Labor Market Institutions, Endogenous Technical Change and Inequality: Demand- and Supply-Side Secular Stagnation

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Several OECD countries have recently experienced a simultaneous rise in income and wealth inequality and a decline in labor productivity growth. We provide an investigation of these stylized facts that focuses on the weakening of labor market institutions. For this purpose, we develop a two-class, demand-led model of growth and the distribution of income and wealth with endogenous technical change and explicit wage bargaining between workers and capitalists. We show that the worsening of labor market institutions not only tilts both the distribution of income and wealth in favor of the capitalist class, but it also lowers both the equilibrium accumulation rate and growth rate of labor productivity.

Keywords: Endogenous Technical Change, Income Shares, Wealth Inequality, Aggregate Demand.

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1 Introduction

Several OECD countries have experienced a simultaneous rise in income and wealth inequality and a decline in labor productivity growth in recent decades. Piketty (2014) and Gordon (2015) have proposed

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an explanation of these trends based on a standard neoclassical growth model. An exogenous decline in labor productivity growth or population growth, both of which anchor the long-run growth rate of the economy, makes the capital (wealth)-income ratio and thus wealth inequality rise. If the substitution elasticity between capital and labor exceeds unity, the decline in the income-capital ratio will also result in a falling labor share of income. We provide a contrasting investigation of these stylized facts that rejects the neoclassical theory of distribution and focuses on the weakening of labor market institutions rather than negative exogenous shocks to the natural growth rate. For this purpose, we develop a two-class, demand-led model of growth and the distribution of income and wealth with endogenous technical change, which features an explicit wage bargaining between workers and capitalists. We show that a worsening of labor market institutions simultaneously tilts the distribution of income and wealth in favor of the capitalist class and lowers both the equilibrium accumulation rate and growth rate of labor productivity, while it has uncertain effects on employment.

This paper is related to multiple streams of literature. We start with a standard wage-led Kaleckian growth model (Rowthorn, 1982; Dutt, 1984; Taylor, 1985), and we use it to investigate the issue of class wealth distribution first introduced by Pasinetti (1962). With respect to the recent and growing literature that has incorporated class wealth distribution into Post-Keynesian growth models (see for example Dutt 1990; Lavoie 1998; Taylor et al. 2019; Palley 2012; Ederer and Rehm 2020, 2021), we make two innovations. First, real wages are the outcome of an explicit bargaining process between workers and firms. This allows us to microfound the wage share as a function of workers' bargaining power and their fallback position in the negotiation, thus opening a space for labor market institutions and policies to affect the distribution of income and wealth and the growth rate of the economy. Second, we introduce endogenous, costly, technical change by assuming that labor productivity growth requires private R&D investment. Some recent papers have introduced private (Caminati e Sordi, 2019) or public (Dutt, 2013; Tavani and Zamparelli , 2017) R&D expenditure in demand-led model, but without analyzing its implications for wealth inequality. In this paper, we simply assume that expenditure in R&D is a direct function of sales in line with Dosi et al. (2010) and Caiani et al. (2019), who explored this hypothesis in agent-based modeling environments.

By linking the amount of resources invested in R&D to short-run demand fluctuations, this paper is also related to the recent neoclassical endogenous growth literature, which has developed a unified analysis of growth and cycles (see Stadler (1990) for a seminal contribution and Cerra et al. (2023) for a recent survey).

The rest of the paper is organized as follows. Section 2 presents the basic model, which is expanded in Section 3 to introduce the public sector. Section 4 concludes.

2 The Model

2.1 Production, Wage Bargaining and Income Shares

Identical competitive firms produce output Y, homogeneous with capital K, using a fixed-proportion technology: $Y = \min\{uBK, AL\}$ where L is labor demand, B is the full capacity income-capital ratio, u is the rate of capacity utilization, and A is labor productivity. The output price is normalized to one throughout. Given the real wage w, total firm profits Π, in turn equal to the product of the uniform profit rate r times capital stock K are given by

$$\Pi \equiv rK = uB\left(1 - \frac{w}{A}\right). \tag{1}$$

Workers bargain collectively with firms over the real wage. We follow the standard labor market literature and use the Nash (1950) solution to the bargaining problems. Firms' gains from bargaining are equal to the profits to be made when labor and capital are used for production purposes, minus the cost of shutting down production, which we assume to be zero throughout. Workers' gains from a successful bargain are equal to the difference between the real wage w and a fallback position $z < w$ times total labor demand L. With workers' bargaining power denoted by η, workers and firms choose the real wage to maximize the weighted Nash product of their respective bargaining gains, that is they choose w to maximize

$$[(w - z)L]^{\eta}\left[B\left(1 - \frac{w}{A}\right)K\right]^{(1-\eta)}. \tag{2}$$

The solution is a real wage equal to a weighted average of the workers' fallback and labor productivity:

$$w = (1 - \eta)z + \eta A. \tag{3}$$

Accordingly, the labor share $\omega \equiv w/A$ can be written preliminarily as a function of workers' bargaining power and the fallback as follows:

$$\omega = (1-\eta)\frac{z}{A} + \eta. \tag{4}$$

2.2 Investment, Innovation and Two-class Capital Accumulation

Firms' investment demand is described by the following function:

$$I \equiv g_K^i K = (\gamma_0 + \gamma_1 u)K. \tag{5}$$

Both workers and capitalists participate in the accumulation process through their savings. As it is standard in the Pasinetti literature, capitalists' and workers' savings are:

$$S^c \equiv g_c^s K^c = s^c uB(1-\omega)K^c \tag{6}$$

$$S^w \equiv g_w^s K^w = s^w(rK^w + wL), \tag{7}$$

where K^c, K^w are the stocks of capital (or wealth, since capital is the only accumulable asset in the economy) owned by capitalists and workers, while s^c, s^w denote the saving propensities of the two classes. Letting $\phi \in [0,1]$ stand for the capitalists' share of wealth, standard algebraic manipulation leads to the following accumulation rates for the two classes and economy-wide accumulation rate:

$$g_c^s = s^c uB(1-\omega) \tag{8}$$

$$g_w^s = \frac{s^w}{1-\phi} uB\left[(1-\phi)(1-\omega)+\omega\right] \tag{9}$$

$$\begin{aligned} g_K^s &= \phi g_c^s + (1-\phi)g_w^s \\ &= uB\left[s^w + \phi(1-\omega)(s^c - s^w)\right]. \end{aligned} \tag{10}$$

To economize on notation in what follows, denote the term in square brackets in equation (10) as $\bar{s}(\omega, \phi)$, the average propensity to save in the economy. It is increasing in the capitalist wealth share ϕ: $\bar{s}_\phi = (1-\omega)(s^c - s^w) > 0$, and decreasing in the labor share ω: $\bar{s}_\omega = -\phi(s^c - s^w) < 0$.

Expenditure on innovation R leads to labor productivity growth g_A through the following technology:

$$g_A = (R/K)^{\alpha}, \alpha \in (0,1). \tag{11}$$

We follow the ABM literature (Dosi et al., 2010; Caiani et al., 2019) in assuming that expenditure on innovation R is a share $\delta \in (0,1)$ of GDP, so that $g_A = (uB\delta)^{\alpha}$.

2.3 Short-Run Equilibrium

National accounting implies that $Y = C + I + R$, or equivalently that $g_K^i = I/K = (Y - C - R)/K$. Some algebra leads to the following IS equilibrium condition:

$$\gamma_0 + \gamma_1 u = uB[\bar{s}(\omega,\phi) - \delta],$$

from which the goods-market equilibrium utilization rate is:

$$u^* = \frac{\gamma_0}{B[\bar{s}(\omega,\phi) - \delta)] - \gamma_1}. \tag{12}$$

Given the postulated shape of the investment function, equilibrium utilization (demand) is wage-led ($u_\omega^* > 0$); furthermore, it decreases in the capitalist wealth share ($u_\phi^* < 0$) and it increases in the propensity to spending in innovation ($u_\delta^* > 0$) since it is a source of aggregate demand.

Plugging equilibrium utilization (12) into the accumulation rate and labor productivity growth leads to:

$$g_K = \frac{\gamma_0 B[\bar{s}(\omega,\phi) - \delta]}{B[\bar{s}(\omega,\phi) - \delta] - \gamma_1} \tag{13}$$

$$g_A = \left(\frac{\delta B \gamma_0}{B[\bar{s}(\omega,\phi) - \delta] - \gamma_1}\right)^{\alpha}, \tag{14}$$

which shows that both growth and innovation are wage led.

2.4 Wealth Distribution

The capitalist share of wealth evolves through the following differential equation:

$$\frac{\dot{\phi}}{\phi} = g_c^s - g_K, \tag{15}$$

and, using what above, has a non-trivial steady state at

$$\phi_{ss} = \frac{s^c[1-\omega] + \delta - s^w}{(s^c - s^w)(1-\omega)}. \tag{16}$$

The long-run capitalist wealth share is increasing in the capitalist propensity to save s^c while decreasing in the workers' propensity to save s^w; it is decreasing in the labor share ω, and in turn in the workers' bargaining power, and increasing in the R&D share δ.

2.5 Long-run growth

To close the model, we endogenize the workers' fallback position z as equal to the *replacement ratio* $\rho \in (0, 1)$ times the going real wage w. Accordingly, the labor share is fixed at each period as an increasing function of the workers' bargaining power η and the replacement ratio ρ, our two main measures of labor market institutions. Plugging $z = \rho w$ into (4) yields:

$$\omega(\eta, \rho) = \frac{\eta}{1 - \rho(1-\eta)} \text{ with } \omega_\eta > 0, \omega_\rho > 0. \tag{17}$$

If we then use this solution for the labor share, we can rewrite the long-run capitalist wealth share as follows:

$$\phi_{ss} = 1 - \frac{s^w \eta - \delta[1 - \rho(1-\eta)]}{(s^c - s^w)(1-\rho)(1-\eta)}, \tag{18}$$

which shows that the capitalists' share of wealth increases in the capitalist propensity to save and the R&D share, while it decreases in the workers' saving propensity, their bargaining power, and the replacement ratio.

In a labor-abundant economy there is no need for the accumulation rate and the growth rate of labor productivity to be equal. Plugging the steady state capitalists' wealth share into (13) and (14), we can solve for the long-run accumulation rate and labor productivity growth as:

$$g_K = \frac{s^c[1-\omega(\eta,\rho)]B\gamma_0}{Bs^c[1-\omega(\eta,\rho)] - \gamma_1} = \frac{s^c(1-\rho)(1-\eta)B\gamma_0}{(Bs^c - \gamma_1)(1-\rho)(1-\eta) - \eta\gamma_1} \tag{19}$$

$$g_A = \left[\frac{\delta B\gamma_0}{Bs^c[1-\omega(\eta,\rho)] - \gamma_1}\right]^\alpha = \left[\frac{\delta B\gamma_0[(1-\rho)(1-\eta) - \eta]}{(Bs^c - \gamma_1)(1-\rho)(1-\eta) - \eta\gamma_1}\right], \tag{20}$$

which shows that both capital accumulation and labor productivity growth are positive functions of the workers' bargaining power and the replacement ratio.

Long-run employment growth can be calculated as the difference between capital accumulation and labor productivity growth

$$g_L = \frac{s^c[1-\omega(\eta,\rho)]B\gamma_0}{Bs^c[1-\omega(\eta,\rho)]-\gamma_1} - \left[\frac{\delta B\gamma_0}{Bs^c[1-\omega(\eta,\rho)]-\gamma_1}\right]^{\alpha}.$$

Whether employment increases or decreases following a shock to the wage share depends on the relative size of the wage share effect on capital and productivity growth. If we let $Bs^c[1-\omega(\eta,\rho)] - \gamma_1 \equiv D$, we can calculate $dg_L/d\omega = dg_K/d\omega - dg_A/d\omega = \frac{Bs^c\gamma_0^\alpha}{D^2} D^{1-\alpha}\left(\gamma_1\gamma_0^\alpha - \alpha B^\alpha \delta^\alpha\right)$. Hence $dg_L/d\omega > 0 \iff \alpha < \gamma_1\left(\frac{\gamma_0}{B\delta}\right)^\alpha$. When returns to R&D are small enough, a higher wage share makes capital accumulation grow faster than productivity growth, so that employment increases. In this case, pro-labor policies simultaneously improve employment, growth and the workers' output share. On the other hand, when the productivity of R&D investment is high a trade off emerges between employment and labor productivity growth.

3 Tax and Policy

In our model, there are no labor supply constraints. This is typically the case of a dual economy, where an informal sector absorbs all unemployed workers. In such an economy, the fallback position consists in being employed in this low-productivity sector. The replacement rate is the ratio between the wage in the modern sector and the wage in the informal. Let us now introduce a role for the government, and see how it can affect the workers' fallback position. The government collects taxes on income by charging the tax rate t. Total taxes $T = tY$ are spent in the provision of a public good (or investment) G, which we assume is capable of improving the productivity of the economy's informal sector. If real wages track productivity, then the replacement rate becomes a positive function of the public good. Specifically, we assume $\rho = \rho(G/Y) = \rho(t)$, with $\rho'(t) > 0$. The introduction of taxation into the economic system affects on the one hand the labor share, which is now a positive function of the tax rate

$$\omega(t) = \frac{\eta}{1-(1-\eta)\rho(t)} \text{ with } \omega_t > 0; \tag{21}$$

and, on the other hand, the economy's accumulation of saving is

$$g_K^s = (1-t)\bar{s}(\omega(t),\phi)uB.$$

It follows that the saving-investment equilibrium turns into

$$\gamma_0 + \gamma_1 u = uB[(1-t)\bar{s}(\omega(t),\phi) - \delta],$$

and the goods-market equilibrium utilization rate is:

$$u^* = \frac{\gamma_0}{B[(1-t)\bar{s}(\omega(t),\phi) - \delta)] - \gamma_1}. \tag{22}$$

Plugging equilibrium utilization (22) into the accumulation rate and labor productivity growth leads to:

$$g_K = \frac{\gamma_0 B[(1-t)\bar{s}(\omega(t),\phi) - \delta]}{B[(1-t)\bar{s}(\omega(t),\phi) - \delta] - \gamma_1} \tag{23}$$

$$g_A = \left(\frac{\delta B \gamma_0}{B[(1-t)\bar{s}(\omega(t),\phi) - \delta] - \gamma_1}\right)^{\alpha}. \tag{24}$$

The tax rate has two distinct positive effects on aggregate demand, accumulation and the amount of resources available for R&D investment. The first effect directly reduces the economy's propensity to save because all taxes are immediately spent on G. The second effect operates through the wage share: higher taxes raise the wage share by increasing the workers' outside option, and the average propensity to save increases accordingly.

The presence of taxation affects the dynamics of the capitalists' share of wealth:

$$\frac{\dot{\phi}}{\phi} = g_c^s - g_K = \frac{\gamma_0(1-t)s^c B(1-\omega(t))}{B[(1-t)\bar{s}(\omega(t),\phi) - \delta] - \gamma_1} - \frac{\gamma_0 B[(1-t)\bar{s}(\omega(t),\phi) - \delta]}{B[(1-t)\bar{s}(\omega(t),\phi) - \delta] - \gamma_1}. \tag{25}$$

The steady state distribution of wealth is

$$\phi_{ss} = \frac{(1-t)[s^c(1-\omega(t)) - s^w] + \delta}{(1-t)(s^c - s^w)(1-\omega(t))}. \tag{26}$$

Substituting (26) into (22), (28) and (29) shows that aggregate demand, capital accumulation and labor productivity growth are positive functions of the tax rate

$$u^* = \frac{\gamma_0}{B[(1-t)s^c(1-\omega(t))-\delta)]-\gamma_1} \tag{27}$$

$$g_K = \frac{B[(1-t)s^c(1-\omega(t))-\delta)]\gamma_0}{B[(1-t)s^c(1-\omega(t))-\delta)]-\gamma_1} \tag{28}$$

$$g_A = \left[\frac{\delta B\gamma_0}{B[(1-t)s^c(1-\omega(t))-\delta)]-\gamma_1}\right]^{\alpha}. \tag{29}$$

4 Conclusion

This paper focuses on the weakening of labor market institutions as a potential source of the simultaneous rise in income and wealth inequality, on one hand, and of the fall of labor productivity growth on the other hand. For this purpose, it offers a two-class, demand-led model of growth and the distribution of income and wealth with endogenous technical change, while the wage rate is set through explicit bargaining between workers and capitalists. In this setting, a worsening of labor market institutions simultaneously tilts the distribution of income and wealth in favor of the capitalist class and lowers both the equilibrium accumulation rate and growth rate of labor productivity, while it has in principle uncertain effects on employment.

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