Armon Rezai

Goodwin Cycles, Distributional Conflict, and Productivity Growth

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Armon Rezai[†]

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Abstract

A combination of an investment-driven macroeconomy and a conflict-determined income distribution gives cyclical behavior. Models of wage-price inflation can be nested in the Goodwinian tradition. Endogenous technical change has ambiguous effects on equilibrium: Kaldor-Verdoorn effects increase the wage share's responsiveness to changes in output, while labor-saving technical change reduces it.

Keywords: Goodwin Cycles; Wage-Price Spirals; Demand Regimes; Profit Squeeze; Endogenous Technical Change; Kalecki-Keynes model

JEL Classification System: B5, E12, E24, E31, E32

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[†] Department of Socio-Economics, Vienna University of Economics and Business, Nordbergstr 15/B/4, 1090 Vienna, Austria; arezai@wu.ac.at

1 Introduction

Economists have sought to explain the interrelation of income distribution, inflation, and growth in various ways. Conflict models as presented in Rowthorn (1977) and Dutt (1990) attempt to do so by juxtaposing wage earners' claims and the price setting behavior of firms in such a way as that each party is aiming at protecting (or extending) its income.

The US wage share describes a cyclical movement over the business cycle (see figure 1). Such an empirical observation and/or a close study of Volterra (1931) and Marx led Goodwin (1967) to adapt a predator-prey model with the wage share as predator and the employment ratio as prey as another form of exploring the relationship between distribution and growth. In a recent paper in this journal Barbosa and Taylor (2006) propose a simple theoretical framework to explain and estimate the observed cyclical behavior of wage share and capacity utilization for the US economy. This model essentially extends the effective demand dynamics of capacity utilization, u, of Dutt (1984), Taylor (1985), and Bhaduri and Marglin (1990) with a generic conflict model's distributive dynamics of the wage share, ψ.

(Figure 1 about here)

The aim of this note is to analyze whether these two ways of thinking about inflation, distribution, and growth can be fruitfully combined in the context of demand-driven growth cycles. The proposed synthesis takes the bare-bones dynamical system around a Kalecki-Keynes model from Barbosa and Taylor (2006) and instills the richness of the wage and price framework into the former's simple inflation core. Desai (1973) asked a similar question, but was not able to derive concrete conclusions on the nature of such a hybrid. Tavani et al. (2011) also implemented a wage-price spiral in a Goodwinian framework. Their analysis does not ask the fundamental question whether Goodwin cycles as found in the data can exist in such a model, but focuses on multiple equilibria in the absence of productivity growth.

In a simple linear world, Goodwin cycles, counter-clockwise dynamics in the u-ψ plane, emerge under the conditions found in Barbosa and Taylor (2006), but the model turns out to be deficient in a different way. In simple specifications of wage-price spirals as used in Tavani et al. (2011) and the standard textbook AS-AD model of Blanchard (2008), distribution has no long run effects on output. Introducing endogenous feedback effects of distribution and output on productivity growth overcomes this weakness. In the extended version of the model, two effects are studied in detail with the following findings: Kaldor-Verdoorn effects make distributive dynamics more responsive, Marx-biased technical change reduces the responsiveness.

While being narrowly focused on specific topics, the analysis of this note is inspired by the work of Goodwin, Kaldor, Kalecki, Keynes, and Steindl. This research builds on their insights on situations of excess capacity and the dynamics surrounding them.

Distributional conflict, effective demand, and technical progress are the keys to understanding the macroeconomy and its evolution through time.

2 Goodwin Cycles

Much theoretical and empirical research effort has been dedicated to exploring the linkages between distribution and the level of economic activity in the past three decades (Dutt, 1984, Taylor, 1985, Bhaduri and Marglin, 1990, Naastepad, 2006, Stockhammer, Onaran and Ederer, 2009). The mainstay of this body of work has been the effect of distribution on output in a static model. At the same time, work on distributional conflict focused on the effect of output on distribution (Rowthorn, 1995, Franke et al., 2006, Flaschel and Krolzig, 2006, Flaschel and Greiner, 2009, Flaschel et al, 2009, Flaschel, 2010). Output determination is not considered at great detail. Dutt (1994) and Taylor (2004) present theoretical models combining the dynamics of output and distribution specifically. Barbosa and Taylor (2006) undertake an empirical investigation.

Following Taylor (2004) who only sketches the relations between conflict, demand, and technical change, I use a standard and well-known Kalecki-Keynes model for the demand side. The difference between injections and leakages determines output through the principle of effective demand, $\hat{u} = f(u, \psi, \ldots)$ (1). Taylor (2004) includes an encompassing treatment of the model and its limitations, Kalecki (1954, 1969, 1971) and Keynes (1936) some of the original sources. On the demand side it suffices to know that the demand null-cline is called *effective demand schedule.* There are two specifications of demand regimes: if output increases with the wage share, $du/d\psi > 0$, demand is supposed to be “wage-led”; if output falls with a rising wage share, $du/d\psi < 0$, demand is “profit-led”. The details can be found in Dutt (1984), Taylor (1985), Bhaduri and Marglin (1990), and, again, Taylor (2004). In their extension, Barbosa and Taylor endogenize income distribution to form a two-dimensional dynamical system. On the distributional side, (2), the model only relies on general notions of wage and price setting and productivity growth. Workers are bargaining for a nominal wage according to their (expected) standard of living. Firms are assumed to use mark-up pricing and set their prices. Productivity growth can have many determinants: A Kaldor-Verdoorn relationship predicts that productivity grows with higher economic activity due to increasing returns to scale or the installation of newer, above-average effective capital. Marx and others predict rising productivity if wages (or the wage share) increase due to increases incentives to reduce labor input. The null-cline of this dynamic equation is labeled *distributive schedule*. It can have two specifications: if the wage share rises with output there is a “profit squeeze” regime; if the wage share falls with higher output, the distributive regime follows “forced saving” adjustment.

$$\hat{u} = f(u, \psi, \dots) \tag{1}$$

$$\hat{\psi} = g(u, \psi, \dots) \tag{2}$$

Empirically, Barbosa and Taylor (2006) present evidence that higher wage increases occur under a higher wage share and a higher level of economic activity. Given the pro-cyclicality of the nominal wage for the US economy, the mark-up varies counter-cyclically. Productivity growth varies pro-cyclically, the standard explanation being labor hoarding, lagged positive responses of productivity growth to the labor share another one. Taylor (2010) presents the stylized facts. Such a macroeconomic dynamic pattern can be summarized in the u-ψ plane by combining a negatively sloped (or profit-led) effective demand schedule and an upward sloping distributive curve. This produces the counter-clockwise Goodwin cycle consistent with the data above. Note that Barbosa and Taylor (2006) assume the standard stability conditions ($d\dot{u}/du < 0$, $d\dot{\psi}/d\psi < 0$) and justify them with their point estimates.

3 Distributional Conflict

Conflict models attempt to explain inflation, income distribution, and growth by juxtaposing wage earners' claims and the price setting behavior of firms in such a way that each party is aiming at protecting its income. Once optimal considerations are dropped, not many frameworks are available to study conflict. I will use a generic set-up of wage and price dynamics (Taylor, 2004).

The model consists only of equations for the inflation of wage, $\hat{w}$, and prices, $\hat{p}$. Hats denote the growth rate or log change of the variable they are placed over. Productivity growth is assumed to be exogenous in a first stage. Wage (price) inflation increases as the output gap, $(u - \bar{u})$, closes and as price (wage) inflation increases. Only the fraction $(1 - \sigma)$ of labor productivity growth, n_x, feeds into wage growth.

$$\hat{w} = \beta_w (u - \bar{u}) + \kappa_w \hat{p} + (1 - \sigma) n_x \tag{3}$$

$$\hat{p} = \beta_p (u - \bar{u}) + \kappa_p \hat{w} \tag{4}$$

κ_w and κ_p are the price elasticity of wages and the wage elasticity of prices; both are assumed to lie on the [0,1] interval. β_w and β_p represent the responsiveness of wages and prices to the tightness of the goods market. As output approaches its capacity limit, wages and prices increase. For simplicity the labor market is not modeled explicitly; wage inflation responds to the tightness of the goods market directly. Under a stable and linear specification of Okun's Law the simplification occurs without loss of generality (Flaschel et al. 2011). A referee suggested an alternative specification of the wage and price dynamics including a target wage share. To keep the results comparable with the contributions on conflict models cited above, such an anchor is not included. In addition, a macroeconomy would have to exhibit a high degree of coordination among firms and workers to make such aggregate considerations feasible.

Goodwin cycles are usually set up as difference or differential equations for u and ψ like the system comprising (1) and (2). Equations (3) and (4), however, depend on w, p, u, and n_x. Using the definition $\hat{\psi} = \hat{w} - \hat{p} - n_x$, a few algebraic steps are needed to project (3) and (4) into the u-ψ plane. In the end, $\hat{\psi}$ emerges on the right hand side as:

$$\hat{\psi} = \frac{(1-\kappa_p)\beta_w - (1-\kappa_w)\beta_p}{1-\kappa_w\kappa_p}\ (u - \bar{u}) + \left[\frac{(1-\sigma)(1-\kappa_p)}{1-\kappa_w\kappa_p} - 1\right]\ n_x \quad (5)$$

with n_x exogenous. In section this assumption is relaxed and n_x can be a function of ψ, w, u, or hat values of any combination. Higher bargaining power on the side of wage earners (higher β_w and κ_w) increase the wage share. Higher productivity growth lowers it.

One immediate fact about the dynamics of ψ is that $\hat{\psi}$ is independent of ψ which implies a vertical distributive curve. The $\hat{\psi}$ null-cline acts like a neoclassical supply curve in that it solely determines equilibrium capacity utilization. In fact, this distributive curve is a restatement of the AS curve for dynamic wage share setting.

If the response of the wage share to capacity utilization is positive, $\mu \equiv (1-\kappa_p)\beta_w - (1-\kappa_w)\beta_p > 0$. Flaschel et al. (2011) call this situation *labor market-led* wage-adjustment. With $\mu < 0$, they speak of *goods market-led* wage-adjustment. The null-cline of the distributive side is sometimes denoted NAIRU. The unique level of equilibrium capacity utilization is determined by the steady-state solution of (5):

$$u^*_{DC} = \bar{u} - \frac{1}{\mu}\left(\kappa_p(\kappa_w - 1) - \sigma(1-\kappa_p)\right)\ n_x = \bar{u} - \frac{\nu}{\mu}\ n_x \quad (6)$$

with $v = \left[\kappa_p(\kappa_w - 1) - \sigma\left(1 - \kappa_p\right)\right] \leq 0$. The equilibrium level of capacity utilization equal to its limit, $\bar{u}$, adjusted for some interactions due to productivity growth. In the absence of productivity growth, capacity utilization tends toward full employment.

Since the equilibrium level of output is determined through the vertical distributive curve, the effects of *ceteris paribus* changes in parameter values on equilibrium output can be studied without specifying the demand side. Taking derivatives, one can show that stronger wage responses (higher values of β_w and κ_w) lower equilibrium output. A wider output gap has to mediate the improved position of workers to stabilize the wage share. Labor market institutions strengthening labor could be added as a catch-all variable z in (3). Its contractionary effect on equilibrium output would be the same as greater bargaining strength. The usual AS-AD logic applies. A similar rationale holds for the productivity pass-through parameter $(1 - \sigma)$. If wage earners receive a higher share of productivity growth, the wage share increases. To hold the rate of change constant, the output gap in (5) has to counteract. Depending on the sign of the first fraction, μ, the equilibrium output can increase or decrease.

4 Distributional Conflict and Goodwin Cycles

To examine the possibility of Goodwin cycles based on the wage-price dynamics spelled out above, the dynamics of $\hat{u}$ need to be introduced. It is important to note that these necessarily must come from the demand side. A closure from the supply side cannot determine the model since it would impose another vertical null-cline in the plane which results in either indeterminacy or the lack of equilibrium. Following Barbosa and Taylor (2006) and Taylor (2004), effective demand of a Kaleckian growth model in some variant of (1) serves readily as an augmented AD curve with differential saving rates and independent investment decisions. For simplicity, let

$$\hat{u} = \alpha u + \beta \psi + \ldots \tag{1'}$$

with $\alpha < 0$ due to the Keynesian stability condition and β determining the demand regime. Let $\tilde{\mu} = \frac{1}{1-\kappa_w \kappa_p} \mu$, then the Jacobian of this system (1') and (5) is

$$J = \begin{matrix} \alpha & \beta \\ \tilde{\mu} & 0 \end{matrix} \tag{7}$$

To avoid saddle point instability, the determinant of the system has to be positive. Since $\det J = -\beta \tilde{\mu}$, β and $\tilde{\mu}$ have to take different signs. This implies that only two possible regime combinations remain: wage-led / goods market-led adjustment and profit-led / labor market-led adjustment (see figure 2). The other two possible combinations result in explosive dynamics due to their self-reinforcing feed-backs.

(Figure 2 about here)

Assuming that the Keynesian stability condition is satisfied, wage-led / goods market-led adjustment gives clockwise cycles. Profit-led / labor market-led adjustment gives the counterclockwise cycles observed in Figure 1.

A discussion of the US economy using wage price spirals might appear unrealistic for the institutional richness usually associated with the concept. The framework described above is, however, very flexible and can also describe macroeconomic situations in which there is very little or no collective bargaining. Stagnation in the real wage can be due to the inability to keep up with price inflation (a low κ_w) or small participation in the benefits of productivity growth (a high σ). If wage earners cannot protect themselves against price inflation, the wage share will not be able to respond positively to increases in output. Prices rise more rapidly than wages. However, a deregulated labor market presumably also translates into more volatile wages in response to the output gap (a high β_w). The first two parameters make the system more likely to be goods market-led, while the latter pushes into a labor market-led direction, leaving the overall affect ambiguous. Lower gains from exogenous productivity growth do not alter the dynamics of the system.

5 Endogenous Productivity Growth

The stability conditions of the system currently do not depend on the evolution of labor productivity. In terms of stability, the wage share follows the real wage directly. This property is clearly at odds with macroeconomic reality. Productivity growth varies procyclically over the business cycle (Taylor, 2010). The real wage and labor productivity and the real wage interact non-linearly (Taylor, 2011). To allow for such behavior, the determinants of labor productivity are made endogenous.

Economists have long sought to pin down the exact determinants of productivity growth and of its fluctuations over the business cycle. I restrict the discussion to those involving the variables of the system, capacity utilization (Taylor, 2004) and the wage share (Foley and Michl, 1999): A Kaldor-Verdoorn relationship links u and n_x positively, invoking increasing returns due to higher capacity utilization. An induced technical change relationship links between ψ and n_x positively along the Marxian argument of labor-saving technical change due to high unit labor costs. With endogenous productivity, the slope of the distributive curve then becomes

$$\frac{d\psi}{du}_{\hat{\psi}=0} = -\frac{\mu+\nu\,\frac{\partial n_x}{\partial u}}{\nu\,\frac{\partial n_x}{\partial \psi}} = \frac{\mu+\nu\frac{\partial n_x}{\partial u}}{-\nu\frac{\partial n_x}{\partial \psi}} \tag{8}$$

The endogenization of productivity growth has tilted the distributive curve away from its infinite (vertical) slope. With $\nu \leq 0$ from (6), the numerator in (8) is positive and the slope of the distributive curve depends on the denominator. If $\mu > -\nu\frac{\partial n_x}{\partial u}$, there is labor market-led adjustment and a profit squeeze, while goods market-led adjustment and forced saving if $u < -\nu\frac{\partial n_x}{\partial u}$ (Taylor, 2004). The introduction of endogenous productivity growth increases the critical value for μ above with labor market-led adjustment occurs. This is due to the fact that wage inflation now also needs to compensate the additional feedback of the Kaldor-Verdoorn effect to hold the wage share constant. For any given distributive regime, the effects of endogenous productivity growth on the schedule are such that Kaldor-Verdoorn effects increase the slope, labor-saving conversely decreases it. Kaldor and Verdoorn are opponents of Marx within the distributive realm in this sense.

Returning to Goodwin cycles, counterclockwise cyclical adjustment can only occur with a stable profit squeeze distributive and a stable profit-led demand regime. Figure 3 depicts the two stable configurations: Forced-saving distribution with wage-led demand and profit-squeeze distribution with profit-led demand. Only the latter gives counterclockwise Goodwin cycles. With endogenous productivity growth, the wage-price spiral has to exhibit labor market-led adjustment, $\mu > -\nu \frac{\partial n_x}{\partial u}$. In economic terms this implies that wage earners need to be, relative to firms, able to protect their income (high κ_w) or to benefit from economic upswings (high β_w). For Goodwin cycles to emerge, this relative strength needs to be compensated on the demand side with profit-led demand. This comes about if investment responds strongly to output and if saving differentials are small (Dutt, 1984, Bhaduri and Marglin, 1990).

(Figure 3 about here)

6 Conclusions

The dynamic Kaleckian framework put forward by Barbosa and Taylor (2006) can accommodate inflation conflict such as the model of wage-price spirals presented here. Both models reveal their commonalities their under slight rearrangement.

Several interesting results emerge in the course of this synthesis: First, in wage-price frameworks productivity growth has to be introduced in order to move equilibrium output away from its limit, thereby opening the possibility of Kaleckian excess capacity and cyclical adjustment. Second, with exogenous productivity growth the distributive curve is vertical and the model follows the usual textbook AS-AD logic in which stronger bargaining power of workers is corrected through higher unemployment. Goodwin cycles occur only under a labor market-led profit squeeze distribution / profit-led demand configuration. Third, the introduction of endogenous productivity growth can help overcome the degenerate vertical distributive curve. Fourth, under endogenous productivity growth the distributive regime is defined by the wage-adjustment regime. Labor market-led processes lead to profit squeeze; goods market-led processes to forced saving. Fifth, under the usual stability assumptions and endogenous productivity, the model generates counter-clockwise cycles in the u-ψ plane only in a labor market-led / profit-led regime. The relative strength of wage earners on the distributive side has to be joined with a strong response of investment to output and low saving differentials.

Turning to endogenous productivity growth, the two channels introduced are Kaldor-Verdoorn effects and Marxian technical change. Unsurprisingly, their impacts on the distributive curve are different in their extent and their direction of action. Kaldor and Verdoorn make the wage share more responsive to changes in output while Marx mitigates their impact. This analysis complements the analysis of Naastepad (2006) of the various effects of productivity growth on effective demand in the sense that the investigation of productivity growth covered functional income distribution rather than effective demand. She finds that a positive response of the productivity growth to a higher wage share pushes effective demand into a wage-led direction. Depending on the distributive regime, either productivity growth channel can have such an effect. Dutt (1994) also investigates the effect of endogenous productivity growth in the form of increasing returns in a similar model of distributional conflict and Kaleckian demand. His analysis is extended by emphasizing cyclical behavior in the short run and the effects of Marx-biased technical change.

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FIGURES:

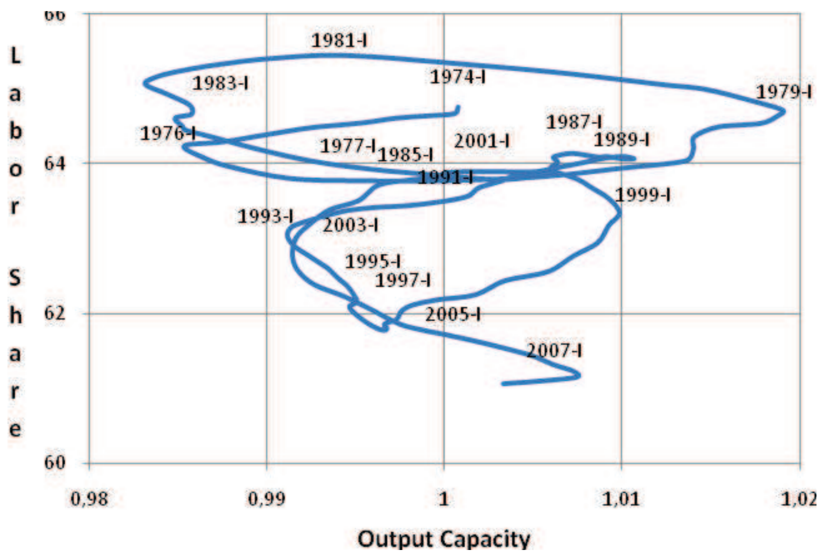

Figure 1: Goodwin Cycles in the US Economy, 1974-2009: Deviation from HP Output Trend and Labor Share for Nonfarm Business from BEA (Source: www.BLS.gov)

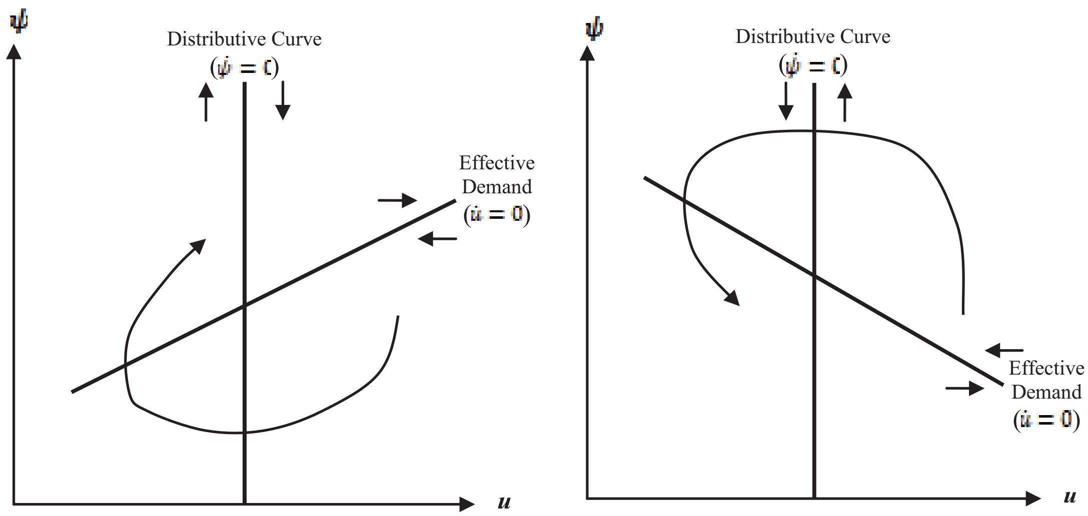

Figure 2: Dynamics for Exogenous Productivity Growth and Goods Market-led / Wage-led (left) and Labor Market-led / Profit-Led Demand (right)

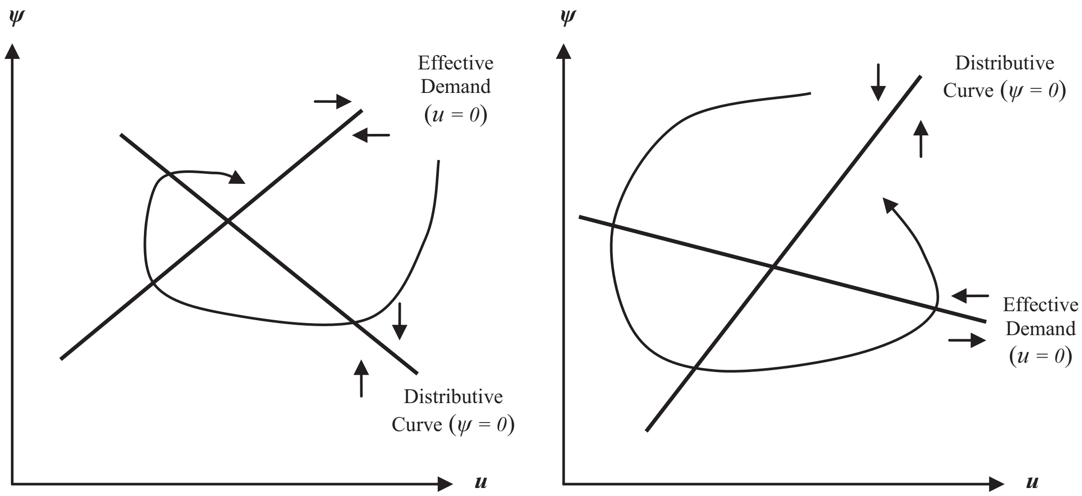

Figure 3: Dynamics for Endogenous Productivity Growth and Goods Market-led / Wage-led (left) and Labor Market-led / Profit-Led Demand (right)