Structural change, aggregate demand and employment dynamics in the OECD, 1970-2010

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Abstract

The paper combines Baumol's model of structural change with a model of aggregate demand growth in the Keynesian-Kaleckian tradition to predict the dynamics of aggregate employment. The model for the demand regime is estimated with – and Baumol's model for the productivity regime is calibrated on – OECD data. The trajectory for employment predicted by the combination of the two models tracks the actual employment dynamics in the OECD over the period 1970-2010 remarkably well.

1. Introduction

Baumol (1967) has introduced differential productivity growth as a cause for structural change.[1] In a nutshell, the story of his model goes like this. Productivity growth is higher in the 'progressive' (secondary) than in the 'nonprogressive' – or 'stagnant' – (tertiary) sector of the economy, but wages grow more or less the same in both sectors. Therefore, unit costs and also prices rise much faster in the tertiary sector than in the secondary. Demand for certain services, like health care and education for instance, is hardly price-elastic, hence consumers are willing to pay the higher prices. Therefore, even if the two sectors keep their proportion in terms of real production, an ever higher share of total expenditures will be channeled into the stagnant sector. This phenomenon is known as the 'cost disease'. Also, since aggregate productivity growth is a weighted average of the sectoral productivity growth rates with the weights provided by the nominal value added shares, the aggregate productivity growth rate will decline over time as the industries with low productivity growth receive an ever-increasing weight.

The growth pessimism immanent in Baumols's model has always been more controversial than the proposition of the 'cost disease'. Oulton (2001), for instance, was able to show that if the tertiary sector produces intermediate services instead of services to the final consumer, the aggregate productivity (and hence the GDP) growth rate may rise over time rather than fall. Sasaki (2007), however, vindicated Baumol's result of a tendency for the economy to stagnate, showing that the GDP growth rate will decline in the long run as long as *some* services are produced for final demand. Ngai and Pissarides (2007), on the other hand, demonstrated that when capital is added to Baumol's model as an additional factor of production, the economy can reach a balanced growth path in the aggregate under certain circumstances while still exhibiting supply-side driven structural change due to differences in (exogenous) total factor productivity growth across sectors and a low elasticity of substitution across final goods. Against the background of this theoretical debate, recent *empirical* studies have found evidence in favour of Baumol's model: structural change seems to cause aggregate productivity growth to decline, see Nordhaus (2008), Hartwig (2011, 2012).

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[1] See Schettkat and Yocarini (2006) for a review of the literature on structural change.

Baumol's model has been criticised for being relatively mute on the demand side of the economy.[2] The lack of focus on the demand side is explained by the fact that Baumol's model is a neoclassical model: it posits Say's Law and full employment. Notarangelo (1999) has augmented Baumol's model in an important way by introducing autonomous demand growth. Notarangelo models productivity growth as in Baumol (1967), but drops the assumption of full employment. Employment growth is driven by the difference between autonomous demand growth and productivity growth. Unemployment then becomes possible due to deficient demand. Ultimately, however, as demand growth is assumed to be constant, and productivity growth tends towards zero, the system tends towards full employment.

In this paper, I go beyond Notarangelo (1999) in *modelling* demand growth instead of assuming a constant rate. For this task, I draw on a model in the Keynesian-Kaleckian tradition: the Bhaduri and Marglin (1990) model. This model for the demand regime will be estimated with OECD panel data and combined with Baumol's model for aggregate productivity growth, which will likewise be calibrated on OECD data. From the combination of the two models, a prediction for the employment trajectory emerges.[3] This trajectory will be compared with the actual employment dynamics in the OECD over the period 1970-2010. The basic question is whether the 'demand-augmented' Baumol model can explain the dynamics of employment in the real world. It will be seen that it can.

The paper is structured as follows. The next section introduces the theory: Baumol's model of 'unbalanced growth', Notarangelo's extension of that model and the Bhaduri-Marglin model for the demand regime. Section 3 explains the empirical methodology, and section 4 presents the results. Section 5 concludes.

2. Theory

2.1. Baumol's model of 'unbalanced growth'

Baumol presents a model in which the economy is divided into a 'progressive' and a 'nonprogressive' – or 'stagnant' – sector. For Baumol, regular productivity growth is the result of technological innovation which manifests itself in new capital goods. Capital goods

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[2] See Harvey (1998) for a discussion of this critique. The demand side is not completely out of the picture, however, as Baumol's model builds on certain – although admittedly not precisely stated – assumptions about the price elasticity of demand (see section 2 below).

[3] 'Prediction' here does not mean that the model delivers forecasts out of sample. It means that the model makes a statement how the employment trajectory should have looked like over the period under investigation.

are also the source of economies of scale, being another source of productivity growth. Regular productivity growth is thus defined to depend on certain physico-technological requirements. In the service industries, Baumol argues, physical capital cannot be employed on a large scale. He cites repeatedly education and health care as examples for industries that will inevitably remain highly labor-intensive. Such industries he relegates to the 'non-progressive' sector. Baumol does not claim that increases in labor productivity are impossible in the 'non-progressive' sector, only that this sector comprises "activities which, by their very nature, permit only sporadic increases in productivity" (Baumol 1967, p. 416). For simplicity, he abstracts from such sporadic productivity increases over the course of his argument. He assumes that labour productivity grows only in the progressive sector, which can be identified as the manufacturing industries. Wages, however, grow in both sectors at a rate set by the productivity growth in the progressive sector. Formally, this can be stated as:

$$Y_{1t} = aL_{1t} \tag{1}$$

$$Y_{2t} = bL_{2t}e^{rt} \tag{2}$$

$$W_t = We^{rt} \tag{3}$$

with Y_1 and Y_2 as output in the two sectors at time t, L_1 and L_2 as quantities of labour employed in the two sectors, r as the (constant) growth rate of labour productivity in the progressive sector (2), W as the wage rate, and a and b as constants.

This simple model has a couple of interesting implications which Baumol draws out. From (1)–(3), we obtain

$$C_1 = W_t L_{1t} / Y_{1t} = We^{rt} L_{1t} / aL_{1t} = We^{rt} / a \tag{4}$$

$$C_2 = W_t L_{2t} / Y_{2t} = We^{rt} L_{2t} / bL_{2t}e^{rt} = W / b \tag{5}$$

That is, costs per unit of output in the stagnant sector tend toward infinity while they stay constant in the progressive sector. Since relative costs also tend toward infinity ($C_1/C_2 = be^{rt}/a$), the stagnant sector will vanish under 'normal' circumstances – that is, when prices rise in proportion to costs and when demand is price-elastic. Yet, parts of the stagnant sector produce necessities for which the price elasticity is very low. Baumol calls attention to education and health care as prime examples. To account for this fact, he assumes that the relation of real output of the two sectors remains unchanged:

$$(b/a)\ Y_1/Y_2 = L_1/L_2 e^{rt} = K \tag{6}$$

where K is a constant. With L ($= L_1 + L_2$) denoting the labour force, it follows:

$$L_1 = (L - L_1)Ke^{rt} \qquad \Leftrightarrow \qquad L_1 = LKe^{rt}/(1 + Ke^{rt}) \tag{7}$$

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and $\quad L_2 = L - L_1 = L/(1 + Ke^{rt})$ (8)

implying that, over time ($t \to \infty$), L_1 tends toward L and L_2 tends toward zero. The model thus predicts structural change in terms of a perpetual shift of both expenditures and employment toward the stagnant sector.

Finally, it can be shown what happens to the GDP growth rate under the assumption of constant 'real shares'. Let I be an index for real GDP which is calculated as a weighted average of the value added of the two sectors:

$$I = B_1 Y_1 + B_2 Y_2 = B_1 a L_1 + B_2 b L_2 e^{rt}$$ (9)

Then, if we insert (7) and (8) into (9) we get:

$$I = L(KB_1 a + B_2 b)e^{rt}/(1 + Ke^{rt}) = Re^{rt}/(1 + Ke^{rt})$$ (10)

with $\quad R = L(KB_1 a + B_2 b)$ (11)

Applying the quotient rule leads to:

$$\begin{aligned} dI/dt &= R[re^{rt}(1 + Ke^{rt}) - Kre^{2rt}]/(1 + Ke^{rt})^2 \\ &= rRe^{rt}/(1 + Ke^{rt})^2 \end{aligned}$$ (12)

We can calculate the growth rate of real GDP as:

$$(dI/dt)/I = r/(1 + Ke^{rt})$$ (13)

It follows that, over time ($t \to \infty$), the GDP growth rate drops asymptotically to zero *ceteris paribus*. *Ceteris paribus* here especially means that L remains constant. If L grows at the rate l, then l must be added at the right hand side of (13). Long-run stagnation then occurs for productivity.[4]

2.2. *Notarangelo's model extension*

In her equation (7), Notarangelo (1999, p. 212) defines:

$$L(t) = \mu(t)N(t) \Leftrightarrow \mu(t) = \frac{L(t)}{N(t)}$$ (14)

So μ designates the participation rate: the ratio of employment L to the population N. Making use of equation (13) above, Notarangelo (1999, p. 217-8) derives:

$$\hat{\mu} = \hat{x}_D - \frac{r}{1 + Ke^{rt}} - n, \qquad \text{for } K = const.$$ (15)

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[4] An alternative derivation of the tendency for productivity growth to decline in Baumol's model can be found in Hartwig (2012, Appendix A).

The expression $\hat{x}_D$ stands for the growth in demand,[5] and $\frac{r}{1+Ke^{rt}}$ designates the productivity growth rate in the overall economy.[6] If we subtract population growth n, we get an expression for $\hat{\mu}$.[7] Equation (15) tells us that when demand outgrows the sum of productivity growth and population growth, the participation rate rises. Additional workers are hired as the existing workforce is unable to increase output sufficiently to satisfy growing demand. The opposite occurs when demand growth is smaller than the sum of productivity growth and population growth. Workers are released, and the participation rate goes down. This can only be a short-term phenomenon in Notarangelo's modelling framework, however, as she assumes a constant demand growth rate $\hat{x}_D$. From some point in time onwards, the productivity growth rate $\frac{r}{1+Ke^{rt}}$ must fall below this constant threshold. Population growth can still prevent a rise in the participation rate, but if n is smaller than $\hat{x}_D$, μ will rise eventually; and it will not stop rising until full employment is established. From here on out, the shortage of labour force puts a break on demand growth.

2.3. The Bhaduri-Marglin model for the demand regime

The Bhaduri-Marglin model allows for studying the impact of functional income distribution on the growth in demand. A higher wage share in total income probably stimulates the demand for consumption goods because wage earners can be expected to have a lower savings rate than profit receivers. It will reduce the demand for investment goods, however, if investment is dependent on profits. The demand for export goods will fall as well if the rise in real wages impairs the international competitiveness of the economy. Bhaduri and Marglin (1990) have designed a model in the Kaleckian tradition which formalises these aspects.

In writing down the model, I follow Naastepad (2006). Table 1 collects the symbols for the relevant variables and parameters.

<Insert Table 1>

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[5] A hat (^) over a symbol denotes a growth rate.

[6] The growth rate of real GDP equals $\frac{r}{1+Ke^{rt}} + l$, so $\frac{r}{1+Ke^{rt}} + l - l$ equals the aggregate productivity growth rate.

[7] In her equation 37 for $\hat{\mu}$, Notarangelo (1999, p. 218) actually omits n.

Demand (x_D) is the sum of private consumption (c), investment (i) and net exports ($e - m$) (see Equation 16).[8] Wage and profit receivers are assumed to have different propensities to save (Equation 17). If the wage earners' propensity to save (σ_w) is smaller than the profit receivers' propensity (σ_π), a redistribution of income towards labour increases consumption demand.

$$x_D = c + i + e - m \tag{16}$$

$$c = (1-\sigma_w)\frac{w}{\lambda}x_D + (1-\sigma_\pi)\pi x_D = [(1-\sigma_w)\upsilon + (1-\sigma_\pi)(1-\upsilon)]x_D; \quad \sigma_\pi > \sigma_w \tag{17}$$

Investment is assumed to depend positively on the profit share (π), output (x_D),[9] and other factors like the 'animal spirits' of entrepreneurs (b) (Equation 18). Exports on their part depend positively on the level of foreign demand (z) and negatively on the ratio of domestic to foreign real unit labour cost (υ/υ_f) (Equation 19).[10] Imports, finally, are assumed to be a linear function of output ($m = \zeta x_D$).

$$i = a_i b^{\phi_0} \pi^{\phi_1} x_D^{\phi_2} \quad \phi_0, \phi_1, \phi_2 > 0 \tag{18}$$

$$e = a_e z^{\varepsilon_0}\left(\frac{\upsilon}{\upsilon_f}\right)^{\varepsilon_1} \quad \varepsilon_0 > 0; \varepsilon_1 < 0 \tag{19}$$

Under these premises, Equation 16 can be rewritten as Equation 20, with α^{-1} being the Keynesian multiplier.

$$x_D = \frac{i+e}{[\sigma_\pi - \upsilon(\sigma_\pi - \sigma_w) + \zeta]} = \frac{1}{\alpha}(i+e); \quad \frac{1}{\alpha} > 1 \tag{20}$$

The growth rates of x_D and μ are given by Equations 21 and 22.

$$\hat{x}_D = -\hat{\alpha} + \frac{\iota}{\alpha}\hat{i} + \frac{\chi}{\alpha}\hat{e} = -\hat{\alpha} + \psi_i\hat{i} + \psi_e\hat{e} \tag{21}$$

$$\hat{\alpha} = -\frac{\upsilon}{\alpha}(\sigma_\pi - \sigma_w)\hat{\upsilon} = -\xi(\sigma_\pi - \sigma_w)\hat{\upsilon} \tag{22}$$

We can derive the equation for the demand regime by calculating the growth rates of investment and exports from Equations 18 and 19 and inserting them into Equation 21. If

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[8] Government consumption is assumed away because it should not be affected by changes in the income distribution.

[9] The same symbol is used for output and demand because it is a fixture of both Kaleckian and Keynesian economics that output is determined by demand.

[10] I follow Naastepad (2006) in assuming that $\upsilon_f = 1$ and that $\hat{b} = 0$.

Equation 22 is also inserted into Equation 21 and use is made of Equation 23, we arrive at the final expression for the demand regime (Equation 24).

$$\hat{\pi} = \frac{\Delta\pi}{\pi} = -\frac{\Delta\upsilon}{\pi}\frac{\upsilon}{\upsilon} = -\theta\hat{\upsilon} \tag{23}$$

$$\hat{x}_D = \frac{\psi_e\varepsilon_0\hat{z}}{[1-\psi_i\phi_2]} + C\hat{\upsilon}; \quad C = \frac{\left[\xi(\sigma_\pi - \sigma_w) - \psi_i\phi_1\theta + \psi_e\varepsilon_1\right]}{[1-\psi_i\phi_2]} \tag{24}$$

Equation 24 shows that the demand regime is driven by two forces: the growth of foreign demand ($\hat{z}$) and the growth of real unit labour cost – or growth of the wage share, respectively – ($\hat{\upsilon}$). The term C describes the impact of a change in the wage share on demand. If C is greater than zero the demand regime is said to be 'wage-led'; it is called 'profit-led' if C is smaller than zero. C can be disaggregated into three components: the effect of a change in the wage share on consumption growth $\frac{[\xi(\sigma_\pi - \sigma_w)]}{[1-\psi_i\phi_2]}$, its effect on investment growth $\frac{-[\psi_i\phi_1\theta]}{[1-\psi_i\phi_2]}$ and its effect on export growth $\frac{[\psi_e\varepsilon_1]}{[1-\psi_i\phi_2]}$.

3.   Empirical methodology

The empirical strategy consists of three steps. The first step is to derive estimates for the parameters $\sigma_w, \sigma_\pi, \phi_1, \phi_2, \varepsilon_0$ and ε_1 of the Bhaduri-Marglin model. This serves two purposes. First, it allows for determining whether the demand regime in the OECD is wage-led or profit-led. And second, these parameter estimates are needed in order to calculate the time series for demand growth from equation 24, which in turn serves as input for the calculation of the model prediction for the dynamics of the participation rate from equation 15.

Thus far, the main focus of empirical studies based on the Bhaduri-Marglin model has been on seven countries: Austria, France, Germany, Japan, the Netherlands, the U.K. and the U.S., see Bowles and Boyer (1995), Stockhammer and Onaran (2004), Naastepad (2006), Naastepad and Storm (2006/7),[11] Ederer and Stockhammer (2007), Stockhammer and Ederer (2008), Hein and Vogel (2008, 2009), Onaran *et al.* (2011), Stockhammer *et al.* (2011).[12] From these studies, the broad picture emerges that the "demand regime in large and medium-sized open economies, as in Germany, France, the UK and the USA, tends to be wage-led, whereas for small open economies, as the Netherlands and Austria, some studies have

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[11] This study also examines Italy and Spain.

[12] In addition, there is a paper by Stockhammer *et al.* (2009) which focuses on the Euro area as a whole.

obtained profit-led results" (Hein and Tarassow, 2010, p. 750). This statement is backed by Hartwig (2013a) – the first study for Switzerland – who found that the demand regime in this small open economy is also profit-led.

Thus far, all empirical studies on the Bhaduri-Marglin model have been single-country studies. Hartwig (2013b) was the first to use pooled cross-section and time-series data for OECD countries.[13] For the present paper, I use a smaller sample of countries than in Hartwig (2013b) – only 17 against 31 countries. This is because data on the participation rate μ – the dynamics of which we hope to be able to explain with the demand-augmented Baumol model – back to 1970 are available for these 17 countries only. The countries are *Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, South Korea, Sweden, Switzerland, the U.K. and the U.S.* Details on the data sources are given in the appendix.

The second step in the empirical strategy is to calibrate the expression for the productivity regime (equation 13) on values that are realistic for an 'average' OECD country. Realistic values for *r*, the productivity growth rate in Baumol's 'progressive' sector – i.e. in manufacturing – and for *K*, the relation of real value added of the stagnant and the progressive sectors have to be chosen. The empirical strategy pursued in this paper thus combines the two dominant heuristics to be found in post-war macroeconomics: the estimation approach and the calibration approach.[14]

The final step in the empirical strategy is to calculate from equation 15 the values for the participation rate μ that the demand-augmented Baumol model predicts and to compare them with the actual employment dynamics in an 'average' OECD country. The goodness-of-fit of

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[13] Hartwig (2013b) discusses the advantages of the panel-econometric approach over single-country regressions as well as the issue of poolability. The upshot of this discussion is that in static panel regression such as those we will run to estimate the parameters $\sigma_w, \sigma_\pi, \phi_1, \phi_2, \varepsilon_0$ and ε_1, pooling gives unbiased estimates of coefficient means. These estimates have to be interpreted as (unweighted) average effects across a group of probably heterogeneous countries. In this sense, we will get results for a hypothetical 'average OECD country'.

[14] The estimation approach dominated the post-war Keynesian mainstream, as is evidenced for instance by the then fashionable large-scale macro-econometric models. These came under attack in the wake of the 'Lucas critique'. Subsequently, the 'real business cycle' (RBC) school brought the calibration method to the forefront. Today's mainstream economics often uses a combination of both heuristics, as for instance in estimated DSGE models, see Fair (1992, 2009), Hoover (1995), Gerrard (1996) and Woodford (1999, 2009).

the model will be evaluated in terms of the statistical significance of the correlation between the two time series.[15]

4. Results

4.1. Results for the demand regime

For the estimation of the parameters σ_w and σ_π a transformation is used that goes back to Bowles and Boyer (1995). It draws on the fact that (nominal) savings (s_n) – which are equal to nominal GDP (x_n) minus consumption – are the sum of employees' and profit receivers' savings, as in Equation 25.

$$s_n = (\sigma_w \upsilon + \sigma_\pi \pi)x_n \tag{25}$$

From this follows Equation 26.

$$\sigma = s_n / x_n = \sigma_w + (\sigma_\pi - \sigma_w)\pi \tag{26}$$

So if we regress the savings rate on a constant and the profit rate, the constant will measure employees' propensity to save and the coefficient on π measures the difference between the profit receivers' and the employees' propensity to save. It is expected that $\sigma_w < \sigma_\pi$.

The investment and exports equations (Equations 18 and 19) are transformed into growth rates to yield Equations 27 and 28.[16]

$$\hat{i} = \phi_1 \hat{\pi} + \phi_2 \hat{x} \tag{27}$$

$$\hat{e} = \varepsilon_0 \hat{z} + \varepsilon_1 \hat{\upsilon} \tag{28}$$

Equations 26-28 can be estimated with Pooled Least Squares provided that the right-hand side variables are exogenous. The Durbin-Wu-Hausman test for endogeneity cannot be run with panel data in EViews7. Previous findings for single countries (see Naastepad 2006, Hartwig 2013) indicate, however, that endogeneity is not an issue with equations 26-28. So the Pooled Least Squares estimator will be applied.

The results are presented in Table 2. For Equations 26 and 27 a (Robertson) lag is added on the profit income variable, and an AR(1) process is allowed for in the error term. Cross-section fixed effects are added.

<Insert Table 2>

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[15] This corresponds to the way in which goodness-of-fit is evaluated in the RBC literature, see Woodford (1999, p. 27).

[16] Recall that I follow Naastepad (2006) in assuming that $\upsilon_f = 1$ and that $\hat{b} = 0$.

In the savings equation, the estimated value for the workers' average propensity to save is 0.181, which is at the upper bound of earlier estimations.[17] The cross-section fixed effects (not shown in Table 2) remove the homogeneity restriction for the workers' propensity to save. They suggest that the latter varies strongly across countries. The highest coefficient on a country dummy variable is 0.132 (for South Korea), the lowest –0.094 (for the U.S.). The estimate for the profit receivers' propensity to save is 0.365 (= 0.181+0.184). This is near the lower bound of earlier studies.[18] Still, we can confirm that $\sigma_w < \sigma_\pi$.

In the investment equation, redistribution (measured by the lagged growth rate of the profit share) has no significant impact on real investment growth.[19] This result is familiar from single-country studies. Hein and Vogel (2008), for instance, find a significantly positive impact of a rise in the profit share on real investment growth only for the Netherlands. For Austria and France they find an insignificantly positive, for Germany and the U.S. an insignificantly negative and for the U.K. a significantly negative impact.

The accelerator – the coefficient on real GDP growth – is positive and significant at the 1% level. Curiously, however, it is more than ten times smaller than the accelerators estimated by Naastepad (2006) for the Netherlands and Hartwig (2013a) for Switzerland. These two studies on the other hand found significantly negative intercepts, while the average intercept estimated from OECD panel data is significantly positive. It indicates an 'autonomous' growth in investment – not driven by redistribution or output growth – of around 2% per year. The coefficients on the country dummy variables (not shown in Table 2) vary between 0.020 (for South Korea) and –0.009 (for the U.K.).

The export equation (equation 28) is estimated with Pooled Least Squares without allowing for an AR(1) process in the error term. Again, cross-section fixed effects are added. The growth rate of foreign demand – proxied (as in Naastepad 2006) by the volume of total OECD exports – affects all countries in the same way, so this variable is similar to time period fixed effects. The coefficients on this variable and on the growth rate of real unit labour cost are both statistically significant and similar in magnitude to earlier findings for single countries

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[17] The highest value for the workers' propensity to save found in the single-country estimations of Equation 26 was 0.18 (for France), see Bowles and Boyer (1995).

[18] The lowest value found in a single-country study was 0.34 (for the U.S.), see Naastepad and Storm (2006/7).

[19] 'Real' always means: in millions of national currency at constant prices, OECD base year. Since all real data enter the model in growth rates, a purchasing power parity (PPP) conversion is neither necessary nor desirable (see Ahmad *et al.* 2003).

(see Naastepad 2006, Hartwig 2013a). The coefficients on the country dummy variables (not shown in the table) vary between 0.076 (for South Korea) and –0.016 (for Norway).

With the estimated coefficients it is possible to calculate *C*. Beforehand, it must be decided how to calibrate the 'shares' (export and import share, investment share, wage share) entering the model. Naastepad (2006) evaluates the shares at the sample mean. Stockhammer *et al.* (2009) report results for both the sample mean and the most up-to-date shares available. Hartwig (2013a) found more plausible results for up-to-date shares. The same goes for this paper. Results for sample mean shares will therefore not be reported here.[20] The up-to-date shares will be calculated by averaging over the most recent shares available for any country.

Special attention must be paid to the export and import shares. The OECD area makes up a large portion of the world economy. Cleary, if the OECD countries were seen as a proxy for the global economy, exports and imports should be excluded from the model altogether. For one thing, if every country engages in wage moderation to the same extent, no country improves its competitiveness, and the trade flows remain unaltered. And even if this was not the case, global net exports are zero at all times and remain zero no matter how income distribution is shocked.

However, the OECD countries are not identical to the world economy. According to the OECD's *Main Economic Indicators*, the share of OECD exports in world trade was 78.0% in 1970. It dropped to 62.8% in 2011. So even 40 years ago the OECD area did not represent the world economy, and it is becoming less representative by the minute.

If we contemplate a simultaneous increase in the wage share in all OECD countries, but not in the rest of the world, this would impair the OECD countries' competitiveness vis-à-vis the non-OECD countries. Exports of OECD countries to non-OECD countries would thus be dampened, but not the intra-OECD exports. The OECD's *International Trade by Commodity Statistics* database allows for calculating the shares of exports and imports which occur between OECD member states and between OECD member states and non-member states, respectively. On average over the years 1989-2011, OECD countries imported 26.6% of their imports from outside the OECD and exported 22.2% of their exports to destinations outside the OECD. These shares started rising around the turn of the millennium and stood at 36.2% and 28.9%, respectively, in 2011.

To capture the redistribution effects on trade between the OECD countries and the rest of the world, I will multiply the up-to-date export share by 0.289 – the degree of openness in

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[20] They are available upon request.

2011. The up-to-date share import share will be calibrated accordingly, which means that it will be multiplied by 0.362.

Table 3 reports values for the remaining parameters and the effects of an increase in wage share growth by one percentage point on consumption growth, investment growth, export growth and the total effect. The signs on the partial demand effects are as expected, and the positive impact of redistribution towards labour on consumption growth is stronger than its negative impact on export growth. (The impact on investment growth is zero.) Altogether, demand growth in the OECD is wage-led on average.[21]

<Insert Table 3>

4.2.   Calibrating the productivity regime

Baumol's model of 'unbalanced growth' predicts that the productivity growth rate of the overall economy ($\hat{\rho}_t$) follows the trajectory given by $r/(1+Ke^{rt})$. This is a model prediction. The productivity growth rates we observe in the data ($\hat{\lambda}_t$) of course deviate from the model: they are highly cyclical and not steadily declining. However, we are interested in whether the demand-augmented Baumol model can trace the trajectory of the participation rate over a time horizon of forty years. This does not presuppose that $\hat{\rho}_t$ and $\hat{\lambda}_t$ are equal each year. They should follow similar trends, however.

In order to simulate the trajectory for $\hat{\rho}_t$, we need values for r – the productivity growth rate of the progressive sector (i.e. manufacturing) – and for K, the relation of real value added of the stagnant and the progressive sectors. In the calibration approach it is not feasible to just pick arbitrary parameter values that would result in the best predictions for the variables under inspection. Parameter values should rather be 'realistic', which means that the calibration procedure should draw upon available sources of information about realistic parameter values.

I will draw on the OECD's 'Structural Analysis' (STAN) database for realistic values for r and K. This database contains data on productivity growth in manufacturing for 14 OECD countries. For each of these countries, the average productivity growth rate in manufacturing was calculated over the longest observation period (1970-2011 or shorter). Afterwards, the

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[21] The results do not differ qualitatively from those obtained by Hartwig (2013b) with the larger sample of countries. Also, Hartwig (2013b) splits the observation period in half without getting much different results. In other words, the finding of wage-led demand growth in the OECD is robust to varying the sample of countries and years.

unweighted average of these 14 growth rates was calculated, which yields a value of 4.1%. This value will be chosen for *r*.

Baumol's model has only two sectors, and we have argued above in section 2.1 that the progressive sector can be identified as the manufacturing industries. I will follow Baumol in relegating all other industries to the remaining sector, despite the fact that not all of them produce 'stagnant services'.[22] Data on the level of real value added in manufacturing (MVA) and in the overall economy (TVA) can also be found in the STAN database for 15 OECD countries. These were used to calculate *K* as (TVA-MVA)/MVA.[23] *K* assumes values between 4 and 8 and stays quite constant in most countries. The two outliers are South Korea, where *K* shows a strong decline, and Norway, where *K* increased sharply (see Figure 1).[24] South Korea was still a developing country in 1970. The drop in its *K* reflects industrialisation: activities shifted from the primary to the secondary sector. In Norway, the opposite happened. The country had the lowest *K* in 1970, yet the growing importance of the oil industry (which belongs to the primary sector) raised *K* to a value of 10 by the year 2000. (Since then, *K* has stabilised in Norway.) For the other countries, Baumol's assumption of a stable *K* seems by and large justified. The average value of *K* for the 13 countries excluding Norway and South Korea is 5.0. This value will be used for the calibration. For *t*, an initial value of −20 is chosen for 1970; *t* rises to +20 in 2010.

<Insert Figure 1>

4.3. Results for the dynamics of employment

Figures 2 and 3 show the growth rates and levels of the actual and of the simulated participation rate μ. The actual level of μ (MY_AV) was calculated as the (unweighted) average of the participation rates of the 17 countries under investigation. Figure 2 shows the growth rates of MY_AV (DLMY_AV). The simulated growth rates of μ (DLMY_SIM) were calculated according to equation 15. This means that the estimated parameters from Table 3,

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[22] Some industries belong to the primary sector and some service industries are not 'stagnant' in terms of productivity growth (see Hartwig 2008).

[23] Again, this is a simplification. Since the latest revision of the System of National Accounts, real value added is calculated as a chain index with the shares of sectoral output in previous year's nominal GDP (or in two adjacent years) used as weights. Therefore, the value added in the rest of the economy deviates a bit from the difference between TVA and MVA. For our purpose of finding a somewhat realistic value for *K*, this is negligible.

[24] The countries with relatively few observations (the Czech Republic, Germany, Hungary and Slovenia) are not shown in Figure 1.

the growth rates of the volume of total OECD exports (our measure for $\hat{z}_t$) and the growth rates of the (unweighted) average of the wages shares of the 17 countries were combined to calculate $\hat{x}_D$ according to equation 24. The simulated productivity growth rate $\hat{\rho}_t = r / (1 + Ke^{rt})$ (see section 4.2) and the (unweighted) average of the population growth rates of the 17 countries were then subtracted from $\hat{x}_D$ to yield DLMY_SIM. MY_SIM was calculated by setting it equal to MY_AV in 1970 and then carrying this value forward with DLMY_SIM.

<center><Insert Figures 2 and 3></center>

The correlation between the actual and the simulated growth rates of μ is 0.614, which is relatively high. Therefore, the simulated level of the participation rate shows a similar dynamics as the actual one. The correlation between the actual and the simulated level of μ is 0.939. Both correlation coefficients are statistically significant at the 1 % level.

However, three time slots can be identified where the model does not perform well. The model underestimates the employment dynamics in 1985/86, and it overestimates it during the 1990s and in 2010. In 1985/86, the sharp drop in the oil price caused a stimulus that is not captured by the model. During the 1990s, on the other hand, many countries in the European Union (EU) adopted a restrictive monetary and fiscal policy because, on the one hand, the Maastricht Treaty of 1992 shifted the policy priorities towards price stability and balanced budgets in general and, on the other hand, those EU countries intending to join the European Monetary Union (EMU) had to abide by the entry conditions (see Lombard 2000, Stockhammer 2004). Since ten of our 17 countries are EU countries and seven are EMU countries, this policy restriction is the most likely reason for the shortfall in employment growth vis-à-vis the model prediction over the 1990s. Finally, the unobserved hike in 2010 is the result of the strong increase in OECD exports – by over eleven per cent – during this year. According to the model, this should have led to a positive employment dynamics, which was held back, however, by the European debt crisis and the extreme fiscal austerity that came along with it.

Every model is an abstraction from reality. The demand-augmented Baumol model abstracts from things like the oil price and fiscal variables. Nevertheless, the employment dynamics that it predicts closely resembles the actual employment dynamics.

5.   Conclusion

This paper starts from three premises. First, structural change leads to a continuing decline in aggregate productivity growth (Baumol 1967). Second, aggregate demand growth in any country depends on the dynamics of global trade activities and on income redistribution at home (Bhaduri and Marglin 1990). Third, these two forces determine the dynamics of employment (Notarangelo 1999).

The demand regime is estimated econometrically using set of panel data for 17 OECD countries over the period 1970-2010. It is found to be 'wage-led'. The productivity regime is calibrated on values that are plausible for an 'average' OECD country. The resulting 'demand augmented Baumol model' makes a prediction for the dynamics of the participation rate over the period under investigation. This prediction traces the actual dynamics very well.

It is natural to ask what conclusions for economic policy can be drawn from these findings. Scholars who have found wage-led demand regimes have called for policies to reverse the decline in the wage share that can be observed in virtually all rich countries over our observation period. I have no objections against this call. What strikes me more, however, is the positive trend in the participation rate – both in the actual rate and in the rate predicted by the model (see Figure 3). The 'usual suspect' cause for this trend is the ongoing integration of women into the labour force. But what causes the latter? The demand augmented Baumol model tells us that the positive trend in the participation rate is a consequence of the negative trend in productivity growth, which is itself a consequence of structural change. Therefore, if we can count on structural change to continue, we can also count on a turnaround in the participation rate as soon as demand recovers. This strikes me as a sign of hope in times of mass unemployment in many parts of the world.

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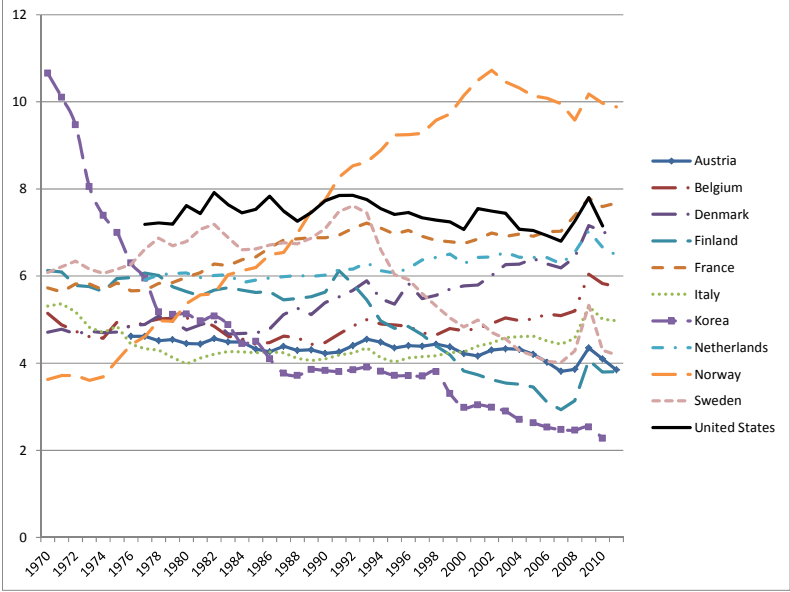
Appendix: Data sources

The source for all (except Swiss) data is the OECD's website (www.oecd-ilibrary.org), more specifically the databases *OECD National Accounts Statistics* (nominal and real data for GDP and the demand-side components), *Main Economic Indicators* (data for international trade, labour input and labour costs), *Employment and Labour Market Statistics* (data for population and unemployment), *International Trade by Commodity Statistics* (data on the trade openness of the OECD area) and *Structural Analysis* (STAN) (data on sectoral productivity and value added).
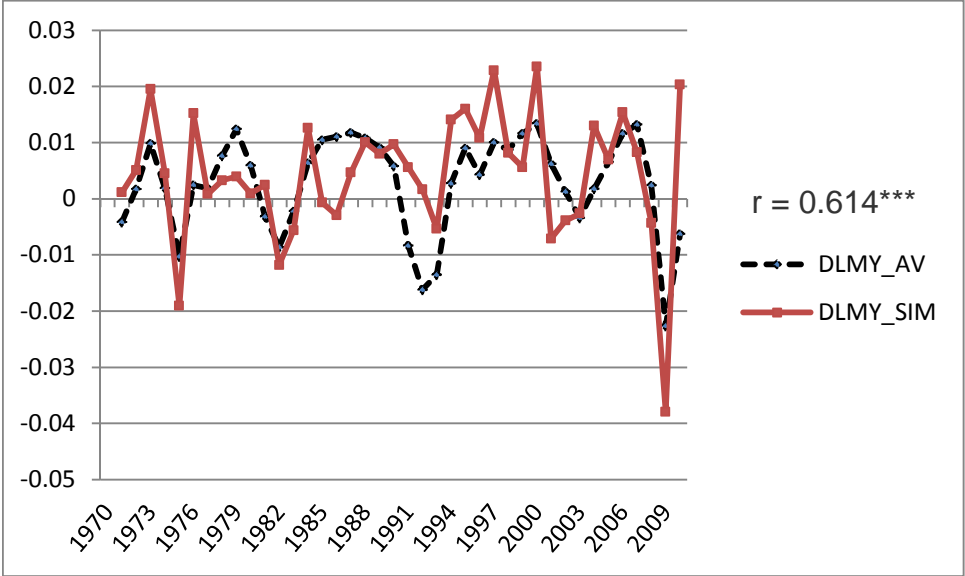
The population series for Germany has a post-reunification break in the OECD database. Data on the German population were downloaded from DESTATIS.

Part of the data for Switzerland has been found to be inconsistent in the OECD databases. (For instance, labour productivity data are not equal to the ratio of real gross value added and employment data, as they should be.) Data for Switzerland have therefore been extracted from the databases of KOF Swiss Economic Institute. These are the same data that were used in Hartwig (2013a). See there for the sources.

Figure 1: Relation of real value added: Rest of the economy/Manufacturing

Legend: Austria, Belgium, Denmark, Finland, France, Italy, Korea, Netherlands, Norway, Sweden, United States

Figure 2: Actual and simulated growth of the participation rate My

Figure 3: Actual and simulated employment dynamics (MY: participation rate)
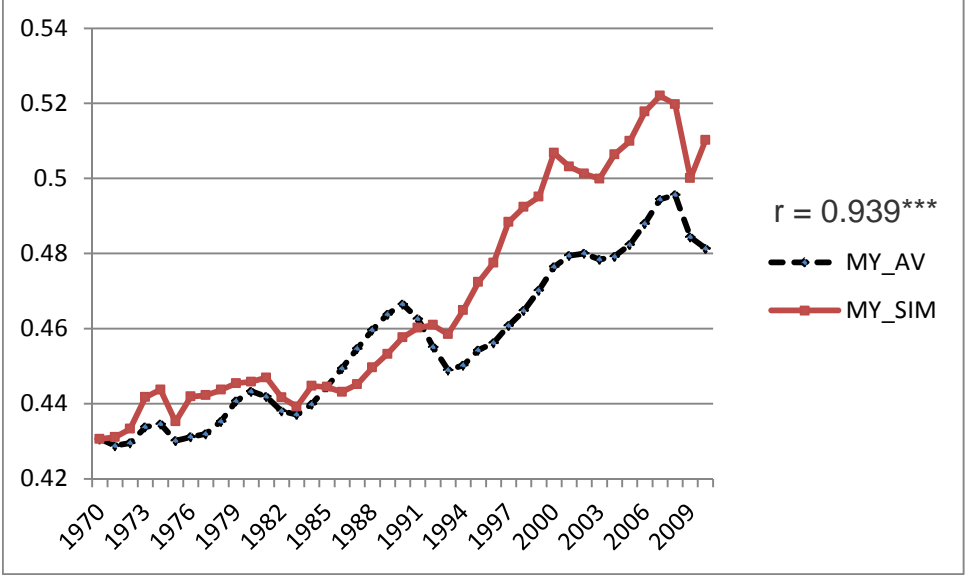
Table 1: Glossary for the Bhaduri-Marglin model

Variables

x: Demand (GDP)	c: Private consumption	i: Gross fixed investment
e: Exports of goods and services	m: Imports of goods and services	w: Real wage
λ: Labour productivity	υ: Wage share in GDP	π: Profit share in GDP
z: Volume of foreign demand	ζ: Import share in GDP	χ: Export share in GDP
ι: Investment share in GDP	α^{-1}: Keynesian multiplier	$\hat{\upsilon}$: Growth rate of real unit labour cost (RULC)
Ψ_i: ι/α	ξ: υ/α	
Ψ_e: χ/α	θ: υ/π	

Parameters

σ_w: Workers' propensity to save	σ_π: Prof receivers' propensity to save	ϕ_1: Profit elasticity of investment
ϕ_2: Accelerator	ε_0: Foreign demand elasticity of exports	ε_1: RULC elasticity of exports
C: Wage share elasticity of demand		

Table 2: Regression results for the demand regime

	(26) σ	(27) $\hat{i}$	(28) $\hat{e}$
Const.		0.021*** (9.198)	0.005*** (2.684)
σ_w	0.181*** (8.424)		
π_{-1}	0.184*** (3.537)		
$\hat{\pi}_{-1}$		-0.007 (-0.700)	
$\hat{x}$		0.128*** (2.894)	
$\hat{z}$			0.849*** (28.442)
$\hat{\upsilon}$			-0.271** (-2.373)
Adj. R^2	0.934	0.314	0.513
SE	0.014	0.021	0.043
D.W.	1.879	1.966	1.620
Obs.	685	671	693
Period	1970-2011	1970-2011	1970-2011

Notes: The estimation method is pooled Least Squares. Cross-section fixed effects (not shown) are added in each equation. Numbers in parentheses below the coefficients are *t*-statistics adjusted for heteroskedasticity (White cross-section standard errors and covariance). Equations 26 and 27 are estimated allowing for an AR(1) process in the error term. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively. SE = standard error. D.W. = Durbin-Watson statistic.

Table 3: Parameter values

Coefficients	σ_w	σ_π	ϕ_1	ϕ_2	ε_0	ε_1	
	0.181	0.365	0.000	0.128	0.849	-0.271	
Other parameters	α^{-1}	ξ	ψ_e	ψ_i	θ		
At up-to-date shares	2.501	1.614	0.335	0.483	1.820		

Effects of an increase in wage share growth by one percentage point on

	Consumption growth $\dfrac{[\xi(\sigma_\pi - \sigma_w)]}{[1-\psi_i\phi_2]}$	Investment growth $\dfrac{-[\psi_i\phi_1\theta]}{[1-\psi_i\phi_2]}$	Export growth $\dfrac{[\psi_e\varepsilon_1]}{[1-\psi_i\phi_2]}$	Total effect C
At up-to-date shares	0.316	0.000	-0.097	0.219