government, monetary policy was expected to bring the inflation rate down to a low and foreseeable level that would protect wealth-holders from unexpected inflation and the erosion of rentier income and wealth. This new age of uncertainty was associated with the "revenge of the rentiers" (Smithin 1996), in which a set of policy responses were implemented to reverse the pattern of income redistribution of the previous Keynesian era during which the share of interest income had been declining compared to productivity growth. Since monetarism put central banks in charge of economic policy, central bankers quickly assumed the position of "third in discord" to protect the income and wealth of rentiers by controlling inflation.

That monetarism is fundamentally flawed is now a simple matter of fact. Toward the end of the 1990s, it became more evident that central banks were incapable of controlling the quantity of money in the economy by restricting its supply. The new macroeconomic consensus that emerged after monetarism acknowledged that money is endogenous, demonstrating that the market for loanable funds does not determine the interest rate. Thus, the alternative to monetarism was a monetary policy strategy that kept the same objective as monetarism in achieving low inflation but saw monetary policy as the "art" of administering the interest rate. Hence, if the central bank sets the interest rate and, therefore, the LM curve is flat, the mechanism that ensures the condition that planned investment equals saving is changes in income. Thus, the Fed maintains its "third in discord" position under the inflation targeting strategy. These administered changes in the interest rate are aimed at stabilizing the income and wealth of rentiers by inducing sufficiently high unemployment to bring down money wage growth and the inflation rate around its target.

The next section seeks to analyze how our variables have interacted across regimes.

4. A threshold vector autoregressive model

We now turn to examine the dynamic structure between our variables in a multivariate framework. Typically, vector autoregression models are the predilected tool for assessing the economic impact of shocks. Nonetheless, as the univariate analysis shows, the US economy has experienced different periods with significant changes in distribution, business cycle dynamics, and monetary policy through the sample period. Thus, we might expect changes in the relationship between the three variables considered. For this reason, we employ a threshold vector autoregressive model (TVAR) that incorporates those instabilities to avoid any loss of power when performing inference.

We conduct an inference exercise by estimating macroeconomic responses and their direction to our set of endogenous variables using the following TVAR:

$$y_t = \left[\Pi_{c,1} + \sum_{j=1}^{p} \Pi_{p,1} y_{t-p} + e_{t,1}\right]\left(\mathrm{I}_{\{Z^*_{t-d} \leq \gamma^*\}}\right) + \left[\Pi_{c,2} + \sum_{j=1}^{p} \Pi_{p,2} y_{t-p} + e_{t,2}\right]\left(1 - \mathrm{I}_{\{Z^*_{t-d} \leq \gamma^*\}}\right) \quad (2)$$

where $y_t = [CU_t, LS_t, PI_t]'$ is the vector that contains our endogenous variables; $\Pi_{c,i}$, $i = 1,2$ is a vector of constants; $\Pi_{j,i}, j = 1, \ldots, p$ are parameter matrices; the error vector $e_{t,i}$ is normally distributed with mean zero and variance-covariance matrix Σ_i; and $\mathrm{I}_{\{\cdot\}}$ is an indicator function that

equals unity when Z^*_{t-d} is inferior to the threshold γ^* and equals zero otherwise. In this two-regime TVAR the threshold variable Z^* is assumed to be the d^{th} lag of the PI and both the threshold γ^* and the delay lag d are estimated from the data. The delay lag implies that if the threshold variable PI_{t-d} crosses the threshold value of γ^* at time $t-d$, the system changes of regime and the endogenous interactions between the variables change, so the variables respond differently to shocks. The separation between regimes is defined by a boundary equal to a certain value of the threshold variable. That specific value should be zero, following the description of the PI in section 2. However, we decided not to impose the threshold but to estimate it freely so that the regimes could emerge from the data. The coefficients of the TVAR system are specific to each regime, where a linear model can describe the process within each regime. By construction, the model is heteroscedastic to account for changes in the variances of the errors.

The main focus of the paper is on PI_t shocks. Identification of these shocks is achieved using Cholesky decomposition. Since the TVAR estimated in this document is small and aimed, we consider the following recursive causal ordering to identify the system to generate meaningful impulse response functions: $PI_t \rightarrow LS_t \rightarrow CU_t$. This implies PI_t does not contemporaneously respond to LS_t and no variable contemporaneously responds to CU_t (they only do it through lags). Thus, this identification condition in the model is essential to isolate monetary policy shocks, assuming that the transmission of shocks in the short-run begins with changes in PI_t. On the other hand, the simultaneous interaction between labor share and capacity utilization modeled in a lower triangular form, in which labor share comes first, is motivated by the literature on wage/profit-led growth. While this ordering of variables could make a difference, in the context of this empirical application, the sequence of these two variables does not affect the results.

To estimate the TVAR, we employ Bayesian machinery. In particular, we estimate the TVAR model by following the Gibbs sampling procedure detailed in Alessandri and Mumtaz (2017) and Chib and Greenberg (1995). For each simulation of the Gibbs sampling, their procedure includes a Metropolis-Hastings step to sample the threshold value. Using the estimation results along with the data sample, we compute generalized impulse responses in the spirit of Koop et al. (1996). With quarterly data, we use p=4 lags in the TVAR and employ 20,000 iterations of the Gibbs sampler, discarding the first 15,000 as burn-in.

Figure 1 reports the two distributive regimes in the US identified using the PI to indicate how monetary policy affects income distribution dynamics. The shaded area represents the median estimate of $\mathrm{I}_{\{Z^*_{t-d} \leq \gamma^*\}}$ that is equal to the regime in which the threshold variable PI_{t-3} falls below the threshold value of 0.6. We refer to this regime as the "working-biased" regime, while the regime in which PI_{t-3} exceeds the value of 0.6 is labeled as the "rentier-biased" regime. In the working-biased regime, income flows in the direction of workers. In contrast, in the rentier-biased regime, from a monetary policy perspective, income distribution blends in favor of rentiers since a positive index generally means that the yield on the bonds was greater than the productivity growth. Thus, Figure 1 shows that the US economy has been moving between two clearly defined regimes. The estimated threshold value of 0.6 appears plausible and consistent with the income distribution dynamics the PI captures, in which the zero value (or a value in the neighborhood, as in the case here) triggers a regime change. The zero line in Figure 1 represents a "fair" real rate in

the Pasinetti (1980) sense that it would be distributionally neutral on average between rentier and non-rentier income.

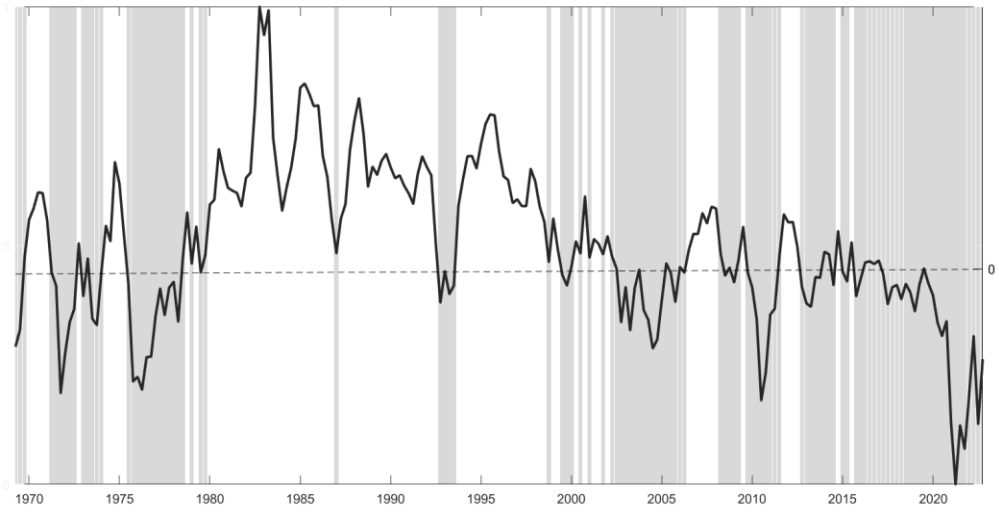

Figure 1. Distributive regimes in the US. Gray bands identify periods when the US economy is estimated to be in the working-biased regime by the TVAR described in equation (2). The series represents the PI, which is assumed to be the threshold variable.

Before the 1980s, most of the time in the sample was spent in the working-biased regime, except for notable spikes in oil prices in the 1970s. During the 1980s and 1990s the US has dwelled predominantly in the rentier regime. Since then, the US economy has been transitioning between regimes. These findings are consistent and corroborate what we found with the univariate analysis. The US has experienced two main changes in distributive regimes with the transition between the Keynesian era and the monetarist age. Neither the univariate nor the multivariate analyses found evidence of a predominant regime after the 2000s. Nonetheless, what stands out is a more rapid reversion to the zero value of the PI during the 2000s and onwards compared to previous periods. It must be emphasized that this coincides with the adoption of the inflation targeting strategy, a period during which the Fed has set interest rates above the inflation rate but not as high as during the years of monetary austerity. This has caused the PI fluctuates around the zero value.

Interestingly, the Covid-19 pandemic has triggered a historic drop in the PI caused by an unanticipated rise in inflation due mainly to supply chain issues and a significant recovery of the labor share. We also observe a sizable drop with the financial crisis that can easily be explained by the fall in policy rates of interest to stimulate economic activity levels. However, Fed's commitment to a positive neutral real interest rate compels it to raise the policy interest rates to bring the PI back to positive levels.

We resort to impulse-response analysis to check how PI shocks impact economic activity and income distribution and whether their impact is different across regimes. In Figure 2, we report

the overall effects of a positive PI shock. The dynamics associated with working-biased and rentier-biased regimes are shown respectively in solid and dotted lines. For each regime, we report median responses and 68% confidence bands. Looking at time variation between regimes, the results indicate more substantial deleterious effects of PI on CU and LS for those moments when the US economy is in the rentier-biased regime. More precisely, the detrimental effects on CU and LS become more pronounced when income is flowing toward rentiers. During the working-biased regime, on the other hand, when income flows toward workers, the adverse effects on CU and LS are less deep. In general, Figure 2 reveal differentiated impacts of a PI shock on economic activity and income distribution, which underpins the identification strategy.

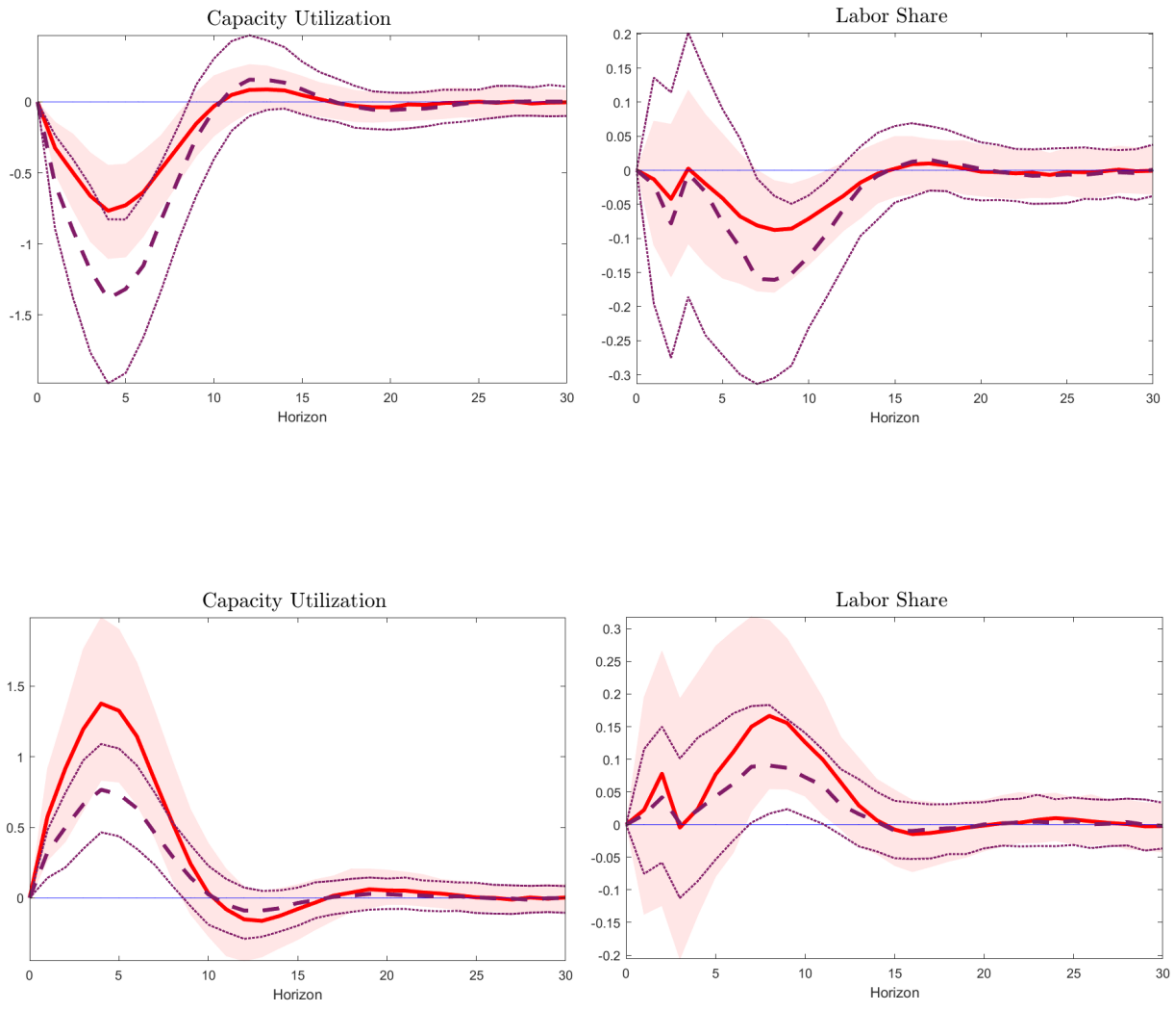

Figure 2. Impulse-response functions were obtained from a one positive standard deviation (top row) and a one negative standard deviation (bottom row) shock to PI. The responses are estimated using the TVAR model of equation (2) and a recursive identification scheme where PI is ordered first, and they are simulated conditioning separately on working-biased (solid line) and rentier-biased regimes (dotted line). For each regime the figure reports the median responses with a 68% confidence band.

The results of this impulse-response analysis are that monetary policy works through income distribution and then eventually on aggregate demand and economic activity. Incremental changes in interest rates affect income distribution between rentiers and workers and among households. Since poorer individuals spend a more siginificant 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 interest rates must be considered. Yet the past three decades have shown the fragility of our economic system when monetary policy is not accommodative to workers. Seccareccia and Lavoie (2016) showed that monetary policy has consistently favored rentiers until the global financial crisis, exacerbating an already unequal income distribution. In other words, monetary policy has acted as an income policy that protected rentiers.

This empirical evidence indicates that monetary policy relies upon two crucial relations: first, the relationship between interest rates and income distribution, and second, the relationship between income distribution and aggregate demand, as reflected in the level of capacity utilization. These are two fields in which post-Keynesian and heterodox economics has made significant theoretical and empirical contributions. On theoretical grounds, Rochon and Setterfield (2007) have shown that the *modus operandi* of the new consensus in monetary policy, personified in the inflation targeting strategy, is to set an interest rate according to an inflation rate target at the cost of a lower labor share in the national income. Their model suggests that the central bank uses its "third position in discord" and employs the interest rate to redistribute income in favor of business profit earners once the distributive conflict triggers. In post-Keynesian and heterodox circles, it is well-known that the interest rate has severe distributive effects. On the connection between labor share and capacity utilization, the logic of this relationship is grounded in the neo-Kaleckian model (Blecker (1989), Bhaduri and Marglin (1990), and Marglin and Bhaduri (1990)). The empirical literature, although still inconclusive, has found that in the US economy, aggregate demand varies positively with the wage share (Onaran and Galanis (2012), Blecker et al. (2022)).

The mainstream side of this story relies upon the relationship between interest rates and aggregate demand and the relationship between aggregate demand (as reflected in the output gap) and inflation. From this perspective, monetary policy is based on the notion that interest rate changes affect consumption and investment through a well-behaved (downward-sloping) IS curve and then inflation through a well-behaved (upward-sloping) Phillips curve. In this sense, the monetary policy circuit is complete, and thus, with changes in interest rates, the Fed can affect economic activity and inflation through this fine-tuning. All adjustment is done through the "cost channel."

Over the years, considerable research has been done on those two relationships. But, unfortunately, the conclusion has not been very kind to the mainstream view. For instance, Cynamon, Fazzari and Setterfield (2013, p. 13) claim that:

"The transmission mechanism from monetary policy to aggregate spending in new consensus models relies on the interest sensitivity of consumption. It is difficult, however, to find empirical evidence that households do indeed raise or lower consumption by a significant amount when interest rates change. Some authors have generalized the link to include business investments (see Fazzari, Ferri, and Greenberg, 2010 and the references provided therein), but a robust interest elasticity of investment has also been difficult to demonstrate empirically."

This suggests that the first relationship between aggregate private spending and interest rates may not be very significant, especially for small, incremental changes, which do not appear to have the intended effects: consumption and investment do not seem to respond all that well to changes in the rate of interest, what the authors refer to as 'interest elasticity'.

Now, what about the second relationship, namely, between unemployment and inflation? Unfortunately, the conclusions are no better. In fact, over the last three decades or so, the relationship has completely collapsed. For instance, Robert Solow has recently argued that "the slope of the Phillips curve itself has been getting flatter, ever since the 1980s, and is now quite small. And last, the standard error around the Phillips curve is large; the relationship is not well defined in the data" (Solow, 2018, p. 423). In other words, inflation no longer moves in response to changes in the unemployment rate (or economic activity), except in a non-incremental way, whereby only extremely low or high unemployment rates can trigger inflation or deflation in wages and prices. This led Arestis and Sawyer (2003, p. 5) to argue correctly that "It is a long and uncertain chain of events from an adjustment in the interest rate controlled by the central bank to a desired change in the rate of inflation."

But then, why do multivariate empirical works find evidence of the cost channel of monetary policy? First, if inflation is higher than its target and the Fed raises interest rates several times, the economy will eventually collapse. Unfortunately, this often happens: central banks generally raise interest rates several times until the economy comes crashing down. Second, in pursuing their inflation targeting strategy, central banks will increase the interest rate, contracting economic activity, which affects labor markets, unemployment, the income of workers, and ultimately on, inflation. For instance, as the rate of interest increases significantly, unemployment soars, workers' bargaining position to demand higher wages weakens, total wages in national income drops, and with it, inflation drops. The immediate conclusion from this comparative analysis between mainstream and post-Keynesian approaches is that monetary policy may work first and foremost through income distribution and then on aggregate spending and economic activity.

What can the Fed do to eliminate the inherent bias of monetary policy? Remember the core of the PI is an interest rate value that leaves the income distribution between creditors and debtors unchanged in the economy. In this sense, Rochon and Setterfield (2007) recommend using the Pasinetti rule and pegging the interest rate to the labor productivity growth rate. Pasinetti's "fair" rate of interest rule is the rate that leaves "unchanged the distribution of income between interest and noninterest income groups, regardless of lending and borrowing activities" (Lavoie and Seccareccia, 1999, p. 543). Going back to section 2, when the central bank sets the real interest rate equal to the rate of growth of labor productivity: "an amount of money equivalent to one hour of labor time, if lent at that normal rate of interest, will still be worth one hour of labor time when recovered with its interest payments. The purchasing power of the rentier will increase if the productivity of the overall economy has increased. The relative situation of the rentiers in the social hierarchy stays the same, whatever economic conditions" (Lavoie, 1996, p. 537).

It is now becoming clear that monetary policy, as currently designed, is not only recessive but also socially regressive.

5. Conclusion

Over the past decade, mainstream economists (and institutions, if we can label institution as "mainstream") showed greater interest on the distributional impacts of monetary policy. While largely absent from this group in the more distant past, this topic has been present in the Post-Keynesian tradition since its very beginning. In the 1980's, an analytical framework to study this relationship was developed by Luigi Pasinetti, and then empirically explored by Marc Lavoie and Mario Seccareccia.

On the present paper, our aim was to contribute to this literature by conducting an econometric analysis of the Pasinetti Index and its relation to economic activity and the functional income distribution. Our sample is composed of US quarterly time-series variables spanning the period 1968:Q1 to 2022:Q3.

The econometric approach followed in this study has revealed that the US economy has experienced different distributive regimes associated with changes in monetary policy. The economy has moved from the stable but volatile Keynesian era toward a less volatile but uncertain period in which monetary policy is employed to protect the income and wealth of rentiers. Moreover, the work also showed that switches to rentier-biased regimes are highly detrimental to aggregate demand and functional income distribution. The threshold vector autoregressive exercise corroborated the finding of the univariate approach that during the monetarist age, monetary policy was heavily biased toward protecting the income and wealth of rentiers in the US economy. Adopting the inflation targeting strategy did not change the position of the Fed as the "third in discord." It just reduced the volatility of the income and wealth of rentiers by tying the inflation rate to a target but augmented uncertainty since now rentiers must accept negative real returns to protect their wealth from broad asset price deflation. This study suggested aligning monetary policy to the Pasinetti rule to keep unaltered the distribution of income between rentiers and workers.

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Appendix

Table AI. Tests for multiple structural changes in the variance and the coefficients

	SupLR4t(m=ma,n=na)						UDmax4t
mean(ma)	1	1	2	2	3	3	M=3
variance(na)	1	2	1	2	1	2	N=2
CU	32.28***	31.90***	24.81***	25.05***	20.88***	20.59***	32.28***
LS	7.11*	6.39*	5.89*	5.49*	4.42	4.45	7.11*
PI	14.06***	9.43***	10.61***	7.78***	8.30***	8.11***	14.06***

Note: ∗, ∗∗, ∗∗∗ indicate significance at the 10%, 5%, and 1% levels, respectively. Truncation parameter ε = 0.15

Table AII. Tests for multiple structural changes in the variance of the errors

	SupLR2t(n=na|m=ma)							
variance(na)	1	1	1	1	2	2	2	2
mean(ma)	0	1	2	3	0	1	2	3
CU	32.58***	38.01***	39.59***	38.20***	29.77***	32.66***	31.12***	28.42***
LS	5.00	7.03	7.06	4.74	8.71**	6.00	5.69	4.69
PI	3.55	11.74**	7.91**	8.84**	6.13	7.12*	4.13	5.58
	SupLR10t(n=na+1|n=na,m=ma)							
variance(na)	1	1	1	1	2	2	2	2
mean(ma)	0	1	2	3	0	1	2	3
CU	16.81***	18.19***	25.61***	23.44***	6.05	5.45	5.35	5.29
LS	8.12	6.19	6.02	6.02	1.69	1.69	2.95	1.57
PI	7.22	8.25	3.51	3.51	8.11	8.25	3.51	3.51
	UDmax2t(N,m=ma)							
	N=2	N=2	N=2	N=2				
	0	1	2	3	Break Dates			
CU	32.58***	38.01***	39.59***	38.20***	1984Q4	2009Q4		
LS	8.71*	7.03	7.06	4.74	1984Q2			
PI	6.13	11.74**	7.91*	8.84*	1989Q1	1988Q3		

Notes: 1. ∗, ∗∗, ∗∗∗ indicate significance at the 10%, 5%, and 1% levels, respectively. 2. The SupLR2t test and the UDmax2t test reduce to the SupLR1t test and the UDmax1t test, respectively when $m_a = 0$. Truncation parameter ε = 0.15

Table AIII. Tests for multiple structural changes in the mean

	SupLR3t(n=na|m=ma)								
mean(ma)	1	1	1	2	2	2	3	3	3
variance(na)	0	1	2	0	1	2	0	1	2
CU	24.29***	35.80***	39.48***	16.88***	23.29***	21.62***	15.25***	18.45***	15.27***
LS	7.29*	9.21**	1.74	5.34	6.33	2.29	4.34	4.22	1.61
PI	6.16	7.68*	6.76	10.72***	9.05**	7.62**	8.31***	6.85**	7.28**
	SupLR9t(m=ma+1|n=na,m=ma)								
mean(ma)	1	1	1	2	2	2	3	3	3
variance(na)	0	1	2	0	1	2	0	1	2
CU	14.57***	22.16***	4.49	18.90***	5.92	4.24	5.92	1.88	1.93
LS	3.33	3.94	3.75	1.83	1.83	1.83	0.00	0.00	4.84
PI	11.35**	9.36*	9.52*	6.68	4.79	4.79	0.13	4.25	4.36
	UDmax3t(N,m=ma)								
	M=3	M=3	M=3						
	0	1	2	Break Dates					
CU	24.29***	35.80***	39.48***	1984Q4	2000Q2	2010Q1			
LS	7.29	9.21**	2.29	2001Q2					
PI	10.72**	9.05**	7.62*	1978Q4	2002Q3				

Notes: 1. ∗, ∗∗, ∗∗∗ indicate significance at the 10%, 5%, and 1% levels, respectively. 2. The SupLR3t test and the UDmax3t test reduce to the SupLR test and the UDmax test, respectively when $n_a = 0$. Truncation parameter ε = 0.15