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Profit maximizing goes global: the race to the bottom

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Abstract

We explore four decades of cyclical and long-run dynamics in income distribution and economic activity for a panel of thirteen OECD countries, as measured by the wage share and the output gap. When modeled as a Goodwin model, our results suggest that economic activity is weakly profit-led and that the wage share is pro-cyclical. Our estimated model is dynamically stable and has a long-run equilibrium in distribution-utilization space. An extension of the model suggests that this equilibrium has been shifting south-west towards a lower wage share and a loss of economic activity. This finding is suggestive of a coordination failure among industrialized nations; it could be that the governments of these countries are engaging in a *race to the bottom* in terms of the wage share; it may even be that this race has the undesirable consequence of decreasing economic efficiency.

Keywords: predator-prey models; distributive-demand dynamics; panel data estimation;
JEL Classification: D3; C23; C61;

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Abstract

We explore four decades of cyclical and long-run dynamics in income distribution and economic activity for a panel of thirteen OECD countries, as measured by the wage share and the output gap. When modeled based on predator-prey dynamics, economic activity in OECD countries is weakly profit-led. Convergence to a long-run equilibrium is relatively slow delaying the profit-squeeze stage for many years. An extension of the model suggests that the long-run equilibrium has been shifting south-west towards a lower wage share and a loss of economic activity. This finding is suggestive of a coordination failure among industrialized nations; it could be that the governments of these countries are engaging in a *race to the bottom* in terms of the wage share; it may even be that this race has the undesirable consequence of decreasing economic efficiency.

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1 Introduction

The great crisis of 2008 and its ongoing impact on economies across the world has not shaken much of the profession's trust in its theoretical postulates.[1] Nonetheless, recent indication of rising inequality has made the profession highlight more the role of income distribution in the making of the financial and economic crises this time around (Taylor (2011), Kumhof and Ranciere (2010), Rajan (2010)). We invoke Goodwin (1967)'s theoretical model of the business cycle to explore cyclical dynamics of distribution and economic activity. We quantify this model as first differences in the wage share and the output gap and estimate this specification on a panel of OECD countries over the past four decades. Looking more deeply, we infer that the countries of the industrialized world may be pursuing policies that progressively increase inequality, they may even be foregoing potential output in a quest for a competitive edge in the global economy. Our results suggest that the increasing inequality associated with *the great crisis* may just be the 'icing on the cake'.

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[1]Among these are views that absolve markets of any failures and assume instead that markets are always efficient, and theories that rely on marginal productivity rules in the determination of factor incomes rather than a more realistic bargaining process between economic classes. We indirectly take issue with both of these postulates.

Using the terminology of this literature, we find a counter-clockwise movement in the capacity-distribution space. Economic activity appears profit-led, and profits get squeezed during the upper part of the cycle. We generalize this econometric specification to allow the long-run equilibrium of this dynamic model to trend, and find evidence that it is migrating south-west in distribution-utilization space, towards a lower wage share and a lower level of utilization. This inequitable and inefficient trend is suggestive of a coordination failure as proposed in von Arnim et al. (2012) and of counter-productive policy in industrialized economies as discussed by Storm and Naastepad (2012) or Stockhammer et al. (2009) among others.

A number of factors may be contributing to this disturbing trend, including macroeconomic shocks, structural changes, government policies and globalization. Appropriate data for studying these issues are available back to around 1970. It was around then when governments turned their attention to income distribution as part of a strategy to achieve increased economic and employment growth (Taylor (2011), Storm and Naastepad (2012)). It has often been asserted that job creation requires wage moderation, that growth requires higher profits attained through a lower labor share. We argue that this view is reinforced by accelerating globalization and that the competition between nations for high profits has given rise to a *race to the bottom*.

Our long-run inefficiency finding in section 3 is certainly empirically weaker than our long-run inequality one, although both are statistically significant. Our story in section 4 highlights policies and institutional changes as likely causes of the decline in the wage share. Several factors can explain the reduction in long-run utilization: a generally contractionary tendency in macroeconomic policy; a decline in capacity utilization necessary to accommodate higher profits; a decline in labor productivity growth in response to a decline in the wage share. Preceding sections 3 and 4 is a review of the relevant literature on distribution-growth dynamics.

2 Goodwin's business cycle model

Goodwin (1967) introduced the predator-prey model by dynamically linking the employment rate and the income distribution.[2] An extensive literature has developed from his path-breaking insight. Goodwin motivates his theory with the classical assumptions of a saving-determined investment and that profits provide all the saving in this economy. However, the labor's power to bargain for a higher wage share increases with its market power derived from its higher employment rate. This conception of the business cycle emphasizes economic power relations; capitalist power lies in her use of investment, while worker power applies to the wage bargain.

Goodwin's equations have been interpreted with other scenarios. Flaschel (2008) and Flaschel (2009) provide a good flavor of the framework's many uses. Prominent among these is the Keynesian view of effective demand as the prime economic driver, substituting for the classical view of saving-driven investment (Barbosa-Filho and Taylor (2007), Nikiforos and Foley (2012), Tavani et al. (2011)). This approach describes the economy in terms of interactions between the capacity utilization and income distribution. Both interpretations can be quantified using the output gap $u = Y/Y^*$, the ratio of actual to potential real output,

[2]This model takes its name from its initial application to wolf and moose populations; Lotka (1925).

and the wage share $\psi = \omega/x$, the ratio of the real wage to labor productivity. Taken together, the utilization-distribution dynamics are formalized by a system of locally stable differential equations:

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

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

There are different ways to describe the law of motion for capacity utilization, however all of them share the Keynesian postulate that excess demand causes increased utilization. Following Nikiforos and Foley (2012) and Taylor (2004) we think of excess demand as the difference between the demand for investment and the supply of saving, both of which are dependent on the capacity utilization and on the wage share. By definition an increase in the wage share implies a reduction in the profit share, which leads to a decline in investment.[3] Even relaxing the classical assumption that workers do not save, a redistribution towards wages has an overall negative effect on saving because workers save less that capitalists. On the other hand, higher capacity utilization positively affects both investment and saving, although if the effect on the latter is not greater the model will be locally unstable. Our assumption that higher capacity leads to higher investment might be explained by either the accelerator principle, or by firms that want to hold excess capacity as a way to meet expected future spikes in demand, or perhaps as a deterrent to rivals (Skott (2010), Steindl (1952)).

Equation (2) captures the reaction of distribution to changes in utilization conditioned on the contemporary state of distribution. This relation may be motivated by observing that the wage share is defined as the ratio of the real wage and labor productivity, and that both of these are also determined by capacity utilization and distribution.[4] Empirical studies have consistently indicated that the real wage tends to rise in expansions and fall in recessions.[5] Labor productivity also depends on utilization and the state of distribution, tending to increase rapidly at the beginning of a recovery. In general, a variety of dynamics are possible, including stable and unstable ones, or both in the presence of nonlinearities, or limit cycles. We describe two of the stable ones with unique long-run equilibria in a phase diagram in $u - \psi$ space, which plots nullclines (the $\dot{\psi} = 0$ and $\dot{u} = 0$ loci) and trajectories (see Figure 1).[6] Our nullclines are linear, although nonlinear ones are often theorized. The turquoise trajectory plots the recovery from an exogenous output shock, specifically a sudden drop in utilization with no change in distribution. Their differences derive from the relative strengths of the several effects modeled by f and g.

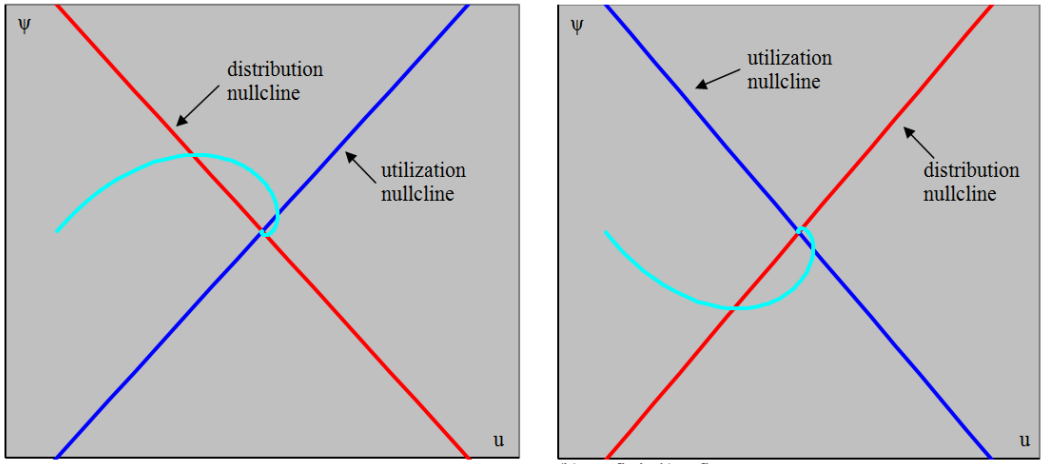
If utilization nullcline slopes up and the distribution curve slopes down, recovery will follow a clockwise trajectory after an adverse utilization shock; this has come to be known as a *wage-led* economy; see the left panel. In this case a rise in the wage share stimulates

[3]The Kaleckian model has been discussed in many papers. Notable contributions are from Blecker (1989), Dutt (1984), Lavoie (1995), Naastepad (2006) among others.

[4]Goodwin's model derives the distribution equation from a Phillips curve, finding a vertical nullcline that depends on labor productivity and expected wage inflation.

[5]Using mostly the US as the relevant case Taylor (2004) explains at length different forces acting on the real wage and labor productivity over the cycles. Inflation also plays a crucial role in the determination of income distribution over cycles. He identifies two factors that affect the wage share, wage inflation that is associated with a profit-squeeze, and price inflation which leads to what is known as 'forced saving'.

[6]Slopes of the two nullclines are given by: $-\frac{\partial f_u}{\partial f_\psi}$ for utilization and $-\frac{\partial g_u}{\partial g_\psi}$ for distribution. The local stability assumption translates in negative signs for the partial derivative signs on the Jacobian's main diagonal.



(a) wage-led/wage-squeeze (b) profit-led/profit-squeeze

Figure 1: Graphical representation of a structuralist Goodwin model

economic activity due to the strong response of consumption to a higher wage share, compared to the weaker negative response of investment demand due to lower profitability. Although the wage share initially rises in wage-led economies, eventually it falls (and the wage share gets squeezed) as the economy returns its long run equilibrium. This late stage effect is described in the 'wage-led/wage squeeze' label. If utilization nullcline slopes down and the distribution curve slopes up, recovery will follow a counter-clockwise trajectory after an adverse utilization shock; this has come to be known as a *profit-led* economy (see the right panel in Figure 1). In this case investment responds strongly to increased profitability implied by a decreasing wage share; sometimes this early stage is known as 'forced-saving', consistent with the classical assumption that capitalist save all their profit.[7] Although the wage share initially falls in profit-led economies, eventually it rises (and the profit share gets squeezed) as the economy returns its long run equilibrium, consistent with the 'profit-led/profit squeeze' label.

Shocks to either of these variables can be temporary or permanent as depicted in Figure 2. A temporary utilization shock, for example, does not shift any nullcline. A permanent shock, on the other hand, might be characterized as a shift of the utilization nullcline (distribution nullcline unchanged), perhaps due to technological change, or rivalry for global markets, or institutional changes that maintain a conservative monetary and fiscal policy stance. The diagram illustrates how a profit-led economy might converge to a new long-run equilibrium at point C. For this example of an adverse utilization nullcline shift, the recovery (from B to C) is incomplete and anti-labor with the new equilibrium at a lower wage share and a higher level of utilization (but less that the initial one at point A). Of course, other scenarios can be imagined and other nullcline shapes assumed.

It is unwise to associate the movement of a specific nullcline with a particular cause without a more complete theory about the nature of equations (1) and (2). Notice that we might also shift to a long-run utilization consistent with the equilibrium point at C by an upward shift of the distribution nullcline. This recovery would be incomplete and pro-labor.

[7] von Arnim et al. (2012) and Rezai (2011) develop a general equilibrium framework for open economies and show that although each individual economy becomes more profit-led with trade, a redistribution away from labor may have adverse effects on global demand and therefore on each individual country's income.

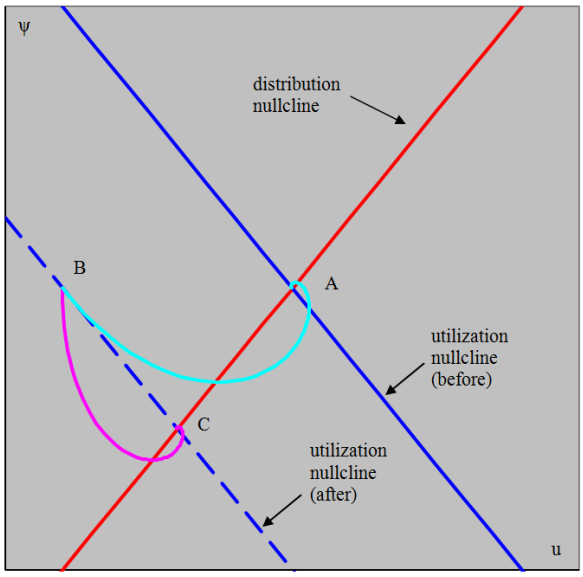


Figure 2: Response to temporary (turquoise) and permanent (pink) utilization shock in a profit-led economy

Notice further that a permanent decline in utilization could occur without consequences for distribution if there were a leftward shift of both nullclines. Finally, notice that all these conclusions are contingent on the profit-led configuration of the phase diagram and could be dramatically different for the wage-led configuration. Although they are obviously related, we conclude that it is easier to theorize about the long-run equilibrium (both its utilization and distribution coordinates) than about individual nullclines. Neither the location of nullclines nor of the long-run are directly observable. The Goodwin model provides a method for measuring the nullcline slopes. This model also provides a method that can be extrapolated to predict the equilibrium.

3 OECD data, econometric models and estimation results

There is an extensive empirical literature relevant to the Goodwin model.[8] Most authors choose a single regression equation to examine distributive effects on different measures of utilization. A recent econometric study by Barbosa-Filho and Taylor (2007) generalize this methodology with a VAR specification and find that the postwar US economy can be described as a profit-led/profit-squeeze case. Stockhammer and Onaran (2004) also use a vector autoregressive model (VAR) to study the interconnection between output, distribution, unemployment and labor productivity in the US, UK and France. They find that utilization is associated with employment growth but are inconclusive about the connection between wages and other macro indicators.

We study this topic with a panel of thirteen OECD countries for the past four decades.[9]

[8]Hein and Vogel (2008) provide a comprehensive review of empirical studies that estimate effects of income distribution on economic activity.

[9]Selected OECD economies are: Australia, Canada, Finland, France, Germany, Ireland, Italy, Japan, South

Table A.1 in the appendix summarizes our data. We measure the income distribution by the wage share index, or real unit labor costs, computed as the ratio of unit labor cost to GDP deflator. We measure capacity utilization by the GDP gap, the percentage difference between actual and potential gross domestic product. Except for Korea, the average wage share index in Figure 3 exceeds the 2005 base in every case, suggesting that the wage share has fallen worldwide over the sample period. Our interpretation of the Korean data is that they reflect a period during which the Korean economy was catching up with the level of development already achieved in the other industrialized countries. Given the OECD definition of the GDP gap, it is a little surprising this statistic averages slightly negative for all countries, except Ireland.[10] Figure 4 shows that utilization has been considerably more volatile than distribution in Figure 3. This plot clearly documents the linkages involved in *the great crisis* of 2008, indicating that the downturn has been felt most severely by Ireland and Finland.

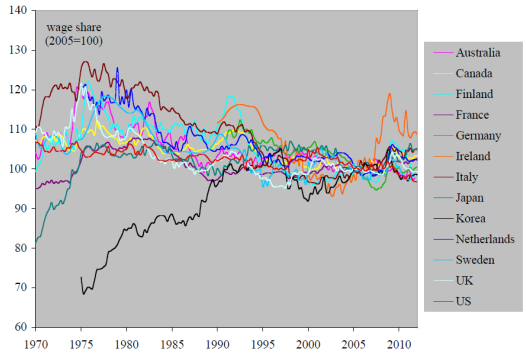


Figure 3: Labor share

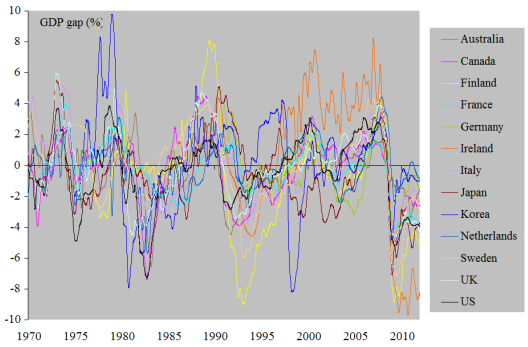


Figure 4: GDP gap

3.1 Cycles and trends

The qualitative features of the pure predator-prey model used by Goodwin are unrealistic when it comes to an actual economy. The model exhibits closed orbits around a unique fixed point (Lorenz (1993)). We can constrain the model to produce these pure Goodwin cycles. The model, which we present in the appendix, performs poorly. We work instead with a difference-equation version of the differential-equation theory (1) and (2):

$$u_{it} - u_{it-1} = \beta_0 \left(\psi_{it-1} - (\psi_t^* - \beta_1 u_t^*) - \beta_1 u_{it-1}\right) + \upsilon_{it} \tag{3}$$

$$\psi_{it} - \psi_{it-1} = \alpha_0 \left(\psi_{it-1} - (\psi_t^* - \alpha_1 u_t^*) - \alpha_1 u_{it-1}\right) + \varepsilon_{it} \tag{4}$$

where the subscript refers to the i^{th} country in the t^{th} period. The $\alpha's$ and $\beta's$ are parameters, and ε_{it} and υ_{it} are error terms. We use several specifications for the long-run coefficients ψ_t^* and u_t^*. We begin by imposing a cross-equation restriction that requires a long-run equilibrium along the wage share axis at $\psi_t^* = \psi_0^*$ (a parameter) and at $u_t^* = u_0^* = 0$ (a restriction). We

Korea, Netherlands, Sweden, US and the US. The data was extracted on 28 Oct 2012 20:27 UTC (GMT) from OECD iLibrary, Economic Outlook 90.

[10] Gianella et al. (2008) and Giorno et al. (1995) among others discuss the OECD methodology for estimating the output gap. More information on the OECD methodology can be found at http://www.oecd.org/eco/sourcesmethodsoftheoecdeconomicoutlook.htmOECD.

refer to the $u_0^* = 0$ specification as the NAIRU restriction because it imposes the conventional assumption that the long-run equilibrium occurs at the potential output. This restriction is consistent with the OECD's method of estimating the GDP gap, although many studies of the Goodwin model do not require that the long-run GDP gap be fixed at zero.[11]

After rearrangement this specification can be seen as a $VAR(1)$; the dependent variables depend entirely on lagged values of themselves. Table 1 reports generalized least squares (GLS) estimates of this model in column (a) under the assumption of different variances for each country, and nonzero intercountry and interequation covariances. In other words, we allow for significant interactions among countries. [12]

model	(a)	(b)	(c)	(d)	(e)
	NAIRU, seemingly unrelated	NAIRU quadratic nullclines, seemingly unrelated	NAIRU country-specific nullclines, seemingly unrelated	general long-run with linear trend, seemingly unrelated	general long-run with stochastic trend, maximum likelihood
wage slope α_1	5.386	5.433	6.422 ave	4.493	4.297
	(6.045)	(5.964)	(-3.520) ave	(6.383)	(4.910)
gap slope β_1	-14.941	-15.527	-22.071 ave	-11.104	-11.562
	(-2.290)	(-2.285)	(-1.660) ave	(-3.122)	(-3.274)
wage squared slope α_2		0.0002			
		(-0.618)			
gap squared slope β_2		-0.614			
		(-1.553)			
wage share scaling α_0	-0.023	-0.023	-0.023	-0.027	-0.029
	(-7.033)	(-6.886)	(-6.946)	(-7.844)	(-6.417)
gap scaling β_0	-0.006	-0.006	-0.005	-0.008	-0.008
	(-2.308)	(-2.303)	(-1.858)	(-3.169)	(-2.917)
long-run wage intercept ψ_0^*	102.81	103.43	102.71	110.36	
	(141.96)	(131.64)	(137.96)	(73.61)	
long-run gap intercept u_0^*				0.890	
				(1.656)	
long-run wage trend ψ_1^*				-0.345	
				(-5.585)	
long-run gap trend u_1^*				-0.045	
				(-2.025)	
Schwarz criterion	-1232	-1224	-1155	-1250	-1729

Table 1: Estimation results, t-statistics in parentheses

Figure 5(a) illustrates model (a); it clearly implies that these economies are profit-led. It suggests that that the Goodwin-style causation is relevant for understanding macroeconomic outcomes.[13] All the coefficient estimates are statistically significant; our distribution nullcline slopes up and the utilization nullcline slopes down consistent with profit-squeeze/profit-led

[11] In unreported regressions we relax the NAIRU restriction by introducing a nonzero value for u_0^*. We estimate that $\psi_t^* = 102.6$ and $u_t^* = -0.09$, and find that the later is insignificantly different from zero.

[12] We can further generalize the error structure by introducing within-equation serial correlation. Although this does yield a somewhat better fit in terms of the Schwarz criterion (an unreported estimate of model (a) achieves Schwartz=-1265), we reject it. Our objection is that the $AR(1)$ errors suggest that the underlying model should be re-specified as a $VAR(2)$, but such a specification loses its intuitive appeal as an analogue of the Goodwin model. In further unreported results we re-estimated these two equations as an unrestricted $VAR(2)$; we find that the dynamic properties of VAR(2) are indistinguishable from those of model (a).

[13] This observation underlines an important difference between our approach and the econometric approach used by Nikiforos and Foley (2012) in that they attempt to estimate these nullclines directly from the scatter of points for the US without specifying the dependent variables as differences.

regimes and the results reported by Barbosa-Filho and Taylor (2007). Overall, our estimates for the two slopes are considerably larger, at $d\psi/du = 5.38$ for the distribution and $d\psi/du = -14.94$ for utilization. These numbers point out to strong profit squeeze but a weak profit-led demand regime. A one-percentage point increase in utilization generates over five percentage points rise in the wage share for the OECD group relative to the base year (2005=100), while a one-percentage point increase in the wage share leads to a $1/14.94 = .06$ percentage points decline in capacity utilization compared to about 0.33 percentage points estimated by Barbosa-Filho and Taylor (2007). When we allow nullcline slopes to vary in model (c), we find that a profit-led regime holds across all 13 countries. Table B.2 in the appendix reports our estimates of country-specific nullclines.

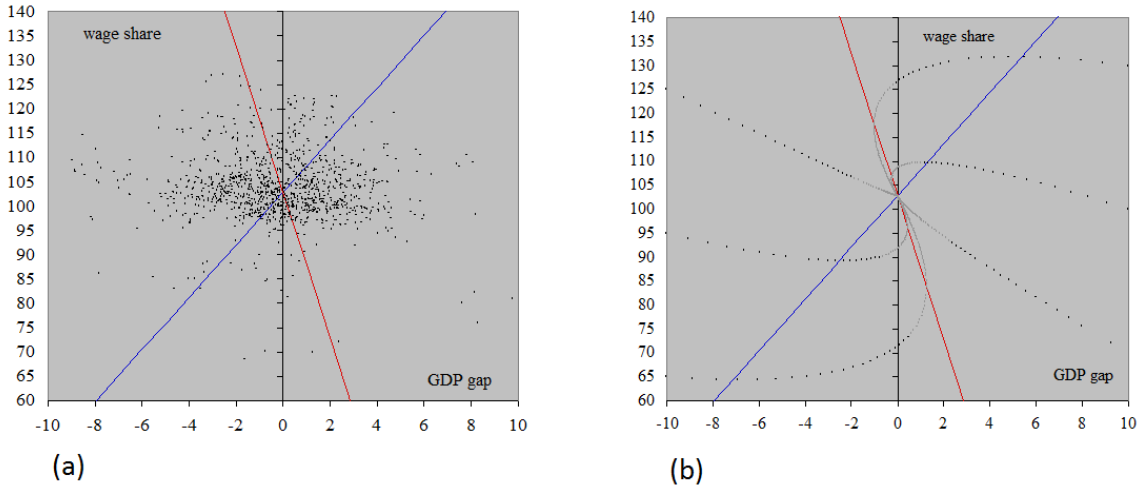


Figure 5: Nullclines (a) and trajectories (b) for model (d),$\Delta u_t = 0$ in red, $\Delta \psi_t = 0$ in blue, and 1933 observations

Business cycle dynamics are further illustrated in Figure 5(b). Here we simulate the model's predictions in the absence of any shocks starting at a variety of initial conditions. The trajectories do not exhibit persistent Goodwin cycles. All paths converge to a long-run equilibrium at the point where the nullclines intersect.[14] Convergence is relatively slow; the first 5 years of each path are denoted in black, the remainder in gray. This slowness indicates that the profit-led stage of the recovery from a temporary output shock (but no distribution shock) can be rather long-lived, delaying the profit-squeeze stage for many years. Comparing these two plots suggests that the elongated scatter of points in Figure 5(a) around the equilibrium may be explained with Figure 5(b) as equilibrating dynamics subsequent to output shocks.

Nikiforos and Foley (2012) emphasize the possibility of multiple long-run equilibria arising from nonlinear nullclines and the counterintuitive inferences that this implies. We investigate this possibility by adding quadratic terms to our basic model's equations, (3) and (4). Estimation results for this specification are reported as model (b) in Table 1. Our results show little statistical support for nonlinearities. Furthermore, plotting the linear and quadratic nullclines

[14]Model (a) has two real roots at 0.96 and 0.93, verifying dynamic stability.

and trajectories together (not shown) reveals that they are essentially indistinguishable.[15]

The result that $\hat{\psi}_0^* > 100$ suggests that the long-run equilibrium may be moving downward. So does the literature's focus on inefficiency as a consequence of suppressing the wage share (see Nikiforos and Foley (2012)). In order to investigate these possibilities, we generalize our specification in model (d) by introducing a linear trend model of the long-run equilibrium; we also relax the NAIRU restriction by allowing the long-run GDP gap to be nonzero. Although the long-run equilibrium is unobservable, it is the conceptually appropriate indicator of the trend in capitalist economies. The ψ_0^* coefficient is reinterpreted as the 1970 wage share equilibrium, and u_0^* as the 1970 utilization equilibrium. This generalization may be motivated by a variety of evidence that there have been long-term trends in the global economy, notably the trend toward greater income inequality. This specification does not impose a direction on these trends, it may be positive or negative. Model (d) finds significant downward trends for both long-run coordinates. Figure 6 illustrates the implication that globally the long-run equilibrium has shifted south-west over the past 4 decades, the utilization nullcline more than the distribution one. Although the significance of our result do not identify a cause for these trends, it is consistent with the argument that the declining wage share has had an adverse impact on utilization. In other words, *the race to the bottom* in terms of wage shares is an inefficient policy.

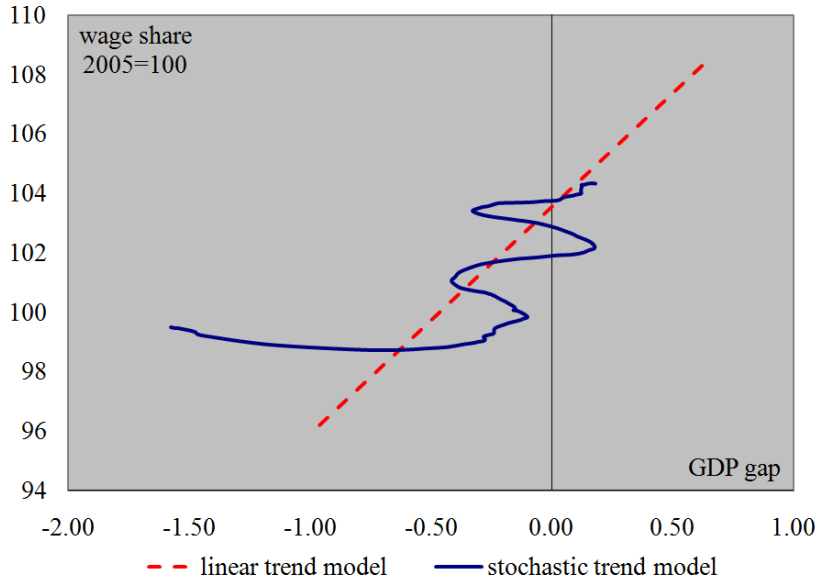


Figure 6: Comparison of alternative trajectories of the long-run equilibrium

We can use the estimates in table 1 to calculate the steady-state solutions for our variables and measure the magnitude of the overall shift. A simple reading and computation using the numbers in column (d) show that the intersection of the two nullclines has shifted from $(\psi^*_{1970} = 110.36, u^*_{1970} = 0.89)$ to $(\psi^*_{2012} = 95.87, u^*_{2012} = -1.0)$. Our linear trending equilibrium specification in Figure 6 assumes that the annual shifts are evenly spaced. We estimate the slope of the steady-state trajectory and obtain $\Delta\psi^*/\Delta u^* = 7.67$. The slope

[15] Adding both quadratic and cubic terms to the basic model does not change this conclusion.

describes the relative movement of these two unobserved variables over time but it is not meant to suggest a causal pattern. All we can say using our model is that a one percentage-point increase in the *steady-state* wage share is associated with $1/7.67 = 0.13$ percent *rise* in capacity utilization at the steady-state. Conversely, a one percent decline in u^* coincides with a 7.67 percentage-point decline in the wage share in the long-run.

Our econometric model contains two error terms ε_{it} and υ_{it} that account for random shocks, both utilization shocks like a temporary fiscal contraction or a Tsunami disaster and wage share shocks like a temporary minimum wage increase. Table 2 averages the 351 estimates in this covariance matrix for model (d). The estimated covariance matrix reinforces the notion that there are global linkages between modern economies.

	average	observations
gap $Var\left(\upsilon_{it}\right) = \sigma_{iu}^2$	1.034	13
wage share $Var\left(\varepsilon_{it}\right) = \sigma_{i\varepsilon}^2$	1.555	13
within $Cov\left(\varepsilon_{it}, \upsilon_{it}\right) = \sigma_{ii\varepsilon\upsilon}$	-0.698	13
between gap $Cov\left(\upsilon_{it}, \upsilon_{jt}\right) = \sigma_{ij\upsilon}$	0.196	78
between wage $Cov\left(\varepsilon_{it}, \varepsilon_{jt}\right) = \sigma_{ij\varepsilon}$	0.107	78
between gap-wage $Cov\left(\upsilon_{it}, \varepsilon_{jt}\right) = \sigma_{ij\upsilon\varepsilon}$	-0.141	156

Table 2: Summary of linear trend model's the between-country covariance matrix

The positive covariance $\sigma_{ij\upsilon}$ of utilization shocks is expected, reflecting obvious demand linkages between countries. Interestingly, we also find a positive covariance $\sigma_{ij\varepsilon}$ of wage share shocks; that there are between-country linkages in wage shocks is less obvious, although it is consistent with our global *race to the bottom* hypothesis; a wage drop in one country is associated with a wage drop in another country.[16] More surprising are the negative covariances $\sigma_{ii\upsilon\varepsilon}$ between wage share and utilization shocks. This finding indicates that temporary negative shocks to the GDP gap in one country is statistically associated with temporary positive shocks to the wage share in another country. This suggests that some aspects of the wage-utilization dynamic still are not captured in our simple linear model. Perhaps this negative between-country wage-utilization covariance indicates yet another source of global linkage.

The econometrics above allowed only temporary shocks, but the observed downward trends in the long-run equilibrium suggests that there may be permanent shocks, as well as temporary ones. We study this distinction in model (e) by further generalizing our specification as a state space model. We suppose that the long-run equilibrium that applies in all countries is subject to persistent random shocks, specifically, the long-run equilibrium (ψ_t^*, u_t^*) is redefined as two random walks.[17] Such models are sometimes called *stochastic trends*. The variances in these equations imply a standard deviation of .05 per year for the wage share step and .01 per year for the GDP gap step; these are chosen to be consistent with the relative trends found in model (d) and also to smooth the evolution of long-run equilibrium. The random walk model is appealing because it is agnostic about the path; it also has the potential of being further generalized to incorporate exogenous determinants of the long-run. In Table 1's results, model (e) is preferred for its goodness-of-fit and statistical significance. When we relax the deterministic linear trend on the equilibrium we find any-

[16] Rudi von Arnim suggested that this finding can also be due to imported price inflation which workers are unable to translate into higher nominal wages.

[17] Specifically we assume $u_t^* = u_0^* + \xi_t$, where $\xi_t \ N(0, 0.01)$ and $\psi_t^* = \psi_0^* + \mu_t$, where $\mu_t \ N(0, 0.25)$.

thing but a linear trend, although the general south-west direction remains unchanged; see Figure 6.

This stochastic trend extension can be estimated as a Kalman filter in which the coordinates of the long-run equilibrium are the state variables according to the random walk specifications and the wage share and the GDP gap are the observation variables. We estimate the coefficients by maximum likelihood on a sample of 145 quarterly observations 1976-2012 on eleven countries.[18] Unreported results of the covariance matrix of the residuals of this stochastic trend model suggest a pattern similar to that of the linear trend model in Table 2. We conclude that both temporary and permanent shocks are relevant in the dynamics of these economies.

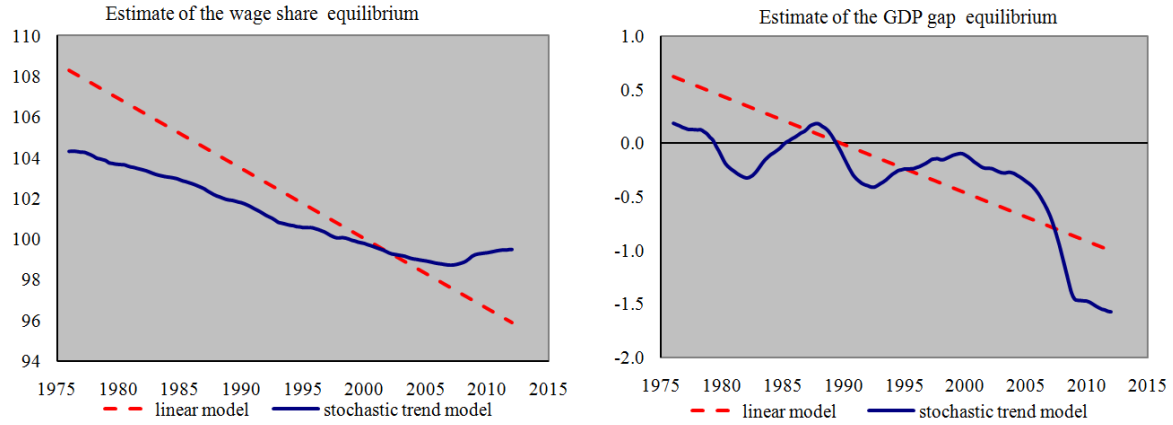


Figure 7: Comparing the linear and stochastic trend estimates of state variables

Figure 7 plots our smoothed estimates of the state variable time series (ψ^*, u^*) in comparison with the linear series predicted by model (d). Despite the flexible nature of the stochastic trend model, the roughly continuous downward trend in the equilibrium wage share is confirmed, although it does turn slightly upward following *the great crisis* of 2008. For the equilibrium utilization, however, the stochastic trend differs markedly from the steady trend enforced on the linear model. The stochastic estimate starts at a point close to zero in 1976, but does not show any sustained trend until after 2005. Then, it drops dramatically at about the 2008 crisis. Perhaps *the great crisis* has brought a long-lasting shift in the efficiency of capitalist economies, perhaps this time is different.

4 The race to the bottom

There has been a trend towards a lower wage share. Also, there is weaker evidence of a decline of economic activity in the long run that is pushing OECD economies below their potential output. These findings could be independent, or they could be related. A variety of causes are possible. Although we have not empirically isolated the causes, nevertheless, in light of the short-run linkages, we believe that there are long-run dynamics that require a political economy perspective.

[18] In order to obtain a balanced panel of observations, we dropped both Germany and Ireland due to data unavailability. We also dropped the first 5 years.

Among possible causes are permanent shifts in technology, increased global capitalist market power either in product or labor markets, and trends in government policies. We offer a *race-to-the-bottom* hypothesis as one version of the latter. We propose that governments have been pursuing a broad set of policies to suppress the wage share in order to increase their exports; they are racing to stimulate output by decreasing labor costs. This worldwide phenomenon has been proceeding steadily during recent decades (see Bowles et al. (1990) and recently Stiglitz (2012), Storm and Naastepad (2012)). Among policies that have contributed to these trends are tight macroeconomic policies, embodied in inflation targeting for monetary policy, and the austerity movement for fiscal policy.

On other fronts, governments have tilted the capital-labor bargain towards greater inequality through the lax regulation of financial markets, reductions in the progressivity of the tax structure and reductions in corporate tax rates, changes in bankruptcy laws and support for anti-labor collective bargaining agreements. Our results suggest that these institutional and policy shocks spread across countries limiting workers' bargaining power to claim productivity gains or higher nominal wages in response to price increases. Continuous efforts towards deregulation and deterioration of antitrust laws since the 1980s, especially in the US, also led to extraordinary concentration of market power which has hindered the process of job creation. As Paul Krugman bluntly put it in a recent op-ed:[19]

> ...antitrust enforcement largely collapsed during the Reagan years and has never really recovered. Yet [...] increasing business concentration could be an important factor in stagnating demand for labor, as corporations use their growing monopoly power to raise prices without passing the gains on to their employees.

Overlooked in this set of policies is the adverse effect on long-run utilization. According to the conventional doctrine embodied in our NAIRU restriction, tight macroeconomic policy has only a temporary effect and the GDP gap returns eventually to zero. We propose that a continuing policy of inflation targeting implies that the GDP gap is below zero for many years and, therefore, it may have a lasting impact. On one hand, our argument mirrors the hysteresis explanation of persistent high unemployment rates in Europe. On the other hand, our results are aligned with Taylor (2011) and Stiglitz (2012)'s claims that macroeconomic policies, because of their distributional impact, may have permanent effects on the economy. Furthermore, increased income inequality and anti-labor policies will have an adverse impact on capacity if they reduce productivity growth or if they lead to lower demand for labor (Storm and Naastepad (2012)). Thus, the consequence of this policy race is certainly a long-run reduction in the wage share but also a loss of efficiency. Our results suggest that while the wage share trend has been steady, the long-run shifts in efficiency have been present but episodic and are linked to financial crises, especially the 2008 *great crisis*.

In retrospect our results emphasize the failure of orthodox economic thinking about macroeconomic management that emerged in the 1970s throughout the profession and around the world. The damage done by *the great crisis* goes beyond the financial collapse and the recent global recession. OECD economies appear to be moving in the wrong direction and, unless significant changes towards institutions that promote a more equal and equitable distribution of income are made, we are likely to see cumulative negative effects on economic efficiency and societies for many decades to come.

[19] See the NYT op-ed by Paul Krugman, 'Robots and Robber Barons', published on December 9, 2012.

A Data

	wage share (2005=100)	GDP gap (%)	observations
Australia	105.4	-0.293	165
Canada	104.8	-0.215	165
Finland	106.1	-0.878	146
France	101.0	-0.216	165
Germany	103.5	-0.563	85
Ireland	106.2	0.573	89
Italy	109.8	-0.201	165
Japan	102.3	-0.523	165
Korea	92.7	0.083	149
Netherlands	106.8	-0.087	165
Sweden	104.6	-0.083	165
UK	103.2	-0.118	165
US	102.4	-0.489	165
average	103.7	-0.246	

Table A.1: Descriptive statistics, 1971-2012, thirteen OECD countries.

B Further estimation results

The specification for our pure Goodwin model is written as:

$$u_{it} - u_{it-1} = \beta_0 u_{it-1} \left((\psi_t^* - \beta_1 u_t^*) - \psi_{it-1} \right) + \upsilon_{it} \tag{5}$$

$$\psi_{it} - \psi_{it-1} = \alpha_0 \psi_{it-1} \left((\psi_t^* - \alpha_1 u_t^*) - u_{it-1} \right) + \varepsilon_{it} \tag{6}$$

where the long-run output gap is constrained to zero. Compared to our main specifications in Table 1 the pure Goodwin model performs poorly in terms of the Schwarz criterion ($Schwarz = -1171$). GLS estimates of this model are also difficult to interpret and insignificant in the case of the gap scaling estimate β_0. The estimates are: $\underset{(14.212)}{\alpha_0 = .001}$, $\underset{(0.865)}{\beta_0 = .001}$ and $\underset{(1.65)}{\psi_0^* = 218.65}$.

country	wage share slope	GDP gap slope	type	modulus	dynamics	roots
Australia	8.267	-32.486	profit-led	0.969	stable	both real
Canada	5.972	-23.047	profit-led	0.968	stable	both real
Finland	6.136	-13.282	profit-led	0.956	stable	complex
France	3.860	-10.388	profit-led	0.963	stable	complex
Germany	7.760	-16.464	profit-led	0.948	stable	complex
Ireland	4.378	-14.148	profit-led	0.960	stable	both real
Italy	6.944	-18.414	profit-led	0.962	stable	both real
Japan	6.145	-21.214	profit-led	0.967	stable	both real
Korea	5.019	-32.285	profit-led	0.972	stable	both real
Netherlands	10.801	-29.832	profit-led	0.966	stable	both real
Sweden	6.088	-15.752	profit-led	0.956	stable	both real
UK	8.018	-28.147	profit-led	0.968	stable	both real
US	4.095	-31.462	profit-led	0.973	stable	both real
average	6.422	-22.071	profit-led	0.964	stable	both real

Table B.2: Country-specific properties of model (c)

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