*Article*

Review of Radical Political Economics
1–20

DOI: 10.1177/0486613417701265
rrpe.sagepub.com

# Profit Squeeze in the Duménil and Lévy Model

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**Abstract**

This article looks at the implications of labor-supply limits and endogenous wage growth in the Duménil and Lévy model. A long-run relationship is established between the employment rate and capitalists' decisions to reinvest profits. Elements of a Marxian approach to macroeconomic policy are sketched. New conditions are derived for being Kaleckian/Keynesian in the short run and classical Marxian in the long run.

**JEL Classification:** E11, J21, O11

**Keywords**

classical Marxian, Goodwin class struggle model, profit squeeze, reserve army of labor, socialization of investment

## 1. Introduction and Overview

Among economists on the Left, there is significant disagreement about the determinants of long-run development in capitalist economies. One position, which can be called Kaleckian (or Keynesian), treats the growth of aggregate demand as the fundamental factor. An opposing position, which can be referred to as classical Marxian, argues that the main causal factor is the amount of saving available to finance productive investment (with this saving itself typically taking the form of profits reinvested by capitalists). There seems to be wide agreement on both sides that aggregate demand is important in the short run, so the real point of contention involves the specific conditions under which the demand-driven short-run fluctuations of a capitalist economy will gravitate toward a classical-Marxian long-run growth path.[1] The Duménil and Lévy model (see Duménil and Lévy 1999), which provides some general conditions under which this occurs, is one of the most interesting and well-known expressions of the classical-Marxian position.

The aim of the present paper is to contribute to the debate between Kaleckians and classical Marxians by pointing out certain shortcomings of the Duménil and Lévy model, and then constructing a reformulated version of the model to address them. Duménil and Lévy's main results

[1]For a detailed discussion of these issues, see Dutt (2011) and Duménil and Lévy (2014).

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Date received: September 7, 2016
Date accepted: March 2, 2017

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are suspect because they rely on unrealistic assumptions about the labor market, including an unlimited supply of labor and a fixed real wage. Moreover, these restrictive assumptions mean that their model is unable to shed light on an important policy issue: the determinants of the employment rate. To deal with this, I incorporate an explicit description of labor-supply limits and wage growth into their model.

We see below that the long-run equilibrium for this reformulated model is still a classical-Marxian one. From there, two main things are accomplished. First, I show that it is possible to increase the equilibrium employment rate by exerting public control over capitalists' saving and investment decisions. This offers an answer to Kaleckians (Lavoie and Kriesler 2007: 595) who have suggested that the classical-Marxian approach does not provide any macropolicy alternative to neoliberalism. I argue further that the practical implications of my analysis differ significantly from what one finds in the neoclassical models, Kaleckian models, and the original Duménil and Lévy model. Second, this paper provides a new set of conditions under which a capitalist economy will be Kaleckian in the short run but classical Marxian in the long run. In particular, we see that it is possible to dispense with an assumption—concerning the interactions between capacity utilization and accumulation—that is a necessary condition for Duménil and Lévy's original results but does not fit macroeconomic data for the United States.

The rest of the paper is organized as follows. In the next section, I briefly review the mechanics of the original Duménil and Lévy model. Then, in section 3, I formulate a new model to address the issues raised above. Section 4 provides an analysis of the model and the main results. Section 5 looks at some extensions of the model. Finally, section 6 concludes the paper.

## 2. Background

As is well known, disagreements about capacity utilization are at the heart of the aforementioned controversy between Kaleckians and classical Marxians. In Kaleckian models, capacity utilization varies so that output can accommodate changes in aggregate demand. A fall in the saving rate or increase in the wage share, by increasing aggregate demand and capacity utilization, can increase national income and the rate of growth (Kalecki 1971). Similarly, if there is an autonomous increase in investment demand, the additional investment "finances itself" by increasing aggregate demand and capacity utilization.

However, for classical-Marxian models, the rate of capacity utilization is typically assumed to stay at a fixed level that is not determined by aggregate demand. As a result, there is a positive association between the aggregate saving rate and the rate of accumulation (Foley and Michl 2010). Because profits provide the main source of saving that finances productive investment, classical-Marxian models imply that there is a trade-off between the rate of economic growth and the wage share. Investment *does not* finance itself; the existence of the requisite finance is contingent upon the ability of capitalists to extract a sufficiently large share of national income as profit.

Duménil and Lévy (1999) create a bridge between these distinct theoretical frameworks by arguing that they both depict realistic features of capitalist economies, but describe the growth process on different time scales. To make this point, Duménil and Lévy start by constructing a model based on the usual Kaleckian assumption that capacity utilization adjusts to accommodate changes in aggregate demand. But they also assume that investment is subject to a financing constraint, with the result that aggregate demand is itself affected by the amount of liquid capital created in the financial system. At the same time, the central bank in their model attempts to limit price inflation by controlling the creation of liquid capital, and firms increase or decrease prices depending on whether capacity utilization is above or below the "normal" rate.[2] As a

[2]The normal rate should be interpreted as the utilization rate that is considered optimal by firms. In principle, the optimal rate of utilization can depend on a number of different variables, and, thus, may change over time, but the long-run variations in capacity utilization in actual economic data are modest (Skott 2012).

consequence of all this, the central bank's efforts to control inflation will push aggregate demand toward the level consistent with normal utilization of aggregate productive capacity. Thus, the classical-Marxian long-run equilibrium, in which the rate of capacity utilization has a fixed value that is not determined by demand, provides a center of gravity for the demand-driven dynamics in the model. If there is a permanent fall in the profit share or capitalists' saving rate, this will initially increase the rate of accumulation, but over time, the economy will settle into a new long-run equilibrium in which the rate of accumulation is lower than it would have otherwise been.

This schema provides an interesting account of the role of aggregate demand within the classical-Marxian framework. However, it is built on some strong simplifying assumptions, and important questions remain about how the results are affected when the simplifying assumptions are removed. The model assumes that the supply of labor is unlimited, income distribution is not affected by other variables, and the inflation rate is completely determined by the rate of capacity utilization. This last point is particularly salient because of the role of inflation in bringing solution trajectories toward the long-run equilibrium.

In contrast with this, a number of economists, building upon Marx's ([1867] 1990) analysis, have developed models that involve interactions between income distribution, inflation, labor-supply limits, the class struggle, and aggregate demand.[3] From this perspective, Duménil and Lévy's assumptions about the labor market represent an important weakness in their model. With these considerations in mind, we now move to construct a new model.

## 3. The Model

### *3.1. Preliminaries and notation*

The following model describes a closed capitalist economy evolving in continuous time. Firms produce a flow of homogeneous output using fixed-coefficients technology. Aggregate real output is denoted by $X$, and nominal output is $pX$, where $p$ denotes the price level. Labor and fixed capital are the only inputs to production, and firms always have some spare productive capacity. There is no technological change or depreciation of fixed capital. The capital stock at any given time is denoted by $K$, and capacity utilization is measured by the output/capital ratio $u = X/K$. The proportion of profit income that is saved is denoted by $s$, and the saving rate for wage income is assumed to be 0. The output/capital ratio determined by normal utilization of capacity is denoted by $\bar{u}$.

The nominal wage in the model is denoted by $w$, and the wage share is denoted by $\psi$. I assume for simplicity that the units have been chosen so that the output-labor coefficient is equal to 1. As a consequence, output is equal to employment, and the wage share is,

$$\psi = \frac{w}{p}. \tag{1}$$

The profit share, $\pi$, is,

$$\pi = 1 - \psi. \tag{2}$$

[3]The starting point for this literature is Goodwin's (1967) classical growth model. Desai (1973) extended the model to include inflation. More recently, economists have formulated models of demand-driven growth that exhibit Goodwin-type dynamics. See von Arnim and Barrales (2015) for an overview. Although Michl (2009) formulates a Duménil and Lévy-type model with an explicit labor-supply constraint, workers play a completely passive role in the model, the inflation rate is completely determined in the product market, and the equilibrium employment rate can take any value; thus, his model does not address the issues raised in this paper.

Prices are determined by a simple markup on unit labor costs: $p = (1+\tau)w$. One can easily verify that $\pi = \tau/(1+\tau)$ and $\psi = 1/(1+\tau)$. A "dot" is used to denote a derivative with respect to time, and a "hat" is used to denote the percentage change (i.e., the growth rate) of a variable. Thus, for example, $\dot{p} = dp/dt$, and $\hat{p} = \dot{p}/p$ is the inflation rate. To make the mathematical expressions to follow more readable, I enclose function arguments in brackets.

I also assume, to start, that the central bank has set its inflation target to 0, and that workers act as if they expect the aggregate rate of price inflation to be equal to the central bank's inflation target. The rationale for this assumption is that, in general, workers have limited information about the aggregate inflation rate, and the central bank's inflation target provides a useful rule of thumb if the actual inflation rate does not stray too far from it for too long. These assumptions are relaxed at a later stage in the paper, but provide a useful starting point.

## 3.2. Workers

In Marx's ([1867] 1990: chapter 25) account, the normal functioning of capitalism depends upon the existence of persistent unemployment. Unemployed workers constitute the *floating reserve army of labor*. During periods when demand for labor is high and the floating reserve army of labor becomes depleted, the bargaining power of the workers rises, and profitability is undermined. Labor market conditions can also influence the rate of growth of the labor force by affecting migration patterns or labor-force participation rates, but this does not change the fact that the growth rate of the labor force is subject to inherent limits, and these limits affect the distribution of power and income between classes (Armstrong, Glyn, and Harrison 1991: chapter 11). As an approximation to this complex reality, one can assume that the labor force grows at a constant rate, and the growth rate of the wage is an increasing function of the employment rate, as in Goodwin's (1967) mathematical formalization of Marx.

I adopt a slightly modified version of Goodwin's model of wage bargaining. At any given time, let $N$ denote the size of the labor force, and let $E$ be the number of employed workers. Then, $e = E/N$ is the employment rate, and $N - E$ is the number of workers in the floating reserve army of labor. The growth rate of $N$ is determined by the equation,

$$\hat{N} = n, \tag{3}$$

where $n$ is a positive constant. Following Taylor (2012), I assume that both the current distribution of income and the level of economic activity influence wage bargaining. At any given rate of employment, workers demand higher wages—and firms are more willing to acquiesce to these demands—if profit margins are relatively high. Similarly, if the profit share $1 - \psi$ is already low and the wage share $\psi$ is high, it is more difficult for workers to successfully bargain for higher wages. Thus, $\hat{w}$, the growth rate of the nominal wage, satisfies,

$$\hat{w} = \alpha\,[e, \psi], \tag{4}$$

where $\alpha$ is a differentiable function, such that $\alpha_e > 0$ and $\alpha_\psi < 0$.

I also assume that the wage stops rising after the profit share falls below a certain critical level, although this critical level itself may be affected by the balance of power between classes (with the distribution of power proxied by the employment rate). Mathematically, this means that there is a function $f$ such that,

$$\alpha\big[e, f[e]\big] = 0,$$

and $0 < f[e] < 1$ for all $e$. Thus, nominal wage growth is equal to 0 when $\psi = f[e]$. This turns out to be an equilibrium condition for the model. Implicit differentiation shows that,

$$f_e = -\frac{\alpha_e}{\alpha_\psi} > 0.$$

Hence, $f$ must be an increasing function; the curve $\psi = f[e]$ defines a monotonically increasing, equilibrium relationship between the real wage and the employment rate.

All this is consistent with the existence of a "wage curve" like the one studied econometrically by Blanchflower and Oswald (1995).[4] From a theoretical perspective, an equilibrium relationship between income distribution and employment can be expected to exist because of the effect of the latter on the cost of job loss; see Bowles (1985) and Bowles, Gordon, and Weisskopf (1986). When the floating reserve army shrinks in proportion to the total labor force, jobs become easier to find, the threat of job termination loses effectiveness as a disciplinary device, and employers must accept a higher real wage to maintain control over employees.

### 3.3. Banks

Let $M$ denote the money supply, and let $m = M / pK$. The dynamics of $m$ are determined by the equation,

$$\dot{m} = \beta_0 (u - \bar{u}) - \beta_1 \hat{p}, \tag{5}$$

where $\beta_0$ and $\beta_1$ are positive constants. This is Duménil and Lévy's (1999) "two-tier" model of the banking system. In equation 5, the term $\beta_0(u-\bar{u})$ represents the fact that, if the economy-wide rate of capacity utilization $u$ is above its normal value $\bar{u}$, firms demand new loans so that they can finance additional fixed-capital investment. By granting these loans, banks increase the money supply (relative to the size of the existing capital stock), and this causes $m$ to rise. Similarly, when the rate of capacity utilization is below the desired level, firms use their cash reserves to pay off loans rather than make new fixed-capital investments, and this causes $m$ to fall. In contrast, the term $\beta_1\hat{p}$ represents the fact that there is a central bank that attempts to regulate the rate of price inflation, $\hat{p}$, by controlling the creation of new credit.

### 3.4. Capital accumulation

Investment plans depend upon current profits, expectations about future profits, and the amount of liquidity in the financial system.[5] Thus, $\hat{K}$, the rate of capital accumulation, satisfies,

$$\hat{K} = \gamma [u, \pi, m], \tag{6}$$

where the partial derivatives $\gamma_u$, $\gamma_\pi$, and $\gamma_m$ are all positive. If $m$ were held at a fixed value, $\gamma$ would reduce to a Keynesian investment function of the form analyzed by Marglin and Bhaduri (1991)

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[4]The evidence compiled by Blanchflower and Oswald strongly suggests that the wage curve has a specific (nonlinear) shape. However, the analysis in this paper does not depend on $f$ having any special functional form.

[5]See Foley (1987) and Duménil and Lévy (1999) for models that emphasize the relationship between liquidity and investment demand. See Marglin and Bhaduri (1991) for a detailed analysis of how capacity utilization and the profit share can affect expectations and investment decisions.

and others. As a result, changes in $m$ can be usefully conceptualized as shifts in the investment function.

### 3.5. Inflation

Firms' pricing decisions depend on two factors: production costs and product market demand. I incorporate this idea into the model by assuming that the aggregate rate of price inflation, $\hat{p}$, satisfies the equation,

$$\hat{p} = \zeta_0 \left(u - \overline{u}\right) + \zeta_1 \left(\hat{w} - \hat{p}\right), \tag{7}$$

where $\zeta_0$ and $\zeta_1$ are positive constants. If $\zeta_1$ were set to 0, then the above equation would reduce to Duménil and Lévy's model of price determination, in which the rate of capacity utilization is a proxy for product market conditions. To understand the meaning of the term $\zeta_1(\hat{w} - \hat{p})$, notice that $\hat{w} - \hat{p}$ is the growth rate of labor costs as a share of aggregate revenue. Thus, the markup is falling when $\hat{w} - \hat{p}$ is positive, and rising when $\hat{w} - \hat{p}$ is negative. The term $\zeta_1(\hat{w} - \hat{p})$, therefore, describes firms' attempts to maintain a targeted markup rate in response to changes in labor costs. Related to this, the term $\zeta_0(u - \overline{u})$ can be interpreted as saying that the targeted markup itself will change over time to bring demand in line with normal utilization of productive capacity. So, although firms are not willing to completely absorb increases in wage costs through changes in the markup, they also do not stubbornly increase prices in defense of a fixed markup if product demand is persistently below the level consistent with normal utilization of capacity. Equation 7 can be rewritten as,

$$\hat{p} = \delta_0 \left(u - \overline{u}\right) + \delta_1 \hat{w}, \tag{8}$$

where $\delta_0 = \zeta_0 / (1 + \zeta_1)$ and $\delta_1 = \zeta_1 / (1 + \zeta_1)$. Notice that $\delta_1$ is between 0 and 1.

### 3.6. Capacity utilization and employment in the short run

At any given time, real fixed-capital investment is equal to $\dot{K}$, and the aggregate saving rate is $s\pi$. The Keynesian short-run equilibrium condition is, therefore, $s\pi pX = p\dot{K}$. After dividing both sides of the short-run equilibrium condition by $pK$, applying equation 6, and noting that $\pi = 1 - \Psi$, we obtain,

$$s\left(1 - \psi\right)u = \gamma\left[u, 1 - \psi, m\right]. \tag{9}$$

I assume that the economy is always in short-run equilibrium. Thus, for given model parameters, equation 9 determines $u$ as an implicit function of the two variables $\Psi$ and $m$.

Let us now define,

$$k = \frac{K}{N}. \tag{10}$$

The employment rate is $e = E / N = X / N = (X / K)(K / N),$ that is,

$$e = ku. \tag{11}$$

(Note that $E = X$ because, as discussed above, the output-labor coefficient is 1.) Hence, the employment rate is jointly determined by aggregate demand (as encapsulated by $u$) and the level of capitalist development (as measured by $k$).

By means of implicit differentiation of equation 9, we can reproduce some standard comparative-static results for the short-run equilibrium rate of capacity utilization (see Marglin and Bhaduri 1991). Because $k$ is given in the short run, these results all have obvious analogues for the determination of the employment rate. First, we have,

$$\frac{du}{ds} = \frac{\pi u}{\gamma_u - s\pi}.$$

Thus, a fall in capitalists' saving rate has expansionary short-run effects—that is, the paradox of thrift holds in the short run—as long as the inequality $\gamma_u < s\pi$ is satisfied. This inequality says, of course, that saving is more responsive to an increase in capacity utilization than is investment demand. This is the familiar Keynesian short-run stability condition.

We also have,

$$\frac{du}{d\psi} = \frac{su - \gamma_\pi}{s\pi - \gamma_u}.$$

Thus, assuming the Keynesian short-run stability condition holds, an increase in the wage share has expansionary short-run effects in this model if $\gamma_\pi < su$. If investment demand reacts more strongly to changes in profitability, so that $\gamma_\pi > su$, then an increase in the wage share will depress aggregate demand. In the former case, the model is said to be *stagnationist* (or *wage-led*), while in the latter case, it is said to be *exhilarationist* (or *profit-led*). There is evidence that the United States and other advanced capitalist economies are exhilarationist, but the issue remains controversial, and the evidence is far from being definitive (see Kiefer and Rada 2015; Nikiforos and Foley 2012; and references therein).[6]

One final point should be made about the short-run dynamics. If the short-run stability condition holds, then it is straightforward to verify that the accumulation rate will rise if the investment function shifts upward. This, of course, is simply an expression of the Kaleckian idea that investment is self-financing. However, as Kalecki (1971: 29) points out, this process can only continue if there is a corresponding expansion of bank credit. These ideas have been formalized in modern post-Keynesian models, with explicitly modeled banking systems that completely accommodate firms' loan demands (Lavoie and Godley 2001–2002). However, in the present model, we will see that the equilibrium would become unstable if the central bank followed a completely accommodationist policy (with $\beta_1 = 0$); macro stability in this model is inconsistent with investment that finances itself in the long run.

## 3.7. The whole system

The equations 1 to 11, which constitute the core model studied in this paper, can be reduced to a system of three nonlinear differential equations. Putting together equations 10, 6, 3, and 9, we obtain by log-differentiation of $k$,

$$\hat{k} = \hat{K} - \hat{N} = \gamma[u, 1-\psi, m] - n = s(1-\psi)u - n.$$

[6]It should be noted also that if the aggregate saving rate is given by a nonlinear function $\sigma$ of $\pi$ (with $\sigma_\pi > 0$), rather than the simple linear specification $s\pi$, then $du / d\Psi$ will be negative if $\sigma_\pi u < \gamma_\pi$ and $\sigma > \gamma_u$. So, for instance, if firms tend to distribute most additional profit to households after the share of retained profits rises above a certain point, then $\sigma\pi$ could be small over most of the empirically relevant range of $\pi$ values. In that case, the economy may be exhilarationist even if investment does not depend very strongly on profitability, and the *average* propensity to save out of profit income is large.

Next, using equation 1 for the wage share, and equation 8 for price inflation, we obtain,

$$\hat{\psi} = \hat{w} - \hat{p} = (1-\delta_1)\hat{w} - \delta_0(u - \bar{u}).$$

We can also plug the expression for $\hat{p}$ in equation 8 into equation 5 to get,

$$\dot{m} = (\beta_0 - \beta_1\delta_0)(u-\bar{u}) - \beta_1\delta_1\hat{w}.$$

Finally, using the fact that $\hat{w} = \alpha[e,\psi]$, we obtain the system,

$$\dot{k} = k(s(1-\psi)u - n), \tag{12}$$

$$\dot{\psi} = \psi((1-\delta_1)\alpha[e,\psi] - \delta_0(u-\bar{u})), \tag{13}$$

$$\dot{m} = (\beta_0 - \beta_1\delta_0)(u-\bar{u}) - \beta_1\delta_1\alpha[e,\psi], \tag{14}$$

where $u$ is a function of $\Psi$ and $m$, defined implicitly by the relation in 9, and $e = ku$.

## 4. Dynamics

### 4.1. Existence of the long-run equilibrium

By a *positive equilibrium solution* for this model, we mean an equilibrium $(k^*, \psi^*, m^*)$ for the system of equations 12 to 14 such that the numbers $k^*$, $\psi^*$, and $m^*$ are positive. To guarantee that the positive equilibrium exists and is unique, we need to impose certain conditions on the nonlinearities in $f$ and $\gamma$.

*Theorem 1. Suppose the following three assumptions are satisfied:*

1. $\beta_0 - \beta_1\delta_0 \neq \beta_0\delta_1$,
2. $s(1-f[1])\bar{u} < n < s(1-f[0])\bar{u}$,
3. $\gamma\left[\bar{u}, \frac{n}{s\bar{u}}, 0\right] < n < \lim_{m\to\infty}\gamma\left[\bar{u}, \frac{n}{s\bar{u}}, m\right]$.

*Then, the model has a unique positive equilibrium solution* $(k^*, \psi^*, m^*)$. *Moreover, in the equilibrium, the rate of capacity utilization is* $u^* = \bar{u}$, *the employment rate* $e^*$ *is determined by the equation* $s(1-f[e^*])\bar{u} = n$, *the wage share is* $\psi^* = f[e^*]$, *the profit share is* $\pi^* = n / s\bar{u}$, *and the rate of accumulation is n.*

For reasons of space, the proof is omitted, but proofs of all results in the paper are available from the author upon request.

The equilibrium described in theorem 1 is, of course, a classical-Marxian long-run equilibrium; capacity utilization is at the normal rate $\bar{u}$, and the rate of economic growth is $s\pi\bar{u}$. The equilibrium employment rate and the distribution of income are determined by the equation,

$$s(1-f[e^*])\bar{u} = n. \tag{15}$$

The investment function $\gamma$, as well as the parameters describing pricing and the banking system, are irrelevant to the determination of the long-run equilibrium values of real variables.

The assumptions in the theorem can be understood as follows. First, the condition $\beta_0 - \beta_1\delta_0 \neq \beta_0\delta_1$ rules out the fluke case in which there is a continuum of equilibria. The second assumption says that, by means of variations in income distribution, it is possible for the economy to generate an aggregate saving rate consistent with balanced growth. The variations in income distribution occur by means of changes in the relative size of the floating reserve army of labor. The two quantities $(1-f[1])$ and $(1-f[0])$ are hypothetical equilibrium profit shares when the employment rate is equal to 1 and 0, respectively; thus, we would expect $(1-f[1])$ to be small and $(1-f[0])$ to be relatively large. This provides some justification for the assumption that $s(1-f[1])\bar{u} < n < s(1-f[0])\bar{u}$. Finally, the third assumption in theorem 1 guarantees that if there is a sufficient amount of liquidity in the economy, it is possible for firms to make investment decisions consistent with balanced growth. The quantity $\gamma[\bar{u}, n/s\bar{u}, 0]$ describes firms' hypothetical investment demand when capacity utilization and the profit share are at equilibrium levels but liquidity has been completely drained from the financial system; the quantity $\lim_{m\to\infty}\gamma[\bar{u}, n/s\bar{u}, m]$ describes investment demand as the amount of liquidity in the system becomes infinite. If the third assumption fails to hold because $\lim_{m\to\infty}\gamma[\bar{u}, n/s\bar{u}, m] < n,$ then the system of equations 12 to 14 can describe a depression-like scenario with persistently low capacity utilization and falling prices. In that case, even an unlimited increase in liquidity will not bring the economy to the equilibrium growth path, and the equations would become a nonequilibrium description of demand-driven growth.

For the rest of the paper, I assume that the conditions in theorem 1 are satisfied. I let ($k^*$, $\Psi^*$, $m^*$) denote the unique positive equilibrium solution of the system of equations 12 to 14.

## *4.2. The long-run effect of changes in capitalists' saving rate*

We have already seen that if capitalists decide to save less, then this can stimulate the economy in the short run. Let us now consider the long-run equilibrium effects. Implicit differentiation of equation 15 yields,

$$\frac{de^*}{ds} = \frac{1-f\left[e^*\right]}{sf_e} > 0. \tag{16}$$

Thus, the long-run equilibrium employment rate is an *increasing* function of capitalists' saving rate. Similarly, because $\psi^* = f[e^*]$, an application of the chain rule shows that,

$$\frac{d\psi^*}{ds} = f_e\frac{de^*}{ds} > 0. \tag{17}$$

Hence, an increase in $s$ will lead to higher real wages and employment, while a fall in $s$ will have the opposite effect.

On an intuitive level, these results are very easy to understand. Starting at the equilibrium $(k^*, \psi^*, m^*)$, if $s$ decreases, then this will cause $s\pi\bar{u}$ (the rate of capital accumulation consistent with normal utilization of capacity) to be lower for any given value of $\pi$. For the rate of accumulation to equal $n$, $\pi$ must increase to compensate for the decreased value of $s$. For workers to accept this redistribution of income from wages to profits, their bargaining power must fall. This shift in the balance of power takes place through an increase in the relative size of the floating reserve army of labor. Thus, for example, if a higher fraction of the social surplus is paid out to shareholders, then to the extent that this income is consumed rather than saved, in the long run, the result will be a more dismal labor market.

In contrast, one can imagine a policy in which the state implements a tax on capitalists' consumption and uses the resulting revenue to finance new investment projects itself. The value of $s$ would then be jointly determined by capitalists' saving decisions, the rate of reinvestment of profits in the publicly owned industries, and the share of the capital stock that is publicly owned. By manipulating these variables, the state could target a higher value for $s$, thus increasing the equilibrium employment rate and wage share. Such a policy would also give the public some control over investment decisions, and could be described as a partial socialization of investment.

Of course, Keynes (1964) famously advocated a socialization of investment. More recently, Pollin (1996) argued a similar point. But their analyses are based on the idea that if investment demand can be increased, then the corresponding flow of savings will be generated automatically (even in the long run). What the present paper shows is that, even if we reject this Keynesian perspective, a socialization of investment (when appropriately financed) can still be a worthwhile endeavor.

### 4.3. Convergence to long-run equilibrium

We can now state some conditions under which solution trajectories will actually gravitate toward the long-run equilibrium:

*Theorem 2. If the inequalities,*

1. $\gamma_u < s\pi^*$,
2. $(1-\delta_1)\alpha_e k^* > \delta_0$,
3. $\beta_0 - \beta_1\delta_0 < \beta_0\delta_1$,
4. $s\bar{u} < \gamma_\pi$,

*are satisfied, where the derivatives are all evaluated at the equilibrium* $(k^*, \psi^*, m^*)$*, then the equilibrium is asymptotically stable. In fact, if only the first three inequalities are satisfied, then there is a positive number C such that if,*

$$s\bar{u} - \gamma_\pi < C,$$

*the equilibrium is asymptotically stable.*

The theorem involves multiple conditions because the model describes the dynamics of several interacting parts: the rate of capital accumulation, firms' pricing decisions, wage determination, the banking system, aggregate demand, and the employment rate. The stability of the equilibrium depends on how all the different interacting parts fit together.

The inequalities stated in theorem 2 have straightforward economic interpretations. The first one, $\gamma_u < s\pi^*$, is simply the Keynesian short-run stability condition, discussed previously. It is important to emphasize that this condition pertains to the instantaneous influence of capacity utilization on investment demand, and not the long-run effect. In this model, there is a lagged influence of capacity utilization on investment, which depends on the dynamics of $m$ (and, thus, the properties of the banking system), and is not captured by the parameter $\gamma_u$ but is discussed below. There is general agreement that the Keynesian short-run stability condition is well justified on both empirical and theoretical grounds, but disagreement concerning the lagged effects of capacity utilization on investment (Skott 2012).

The second inequality, $(1-\delta_1)\alpha_e k^* > \delta_0$, pertains to the dynamics of wages and prices. It ensures that, in the vicinity of the equilibrium, higher rates of capacity utilization are associated with higher rates of increase in the wage share. We can easily see this if we take the partial derivative of both sides of equation 13, and evaluate the resulting expressions at the equilibrium point. We obtain,

$$\frac{\partial \dot{\psi}}{\partial u} = \psi^* \left( (1-\delta_1) \alpha_e k^* - \delta_0 \right).$$

When capacity utilization rises above its equilibrium value, this causes the nominal wage to rise because there is an increase in the employment rate, but also induces firms to increase prices; the inequality $(1-\delta_1)\alpha_e k^* > \delta_0$ says that the former effect dominates the latter. Thus, a "profit squeeze" occurs. This appears to be a realistic assumption, at least for the U.S. economy. See von Arnim and Barrales (2015) for a discussion of the evidence.

The third inequality in theorem 2, $\beta_0 - \beta_1\delta_0 < \beta_0\delta_1$, involves the properties of the banking system. Duménil and Lévy made a substantially stronger assumption, namely, that $\beta_0 < \beta_1\delta_0$, in their model. To understand the meaning of these two different inequalities, it is necessary to recall the equation for the dynamics of $m$,

$$\dot{m} = (\beta_0 - \beta_1\delta_0)(u - \bar{u}) - \beta_1\delta_1\alpha[e, \psi]. \tag{18}$$

Although $e = ku$, it is useful to consider the dynamics of $u$ and $e$ separately to compare the behavior of the model with the relevant econometric evidence. If $\beta_0 < \beta_1\delta_0$, then the first term on the right-hand side of equation 18 says that, if the rate of capacity utilization rises above its equilibrium value, then $m$ will decrease, causing the investment function to shift downward over time. In macroeconomic data for the U.S. economy, however, Skott and Zipperer (2012) find that when capacity utilization rises above its long-run value, the investment function gradually shifts *upward*, suggesting that $\beta_0 > \beta_1\delta_0$, in contradiction with Duménil and Lévy's assumption. (See also Skott 2012.) However, Skott and Zipperer also find that high values for the employment rate are associated with downward shifts in the investment function over time. In the present model, this can occur because high rates of employment are associated with high rates of inflation, and the central bank reacts to inflation by reducing the supply of credit; this tightens the financing constraint and gradually causes investment demand to decrease. These combined interactions between the employment rate, the rate of capacity utilization, and investment demand can have an overall effect that stabilizes the long-run equilibrium. The inequality $\beta_0 - \beta_1\delta_0 < \beta_0\delta_1$ gives the specific condition under which this occurs in the present model.[7] Thus, by incorporating labor market dynamics into Duménil and Lévy's model, we obtain stability conditions that better agree with Skott and Zipperer's econometric results.

[7]Skott (2010) has formulated a model in which, when $u$ rises above $\bar{u}$, investment increases, but at the same time, there is a "general deterioration in the business climate associated with high employment rates," and this discourages firms from expanding. As in the present paper, the combined variations in investment, capacity utilization, and employment can have a stabilizing effect overall. The distribution of income, however, is determined by a Kaldorian mechanism in Skott's model, and a fall in capitalists' saving rate will have expansionary long-run effects.

Finally, the fourth condition listed in theorem 2 says that the model is exhilarationist, at least near the long-run equilibrium. But this assumption is not a necessary condition for stability. As theorem 2 asserts, as long as the inequalities 1, 2, and 3 are satisfied, there is a positive constant $C$ such that if $s\bar{u} - \gamma_\pi < C$, the equilibrium is stable. Hence, if the first three inequalities are satisfied and the model is not too strongly stagnationist, then it will still be true that $s\bar{u} - \gamma_\pi < C$, and the equilibrium will still be stable. Thus, the stability conditions are consistent with both exhilarationist and (to some extent) stagnationist demand regimes.

When the stability conditions are satisfied, solution trajectories that start sufficiently close to the long-run equilibrium point will gravitate toward it. As an example, one can imagine a situation in which, starting from the equilibrium point, there is a sudden upward shift in the investment function, due to a change in firms' animal spirits. The rate of capacity utilization and the rate of capital accumulation will both rise. As a consequence, the employment rate, the real wage, and the inflation rate will also rise. Eventually, the central bank will impose a brake on the expansion by restricting the creation of new bank loans, and the investment function will shift back down again. Over time, these interactions bring the economy back to the long-run equilibrium. The actual convergence process, however, may be complicated, and can exhibit cyclical interactions between income distribution and employment that cause solution trajectories to gravitate toward the equilibrium along spiraling paths.

All this is broadly consistent with the econometric work by Kiefer and Rada (2014), who calibrated models using data for a panel of advanced capitalist countries. In their paper, aggregate demand is found to be exhilarationist, and income distribution is shown to follow a profit-squeeze dynamic. Solution trajectories converge to the equilibrium along counterclockwise paths in the $(u, \Psi)$ plane, although in their model, the equilibrium rate of capacity utilization need not equal any "normal" rate.

### *4.4. Instability, crisis, and long-run average capacity utilization*

Although I argue that the stability conditions in theorem 2 are plausible, there certainly is no guarantee that they will always hold in actual capitalist economies. In this respect, the third condition, which states that $\beta_0 - \beta_1\delta_0 < \beta_0\delta_1$, deserves particular attention. Given the other parameter values (and the assumption that $\delta_0 > 0$), it is always possible to increase $\beta_1$ up to a point at which the inequality $\beta_0 - \beta_1\delta_0 < \beta_0\delta_1$ is satisfied. Thus, in principle, the monetary authorities can make the stability condition become satisfied by implementing a sufficiently aggressive anti-inflation policy. However, for given parameters describing monetary policy and firms' pricing decisions, if the banking system becomes too accommodating to firms' loan demands (i.e., if $\beta_0$ becomes too large), the equilibrium can become unstable.

In practice, it may be difficult for public policy to change the parameters $\beta_0$ and $\beta_1$ in a lasting way. Because firms and financial institutions are constantly innovating and adapting to regulatory changes, Duménil and Lévy (1993) argue that capitalist economies are "constantly close to the stability limit, like an object on the edge of a table waiting to fall at any instant." This means that severe crises, resulting from a process of perpetual institutional change, can occasionally disrupt capital accumulation to a significant degree, and drive the economy far away from the long-run equilibrium. Indeed, Duménil and Lévy (2011: chapter 14) argue that this type of dynamic, involving a loss of control by monetary authorities, was a cause of the 2008 Global Financial Crisis.

It should be emphasized that this view is based on the idea that instability is not a normal feature of capitalism; instead, instability occurs only during transient periods of crisis. But from a Keynesian perspective, one may question whether the condition $\beta_0 - \beta_1\delta_0 < \beta_0\delta_1$ is *ever* satisfied in real capitalist economies. Indeed, many Kaleckian and Keynesian economists strongly dispute the effectiveness of monetary policy as a means of controlling key macroeconomic variables (Dutt 2011; Godley and Lavoie 2007), and in the present model, this could be reflected by a small value for $\beta_1$. In that case, instability could be the normal state of affairs, and the relevance of the key results in this paper would have to be seriously questioned.[8] When the equilibrium is unstable, solutions may exhibit Kaleckian features on long-run time scales.

One can show, however, that under certain conditions, the long-run *average* rate of capacity utilization will still have to *eventually* tend toward the normal rate:

*Theorem 3. Suppose* $(k,\psi,m)$ *is a solution to the model on the interval* $[t_0,\infty)$. *Assume that* $\beta_0-\beta_1\delta_0 \neq \beta_0\delta_1$, $m$ *is bounded on* $[t_0,\infty)$, *and there is some positive number b such that* $b<\psi\leq 1$ *on* $[t_0,\infty)$. *Then* $\lim_{t\to\infty} 1/(t-t_0)\int_{t_0}^{t} u(t)dt=\bar{u}$ .

Recall that $\beta_0-\beta_1\delta_0 \neq \beta_0\delta_1$ is the condition from earlier in the paper that rules out the fluke case of infinitely many equilibria. Theorem 3 asserts that as long as this condition holds, and the variables $m$ and $\Psi$ stay within realistic bounds, the behavior of the model will be classical Marxian in a long-run average sense. Of course, this does not address the question of whether, under realistic assumptions, the state variables will actually stay within the bounds assumed by the theorem; if the equilibrium tends to be unstable and the answer to this question is no, then some of the core assumptions used to formulate the model might have to be rejected.

Finally, it is worth pointing out that a socialization of investment could be used to stabilize the equilibrium. By influencing aggregate investment demand, the state could affect many of the key parameters in theorem 2. Thus, in practice, the socialization of investment should be implemented in such a way that both capitalists' saving decisions and investment demand are under (complete or partial) public control.

### *4.5. Comparison with other frameworks*

Now that the main results have been established, we can pause to discuss how they relate to the existing literature. A good starting place is the Goodwin (1967) model and its extensions. As pointed out by Skott (1989: 35–38), the original Goodwin model does not provide a fully satisfying framework for understanding the dynamics of capitalist economies, because it does not allow aggregate demand to play any causal role. Instead, the Goodwin model assumes that capacity is fully utilized at all times, aggregate demand instantaneously adjusts to aggregate supply, and the rate of accumulation is passively determined by the aggregate saving rate. In response to this, economists have relaxed the assumptions in the Goodwin model in various ways, giving rise to a large literature on Goodwin-type models of demand-driven growth (von Arnim and Barrales 2015). This literature comprises many different models, but each one has some subset of the following characteristics: the long-run rate of capacity utilization is determined by aggregate demand, high levels of economic activity cause the profit share to *rise* (rather than fall), and the growth rate of the labor force passively adjusts to the rate of economic growth (so that labor-supply limits play no actual role). Each of these characteristics represents a fundamental—and, from the point of view of the present paper, rather objectionable—departure from the original Goodwin framework.

Thus, I have taken a different approach. For the model constructed in this paper, the fluctuations in aggregate demand are crucially important (particularly for stability), but the long-run equilibrium is determined by a mix of supply-side factors and class conflict. This means that the long-run properties of the present model are very different from what one finds in a model of demand-driven growth. For example, in models of demand-driven growth, if capitalists decide to consume more, this has expansionary long-run effects—the opposite of what happens in the present model.

[8]It might be possible to address this issue with countercyclical fiscal policy.

Because the model developed in this paper is not Kaleckian or Keynesian in the long run, it bears some resemblance to neoclassical growth models, which emphasize trade-offs between different uses of existing resources and the positive effects of saving. But there are also enormous differences. For the purposes of comparison, we can consider the Ramsey model as a good representation of neoclassical growth theory (Taylor 2004: chapter 3). In the Ramsey model, a "representative household" with perfect foresight and unlimited computational ability chooses a mix of saving and consumption so as to maximize lifetime utility. Any state policy seeking to change aggregate saving decisions would simply frustrate this process and make the representative household—in effect, society as a whole—worse off. In contrast, for the model in the present paper, the concept of an optimal saving plan for society makes no sense; instead, there is a monotonic relationship between capitalists' saving decisions and the structural power of the working class.

Neoclassical macroeconomists have also emphasized the existence of "frictions" in the labor market that act as barriers to full employment; on the basis of such ideas, they argue that policymakers should try to increase employment by curtailing the ability of workers to demand higher wages (Friedman 1968: 9). This type of reasoning finds support in the original Goodwin model, where it is possible to increase the equilibrium employment rate by shifting the wage bargaining function downward. A similar effect occurs in the present model as well: if the curve $\Psi = f[e]$ shifts downward in the $(e, \Psi)$ plane, then (in the absence of other parameter changes) the equilibrium employment rate will rise. But, in contrast with both the Goodwin model and neoclassical macroeconomics, the present paper has also offered an alternative path toward full employment: subjecting capitalists' saving and investment decisions to public control.

Finally, it should be noted that, compared with the Duménil and Lévy model, the present paper provides a significantly different perspective on the role of aggregate demand in the long run. As Foley and Michl (2010: 56) explain, in the Duménil and Lévy model, a temporary shock to aggregate demand can permanently affect the level of national income. For example, if the investment function shifts upward, and the central bank does not immediately stamp out the resulting boom, then when the system finally *is* brought back to its long-run equilibrium, the level of national income will be higher than it would have otherwise been. In contrast, for the model in this paper, national income is tied to employment, and, therefore, is uniquely determined in long-run equilibrium by the model parameters. If aggregate demand grows at an above-equilibrium rate for too long, and there are no changes to key model parameters, a profit-squeeze crisis may result.

## 5. Extensions of the Model

### 5.1. Motivation

Before concluding the paper, I briefly discuss two extensions of the model. First, because inflation plays such an important role in the model, I explore the effects of a nonzero inflation target. The results then depend upon how agents react to long-run changes in the rate of inflation. Second, I insert a more general saving function into the model, which accounts for borrowing and saving by workers, as well as executive pay. These extensions, I argue, provide additional insights but do not significantly change the logic of the model.

Obviously, there are many other ways in which the model could be generalized. For example, it could easily be extended to make the growth rate of the labor force endogenous.[9] A more

[9]We could assume, following Skott and Zipperer (2012), that $n$ is a function of $e$ and $n_e > 0$. In that case, higher values of $s$ would be associated with higher equilibrium employment, wages, and economic growth. If workers make more aggressive wage demands (so the curve $\psi = f[e]$ shifts upward in the $(e, \psi)$ plane), then the wage share would rise while the employment rate and the rate of accumulation would fall.

ambitious extension would incorporate a sophisticated financial system with multiple financial assets, and describe the way financial stock-flow norms affect consumption decisions, as in Lavoie and Godley (2001–2002). Following Duménil and Lévy (1999), one could also generalize the model to include heterogeneous commodities. Technological change, which has been completely ignored, could also be incorporated into the model in various ways.

The advantage of neglecting these issues is that I have been able to formally analyze the stability properties of the model, while accounting for some important dynamic interactions that shape the evolution of modern capitalist economies. If more real-world complications are brought into the model, then formal stability analysis might become impractical, but theorem 2 could still provide a useful guide for understanding simulation results.

### *5.2. Another look at monetary policy and inflation*

As Lavoie and Kriesler (2007) point out, the nature of the equilibrium for Duménil and Lévy's model—including, in particular, the long-run equilibrium value of $u$—depends upon specific assumptions regarding central bank policy and inflation dynamics. This is also the case in the present model. Thus, before ending the paper, it is useful to examine more closely the role of inflation in the above analysis.

First, to incorporate a nonzero inflation target into the model, we can replace equation 5 with the equation,

$$\dot{m} = \beta_0 \left(u - \bar{u}\right) - \beta_1 \left(\hat{p} - \hat{p}_T\right), \tag{19}$$

where $\hat{p}_T$ denotes the inflation target. Next, if workers expect the price level to grow at the rate $\varepsilon_w$, then equation 4 is replaced with,

$$\hat{w} = \alpha\,[e, \Psi] + \eta\varepsilon_w. \tag{20}$$

The constant $\eta$ is a positive number less than or equal to 1. If $\eta$ is strictly less than 1, then this means that workers suffer from the money illusion as in Desai (1973). Finally, we can also add a term to equation 7 describing firms' expectations about the price increases of their competitors. Thus, we obtain the new equation,

$$\hat{p} = \zeta_0 \left(u - \bar{u}\right) + \zeta_1 \left(\hat{w} - \hat{p}\right) + \varepsilon_F, \tag{21}$$

where $\varepsilon_F$ denotes the aggregate rate of price inflation expected by firms. This equation implies that if capacity utilization is at the desired level and labor costs are constant as a share of total revenue, then firms will attempt to keep their prices constant relative to the prices of their competitors by increasing their own prices at the rate $\varepsilon_F$. Although firms always would like profit margins to be higher, they will not attempt to increase profit margins if they believe that doing so will cause demand for their products to fall below the level consistent with normal utilization of capacity.

When equations 5, 4, and 7 are replaced by equations 19, 20, and 21, respectively, we obtain a generalized model in which the equilibrium inflation rate may be nonzero. Some algebra shows that if,

$$\varepsilon_w = \varepsilon_F = \hat{p}_T, \tag{22}$$

and in addition workers do not suffer the money illusion (so η = 1), then the generalized model reduces to the original system in 12 to 14. If $\epsilon_W$ and $\epsilon_F$ are merely close to $\hat{P}_T$, then the long-run equilibrium will be perturbed slightly but the qualitative properties of the model will be essentially the same. Thus, the core models 12 to 14 should be seen as approximating an economy in which expectations about the actual inflation rate stay close to the central bank inflation target, and workers do not suffer from the money illusion.

If workers do suffer from the money illusion (so $0 < \eta < 1$), then the equilibrium employment rate will depend on monetary policy. If equation 22 holds, then we again obtain the system in 12 to 14, but $\alpha[e, \Psi]$ will be replaced by $\alpha[e, \Psi] - (1-\eta)\,\hat{P}_T$. In effect, workers are tricked into accepting a lower real wage at any given employment rate. The equilibrium employment rate will be an increasing function of $\hat{P}_T$ and a decreasing function of η. However, the equilibrium rate of capacity utilization will still be $\bar{u}$. Similarly, if $\varepsilon_F = \hat{p}_T$ but $\varepsilon_w \neq \hat{p}_T$, then $\alpha[e, \Psi]$ is replaced by $\alpha\,[e, \Psi] + \eta\varepsilon_w - \hat{p}_T$, but equilibrium capacity utilization will still be $\bar{u}$.

Finally, one may question the assumption that $\varepsilon_F = \hat{p}_T$. Indeed, it is far from clear that the central bank inflation target should have much direct influence on pricing or wage bargaining decisions. Thus, if the central bank sets an inflation target that is very different from what workers and/or firms expect the inflation rate to be, then it is possible in this model for monetary policy to affect capacity utilization and/or employment for extended periods of time. However, if expectations about inflation adapt to the *actual* inflation rate, as in the equations,

$$\dot{\varepsilon_w} = \theta_w\,(\hat{p} - \varepsilon_w), \tag{23}$$

and

$$\dot{\varepsilon_F} = \theta_F\,(\hat{p} - \varepsilon_F), \tag{24}$$

(where $\theta_W$ and $\theta_F$ are positive constants), then the system 12 to 14 extends to a five-dimensional dynamical system, and one can easily verify that when this system is in equilibrium, equation 22 must be satisfied. Thus, equation 22—and, by extension, the core model studied in this paper—describes a situation in which expectations about inflation have fully adjusted to their equilibrium values. Of course, this assumption does not describe all capitalist economies at all times, but may roughly approximate, for example, the U.S. economy during most of the neoliberal period.[10]

To some extent, the above results are in accord with the view that it is possible for the central bank to increase the employment rate by setting a higher inflation target. However, in the long-run equilibrium, this strategy will only be effective if workers suffer from the money illusion. In contrast, the partial socialization advocated earlier in the paper will increase both the real wage and the employment rate. The crucial point is that, even if the central bank is unable to stimulate employment in the long run because agents take full account of monetary policy in their pricing and wage bargaining decisions, it is still possible for the state to simultaneously improve

[10]Of course, the dynamics of inflation expectations may also affect the stability of the long-run equilibrium, as in Desai (1973). When equations 23 and 24 are incorporated into the model, the nonequilibrium properties of solutions would probably be best explored by means of simulations, rather than a formal stability analysis. However, theorem 2 still provides a useful starting point for understanding the stability properties of the extended model.

macroeconomic performance and shift the balance of power in favor of the working class by taxing profits and undertaking new investment projects itself.

### *5.3. Executive compensation, consumer credit, and the Pasinetti theorem*

As shown by Mohun (2014), executive salaries and other nonworking-class wages have taken an increasingly important role in the distribution of the surplus under modern capitalism. To look at the implications of this within the context of the present model, I now assume there are three different classes: productive workers, company executives (or managers), and capitalists. The working-class real wage per unit of output is denoted by $\Psi$, the executive wage per unit of output is denoted by $\mu$, and profit per unit of output is denoted by $\pi$ (so $\Psi + \mu + \pi = 1$). All three income groups are now allowed to save, and as a result, they can also receive some profit income as a return on their savings (I assume that the rate of return on all saving is equal to the rate of profit).

For simplicity, I assume that executive wages are fixed as a share of national income, so $\mu$ is equal to a positive constant $\overline{\mu}$. Workers, as before, have bargaining power that fluctuates with the relative size of the floating reserve army of labor. Thus, in long-run equilibrium, I continue to assume that the real wage and the employment rate are linked by the equation,

$$\psi = f\left[e\right],$$

where $f$ is an increasing function. Finally, I let $s_c$ be capitalists' saving rate, and I assume that managers and workers both save at a common rate $s_w$. Let $K$ be the total stock of productive capital (as before), and let $K_c$ be capitalists' wealth. The saving-investment identity can be written as,

$$s_w X + \left(s_c - s_w\right) r K_c = I.$$

Under these conditions, the Pasinetti theorem (Pasinetti 1962) implies that, if the assumption $s_w < \frac{n}{\overline{u}} < s_c$ is satisfied,[11] we obtain,

$$\pi^* = \frac{n}{s_c \overline{u}}.$$

Workers' saving, thus, has no effect on the equilibrium profit share. As is well known, this occurs because changes in the personal distribution of income, resulting from changes in the distribution of wealth, act together with changes in the functional distribution to bring about the long-run equilibrium.

It follows that the equilibrium working-class wage share is,

$$\psi^* = 1 - \frac{n}{s_c \overline{u}} - \overline{\mu},$$

and the equilibrium employment rate is determined by the equation,

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[11]Notice that in equilibrium, $n / \overline{u}$ is identical with the investment-output ratio $1 / Y$. The inequality $s_w < 1 / Y < s_c$ seems to be very plausible (Kaldor 1966). If it were the case that $s_w < s_c < 1 / Y$ or $1 / Y < s_w < s_c$, then balanced growth (with $u = \overline{u}$ and $\hat{K} - n$) would be impossible.

$$f\left[e^{*}\right]=1-\frac{n}{s_c\bar{u}}-\bar{\mu}.$$

Any fall in capitalists' saving rate will have the same result as before: lower equilibrium employment and wages. Increases in executive pay (i.e., increases in $\bar{\mu}$) will also have this effect.

The Pasinetti theorem can also be extended to account for borrowing by workers. Indeed, as Kaldor (1966: 313–14) points out, the Pasinetti theorem still holds if $s_w$ is negative (meaning that capitalists are net lenders to the rest of the economy). Again, the functional distribution of income would be determined as before, and the value of $s_w$ would be irrelevant. Thus, credit-fueled consumption by workers, in and of itself, does not alter the above results.[12] But it should be emphasized that these results are based on a simplified picture of the financial system. Many post-Keynesian economists reject Pasinetti's assumption that the long-run interest rate equals the rate of profit, and as a result, there are models in which the Pasinetti theorem does not hold (Lavoie and Godley 2001–2002; Skott 1989).

## 6. Conclusion

Pollin (1998), discussing the concept of the reserve army of labor, makes a useful distinction between full employment that occurs as a result of workers' vulnerability and full employment that occurs as a result of workers' strength. On one hand, if workers are in a position of vulnerability that undermines their capacity to demand wage increases, then high rates of employment may be consistent with the high profits, and, therefore, potentially feasible without any political struggle. On the other hand, if the working class is strong, workers may be able to directly challenge the power of the capitalist class, and win institutional changes that make full employment and high wages compatible with other macroeconomic objectives.

In this paper, I developed an analysis of these issues within a classical-Marxian framework. To do this, I extended the Duménil and Lévy model to include an explicit theory of income distribution and labor market dynamics. As we see, the implications of this analysis are different from what a Keynesian or Kaleckian framework would suggest, as the usual demand-side policies cannot stimulate the economy in the long run. Nevertheless, the model does offer some clear policy suggestions. A reformist program, based on limiting executive pay and shareholder dividends, could increase the equilibrium working-class wage share and employment rate. A more ambitious radical-left program would subject firms' investment and profit-retention decisions to public control, use a tax on profits to pay for investments in publicly owned firms, and allocate finance based on democratically chosen priorities.

Such proposals may be consonant with Keynes's (1964) suggestion concerning the socialization of investment, but could also be articulated as transitional demands within a larger socialist project. This should be contrasted with other political-economic programs that focus demands more narrowly on redistributing income and increasing working-class power on the shop floor,

[12]Changes in the availability of consumer credit, as well as variations in workers' net wealth, could also have implications for the social relations of production and the cost of job loss. In this model, this would be reflected in shifts of the function *f*. Hence, for example, if workers become more heavily indebted, and need to stay employed to avoid financial ruin, then this would entail a higher cost of job loss. The function *f* would shift down, and a higher employment rate would become consistent with the equilibrium distribution of income.

without challenging capitalists' control over the accumulation rate. The analysis in this paper suggests that such programs could simply lead to a profit-squeeze crisis. A socialization of investment, however, even if it is only partial, could help to meet the immediate needs of working people and, at the same time, point the way toward broader social transformations.

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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## Author Biography

**Stephen Thompson** teaches mathematics at the University of Maryland, Baltimore County. He is an active member of Democratic Socialists of America.