Institutional changes, effective demand and inequality: a structuralist model of secular stagnation*

Vinicius Curti Cícero† Daniele Tavani‡

vinicius.cicero@colostate.edu daniele.tavani@colostate.edu

Abstract

This paper addresses the factors driving economic stagnation and inequality in the US over recent decades. We study a demand-driven model with joint adjustment of the functional distribution and capacity utilization in the short run, and explore the dynamics of wealth accumulation and labor productivity growth in the long run. Our analysis formally explains several stylized facts observed in the US economy: the decline in labor share of income, the increase in the top 1% wealth share, the slowdown in labor productivity growth, and the reduction in the income-capital ratio. Institutional changes that weakened workers' bargaining power or strengthened firms' market power have reduced the labor share of income. While these changes may have initially stimulated short-term economic activity and growth within a profit-led demand regime, their long-term effects are concerning. In particular, a lower labor share negatively impacts labor productivity growth and, in turn, slows down the growth rate of the economy in the long run. To achieve balanced growth, the income-capital ratio, proxied by the rate of capacity utilization, must eventually decrease. The long-run behavior of our model is captured by a simple 2D dynamical system analyzing the capitalist wealth share and the labor share. Our findings demonstrate that an institutionally driven decline in the labor share exacerbates wealth inequality over time. These results point to the importance of policies counterbalancing the labor-crushing developments of the past decades to escape the process of stagnation and inequality.

Keywords: Secular stagnation; income shares; wealth inequality; aggregate demand.

*We benefited from fruitful discussions and comments from Gilberto Tadeu Lima. A preliminary version of this paper was presented at the 49th Eastern Economic Association Annual Conference, New York, NY (USA), February 2023. We are grateful to conference participants for helpful comments. Any remaining errors are our own.

†Ph.D. candidate, Department of Economics, Colorado State University, USA.

‡Professor, Department of Economics, Colorado State University, USA.

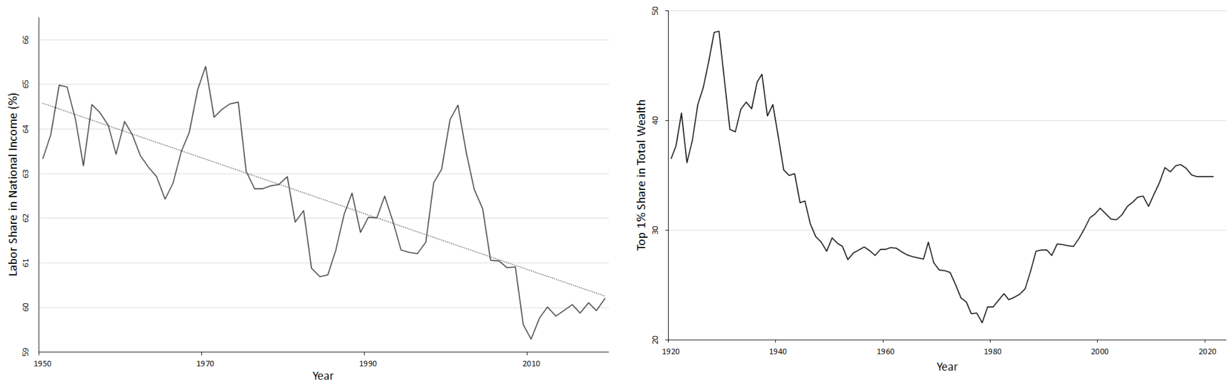
1 Introduction

Recent decades have been marked by two major and approximately general trends in advanced economies: the increase in income and, especially, wealth inequality within countries, and the long-run decline in labor productivity growth (secular stagnation). Despite the long preoccupation by economists working in the Classical Political Economy (CPE henceforth) and post-Keynesian (PK) tradition with the role of distributional changes in fostering or hampering the growth process, the mainstream of the economics profession has not paid enough attention to questions related to income and wealth distribution for many decades. Certainly, Thomas Piketty's *Capital in the XXI Century* (Piketty, 2014), which used a neoclassical framework to explain the process of rising inequality and stagnation, played a fundamental role in reviving the interest of mainstream economists in these issues. However, as argued by Petach and Tavani (2020), this approach can only explain the two trends under the assumptions of a high elasticity of substitution between capital and labor and an exogenous growth rate.

Focusing on the US economy, its recent economic history is distinguished by five interrelated stylized facts. First, a downward trend in the labor share has been observed nationally since the mid-1970s. As the relative constancy of the wage share in the longer run used to be seen as a stylized fact of economic growth (Kaldor, 1961), the recent global trend of decline in wage shares has attracted a great deal of research attention. For instance, Karabarbounis and Neiman (2014) and Stockhammer (2017) show that the wage share has fallen significantly in advanced economies. Second, the share of wealth held by the top percentile has dramatically increased since the late 1970s. These trends in income and wealth inequality are illustrated in Figure 1.

Third, labor productivity growth in the U.S. has shown a slightly decreasing trend since the 1960s, although arguably still growing faster than wages –contributing to the pronounced decline in the wage share as depicted in Panel (a) of Figure 1. This trend is illustrated through the filtered data on labor productivity growth from 1960 to 2022 in Panel (a) of Figure 2. Fourth, as documented in Piketty (2014) and Piketty and Zucman (2014), the income-capital ratio has displayed an upward trend since the 1960s, as shown in Panel (b) of Figure 2.

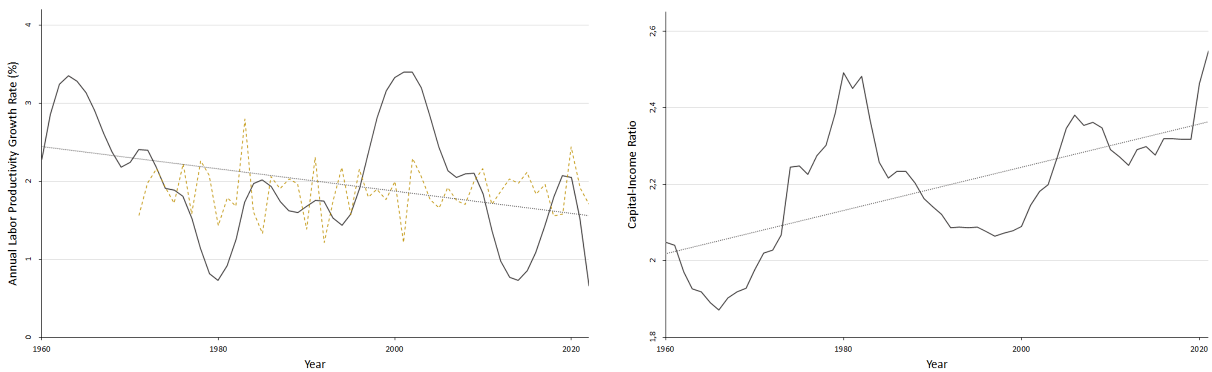
Lastly, since the mid-1970s, the US economy has experienced a clear institutional shift, with economic power moving away from labor towards capital. This shift is evidenced by the consistent reduction in the bargaining power of workers, exemplified by the declining unionization rate of the labor force, as documented by Grossman and Oberfield (2022). Stansbury and Summers (2020) relate this reduction in labor power to lower wage levels and higher profit shares. Panel (a) of



(a) Share of Labor Compensation in GDP, 1950-2020 (b) Share of Top 1% in Total Wealth, 1920-2022

Figure 1: Income and wealth inequality in the US economy

Notes: Data for Panel (a), the labor share, is from the Federal Reserve. The dotted line indicates a linear trend in Panel (a). The top 1% wealth share data - used in Panel (b) - is from the World Top Income Database.

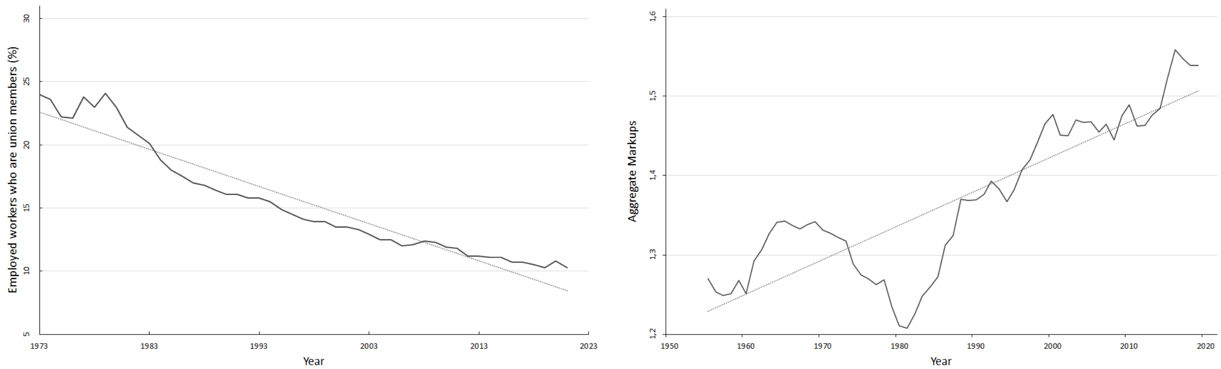


(a) Labor Productivity Growth, 1960-2022 (b) Capital-Income Ratio, 1960-2021

Figure 2: Productivity growth and capital-income ratio in the US economy

Notes: Data used for Panel (a) is from the Bureau of Labor Statistics (BLS). The thick line represents the filtered series using the Hodrick-Prescott filter, while the dashed line shows the filtered series using the method described in Hamilton (2018). Data on the capital-income ratio is from the Bureau of Economic Analysis (BEA), using the current-cost net stock fixed of fixed assets and the nominal GDP. In both panels, the dotted line indicates the fitted values.

Figure 3 presents this declining trend in unionization rates since the end of the 1970s. Notably, this weakening of unionization is especially significant in the private sector, which constitutes the majority of U.S. employment.[1] Concurrently, there has been a significant increase in the market power of firms, observed through rising market concentration since the early 1980s. De Loecker et al. (2020) describe the evolution of market power based on firm-level data for the US economy, indicating that aggregate markups began to rise from 21% above marginal cost in 1980 to 61% currently.[2] Autor et al. (2020) link the rise of "superstar firms", responsible for the largest increases in the average markup rates, to the decline in the labor share in the U.S. Panel (b) of Figure 3 indicates this increasing trend on the average market power of firms using the aggregate average markup of US publicly traded firms.



(a) Union Membership, 1973-2021 (b) Average Aggregate Markups, 1960-2020

Figure 3: Labor bargaining power and increasing average markups in the US economy

Notes: Data for Panel (a) is from Current Population Survey (CPS), using the methods and aggregate compilation described in Hirsch and Macpherson (2003) and updated annually in https://unionstats.com/. In Panel (b), data on revenue-weighted average markup of US publicly traded firms is from De Loecker et al. (2020). In both panels, dotted lines indicate fitted values.

Despite some notable exceptions (Cruz & Tavani, 2023; Ederer & Rehm, 2020; Petach & Tavani, 2020; Taylor et al., 2019), most theoretical frameworks do not generally provide a clear link between a rising capital-income ratio, a falling labor share, and growing wealth inequality, and to what extent these distributional changes impact the reduction in labor productivity growth and the growth rate of the economy. This limitation is even more pronounced considering the fundamental role of insufficient aggregate demand as a driving force behind the phenomenon of

[1]A related phenomenon is the rising concentration of power on firms in the labor market, characterized by the increase in the monopsony power of US firms in the past two decades (Manning, 2021; Yeh et al., 2022).

[2]This dynamic is also observed, albeit in a less pronounced manner, in several advanced economies (De Loecker & Eeckhout, 2018).

secular stagnation in advanced economies. This paper aims to bridge these gaps by proposing an alternative theoretical to better organize and interpret the stylized facts outlined previously.

Drawing both upon the CPE and the neo-Kaleckian traditions, we develop a formal model that not only addresses the five stylized facts detailed earlier but also integrates the crucial role of insufficient aggregate demand to elucidate the dynamics of secular stagnation, income and wealth inequality. Although demand-led models have been previously used to discuss the process of wealth accumulation and income distribution in recent contributions –for instance in Kumar et al. (2018), Ederer and Rehm (2020), Taylor et al. (2019) and Stamegna (2023)– to our knowledge this paper is the first to structure a condensed explanation of trends in distributive, technological, and labor bargaining power that affect the US economy in past decades.

The second contribution of this paper is a nuanced examination of the institutional changes that have unfolded since the late 1970s, changes we argue are central to understanding the recent history of the U.S. economy. Petach and Tavani (2020) and Cruz and Tavani (2023), following the induced innovation hypothesis by Kennedy (1964), link factor-augmenting technologies and factor shares and consider the effect of changes in a "catch-all" institutional variable affecting the labor share in the long run. We develop an alternative, plausible logic for the determination of a similar institutional or policy parameter within the model, that has the advantage of indicating more clearly the connection of this variable with the functional distribution of income and the dynamics of the labor market. Our formulation draws on the structuralist tradition, modeling wage- and price-setting behaviors as manifestations of the conflicting claims of workers and firms over the social product (Dutt, 1987; Rowthorn, 1977; Taylor, 1985). Importantly, the reduced form dynamics of such conflicting claims deliver a *distributive curve* that links the labor share of income to aggregate demand (Barbosa-Filho & Taylor, 2006).

Our results are as follows. Institutional or policy changes that, at the same time, deteriorated workers' bargaining power and increased firms' market power have negatively impacted the wage share. This, in turn, may have positively affected economic activity and accumulation in the short term if the demand regime on the economy is profit-led, which would have reinforced the initial negative shock. However, the direct relationship between the labor income share and the rate of labor-augmenting technological progress implies that the decline in labor power will produce a reduction in the natural growth rate of the economy, which is linked to labor productivity growth.[3] In other words, the economy is wage-led in the long run because of supply forces, namely the wage-led nature of labor productivity growth. For balanced growth to be restored, an increase in

[3] And the growth rate of the labor force, which however we assume to be zero in the analysis.

the capital-income – a decline in the income-capital – ratio is necessary. In addition, we analyze in detail the evolution of wealth distribution, whose Pasinetti (1962) dynamics reveals a long-term inverse relationship between the wage share and the capitalist (top, in the data) wealth share, as well as between the top wealth share and the rate of capacity utilization.

The remainder of the paper is structured as follows. Section 2 presents a formal model inspired by the neo-Goodwinian literature and analyzes the behavior of the endogenous variables - capacity utilization and functional distribution of income - in the short run. In Section 3, we analyze the long-run dynamics of the model, exploring the accumulation of wealth and the conditions for a balanced growth path in the economy (and its implications). Section 4 examines the impacts of exogenous institutional and policy shocks on the short- and long-run dynamics of the model, exploring the policy implications of the recent trends for unionization rates and aggregate firms' markups in the US economy. Finally, Section 5 summarizes our main findings and provides concluding remarks.

2 Model structure and short-run behavior

Consider a one-sector closed economy without government. For simplicity, time is continuous and the population is assumed constant and normalized to unity. Following the CPE tradition, we consider that the economy is populated by two types of households divided into classes: workers and capitalists (exclusively profit earners). We assume that workers supply labor services inelastically to firms, earn wages and profits, and consume and save a constant fraction of their total income, s^w. Capitalists, on the other hand, own the capital stock and derive their income from capital returns. From those profits, the capitalist class saves a fraction s^c of their profits.

As our analysis focuses on the distribution of wealth between classes, it is essential to consider the composition of capital stock in this economy. Given that the model is one sector, it is natural to assume homogeneity between capital and output, as well as between the capital owned by capitalists and that owned by workers, so that the price of output and both homogeneous capital stocks can be set equal to one throughout. Thus, we have that $k = k^w + k^c$ where k^i is the stock of capital (normalized by population) that is owned by class i, with $i = \{w, c\}$. Output per worker y is produced according to a Leontief production function given by:

$$y = \min\{A, uk\} \tag{1}$$

where A is labor productivity, u is the output-capital ratio and k denotes the total capital stock per worker.

We also follow the structuralist tradition of growth models and deal with another component of the process of secular stagnation in advanced economies: the insufficiency of aggregate demand. Arguably, this problem has become even more relevant due to the fiscal austerity measures that pervaded the neoliberal period. Note that, from equation (1), we can represent u as the output-to-potential output ratio:

$$u = \frac{y}{y^p} = \frac{y}{k}\frac{k}{y^p}$$

where y^p describes the potential output of the economy, and the ratio of capital to potential output is equal to one. Hence, $u = \frac{y}{k} \in [0, 1]$ can be understood as the rate of capacity utilization of the (aggregate) capital stock in the economy, our variable of interest to consider the problems arising with lackluster aggregate demand.

2.1 Aggregate demand and accumulation

To simplify the analysis, we rule out depreciation for both types of capital stock. Further, we assume that both types of households are price-taking in goods and factor markets. We define r as the uniform rate of return on capital, endogenous in the model but given to each household, and w as the real wage rate uniform to all workers in the economy. The real wage is given by $\frac{W}{P}$, where W is the nominal wage and P is the aggregate price level.

The working class participates in the capital accumulation in this economy through their savings. As in Petach and Tavani (2020), it is important to highlight that not every worker will be employed at any given period. From the fixed coefficient production function, given by equation (1), the employment rate in this economy is $\frac{uk}{A}$. Then, total workers' savings can be represented as follows:

$$g_S^w \equiv \frac{S^w}{k^w} = s^w \left[\frac{w}{A}uk + rk^w\right] \tag{2}$$

where S^w describes the aggregate savings of the workers in this economy.

In order to represent the accumulation rates in terms of the endogenous variables of this model, let us define the capitalists' share of wealth by $\phi \equiv \frac{k^c}{k^c+k^w} \in [0, 1]$. Moreover, we can define the (endogenous) wage share as $\sigma = \frac{w}{A}$ and, consequently, the profit share as $\pi = 1 - \sigma$. Also, it is worth indicating that the uniform rate of return, r, can simply be stated in terms of two of the endogenous variables of the model: $r = (1 - \sigma)u$. We can then rewrite the workers' accumulation rate as:

$$g_S^w = \frac{s^w}{1-\phi}\left[\sigma + (1-\sigma)(1-\phi)\right] u \tag{3}$$

Next, focusing on capitalist households, remember that this class only receives profit income. Hence, the capitalists' savings function (normalized to their share of the capital stock) is simply given by the Cambridge equation:

$$g_S^c \equiv \frac{S^c}{k^c} = s^c r = s^c(1-\sigma)u \tag{4}$$

where S^c describes the aggregate savings of the capitalists (or exclusively profit earners).

From equations (3) and (4), we can describe the economy-wide savings rate –that is, the warranted growth rate– as follows:

$$g_S \equiv \phi g_S^c + (1-\phi) g_S^w = u[s^w + \phi(1-\sigma)(s^c - s^w)] \tag{5}$$

We follow the usual assumption in the literature that $1 > s^c > s^w > 0$ (Kumar et al., 2018; Petach & Tavani, 2020; Taylor et al., 2019). Further, we assume an independent investment function based on the formulation by Bhaduri and Marglin (1990), which broadened the analysis of (neo)-Kaleckian growth and distribution models to account not only for the possibility of stagnationist but also of exhilarationist outcomes (Blecker, 2002).[4] That is, the accumulation rate determined by investment in this economy is given by:

$$g_I = \frac{I}{k} = g_0 + g_1 u + g_2(1-\sigma) \tag{6}$$

where I is the aggregate investment per worker, $g_0 > 0$ is a parameter denoting autonomous investment or "animal spirits", g_1 and g_2 are positive parameters that measure the responsiveness of investment to aggregate demand and the profit share respectively.

In this model, the macroeconomic balance condition is simply given by the equality of private savings and investment. The adjustment process through output variations follows the dynamic equation for the rate of capacity utilization:

$$\dot{u} = f(ED) = f(g_I - g_S) \tag{7}$$

where ED represents the excess demand for the unique good in this economy, $f'(.) > 0$, and $f(0) = 0$.

[4] An alternative modeling for the investment function is presented, for instance, in Kumar et al. (2018). The qualitative results are similar to the ones presented in this section; but it is worth reiterating that the functional distribution of income is endogenous in our model.

From equations (5) and (6), it is direct to note that the rate of change of utilization responds to the functional distribution of income, the distribution of wealth, and the rate of capacity utilization. With that in mind, we can simplify the dynamic equation above as follows:

$$\hat{u} = \eta_0 + \eta_1 u + \eta_2(1-\sigma) + \eta_3\phi \tag{8}$$

where $\eta_1 < 0$ as usual in neo-Kaleckian models (see discussion regarding the stability condition below), $\eta_2 \gtrless 0$ and $\eta_3 < 0$.

Next, from equation (7) and using equations (5) and (6), we can describe the nullcline $\dot{u} = 0$ as follows:

$$u(\phi,\sigma) = \frac{g_0 + g_2(1-\sigma)}{s^w + \phi(1-\sigma)(s^c - s^w) - g_1} \tag{9}$$

Equation (9) describes the *demand regime* of the economy as a function of the wealth and income distribution, along the (u,σ) space. In order to guarantee economic meaning for the nullcline $\dot{u} = 0$, we assume that $s^w + \phi(1-\omega)(s^c - s^w) > g_1$. That is, we assume that the denominator of the expression is positive. Note that this requirement is a modified version of the usual Keynesian stability condition (KSC) in neo-Kaleckian models, as we are assuming that savings respond more than investment to output variations. In addition, we assume that the combination of parameters is such that $u \in [0,1]$. From equation (7), note that we have:

$$\frac{\partial \dot{u}}{\partial u} = f'\left[\frac{\partial g_I}{\partial u} - \frac{\partial g_S}{\partial u}\right]$$

Thus, if the modified KSC holds, there is a self-adjusting dynamic for the rate of capacity utilization in the model – i.e. $\frac{\partial \dot{u}}{\partial u} < 0$, whenever $\frac{\partial g_S}{\partial u} > \frac{\partial g_I}{\partial u}$.

Further, note that the effect of changes in the functional distribution on equilibrium utilization is ambiguous:

$$\frac{\partial u}{\partial \sigma} = \frac{\phi(s^c - s^w)g_0 - g_2(s^w - g_1)}{\left[s^w + \phi(1-\sigma)(s^c - s^w) - g_1\right]^2} \gtrless 0 \tag{10}$$

This economy presents a wage-led demand regime if the partial derivative of the curve with respect to the wage share is positive –i.e. $\frac{\partial u}{\partial \sigma} > 0$– and a profit-led demand regime if $\frac{\partial u}{\partial \sigma} < 0$. In a deeper analysis, it is worth highlighting that the sign of the difference $s^w - g_1$ is crucial in determining the possibility of profit-led demand. To focus on the more interesting cases, we assume that $s^w > g_1$. Note that this inequality is a stronger version of the KSC discussed above. Even with this assumption, the magnitude of the parameters still plays a crucial role in determining the sign of the partial derivative. In particular, note that if

$$\phi > \frac{g_2(s^w - g_1)}{g_0(s^c - s^w)}$$

increases in the share of income received by workers positively impact aggregate demand. On the other hand, if

$$\phi < \frac{g_2(s^w - g_1)}{g_0(s^c - s^w)}$$

increases in the wage share reduce economic activity and, hence, the demand regime is profit-led.

Thus, all else constant, higher wealth inequality in favor of the capitalist class tends to be associated with a wage-led demand regime in the short run. On the other hand, a more equal distribution of wealth among classes, or even an unequal one that favors workers, tends to generate a profit-led demand regime in the model.

2.2 Conflicting claims and distributive dynamics

We now turn to the distributive side of the economy. Drawing inspiration from various heterodox traditions, we recognize the fundamental role of class conflict in the determination of the distribution of the social product in a capitalist economy.

The framework of conflicting claims serves as our analytical tool to investigate the distributive conflict between workers and capitalists. As highlighted in Blecker and Setterfield (2019), conflicting claims theories of inflation were developed in the late 1950s and early 1960s by Latin American structuralists, particularly Sunkel (1958/2016), Furtado (1963) and other authors affiliated with UN-ECLAC (United Nations Economic Commission for Latin America and the Caribbean), such as Noyola Vázquez (1956).[5] Building upon these theoretical foundations, contemporary structuralist macroeconomists have modeled wage- and price-setting behavior as reflecting the conflicting claims of workers and firms over the total product of a society (Dutt, 1987; Rowthorn, 1977; Taylor, 1985).

We assume, for simplicity, that the workers' claim in this bargaining process can be represented by a certain fraction of the social product. In particular, we draw upon heterodox formulations that workers' target or claim for the wage share is endogenous to macroeconomic conditions, particularly the unemployment rate (Setterfield & Lovejoy, 2006; Stockhammer, 2011). As highlighted previously, the employment rate in this economy is directly related to the rate of capacity utilization, so the unemployment rate is inversely related to our measure of output (and aggregate demand). With that in mind, the workers' desired or target wage share can be described by:

$$\sigma^w = \alpha_0 + \alpha_1 u \tag{11}$$

[5] The origins of the Latin American structuralists are detailed, for instance, in Boianovsky and Solís (2014). A comprehensive discussion on methodological approaches and theoretical frameworks is presented in Rodríguez (1993).

where $\alpha_0 > 0$ represents a combination of institutional factors that might be directly related to the bargaining power of labor, and $\alpha_1 > 0$ represents the degree to which capacity utilization boosts the workers' bargaining power in the sense of increasing their target for the wage share.

Following Dutt (1987), we assume that the workers exert their bargaining power over the nominal wages in this economy. Thus, workers bargain with capitalists in such a manner that any gap between the target and the actual wage share will lead to an increase in the nominal wages. This bargaining process can be described in a simple reaction function:

$$\hat{W} = \beta \left(\sigma^w - \sigma\right) \tag{12}$$

where $\beta > 0$ represents the adjustment rate of nominal wages to the gap between the functional distribution of income and the desired wage share by the workers.

Substituting equation (11) in (12), we can describe the evolution of nominal wages as a function of the rate of capacity utilization and the functional distribution of income:

$$\hat{W} = \beta \left[\alpha_0 + \alpha_1 u - \sigma\right] \tag{13}$$

On the other hand, firms (or capitalists) are assumed to have a target markup which can be translated into a desired or target profit share. Blecker and Setterfield (2019) discuss that such a target is influenced by several factors, including market concentration and product differentiation. Specifically, we posit that the desired markup rate depends on the rate of capacity utilization in the economy.[6] Nevertheless, the relationship between the target profit share and capacity utilization can be ambiguous. On one hand, firms might try to raise profits per unit when sales are slack, indicating an inverse relationship between the variables (Blecker & Setterfield, 2019). Conversely, more buoyant demand conditions might allow firms to raise prices without losing customers. For simplicity, we assume that the latter channel dominates the former, and describe a simple linear function for the firms' target profit share as follows:

$$\pi^c = 1 - \sigma^c = \delta_0 + \delta_1 u \tag{14}$$

where $\delta_0 > 0$ describes the degree of the firms' market power and $\delta_1 > 0$ measures the sensitivity of the target profit share to variations in demand conditions, which we posit as positive.

With the established relationship between the target profit share and capacity utilization in mind, our model posits a scenario where, if the actual profit share falls below the target set by

[6] For instance, Spence (1977) discusses how firms in oligopolistic market structures choose to keep spare capacity as an entry-deterrence mechanism. This process might ensure a certain desired profitability for firms.

firms, they will respond by adjusting prices. This adjustment follows a simple reaction function:

$$\hat{P} = \varepsilon \left[\sigma - \sigma^c \right] \tag{15}$$

where $\varepsilon > 0$ is the speed of adjustment of prices.

Substituting equation (14) in (15), we can describe the price reaction function of firms (or capitalists) in this economy, similarly to the nominal wage dynamics, as a function of the rate of capacity utilization and the functional distribution of the social product:

$$\hat{P} = \varepsilon \left[\sigma - (1 - \delta_0) + \delta_1 u \right] \tag{16}$$

Furthermore, the evolution of the income shares in this economy depends not only on the real wages (determined by the nominal wages and prices) but also on the dynamics of labor productivity. To fully encapsulate the framework of conflicting claims within this economy, it is crucial to consider the endogeneity of labor productivity growth – denoted as λ.

Blecker and Setterfield (2019) argue that the growth rate of labor productivity can depend on several macroeconomic variables. For instance, we can consider that labor productivity is an increasing function of capacity utilization in the presence of overhead labor (Lavoie, 2022). Generally, this case indicates a relationship between utilization and the level of labor productivity. For the purposes of our model, and in line with existing literature, we simplify this relationship by positing a direct positive correlation between capacity utilization and productivity growth. This assumption is grounded in the *rationale* that improved demand conditions, which typically increase capacity utilization, also incentivize firms to invest more in new capital equipment. Such investments are likely to boost the growth rate of labor productivity over time.

Moreover, an increased wage share is often correlated with enhanced productivity growth, a relationship substantiated by various economic theories. One potential *rationale* for such a relationship follows the induced innovation hypothesis described in Kennedy (1964) and largely explored in both the heterodox and mainstream literature (Funk, 2002; Julius, 2005; Tavani, 2012, 2013; Zamparelli, 2015). In short, under such a framework, firms behave according to the classical choice of technique criterion and choose a profile of technological improvements to maximize the rate of reduction in unit costs –or equivalently the rate of change in the profit rate– subject to a technological constraint given by an *innovation possibility frontier*. The solution for the problem delivers a dependence of growth rates of factor-augmenting technologies on their respective income shares. Drawing on this literature, we capture the biased nature of technical change by assuming that a higher wage share provides incentives for firms to seek labor-augmenting technologies which, in turn, increases the growth rate of labor productivity (Storm, Naastepad, et al., 2012; Taylor et al., 2019). Another potential explanation for such a positive relationship between the variables is that a higher wage share could boost workers' effort and their productivity, as per the implications of efficiency wage theory (Shapiro & Stiglitz, 1984).

Following Barbosa-Filho and Taylor (2006), we combine the theoretical elements discussed above in a simplified manner, describing the productivity growth equation as follows:

$$\lambda = \frac{\dot{A}}{A} = \lambda_0 + \lambda_1 u + \lambda_2 \sigma \tag{17}$$

where $\lambda_0 > 0$ represents some exogenous underlying trend of productivity growth that is not related to capacity utilization or distribution, while $\lambda_1 > 0$ and $\lambda_2 > 0$ capture, respectively, the direct relationship between capacity utilization and productivity growth, and, wage share and productivity growth.

Remember that the wage share in this economy is simply given by $\frac{W}{PA}$. Thus, by definition, the rate of change of the wage share can be described as:

$$\hat{\sigma} = \hat{W} - \hat{P} - \lambda \tag{18}$$

Using equations (13), (16), and, (17), we can describe the dynamics of the functional income distribution as follows:

$$\hat{\sigma} = \frac{\dot{\sigma}}{\sigma} = \beta\alpha_0 + \varepsilon(1 - \delta_0) - \lambda_0 + \left[\beta\alpha_1 - \varepsilon\delta_1 - \lambda_1\right] u - \left[\beta + \varepsilon + \lambda_2\right] \sigma \tag{19}$$

We are then able to derive the *distributive curve*, which represents combinations of capacity utilization and the wage share such that the latter is constant – i.e. $\hat{\sigma} = 0$ (Barbosa-Filho & Taylor, 2006; Kiefer & Rada, 2015; Taylor et al., 2019). Imposing this condition on equation (19) and solving for the wage share, we obtain:

$$\sigma(u) = \frac{\beta\alpha_0 + \varepsilon(1 - \delta_0) - \lambda_0 + \left[\beta\alpha_1 - \varepsilon\delta_1 - \lambda_1\right] u}{\beta + \varepsilon + \lambda_2} \tag{20}$$

Note that the slope of the distributive curve is generally ambiguous and given by the following expression:

$$\frac{\partial\sigma}{\partial u} = \frac{\beta\alpha_1 - \varepsilon\delta_1 - \lambda_1}{\beta + \varepsilon + \lambda_2} \gtreqless 0 \tag{21}$$

Thus, the dependence of distribution on utilization depends directly on the sign of the numerator of equation (21). In particular, if $\beta\alpha_1 > \varepsilon\delta_1 + \lambda_1$, we have a profit-squeeze distribution regime, in which rising utilization raises the wage share (and reduces the profit share). Note that, for that to be the case, the impact of higher utilization and employment on wage increases must overcome the impact on price increases and productivity growth. On the other hand, if $\beta\alpha_1 < \varepsilon\delta_1 + \lambda_1$, the distributional regime is wage-squeeze, in which rising utilization reduces the wage share (Kiefer & Rada, 2015).

For greater comparison with the previous literature, we can simplify the dynamic equation for the labor share and rewrite equation (19) as follows:

$$\hat{\sigma} = a_0 + a_1 u + a_2 \sigma \tag{22}$$

where $a_0 = \beta\alpha_0 + \varepsilon(1 - \delta_0) - \lambda_0$, $a_1 = \beta\alpha_1 - \varepsilon\delta_1 - \lambda_1$ and $a_2 = \beta + \varepsilon + \lambda_2$. Equation (22) is similar to the distributive curve in Barbosa-Filho and Taylor (2006) and Kiefer and Rada (2015), for instance. Again, note that the distributional regime of this economy is profit-squeeze (wage-squeeze) if $a_1 > 0$ ($a_1 < 0$).

2.3 Short-run equilibrium and comparative statics

Equations (8) and (22) compose the two-dimensional dynamical system that characterizes the short-run behavior of this economy – with capacity utilization and the functional distribution of income as both endogenous. We now turn to some comparative statics exercises.

To sharpen our analysis, we follow the literature in making assumptions regarding the sign of the partial derivatives presented in equations (10) and (21). In a comprehensive survey of relevant empirical evidence, Barrales-Ruiz et al. (2022) indicate that the cyclical dynamics of income distribution and capacity utilization usually presents a profit-led/profit-squeeze pattern (Barbosa-Filho & Taylor, 2006; Barrales & von Arnim, 2017; Basu & Gautham, 2020; Carvalho & Rezai, 2016; Kiefer & Rada, 2015). Hence, we assume that $\eta_2 > 0$ and $a_1 > 0$.

In particular, following Kiefer and Rada (2015) and Taylor et al. (2019), we assume that the distributive curve is less steep in absolute value than the demand regime. Accordingly, the demand regime is *weakly* profit-led, while the distributive curve displays a *strong* profit-squeeze nature. We show in Appendix A that under such assumptions there is a stable short-run equilibrium (a sink) to the dynamical system formed by the growth rates of capacity utilization and the wage share. Barbosa-Filho and Taylor (2006) and Blecker and Setterfield (2019) show that damped neo-Goodwinian cycles are found around the short-run equilibrium. The dynamic interaction between the variables generates a counterclockwise cyclical rotation that is in line with the evidence presented for the US business cycles (Barrales & von Arnim, 2017).[7]

[7] Stockhammer and Michell (2017) have argued that pseudo-Goodwin cycles–that is, counterclockwise rotations

Figure 4 presents a simple graphical representation of the dynamical system under such assumptions. Note that the intercepts follow from equations (9) and (20), with $\sigma = 1$ and $u = 0$, respectively. The intersection of the schedules or nullclines in point A indicates the short-run equilibrium in this dynamical system given by (u^*, σ^*).

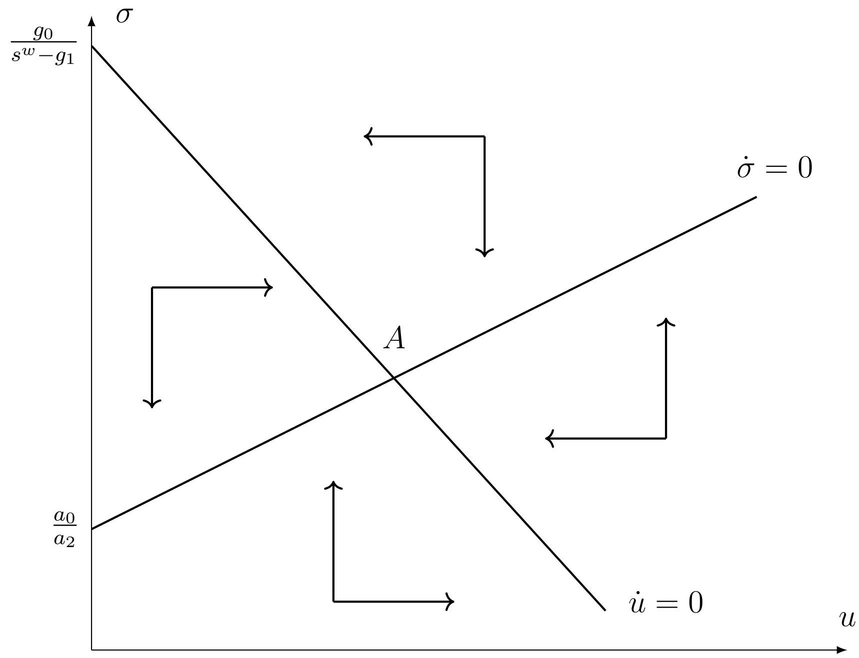


Figure 4: Demand regime ($\dot{u} = 0$) and distributive curve ($\dot{\sigma} = 0$).

We are now set to explore the comparative statics of this equilibrium. First, we look at the impact of exogenous changes in the capitalists' share of wealth on the short-run equilibrium. From equations (9) and (20), it is straightforward to note that an increase in the share of wealth detained by capitalists will directly and negatively impact the rate of capacity utilization from the aggregate demand curve (the $\dot{u} = 0$ nullcline), but this change in wealth distribution will impact factor shares only indirectly (that is, through a movement along the distributive curve) through utilization. Given the profit-squeeze distribution regime, increases in the capitalists' wealth share will reduce the

around an activity-wage share equilibrium–are possible in a wage-led economy provided that there is a financial debt cycle. Barrales-Ruiz et al. (2022) have countered that such pseudo-Goodwin cycles require the wage share –and not economic activity– to be the leading variable, which runs contrary to the empirical evidence on the United States where in fact activity, be that measured as the employment rate or the utilization rate, leads the cycle. The profit-led/profit-squeeze neo-Goodwinian model by Barbosa-Filho and Taylor (2006) and the literature that follows is more parsimonious and fits the data better, reason for which we focus on the corresponding dynamics in this paper.

wage share by negatively impacting the utilization in the short run. That is, we have that:

$$\frac{\partial u^*}{\partial \phi} < 0$$

$$\frac{\partial \sigma^*}{\partial \phi} < 0$$

This effect is displayed in Figure 5. An increase in ϕ alters the slope of the AD curve indicating a new nullcline $\dot{u}' = 0$. Again, the intersection of the nullclines indicates the new short-run equilibrium in the model given by point B and the vector (u^{**}, σ^{**}).

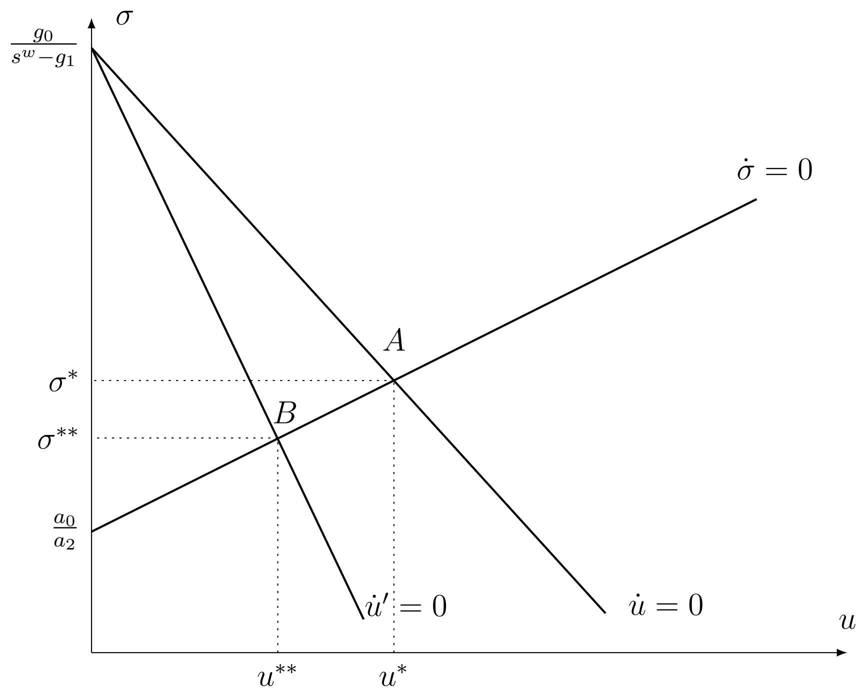


Figure 5: Short-run equilibrium: exogenous wealth distribution shock.

3 Long-run dynamics

This section shifts our focus towards the long-run processes of capital accumulation and wealth dynamics within the economy. By differentiating between short-run and long-run dynamics, we acknowledge that the mechanisms of adjustment and accumulation of wealth typically unfold at a slower pace compared to the more immediate fluctuations observed in aggregate demand and income distribution. This temporal distinction is critical for understanding how foundational economic structures gradually reshape the distribution of wealth over extended periods.

3.1 Wealth accumulation and the Pasinetti steady state

From the definition of the capitalists' wealth share and using the accumulation rates from equations (4) and (5), we can describe the evolution of wealth distribution (measured by ϕ) over time following a simple replicator equation (Cruz & Tavani, 2023; Ederer & Rehm, 2020):

$$\dot{\phi} = \phi(g^c - g) = \phi u \left[(1-\phi)(1-\sigma)(s^c - s^w) - s^w \sigma\right] \tag{23}$$

Equation (23) has two steady-state solutions. On the one hand, we have the simple case in which $\phi = 0$, characterizing the so-called *dual* steady state described in Samuelson and Modigliani (1966), with the economy boiling down to a workers' society. As discussed in Taylor et al. (2019), this case arises, for instance, when $s^w = s^c = s$. Under that assumption, workers are similar to capitalists but also receive wages and use this extra source of income to out-save capitalists in the long run.

Note that, in this example, the evolution of the capitalists' wealth share can be described simply by $\dot{\phi} = -s(1-\sigma)u\phi$. At $\phi = 0$, we have that:

$$\frac{d\dot{\phi}}{d\phi} = -s(1-\sigma)u < 0$$

so the wealth ratio is locally stable around the dual steady state. In fact, the case with uniform savings rates seems to reduce to the canonical Solow (1956) growth model (Darity, 1981; Samuelson & Modigliani, 1966; Taylor et al., 2019).

The other well-known steady state is such that the accumulation rates by the capitalist class are equal to the economy-wide accumulation rate, i.e. the Pasinetti Theorem. In this case, we must have $g^c = g = \bar{g}$ for $\dot{\phi} = 0$ if $\phi \in (0, 1]$, where $\bar{g}$ is an (endogenous) steady state growth rate. For this result to emerge, it is sufficient that $s^c > s^w$ – the capitalist wealth share will adjust in order to ensure the equality between g^c and $\bar{g}$.[8] Imposing that equality, we can represent the $\dot{\phi} = 0$ nullcline as follows:

$$\phi(\sigma) = \frac{s^c(1-\sigma) - s^w}{(1-\sigma)(s^c - s^w)} = \frac{(s^c - s^w) - \sigma s^c}{(s^c - s^w) - \sigma(s^c - s^w)} \tag{24}$$

Alternatively, we can represent equation (24) in terms of the workers' share of wealth (or capital stock) as follows:

$$1 - \phi(\sigma) = \left[\frac{s^w}{(s^c - s^w)}\right]\left[\frac{\sigma}{1-\sigma}\right]$$

[8] Note that this condition for the existence of a Pasinetti steady state boils down to the famous Cambridge equation, $s^c r = \bar{g}$. Thus, note that if $s^c < 1$, the "fundamental law of capitalism" responsible for wealth concentration in Piketty (2014) - $r > g$ - is trivially satisfied (Taylor et al., 2019; Zamparelli, 2017).

Note that, if $0 < \sigma < 1$ and $s^w > 0$, the workers' share of capital stock $(1 - \phi)$ has to be positive at steady state. As discussed in Taylor et al. (2019), this fact sets an upper bound on ϕ.

Moreover, along a Pasinetti steady state, it is direct to see from equation (24) that the capitalists' wealth share is negatively related to the wage share:

$$\frac{\partial \phi}{\partial \sigma} = -\frac{s^w}{(1-\sigma)^2(s^c - s^w)} < 0 \tag{25}$$

The intuition is that a higher wage share increases the funds available to workers to save and accumulate capital, therefore reducing the capitalist share of wealth in the long run. To facilitate the evaluation of the stability around a Pasinetti steady state, we return to the dynamics represented in equation (23) and define:

$$h(\phi) = [s^c(1-\phi) + s^w\phi](1-\sigma) - s^w = s^c(1-\sigma) - s^w - (s^c - s^w)(1-\sigma)\phi \tag{26}$$

We can total differentiate equation (26) as follows:

$$\frac{dh}{d\phi} = h_\phi = -(s^c - s^w)(1-\sigma) + [s^c(1-\phi) + s^w\phi]\frac{\partial(1-\sigma)}{\partial\phi} \tag{27}$$

However, from our previous analysis, we assumed that $\frac{\partial\sigma}{\partial u} > 0$ and shown that $\frac{\partial u}{\partial\phi} < 0$. Thus, it must be the case that $\frac{\partial(1-\sigma)}{\partial\phi} = \frac{\partial\pi}{\partial\phi} > 0$. That said, the sign of equation (27) is ambiguous.

Using the previous expression, we can rewrite the dynamic of the wealth ratio – equation (23) – as follows:

$$\dot{\phi} = \phi h(\phi)u \tag{28}$$

Total differentiating equation (28) we have:

$$\frac{d\dot{\phi}}{d\phi} = \phi[h_\phi u + hu_\phi] + hu \tag{29}$$

Even though, as discussed earlier, equation (29) permits several steady-state solutions for the wealth shares, for a Pasinetti steady state we must have that $h(\phi) = 0$. In that case, we have that $\frac{d\dot{\phi}}{d\phi} = \phi h_\phi u$. From equation (27), note that relatively low values for $\frac{\partial(1-\sigma)}{\partial\phi}$ or large differences between s^c and s^w indicate the local stability of the wealth ratio along a Pasinetti steady state.

Interestingly, if these conditions are not satisfied, ϕ will diverge towards zero –the previously discussed Samuelson and Modigliani (1966) dual steady state– or to the maximum level allowed by workers' saving, that is the *anti-dual* solution described in Darity (1981) and analyzed in Zamparelli (2017) and Taylor et al. (2019).

To simplify our analysis, we restrict our attention to the locally stable interior solution, in which g responds more strongly than g^c to variations in the wealth ratio. Figure 6 visually describes the dynamics of ϕ around a Pasinetti steady state. Our discussion in the remainder of this paper will be based on such a stable equilibrium.

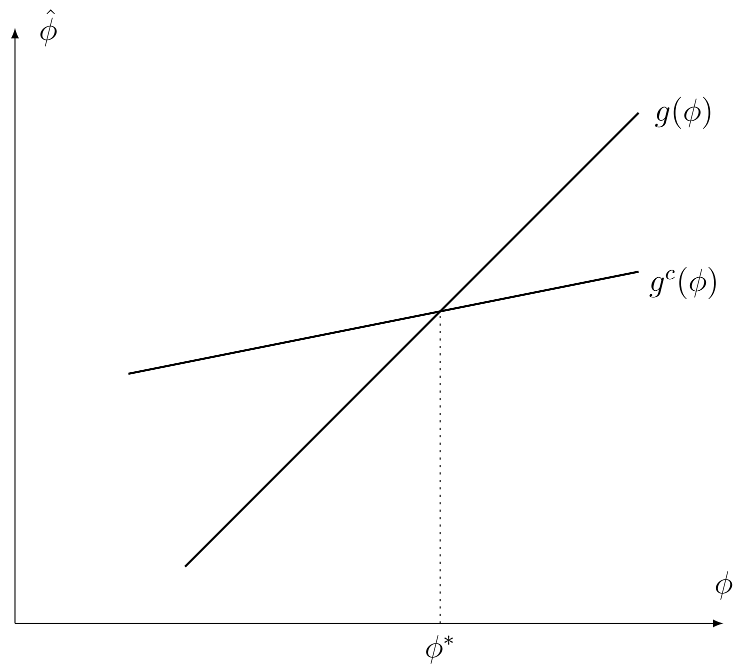


Figure 6: Dynamics of ϕ around a Pasinetti steady state

3.2 Balanced growth path

Following the CPE tradition, we consider that, in the long run, or along a balanced growth path, the economy grows at its natural growth rate. Given the structure of the economy, as described in detail in Section 2, this growth rate is simply given by labor productivity growth. That is, $\bar{g} = \lambda$. But remember, from equation (17), that productivity growth is endogenous to the capacity utilization and functional distribution of income in our model. To sharpen our analysis, consider that the impact of changes in the wage share is greater than changes in the productive capacity on productivity growth. In this case, the natural growth rate depends directly on the functional distribution of income and, in particular, decreases with a fall in the wage share. Therefore, in a long-run scenario with a Pasinetti steady state and along a balanced growth path, the growth regime of this economy is wage-led.

It is important to highlight that, although a reduction in the labor share -— as witnessed in several mature economies over recent decades -— might stimulate demand and possibly enhance growth in the short term, it adversely affects the long-run growth rate of the economy. This decline is attributed to the detrimental impact on labor productivity growth. Consequently, it becomes evident that policies leading to a decrease in the wage share, and thereby exacerbating income inequality, could significantly contribute to the phenomenon of secular stagnation that challenges the US economy.

Moreover, in a Pasinetti steady state with $\phi^* \in (0, 1)$, the rate of accumulation reduces to the Cambridge equation as discussed earlier. Thus, we have that $g = g^c = s^c(1 - \sigma)u$. Drawing from Harrod's seminal contribution to macrodynamics, the condition for a balanced growth path necessitates alignment between the warranted growth rate –characterized by the Cambridge equation here– and the natural growth rate (Harrod, 1939). Therefore, if productivity growth falls in the long run due to a reduction in the wage share, and the profit share rises for the same reason, the long-run rate of capacity utilization must *fall* to restore the balanced growth condition. As this last variable is a proxy for the income-capital ratio in our model, this prediction matches the upward trend in the capital-income ratio for the US economy presented in Figure 2.

4 Long-run policy implications

It remains now to examine in greater detail the implications of significant institutional changes within the U.S. economy.

4.1 Labor-crushing institutional changes

As outlined in Section 2, let us consider that both the sharp drop in the unionization rate of workers as well as the increase in the market power of firms (measured by aggregate markups), two important recent trends in the US economy shown in Figure 3, are captured by a reduction in the parameter a_0. Arguably, other factors affect the bargaining power of workers and firms that can also be represented by such a parameter in our model, such as the growing monopsony power of firms in the labor market (Manning, 2021) or even the global "race to the bottom" in unit labor cost reductions (Kiefer & Rada, 2015; Rada & Kiefer, 2016).

Nevertheless, and differently from previous models, instead of representing the intercept of the innovation possibility frontier, our institutional parameter emerges directly from the distributive conflict between the two classes of this economy. In this sense, this paper is also related to a literature that models the bargaining dynamics between workers and firms in growth models with biased technological change, showing the importance of workers' outside option and bargaining power in determining factor shares over the long run (Tavani, 2012, 2013).

First, a reduction in the institutional parameter a_0 directly affects the distributive curve in the short run. From equation (20), a drop in a_0 shifts the nullcline $\dot{\sigma} = 0$ intercept downwards. In addition to negatively affecting the wage share, such a reduction in the institutional parameter indirectly affects the capacity utilization rate, increasing the level of such variable in the new short-run equilibrium (since we are dealing with a profit-led demand regime). That is, in the short-run equilibrium, we have that:

$$\frac{\partial \sigma^*}{\partial a_0} < 0$$

$$\frac{\partial u^*}{\partial a_0} > 0$$

These effects are visually represented in Figure 7, which illustrates a scenario where $a_0' < a_0$. Point B denotes the new short-run equilibrium, (u^{**}, σ^{**}), which results from the reduction in the institutional parameter.

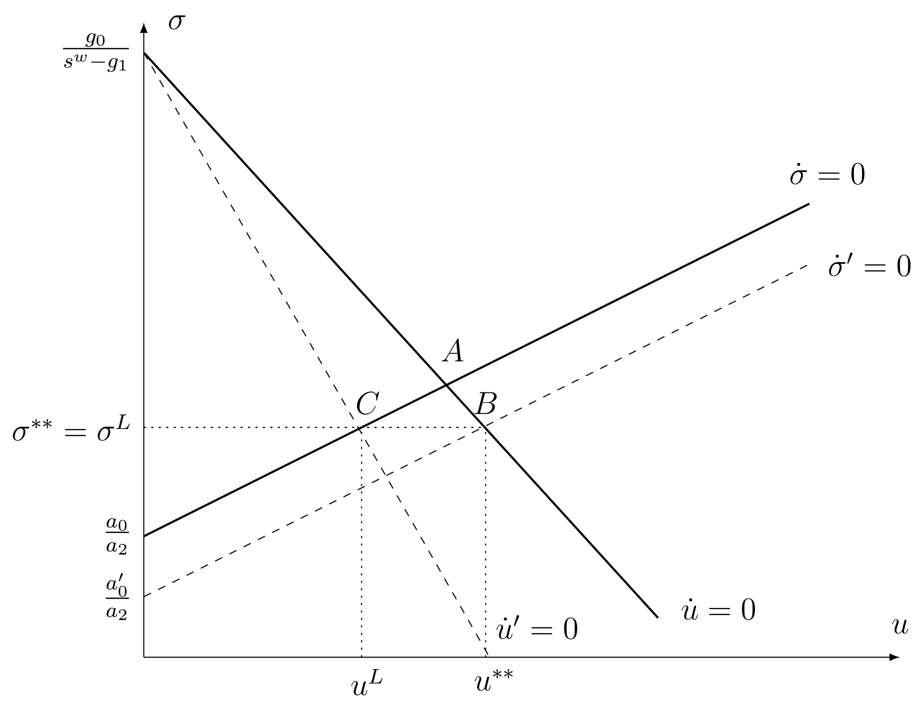


Figure 7: Institutional shock: income distribution and utilization adjustments

Second, in addition to the short-run effects, institutional changes also profoundly impact the long-run dynamics of this economy. Particularly considering the Pasinetti steady state for the wealth dynamics presented in Section 3, note that by reducing the wage share (and therefore workers' aggregate savings), a fall in the institutional parameter a_0 leads to an increase in the capitalists' wealth share in steady state, ϕ^*. That is,

$$\frac{\partial \phi^*}{\partial a_0} = \frac{\partial \phi}{\partial \sigma}\frac{\partial \sigma}{\partial a_0} < 0$$

This dynamic adjustment is graphically illustrated in Figure 8, which depicts changes in both income and wealth distribution over the long run. Following a reduction in the institutional parameter $a_0' < a_0$, the $\dot{\sigma} = 0$ nullcline shifts downward prompting a movement from point A to point B on the graph.[9]

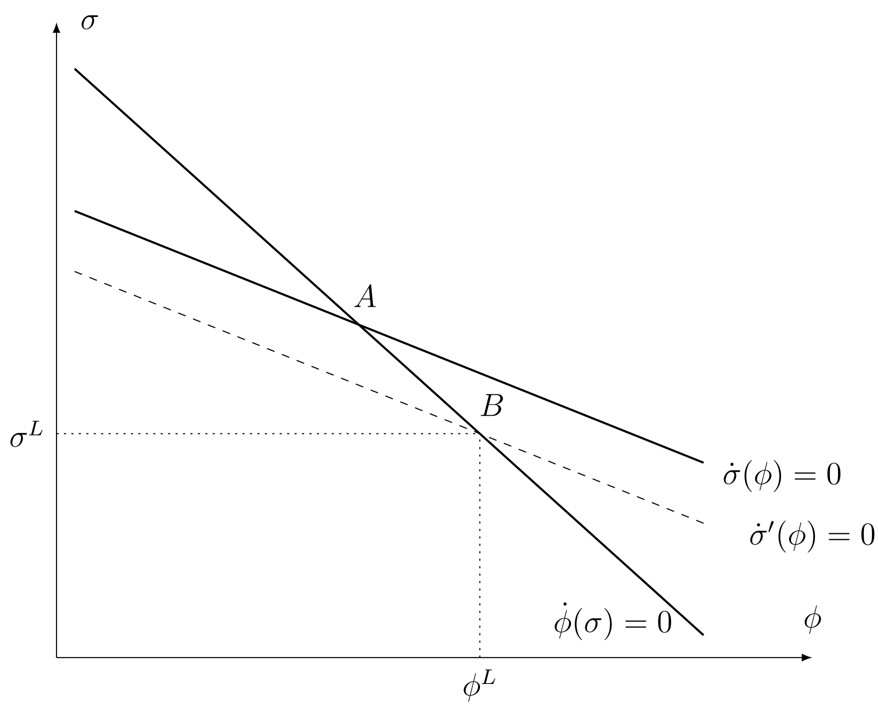


Figure 8: Institutional shock: income and wealth distribution adjustments

Third, we now consider the effects of the institutional change captured by the reduction in a_0

[9]In principle, the slope of the nullcline $\dot{\phi}(\sigma) = 0$ can be either positive or negative. However, in a similar model Cruz and Tavani (2023) find a negative slope for the nullcline at full utilization: thus, we assume that the $\dot{\phi} = 0$ nullcline is downward sloping. However, it is possible that it may be steeper than the $\dot{\sigma} = 0$ nullcline: but if this was the case, a reduction in the wage share would reduce the capitalist share of wealth. Thus, and in order to match the stylized facts that motivate our analysis, we only consider the case in which the distribution nullcline is flatter than the wealth nullcline.

on the growth rate of the economy in the long run. As established in our model's structure, labor productivity growth is significantly influenced by the wage share in this economy. In particular, a reduction in the wage share decreases the growth rate of productivity for several reasons, including, for example, a lower incentive for biased technological change toward labor. Nevertheless, remember that, in the long term, a balanced growth path requires equality between the warranted and the natural growth rates in Harrodian terms. Thus, by reducing the growth rate of labor productivity and, therefore, the natural growth rate, a reduction in our institutional parameter negatively impacts the economy's long-run growth (along a balanced growth path).

Fourth, a consequence of the impact of such institutional change on productivity growth is a change in the capacity utilization rate (our proxy for the income-capital ratio) in the long run. As discussed in Section 3, in a Pasinetti steady state the warranted growth rate is given by the Cambridge equation, and the condition for balanced growth is given by:

$$\lambda = s^c(1-\sigma)u$$

For a given s^c, as a reduction in a_0 directly increases the profit share, $(1-\sigma)$ and reduces λ, u must fall to ensure that the accumulation rate is equal to labor productivity growth along a balanced growth path. This change is represented in Figure 7, with a shift in the nullcline $\dot{u} = 0$ so that the new (long-run) equilibrium utilization is given by u^L.

Based on the discussion above, we argue that the institutional trends presented in Figure 3 of reduction in the relative bargaining power of workers and increase in the bargaining power of firms are closely related to the dynamics of the functional income distribution, marked by the reduction of wage share in recent decades, and an escalation in wealth concentration among the top percentile, presumably the capitalists in our model. The observed decline in the wage share, according to our model's predictions, correlates with a decrease in labor productivity growth in the long run and an increase in the income-capital ratio, both of which are documented in Figure 2. Moreover, the reduction in the labor share not only impacts productivity but also significantly curtails the economy's growth rate along a balanced growth path, potentially leading to long-run stagnation. Consequently, the simplified model presented in this paper successfully aligns with the stylized facts introduced in Section 1, effectively capturing some of the underlying mechanisms of secular stagnation in the US economy.

Similarly to Cruz and Tavani (2023) and Petach and Tavani (2020), we argue that the decline in wage share is a critical initial factor in the economic chain reaction that has culminated in both stagnation and inequality in the US economy over recent decades. Thus, the predictions of our model have clear policy implications. Even though such institutional changes may have increased profitability and created favorable momentary conditions in terms of demand, the long-run effects are disastrous for the distribution of wealth in the economy, for labor productivity, and, as a consequence, for long-run growth. Therefore, it seems timely to follow a political agenda aimed at reversing the decline in workers' bargaining power and curbing the increasing market power of firms, to mitigate the processes of stagnation and inequality. However, despite pressing, considering the dynamics of global competition for reductions in unit labor costs and the recent resurgence in austerity-driven political rhetoric in response to inflationary pressures, the likelihood of implementing such transformative policies remains slim in the foreseeable future.

4.2 Tax policy, income and wealth inequality

A distinctive aspect of our model is that, given the interaction between the functional distribution of income and the distribution of wealth, policymakers can effectively use taxation on capitalist income to mitigate both income and wealth inequality. This feature contrasts sharply with supply-driven models such as Cruz and Tavani (2023) and Petach and Tavani (2020), where taxing capitalist income impacts wealth distribution but does not affect income distribution.

Drawing upon Zamparelli (2017) and Cruz and Tavani (2023), let us consider a proportional tax $\tau \in (0, 1)$ on capitalist profits, which is then redistributed as a subsidy to workers. Assuming a balanced government budget, this tax modifies the accumulation rates for the two classes as follows:

$$g^c(\tau) = s^c u(1-\sigma)(1-\tau) \tag{30}$$

$$g^w(\tau) = s^w \frac{u}{1-\phi}\left[1-\phi(1-\sigma)(1-\tau)\right] \tag{31}$$

Simplifying these equations, the dynamics of the capitalist share of wealth under this tax policy are governed by:

$$\dot{\phi}(\tau) = \phi u \left\{ s^c(1-\sigma)(1-\phi)(1-\tau) - s^w\left[1-\phi(1-\sigma)(1-\tau)\right]\right\} \tag{32}$$

At the Pasinetti steady state, the equation simplifies to:

$$\phi^*(\tau) = \frac{s^c(1-\tau)(1-\sigma) - s^w}{(s^c - s^w)(1-\sigma)(1-\tau)} \tag{33}$$

From equation (33), it is direct to show that an increase in τ reduces the capitalist share of wealth since:

$$\frac{\partial \phi^*}{\partial \tau} = -\frac{s^w(1-\tau)(s^c-s^w)}{\left[(s^c-s^w)(1-\sigma)(1-\tau)\right]^2} < 0$$

Consequently, raising the tax rate on capitalist income lowers (shifts down) the wealth nullcline $\dot{\phi}(\sigma) = 0$, resulting in a lower capitalist share of wealth for any given labor share. As the income distribution nullcline is downward sloping, this policy leads to an unambiguous increase in the labor share. These changes are visually represented in Figure 9, showing that following a tax increase on capitalist income, the new long-run equilibrium (point B) not only diminishes the capitalists' wealth share but also coincides with an increase in the wage share.

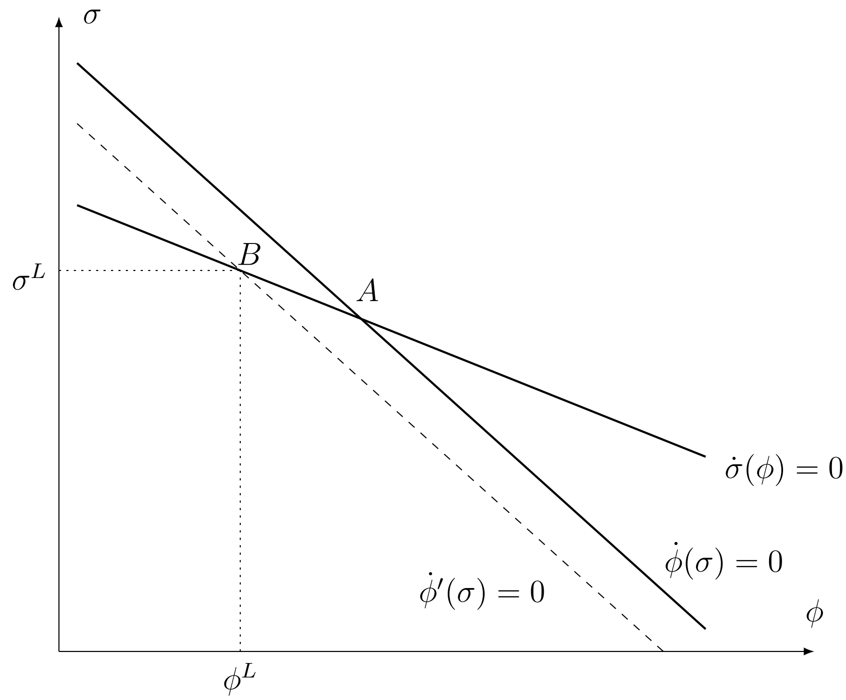


Figure 9: Tax policy: income and wealth distribution adjustments

As anticipated, this policy outcome notably diverges from previous work focusing on the supply side, where income distribution was ultimately independent of demand and wealth. For example, in Cruz and Tavani (2023) taxation on capitalist income was shown to effectively curb wealth inequality but had no impact on income distribution. In stark contrast, our model reveals that due to the interconnection between the labor share and wealth distribution, tax policy can simultaneously address both wealth and income inequality. This result aligns with Piketty (2014), yet it is the role of aggregate demand -— rather than the elasticity of substitution in the production function – that our model identifies as the critical mechanism influencing these outcomes.

Furthermore, along a balanced growth path, an increase in the long-run wage share, which boosts labor productivity growth, necessitates a corresponding rise in the rate of capacity utilization to maintain balanced growth, assuming a constant capitalist savings rate. Therefore, a tax policy focused on redistributing wealth not only addresses equity concerns but also reinforces aggregate demand over the long run, thereby raising the income-capital ratio along a balanced growth path.

5 Conclusion

This paper provided a structuralist model of demand, income distribution, and wealth inequality to explore the role of labor-crushing institutional changes in determining secular stagnation and inequality, thus contributing to the recent literature in the heterodox tradition (Cruz & Tavani, 2023; Petach & Tavani, 2020; Taylor et al., 2019).

Our model considers the fundamental role of lackluster aggregate demand for a better understanding of the dynamics and mechanisms underlying the process of secular stagnation and inequality in mature developed economies, and the US in particular. We have considered a neo-Goodwinian closure in the short run, with economic activity –captured by the rate of capacity utilization– adjusting to variations in the excess demand in the economy; and factor shares adjusting to the dynamics of distributive conflict between workers and capitalists. We show that initial variations in the functional distribution of income, arising from institutional shocks such as the significant loss of labor bargaining power due to a reduction in unionization rates or the increase in firms' market power, initially generate positive demand conditions and potentially accelerate capital accumulation in the short run. Nevertheless, the impacts of such distributional change in the long run are perverse.

To explore the long-run behavior of the model, we present an analysis of the evolution of wealth distribution, with dynamics *à la* Pasinetti (1962), showing a long-run inverse relationship between wage share and top wealth share and between top wealth share and capacity utilization. In addition to generating wealth concentration in favor of capitalists, institutional shifts that reduce the labor share negatively impact labor productivity growth and, hence, the natural growth rate of the economy. In a Pasinetti steady state, we show that this reduction in productivity growth associated with an increase in the profit share indicates that the income-capital ratio (proxied by the rate of capacity utilization) must fall to ensure the balanced growth condition, that is the equality between the natural and the warranted growth rate (Harrod, 1939).

As such, this paper provided a simple yet rich approach to describe an economy with profit-led demand and growth regimes in the short run that nevertheless presents wage-led growth dynamics in the long run. The short run of the model is virtually identical to the neo-Goodwinian analysis in

Barbosa-Filho and Taylor (2006), while the long run boils down to a two-dimensional dynamical system in the labor share and the capitalist share of wealth. In this framework, the policy effects of the neoliberal period, such as a reduction in the bargaining power of labor, have a positive impact on economic activity in the short run; yet, they generate a long-lasting negative impact on growth. Hence, the policy implication of these results is direct: it seems timely to follow a political agenda that seeks to reverse the trends of reduction in the bargaining power of workers and the increase in the market power of the firms to escape the process of stagnation and inequality that characterizes the US economic reality.

For completeness, it is worth mentioning another policy channel that, although not explicitly studied in this paper, appears relevant in the post-COVID recovery in the United States. Expansionary fiscal policy that shifts the utilization nullcline up in Figure 7 will increase the labor share of income. The latter will reduce the capitalist share of wealth in Figure 8. Thus, a government authority can either target the labor share directly or indirectly through boosting economic activity. Either way, the workers' distributional position will improve both in terms of their share of income and their share of wealth.

Summing up, one of the main contributions of this paper is to consider both the functional distribution of income and the distribution of wealth endogenous and demand-determined; but of course, it should be considered as a first attempt in this direction. From a theoretical perspective, it seems that further research should be directed towards extending this approach. For example, our adherence to the neo-Goodwinian tradition implies an ever-adjusting equilibrium utilization rate in response to shocks to demand and distribution. It seems important to explore clearer adjustments of the rate of capacity utilization in the long run of the model, seeking to endogenize the desired rate and analyze the possibilities of path dependence and hysteresis on the process of secular stagnation.

References

Autor, D., Dorn, D., Katz, L. F., Patterson, C., & Van Reenen, J. (2020). The fall of the labor share and the rise of superstar firms. *The Quarterly Journal of Economics*, *135*(2), 645–709.

Barbosa-Filho, N. H., & Taylor, L. (2006). Distributive and demand cycles in the US economy—a structuralist Goodwin model. *Metroeconomica*, *57*(3), 389–411.

Barrales, J., & von Arnim, R. (2017). Longer-run distributive cycles: Wavelet decompositions for the US, 1948–2011. *Review of Keynesian Economics*, *5*(2), 196–217.

Barrales-Ruiz, J., Mendieta-Muñoz, I., Rada, C., Tavani, D., & Von Arnim, R. (2022). The distributive cycle: Evidence and current debates. *Journal of Economic Surveys*, *36*(2), 468–503.

Basu, D., & Gautham, L. (2020). What is the impact of an exogenous shock to the wage share? var results for the us economy, 1973–2018. In *Conflict, demand and economic development* (pp. 142–167). Routledge India.

Bhaduri, A., & Marglin, S. (1990). Unemployment and the real wage: The economic basis for contesting political ideologies. *Cambridge Journal of Economics*, *14*(4), 375–393.

Blecker, R. A. (2002). Distribution, demand and growth in neo-kaleckian macro-models. In *The economics of demand-led growth*. Edward Elgar Publishing.

Blecker, R. A., & Setterfield, M. (2019). *Heterodox macroeconomics: Models of demand, distribution and growth*. Edward Elgar Publishing.

Boianovsky, M., & Solís, R. (2014). The origins and development of the latin american structuralist approach to the balance of payments, 1944–1964. *Review of Political Economy*, *26*(1), 23–59.

Carvalho, L., & Rezai, A. (2016). Personal income inequality and aggregate demand. *Cambridge Journal of Economics*, *40*(2), 491–505.

Cruz, M. D., & Tavani, D. (2023). Secular stagnation: A classical–marxian view. *Review of Keynesian Economics*, *11*(4), 554–584.

Darity, W. A. (1981). The simple analytics of neo-ricardian growth and distribution. *The American Economic Review*, *71*(5), 978–993.

De Loecker, J., & Eeckhout, J. (2018). *Global market power* (Working Paper No. 24768). National Bureau of Economic Research.

De Loecker, J., Eeckhout, J., & Unger, G. (2020). The rise of market power and the macroeconomic implications. *The Quarterly Journal of Economics*, *135*(2), 561–644.

Dutt, A. K. (1987). Alternative closures again: A comment on'growth, distribution and inflation'. *Cambridge Journal of Economics*, *11*(1), 75–82.

Ederer, S., & Rehm, M. (2020). Making sense of piketty's fundamental laws in a post-keynesian framework: The transitional dynamics of wealth inequality. *Review of Keynesian Economics*, *8*(2), 195–219.

Funk, P. (2002). Induced innovation revisited. *Economica*, *69*(273), 155–171.

Furtado, C. (1963). *The economic growth of brazil*. University of California Press.

Grossman, G. M., & Oberfield, E. (2022). The elusive explanation for the declining labor share. *Annual Review of Economics*, *14*, 93–124.

Hamilton, J. D. (2018). Why you should never use the hodrick-prescott filter. *Review of Economics and Statistics*, *100*(5), 831–843.

Harrod, R. (1939). An essay in dynamic theory. *The Economic Journal*, *49*(193), 14–33.

Hirsch, B. T., & Macpherson, D. A. (2003). Union membership and coverage database from the current population survey: Note. *ILR Review*, *56*(2), 349–354.

Julius, A. J. (2005). Steady-state growth and distribution with an endogenous direction of technical change. *Metroeconomica*, *56*(1), 101–125.

Kaldor, N. (1961). Capital accumulation and economic growth. In D. C. Hague (Ed.), *The Theory of Capital* (pp. 177–222). Palgrave Macmillan UK.

Karabarbounis, L., & Neiman, B. (2014). The global decline of the labor share. *The Quarterly journal of economics*, *129*(1), 61–103.

Kennedy, C. (1964). Induced bias in innovation and the theory of distribution. *The Economic Journal*, *74*(295), 541–547.

Kiefer, D., & Rada, C. (2015). Profit maximising goes global: The race to the bottom. *Cambridge Journal of Economics*, *39*(5), 1333–1350.

Kumar, R., Schoder, C., & Radpour, S. (2018). Demand driven growth and capital distribution in a two class model with applications to the united states. *Structural Change and Economic Dynamics*, *47*, 1–8.

Lavoie, M. (2022). *Post-keynesian economics: New foundations*. Edward Elgar Publishing.

Manning, A. (2021). Monopsony in labor markets: A review. *ILR Review*, *74*(1), 3–26.

Noyola Vázquez, J. (1956). El desarrollo económico y la inflación en méxico y otros paıéses latinoamericanos. *Investigación económica*, *16*(4), 603–648.

Pasinetti, L. (1962). Rate of profit and income distribution in relation to the rate of economic growth. *Review of Economic Studies*, *29*(4), 267–279.

Petach, L., & Tavani, D. (2020). Income shares, secular stagnation and the long-run distribution of wealth. *Metroeconomica*, *71*(1), 235–255.

Piketty, T. (2014). *O capital no século xxi*. Editora Intrıénseca.

Piketty, T., & Zucman, G. (2014). Capital is back: Wealth-income ratios in rich countries 1700–2010. *The Quarterly journal of economics*, *129*(3), 1255–1310.

Rada, C., & Kiefer, D. (2016). Distribution-utilization interactions: A race-to-the-bottom among oecd countries. *Metroeconomica*, *67*(2), 477–498.

Rodríguez, O. (1993). *La teoría del subdesarrollo de la CEPAL*. Siglo XXI.

Rowthorn, R. E. (1977). Conflict, inflation and money. *Cambridge Journal of Economics*, *1*(3), 215–239.

Samuelson, P. A., & Modigliani, F. (1966). The pasinetti paradox in neoclassical and more general models. *The Review of Economic Studies*, *33*(4), 269–301.

Setterfield, M., & Lovejoy, T. (2006). Aspirations, bargaining power, and macroeconomic performance. *Journal of Post Keynesian Economics*, *29*(1), 117–148.

Shapiro, C., & Stiglitz, J. E. (1984). Equilibrium unemployment as a worker discipline device. *The American economic review*, *74*(3), 433–444.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, *70*(1), 65–94.

Spence, A. M. (1977). Entry, capacity, investment and oligopolistic pricing. *The Bell Journal of Economics*, 534–544.

Stamegna, M. (2023). A kaleckian growth model of secular stagnation with induced innovation. *mimeo*.

Stansbury, A., & Summers, L. H. (2020). *The declining worker power hypothesis: An explanation for the recent evolution of the american economy* (tech. rep.). National Bureau of Economic Research.

Stockhammer, E. (2011). The macroeconomics of unemployment. In *A modern guide to keynesian macroeconomics and economic policies* (pp. 137–164). Edward Elgar Cheltenham.

Stockhammer, E. (2017). Determinants of the wage share: A panel analysis of advanced and developing economies. *British Journal of Industrial Relations*, *55*(1), 3–33.

Stockhammer, E., & Michell, J. (2017). Pseudo goodwin cycles in a minsky model. *Cambridge Journal of Economics*, *41*(1), 105–125.

Storm, S., Naastepad, C. W. M., et al. (2012). Macroeconomics beyond the nairu. *Economics Books*.

Sunkel, O. (2016). Inflation in chile: An unorthodox approach. *ECLAC Thinking, Selected Texts (1948-1998). Santiago: ECLAC, 2016. p. 173-194*. (Original work published 1958)

Tavani, D. (2012). Wage bargaining and induced technical change in a linear economy: Model and application to the us (1963–2003). *Structural Change and Economic Dynamics*, *23*(2), 117–126.

Tavani, D. (2013). Bargaining over productivity and wages when technical change is induced: Implications for growth, distribution, and employment. *Journal of Economics*, *109*, 207–244.

Taylor, L. (1985). A stagnationist model of economic growth. *Cambridge Journal of Economics*, *9*(4), 383–403.

Taylor, L., Foley, D. K., & Rezai, A. (2019). Demand drives growth all the way: Goodwin, kaldor, pasinetti and the steady state. *Cambridge Journal of Economics*, *43*(5), 1333–1352.

Yeh, C., Macaluso, C., & Hershbein, B. (2022). Monopsony in the us labor market. *American Economic Review*, *112*(7), 2099–2138.

Zamparelli, L. (2015). Induced innovation, endogenous technical change and income distribution in a labor-constrained model of classical growth. *Metroeconomica*, *66*(2), 243–262.

Zamparelli, L. (2017). Wealth distribution, elasticity of substitution and piketty: An 'anti-dual' pasinetti economy. *Metroeconomica*, *68*(4), 927–946.

Appendix A

Stability analysis: short-run equilibrium

In order to analyze the existence and stability of the short-run equilibrium described in Section 2, let us consider the Jacobian matrix that characterizes the dynamical system given by equations (8) and (22). The Jacobian matrix is given by:

$$J = \begin{bmatrix} J_{11} & J_{12} \\ J_{21} & J_{22} \end{bmatrix} = \begin{bmatrix} \frac{\partial \hat{u}}{\partial \hat{u}} & \frac{\partial \hat{u}}{\partial \hat{\sigma}} \\ \frac{\partial \hat{\sigma}}{\partial \hat{u}} & \frac{\partial \hat{\sigma}}{\partial \hat{\sigma}} \end{bmatrix} \tag{34}$$

All the entries of the Jacobian matrix presented in equation (34) can be described as follows:

$$\begin{aligned} J_{11} &= \tfrac{\partial \hat{u}}{\partial \hat{u}} = \eta_1 \\ J_{12} &= \tfrac{\partial \hat{u}}{\partial \hat{\sigma}} = -\eta_2 \\ J_{21} &= \tfrac{\partial \hat{\sigma}}{\partial \hat{u}} = a_1 \\ J_{22} &= \tfrac{\partial \hat{\sigma}}{\partial \hat{\sigma}} = a_2 \end{aligned}$$

Analyzing the sign of each term, first, the impact of changes in capacity utilization on the proportionate rate of change of the same variable was assumed to be negative in our model. Again, this follows from the KSC for the equilibrium value of the rate of capacity utilization in the short run. That is, $J_{11} < 0$. Second, variations in the wage share have a negative impact on the proportionate rate of change of capacity utilization, as we considered, following the empirical evidence for the US, that the demand regime is profit-led. So, we have that $J_{12} < 0$.

Furthermore, changes in capacity utilization positively impact the rate of change in the labor share. This follows from another assumption arising from empirical evidence for the US economy - that the distributive regime is profit-squeeze. Thus, we have that $J_{21} > 0$. Lastly, as described in Section 2, the wage share dynamics is self-stabilizing . So, we have $J_{22} < 0$.

Clearly, the trace of matrix J, given by $J_{11} + J_{22}$, is negative. Moreover, following the previous assumptions, the determinant of the Jacobian matrix is given by:

$$det(J) = J_{11}J_{22} - J_{12}J_{21} = \eta_1 a_2 + \eta_2 a_1$$

It is clear to see that both the terms on the right-hand side of the previous expression have a positive sign. Thus, the determinant of the Jacobian matrix is positive. This implies that the system presents stability - particularly, it is a stable focus - and converges to the long-run equilibrium.