

# Endogeneity of labor productivity and the real wage rate in a Kaleckian model - Why it makes a difference

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## Abstract

In this paper, endogenous labor productivity and endogenous real wages are incorporated into an open economy version of the Bhaduri-Marglin model. Productivity is influenced by the real wage rate and the rate of utilization of the capital stock. Real wages are a function of the rate of capacity utilization to reflect changes in the bargaining position of labor unions. Taking these relations into account, the conditions for wage-led or profit-led regimes do not change, but with a pro-cyclical profit share, the negative effect of real wage restraint on output in a wage-led demand regime is smaller than in the standard framework, i.e. the IS-curve is flatter. The reasons are the redistributive effects of the decrease in productivity and the second round fall in profit share after the initial fall in output. For the profit-led demand regime, the result is ambiguous. The positive impact of real wage restraint on output can either be larger or smaller than in the standard model, depending on whether the negative productivity effect, caused by lower rationalization pressure, or the positive second round effect of a pro-cyclical profit share dominates.

## 1 Introduction

Post-Keynesians generally claim that their models are more realistic than Neoclassical models. Nevertheless, of course also Post-Keynesian models have to work with simplifying assumptions. In general, some people might agree to the statement that omissions are less controversial when they do not influence the result in a crucial way. The problematic issue in this context is the definition of what "in a crucial way" means. As for Kaleckian models, we could argue, on the one hand, that it is appropriate to ignore the endogeneity of certain variables if an endogenous treatment does not substantially change the conditions for wage-led and profit-led regimes. As a justification we could use that we are primarily interested in policy conclusions,

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i.e. whether to turn to a policy that puts more emphasis on redistribution (when the demand regime is thought of being wage-led) or not (when the demand regime is thought to be profit-led). On the other hand, reality is not only black and white: demand regimes will be more wage-led in one country and less so in another country, although both carry the label "wage-led", the same for profit-led regimes. If we are also interested in this issue, not only the sign of the slope of the IS-curve becomes important, but also its magnitude. In this case, everything that improves our understanding of these models and brings in more complexity will be of interest. This paper will illustrate that accounting for the endogeneity of labor productivity and the real wage rate does not change the conditions for wage-led and profit-led demand regimes known from the standard model. Although the illustration of this fact also contributes to the knowledge about Kaleckian models, it will not be the main point of this paper, because what it will also show is that introducing these relationships leads to interesting second round effects within the model. Though these effects do not change the conditions for wage-led and profit-led demand regimes, they are nevertheless interesting from another point of view: First, they draw attention to a second round effect already in the model, which usually gets lost in the stability condition and whose implications for the results are rarely discussed: the effect of excess demand on investment and its effect on the slope of the IS-curve. This is particularly interesting as Post-Keynesians stress a lot the importance of demand, also when it comes to investment. Bhaduri and Marglin (1990) have introduced an investment function which depends on the rate of capacity utilization and the profit share, but usually only the profit share effect draws on attention, but the crucial effect of demand on investment is neglected and only mentioned when referring to the stability condition. Second, this paper will show that the newly introduced second round effects influence the slope of the IS-curve in at least one regime in an unambiguous direction. And finally third, since these second round effects influence the slope of the IS-curve, they may be of interest for empirical work based on these kinds of models.

There already exists some work that considers the endogeneity of labor productivity or real wages, sometimes both, in growth models. However there are less attempts of introducing these changes in models not dealing with growth. Naastepad (2006) works with a model where productivity growth is determined endogenously, while the real wage rate is assumed to grow at a constant rate. Labor productivity growth influences the profit share and unit costs. While Naastepad discusses the distributional consequences of labor productivity growth, Hein and Tarassow (2008), who also include endogenous labor productivity in a growth model, refrain from doing so. They assume income distribution to be determined by institutional factors and relative powers of capital and labor in the long run. Productivity growth only influences output growth through a positive impact on investment. Bhaduri (2006) introduces a model in which labor productivity growth is driven by real wage growth when firms try to reduce wage claims by increasing the rate of unemployment. These wage claims are a function of the rate of unemployment. The growth model incorporates both of the discussed features: productivity and real wages are determined endogenously. Another growth model that includes both features can be found in a paper by Cassetti (2003). Similar to Bhaduri (2006) workers income

claims are a function of employment growth. Interesting aspects can be found in a paper by Raghavendra (2006), though it differs from the models we are dealing with as Raghavendra formulates a dynamic business cycle model. He uses the investment function proposed by Bhaduri and Marglin (1990) and allows labor productivity as well as the real wage rate to be determined by the rate of capacity utilization to make the distribution of income vary over the business cycle.

As already mentioned, all of the models discussed so far deal with growth, except for the last one, and none of them tries to incorporate endogenous labor productivity and endogenous real wages in a standard Kaleckian short run model like the Bhaduri/Marglin (1990) model.

This paper will be organized as follows: The second section will introduce a basic open economy Kaleckian model based on the Bhaduri/Marglin (1990) model with both labor productivity and the real wage rate exogenous. The only difference will be that Bhaduri and Marglin (1990) did not carry out there analysis for the open economy, although they illustrated how a change in the profit share can be achieved in the open economy through a change in the nominal exchange rate. Since empirically the possibility of a profit-led demand regime usually depends crucially on the export channel and policy makers, when arguing in favor of real wage restraint, emphasize a lot the favorable impact on international competitiveness through the cost channel, this paper will, as an additional contribution, make up for this shortcoming in this section. The third section will drop the exogeneity assumptions for labor productivity and the real wage rate and will then compare the outcome to the standard results from section 2. The fourth section concludes.

## 2 Basic model

The open economy Kaleckian model that will be introduced in this section builds largely on the work by Bhaduri and Marglin (1990). Firms are assumed to set a constant mark-up on unit costs. Since purchases and sales of intermediate goods and materials produced within the country cancel each other out, unit costs are given by unit labor costs and costs for imported raw materials and intermediate goods, which makes the price equation

$$p = (1 + m) \left( \frac{w}{\lambda} + Ep_f\mu \right), \quad (1)$$

where  $m$  is the mark-up,  $w$  the nominal wage rate,  $\lambda$  labor productivity,  $E$  the nominal exchange rate defined as units of domestic currency per unit of foreign currency,  $p_f$  the foreign price level and  $\mu$  the number of imported intermediate goods used per unit of output (Bhaduri and Marglin, 1990). The mark-up, the nominal exchange rate, the foreign price level and the number of imported intermediate goods per unit of output will be treated constant throughout the whole paper. Of course these restrictions carry their problems. Nominal exchange rates are changing all the time and the ratio of imported goods needed for production can also change when relative prices change. Also the mark-up may not be as constant in an open economy, as pointed out by Blecker (1999), since firms might not be able to pass through cost

increases into prices when facing international competition. Nevertheless, these assumptions are necessary in order to retain clarity.

For simplicity we assume no economic activity by the state. In goods market equilibrium, aggregate production of goods ( $Y$ ) must equal aggregate demand for goods, consisting of consumption ( $C$ ), investment ( $I$ ) and net exports ( $NX$ ):

$$Y = C + I + NX, \quad (2)$$

which can be rearranged to yield the well known condition that aggregate saving must equal aggregate investment plus net exports:

$$S = I + NX \quad (3)$$

It is assumed that capitalists save a constant fraction ( $s$ ) of their income, while workers consume all their income. This does not imply that individual workers do not save, but only that for workers as a class, the saving of some households is matched by the dissaving of others.<sup>1</sup> Capitalist income is made up of total profits  $\Pi$ , which makes aggregate savings

$$S = s\Pi \quad (4)$$

Furthermore, it is assumed that there is a level of full capacity output ( $Y^*$ ), which is determined by the firms' capital stock ( $K$ ). The capital stock is fixed in the short period, which means that the level of full capacity output is also given for the short period. The level of capacity utilization is defined as  $z = Y/Y^*$ . Firms hold excess capacities because the capital stock is given in the short run and they want to be able to react to unexpected increases in demand (Bhaduri and Marglin, 1990).<sup>2</sup> Applying the concept of capacity utilization, equation (4) can be written in the following way:

$$S = s \frac{\Pi}{Y} \frac{Y}{Y^*} Y^* = shz \quad (5)$$

where the last equation uses the fact that we can normalize all variables as proportions of full-capacity output and set  $Y^* = 1$ . Aggregate saving is a function of the saving propensity out of profits, the profit share ( $h$ ) and the rate of capacity utilization.

It is assumed that the demand for investment depends positively on the rate of capacity utilization and the profit share. In this short run approach, the level of capacity utilization works as a predictor of future demand (Bhaduri and Marglin, 1990). When firms see their plants working at very high rates of utilization and they expect this state to persist, they will be more inclined to invest in additional capital (additional capacities) than in a state where plants are working at already low rates of utilization. The second determinant of investment is the profit share. This works

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<sup>1</sup>It would be easy to also account for a workers' saving rate, which would not change the notion of the results as long as this saving propensity is smaller than the saving propensity of capitalists. However, this assumption simplifies the algebra.

<sup>2</sup>For empirical evidence see Lalonde (1999). Actual utilizations rates in the US seem to move around the level of 80 percent.

in two ways: On the one hand, a higher current profit share may translate into a higher expected profit share, i.e. higher expected future profits. In this case, firms will invest into additional capital because return expectations are high (Bhaduri and Marglin, 1990). On the other hand, in a world of imperfect capital markets, a higher profit share leaves more room for internal finance when bank loans are costly and makes access to credit easier. This is summed up in the following investment function:

$$I = I(h, z) \quad \frac{\partial I}{\partial h} > 0 \quad \frac{\partial I}{\partial z} > 0 \quad (6)$$

Bhaduri and Marglin (1990) did not analyze an exogenous change in  $\omega$  for the open economy, although they illustrated how a change in the profit share can be achieved in the open economy through a change in the nominal exchange rate. Omitting foreign trade is, however, a major simplification. Bhaduri and Marglin (1990) themselves say that the reaction of investment might be small compared to consumption in the short run due to different speed of adjustments of the variables. According to them, including openness to trade makes the possibility of a profit-led demand regime much more credible. This is also confirmed by the empirical work on these models. Another point is that policy makers, when arguing in favor of real wage restraint, usually emphasize the favorable impact on international competitiveness through the cost channel. Leaving out their point would make our analysis less credible. Therefore, the present paper will make up for this shortcoming.

A fall in real wages will decrease domestic prices relative to foreign prices, which increases international price competitiveness and the demand for exports. In other words, real wage restraint leads, keeping the nominal exchange rate, foreign prices and the domestic mark-up constant, to an increase in the real exchange rate, i.e. a real depreciation. The real exchange rate is defined as

$$e = \frac{Ep_f}{p} \quad (7)$$

A higher rate of utilization of the capital stock means higher income. Higher income leads to an increase in demand for consumption goods, where some part falls on foreign goods. The consequence is an increase in demand for imported consumption goods and a decrease in net exports. Taking these things together, net exports can be described as an increasing function of the real exchange rate and a decreasing function of the rate of capacity utilization:<sup>3</sup>

$$NX = NX(e, z) \quad \frac{\partial NX}{\partial e} > 0 \quad \frac{\partial NX}{\partial z} < 0 \quad (8)$$

The profit share is defined as the share of profit income in total income:

$$h = \frac{\Pi}{\Pi + wL} \quad (9)$$

where  $L$  is total employment. This can be shown to be equal to

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<sup>3</sup>Bhaduri and Marglin (1990) assume the same forces driving net exports. See also Blecker (1999), Blecker (2002) and Hein and Vogel (2008).

$$h = \frac{m \left( \frac{\omega}{\lambda} + e\mu \right)}{\frac{\omega}{\lambda} + m \left( \frac{\omega}{\lambda} + e\mu \right)}, \quad (10)$$

where  $\omega$  is the real wage rate. In the numerator we have real profit income per unit of output, made up by the mark-up times real unit cost. In the denominator we have real total income (per unit of output), made up by real unit labor income ( $\omega/\lambda$ ) and real per unit profit income.

We want to know whether capacity utilization is profit-led or wage-led, i.e. how aggregate demand reacts to a fall in  $\omega$ . Deriving  $dz/d\omega$  now involves one extra step compared to Bhaduri and Marglin (1990), since we have incorporated the open economy. We need the change in the price level resulting from a decrease in real wages, but only nominal wages enter the price equation in (1) and real wages are themselves a function of prices. In order to solve this problem, we take the total derivative of the definition  $\omega = w/p$  and substitute the resulting  $d\omega$  into the total derivative of the price equation. Some rearrangement yields the change in the price level as a function of the change in real wages:

$$dp = \frac{(1+m)\frac{1}{\lambda}p}{1 - (1+m)\frac{\omega}{\lambda}} d\omega \quad (11)$$

Now we can calculate  $dz/d\omega$  by taking the total derivative of (3) and substituting for  $dh$ ,  $de$  and  $dp$ . This yields after some manipulation the final result:

$$\frac{dz}{d\omega} = \frac{\left( sz - \frac{\partial I}{\partial h} \right) \psi - \frac{1}{\lambda\mu} \frac{\partial NX}{\partial e}}{sh - \frac{\partial NX}{\partial z} - \frac{\partial I}{\partial z}} \quad (12)$$

where 
$$\psi = \frac{\frac{m}{\lambda} \left( \frac{\omega}{\lambda} + e\mu \right)}{\left[ \frac{\omega}{\lambda} + m \left( \frac{\omega}{\lambda} + e\mu \right) \right]^2}$$

For the stability of the system, saving and net exports must be more responsive to a change in capacity utilization than investment. This is a standard restriction in these kinds of models. Intuitively speaking, if this assumption did not hold, an exogenous one time increase in demand would lead to an infinite increase in output: This would be the case because the initial increase in demand leads to an increase in income. This income generates further demand and further income. If saving and the demand for imports does not respond sufficiently, this process continues forever. Only when the response of saving and net exports is larger than the response of investment, is a sufficient part of income taken out of the multiplier process each period to guarantee that subsequent increases in demand get smaller and smaller until they reach zero.<sup>4</sup> This implies that

$$sh - \partial NX/\partial z - \partial I/\partial z > 0, \quad (13)$$

which makes the denominator strictly positive. With the denominator positive, the sign of  $dz/d\omega$  depends on the numerator. The latter has basically two components: a domestic and a foreign one. A decrease in real wages leads to an increase

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<sup>4</sup>The condition seems to hold empirically, see for example Stockhammer et al. (2009).

in the rate of capacity utilization if the sign of  $dz/d\omega$  is negative. If real wages decrease, this leads to an increase in the profit share. Since the propensity to consume out of profit income is lower, this leads, on the one hand, to a fall in consumption ( $sz$ ). On the other hand, a higher profit share increases investment ( $\partial I/\partial h$ ). Whether domestic demand increases depends on which effect dominates. This result corresponds to the result obtained by Bhaduri and Marglin (1990). The domestic effect is multiplied by  $\psi$ , which gives it a weight and is equal to  $-dh/d\omega$ , but this parameter won't be of importance for our analysis. Additionally there is now the effect on net exports: A fall in domestic real wages decreases prices and increases net exports ( $\partial NX/\partial e$ ) in this model. This term is multiplied by  $1/(\lambda\mu)$ , which is only the weight of this effect and is equal to  $-de/d\omega$ , but won't be of importance either. This leaves us with the standard result for a Kaleckian model using the Bhaduri/Marglin investment function: domestic output will increase as a result of real wage restraint (demand is profit-led) if the numerator in equation (12) is negative (otherwise it will be wage-led). In other words, for demand to be profit-led, additional demand for investment and exports must compensate for the decrease in consumption demand after a fall in the real wage rate.

This is how far recent analysis usually got: identifying the conditions for the different regimes. An aspect which is always left out of the analysis is the effect of excess demand on investment.<sup>5</sup> This is surprising as Post-Keynesians usually put great emphasis on demand and as it is an important feature of Post-Keynesianism to think of investment driven by the need of firms to acquire additional capital when demand exceeds their existing production capacities. Nevertheless, this second part of the investment function is usually neglected in the analysis and discussed only in conjunction with the stability condition. The demand effect on investment cannot switch the sign of the IS-curve (which is the sign of the demand curve in the  $\omega/z$ -space), but influence the magnitude of the slope. For any demand regime, there is a difference whether the effect of demand on investment is larger or smaller. For example in a profit-led demand regime, a reduction in real wages will produce a positive demand stimulus. If  $\partial I/\partial z$  is small, the effect on equilibrium capacity utilization will be low, since excess demand does not further promote the stimulus. If, however,  $\partial I/\partial z$  is large, the result will be a much larger expansion and a much larger increase in capacity utilization. And this is what can be seen in (12): as  $\partial I/\partial z$  gets larger, the denominator will get closer and closer to zero (but not negative, because we have to assume a positive denominator for stability). Therefore, the denominator decides whether the expansion will be a small or a large one. The same is of course true for the case of a wage-led demand regime: In this case, a real wage reduction will cause a decrease in demand. If investment is highly sensitive to the utilization rate of the capital stock, this will lead to a large decrease in investment, causing a recession. If  $\partial I/\partial z$  is rather small, investment is only mildly affected and output decreases only slightly. Again it shows in (12) that as  $\partial I/\partial z$  increases and the denominator gets closer to zero, the slope of the IS-curve increases, which means

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<sup>5</sup>When referring to recent analysis, this excepts Bhaduri and Marglin (1990), since they took the second round effect of excess demand on investment into account when they discussed their well known condition for cooperative capitalism. Only their successors seem to have forgotten about the second part of the investment function.

a larger decrease in capacity utilization after a real wage reduction. Despite its importance, the second round demand effect (and the denominator in general) is rarely addressed without referring to the stability condition. The denominator will move further into the center of attention in the next section.

### 3 Extensions of the model

The last section introduced a basic Kaleckian model. This model will be used as the bench mark case when it comes to comparing the results of the model which will be introduced in this section, accounting for the endogeneity of labor productivity and the real wage rate. Let us first turn to the productivity function. Taylor (1991) includes unit labor cost in the productivity function. Lavoie (1992) and Naastepad (2006) take the real wage rate instead and Casetti (2003) and Hein and Tarassow (2008) use the profit share. All approaches have in common that they assume that more expensive labor spurs the search for productivity gains, since firms want to stay competitive and prevent their profit share from falling.<sup>6</sup> The present paper will use the approach taken by Naastepad (2006).<sup>7</sup>

Furthermore, Lavoie (1992), Raghavendra (2006) and Hein and Tarassow (2008) have argued that labor productivity is a function of the rate of capacity utilization. Hein and Tarassow (2008), looking at it from a growth perspective, argue with Verdoorn's law, while Lavoie (1992) and Raghavendra (2006) argue with the concept of overhead labor. According to Verdoorn's law, a higher rate of output growth increases productivity growth because a growing market allows for more specialization. Since it is a long term relationship, it is not appropriate for our short term model. The concept of overhead labor argues that since in the short run the capital stock and some fraction of the staff are fixed, a falling rate of utilization of the capital stock decreases the level of productivity. In this paper we will make use of the latter argument. Hence the productivity function that will be used takes the following general form:

$$\lambda = \lambda(z, \omega) \quad \frac{\partial \lambda}{\partial z} > 0 \quad \frac{\partial \lambda}{\partial \omega} > 0 \quad (14)$$

The real wage rate is the outcome of a complex process. On the one hand, it depends on the relative powers of workers and firms in wage negotiations (dependent on the supply and demand conditions on the labor market), on the other hand it depends on firms' price setting policy. Casetti (2003) incorporated this process into his model by assuming that both workers and firms have a target profit share. Whenever the actual profit share exceeds the workers target profit share, i.e. workers think that the profit share is too high, nominal wages increase. Whenever this share is below the firms' target, firms increase prices. The workers' target profit share is a decreasing function of employment. The result is the real wage rate as a function

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<sup>6</sup>Actually, Lavoie (1992) discusses various possible reasons why real wages could influence labor productivity, where the latter is only one of them. According to Lavoie, another possible reason could be that more expensive labor pushes less efficient firms out of the market, thereby increasing aggregate productivity.

<sup>7</sup>In the empirical part of her paper, Naastepad (2006) finds this effect to be mainly responsible for the Dutch productivity growth decline after 1984.

of employment. In Bhaduri (2006), prices are a function of the rate of technological progress and nominal wages are a decreasing function of unemployment. The real wage rate depends again on the conditions on the labor market. Raghavendra (2006) uses a simpler approach by assuming real wages to be a function of the rate of capacity utilization. This is also the approach that this paper will follow: As production increases, demand for labor increases and as a consequence workers will find themselves in a better bargaining position, resulting in higher real wages. The following functional form is assumed:

$$\omega = \alpha + \beta z \quad (15)$$

Of course this function is a simplification. When labor unions care about productivity gains and want them to be partially passed on, also labor productivity would have to enter in the upper equation. However, the degree to which labor unions can claim a share in realized productivity gains depends again on the relative powers of both parties, i.e. the rate of capacity utilization. Therefore, in order to make the model not too complicated, productivity will not enter the above equation.

Equation (15) completes the model. If we now want to model an exogenous change in the real wage rate, this can be done through a change in  $\alpha$ . In order to derive  $dz/d\alpha$ , we need the total derivative of the equilibrium equation in (3) again and substitute for  $dh$ ,  $de$ ,  $dp$ ,  $d\lambda$  and  $d\omega$ .  $dp$  is now a function of  $d\omega$  and  $d\lambda$ .  $d\omega$  is again obtained through the total derivative of the definition  $\omega = w/p$ .  $d\lambda$  is gained from (14). Substituting for these variables in the total derivative of the price equation in (1) and rearranging yields the change in prices as a function of the change in real wages and the rate of capacity utilization:

$$dp = \frac{p}{\lambda} \left[ \left( p - \frac{w}{\lambda} \frac{\partial \lambda}{\partial \omega} \right) d\omega - \frac{w}{\lambda} \frac{\partial \lambda}{\partial z} dz \right] \quad (16)$$

Substituting  $dh$ ,  $de$ ,  $d\lambda$ ,  $d\omega$  (which is given by  $d\omega = d\alpha + \beta dz$ ) and  $dp$  into the total derivative of (3) yields after some manipulation the final result:

$$\frac{dz}{d\alpha} = \frac{\left[ \left( sz - \frac{\partial I}{\partial h} \right) \psi - \frac{1}{\lambda \mu} \frac{\partial NX}{\partial e} \right] (1 - \varepsilon_{\lambda, \omega})}{sh - \frac{\partial NX}{\partial z} - \frac{\partial I}{\partial z} + \left[ \left( sz - \frac{\partial I}{\partial h} \right) \psi - \frac{1}{\lambda \mu} \frac{\partial NX}{\partial e} \right] \left[ \frac{\omega}{\lambda} \frac{\partial \lambda}{\partial z} - \beta (1 - \varepsilon_{\lambda, \omega}) \right]}, \quad (17)$$

where  $\varepsilon_{\lambda, \omega} = \frac{\omega}{\lambda} \frac{\partial \lambda}{\partial \omega}$ .

Closer examination of the denominator reveals that it is equal to

$$dS/dz - dNX/dz - dI/dz > 0 \quad (18)$$

If it were not positive, the system would be unstable (as already explained in the basic model). Looking at the corresponding differential equations confirms that the denominator in (17) is equal to (18):

$$\frac{dS}{dz} = sh + sz\psi \left[ \frac{\omega}{\lambda} \frac{\partial \lambda}{\partial z} - \beta (1 - \varepsilon_{\lambda, \omega}) \right] \quad (19)$$

$$\frac{dNX}{dz} = \frac{\partial NX}{\partial z} + \frac{1}{\lambda\mu} \frac{\partial NX}{\partial e} \left[ \frac{\omega}{\lambda} \frac{\partial \lambda}{\partial z} - \beta(1 - \varepsilon_{\lambda,\omega}) \right] \quad (20)$$

$$\frac{dI}{dz} = \frac{\partial I}{\partial z} + \frac{\partial I}{\partial h} \psi \left[ \frac{\omega}{\lambda} \frac{\partial \lambda}{\partial z} - \beta(1 - \varepsilon_{\lambda,\omega}) \right] \quad (21)$$

It can be seen that each of these equations consists of two terms, with the first term being familiar from the denominator in the basic model and an additional second term, which is due to the effect of  $z$  on productivity and wage bargaining. The term in square brackets is equal in each of the three equations and reflects the impact of  $z$  on the profit share and the real exchange rate.<sup>8</sup> The first term that it contains reflects the positive impact of a rise in  $z$  on labor productivity ( $\partial\lambda/\partial z$ ). The second term reflects the rise in wages due to the better bargaining positions of workers ( $\beta$ ). Since higher wages have a positive impact on productivity, there is also a moderating effect shown by the elasticity term ( $1 - \varepsilon_{\lambda,\omega}$ ). This means that for the profit share to be pro-cyclical in this model, the positive productivity-effect must outweigh the negative wage-effect.

Summarizing, in the current model (as well as in the basic model), a change in  $z$  directly increases saving (due to higher total income), decreases net exports (due to higher demand for imports) and increases investment (due to higher demand). These effects always appear in the first term of the respective equations. Additionally, in the extended model a change in  $z$  leads to a change in the profit share and the real exchange rate, which affects savings, net exports and investment. These effects appear in the second terms in (19)-(21).

Returning to equation (17), we know that the denominator has to be positive. Therefore, as in the basic model, it is the numerator that decides over the sign of the result. The numerator is now multiplied by one minus the elasticity of productivity with respect to the real wage rate. It seems plausible that this elasticity should not exceed unity in reality, which would make the new term in brackets positive. Therefore, what we obtain, is the multiplication of the numerator from the basic model by a positive number which is smaller than one. This means that the basic conclusion from the primary model still holds: Real wage restraint will boost output (the demand regime is profit-led) if the term in square brackets in the numerator ( $((sz - \partial I/\partial h)\psi - 1/(\lambda\mu)\partial NX/\partial e)$ ), which is equal to the numerator from the basic model, is negative, otherwise it will be wage-led. The introduction of equations (14) and (15) therefore did not change the condition for profit- and wage-led demand regimes.

We have identified the condition that determines profit-led and wage-led regimes in this model and know now that this condition does not change in our new model. The next question of interest is, whether treating productivity and real wages endogenously changes the size of positive or negative effects, or in other words, whether this has any systematic effects on the slope of the IS-curve ( $dz/d\alpha$ ), which is indeed

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<sup>8</sup>The respective derivatives are

$$\frac{dh}{dz} = \psi \left[ \frac{\omega}{\lambda} \frac{\partial \lambda}{\partial z} - \beta(1 - \varepsilon_{\lambda,\omega}) \right]$$

and

$$\frac{de}{dz} = \frac{1}{\lambda\mu} \left[ \frac{\omega}{\lambda} \frac{\partial \lambda}{\partial z} - \beta(1 - \varepsilon_{\lambda,\omega}) \right]$$

the case. First, it is interesting to see whether negative/positive effects of real wage restraint are larger or smaller in this model compared to the basic model. Doing this, let us first discuss the wage-led demand regime. In this case, the square bracket in the denominator is positive. Since it is multiplied by a positive number smaller than one, the numerator is now smaller than in the basic model. Turning to the denominator, the first three terms are equal to the denominator in the basic model. Under the wage-led regime, the content of the first square brackets is positive. If the profit share is pro-cyclical, the content of the second square brackets is positive as well. With both brackets positive, the denominator is now larger than in the basic model. Since the numerator has become smaller and the denominator larger,  $dz/d\alpha$  has unambiguously decreased compared to  $dz/d\omega$  in the basic model. The reason for this is quite straight forward: In the extended model, a fall in real wages has an additional direct negative impact on productivity (see the numerator) since it reduces firms' incentives to rationalize. This reduces the increase in the profit share and moderates the fall in demand. Nevertheless demand falls, which reduces  $z$ , leading to a fall in the (pro-cyclical) profit share. The fall in the profit share has a positive impact on aggregate demand (see the denominator). Both of these discussed effects decrease the negative impact of real wage restraint, making  $dz/d\alpha$  smaller than  $dz/d\omega$  from the basic model, i.e. the slope of the IS-curve decreases (Figure 1).<sup>9</sup>

In the profit-led scenario, we cannot tell whether the effect of real wage restraint is now larger or smaller than in the initial model if the profit share is assumed pro-cyclical. The numerator in (17) is, like in the wage-led demand regime, smaller than in the basic model. The difference to the wage-led case is that the first square bracket in the denominator is now negative, decreasing the denominator. With both the numerator and the denominator smaller than before, the overall change in slope depends on which of these effects is larger. The reason for that is again straightforward: The fall in real wages leads to a direct fall in productivity (because it reduces firms' efforts to raise productivity), which reduces the initial rise in the profit share (see the numerator). Since a higher profit share has, nevertheless, a positive impact on demand in this regime,  $z$  increases, but by less compared to the initial model. The increase in  $z$  further increases the (pro-cyclical) profit share, having a positive impact on aggregate demand in the profit-led demand regime (see the denominator). This means that the positive impact of real wage restraint can either be smaller or larger compared to the initial model, depending on whether the negative productivity effect (because lower wages reduce firms' efforts to increase productivity, which has a negative influence on the profit share) or the positive effect of the pro-cyclical profit share dominates (Figure 1).<sup>10</sup> The positive impact of real

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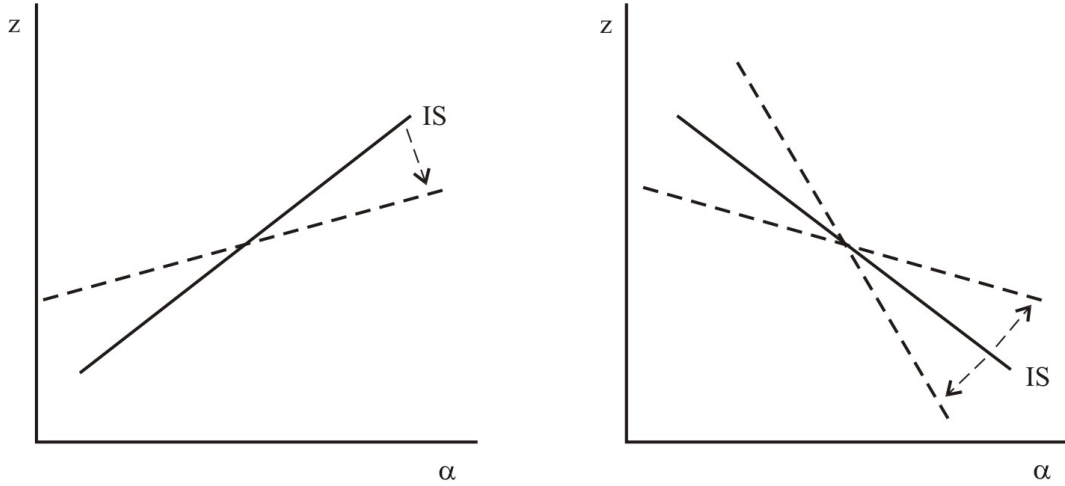
<sup>9</sup>If the profit-share was counter-cyclical, the numerator would have decreased whereas the denominator would have also decreased compared to the model with exogenous productivity, making it ambiguous whether  $dz/d\alpha$  increased compared to  $dz/d\omega$  in the basic model. The reason is that the initial smaller fall in demand (compared to the basic model) would lead to a rise in the profit share (because wage aspirations go down a lot), leading to an additional decrease in demand. Then it would depend on whether the additional positive or the additional negative effect dominates.

<sup>10</sup>If the profit share was not pro-cyclical, the positive effect of real wage restraint on  $z$  would unambiguously be smaller than in the basic model (the IS-curve would get flatter), because both additional effects would be negative: first the direct fall in productivity (through reduced rational-

wage restraint on  $z$  will be larger in the extended model (the IS-curve will be more downward sloping) if

$$-\frac{\left(sz - \frac{\partial I}{\partial h}\right)\psi - \frac{1}{\lambda\mu} \frac{\partial NX}{\partial e}}{sh - \frac{\partial NX}{\partial z} - \frac{\partial I}{\partial z}} \left[ \frac{\omega}{\lambda} \frac{\partial \lambda}{\partial z} - \beta(1 - \varepsilon_{\lambda,\omega}) \right] > \varepsilon_{\lambda,\omega} \quad (22)$$

which becomes more likely as the profit share gets more pro-cyclical (the term in square brackets increases).



**Figure 1:** The modifications' total impact on the slope of the IS-curve: In the wage-led regime (left), the slope of the IS-curve decreases compared to the standard model. The change is ambiguous in the profit-led regime (right).

Next we want to see how the result depends on the responsiveness of productivity to changes in the real wage rate. As  $\varepsilon_{\lambda,\omega}$  increases, the slope of the IS-curve gets flatter in the wage-led demand regime (Figure 2).<sup>11</sup> This means that in a wage-led demand regime where productivity is more responsive to changes in the real wage rate, the extent to which it is wage-led is smaller. The reason is that real wage restraint, by decreasing productivity in the first place (by reducing firms' incentives to rationalize), reduces the rise in the profit share and the fall in demand. As real wages decrease further after the initial fall in demand (through  $\beta$ ),  $\varepsilon_{\lambda,\omega}$  leads to again to a fall in productivity and further moderation in the rise of the profit share. Both effects decrease the negative impact on output by reducing the profit share. This leaves us with a flatter IS-curve.

The effect in a profit-led demand regime is ambiguous (Figure 2). On the one hand, a larger  $\varepsilon_{\lambda,\omega}$  leads to a smaller increase in the profit share after the decrease in

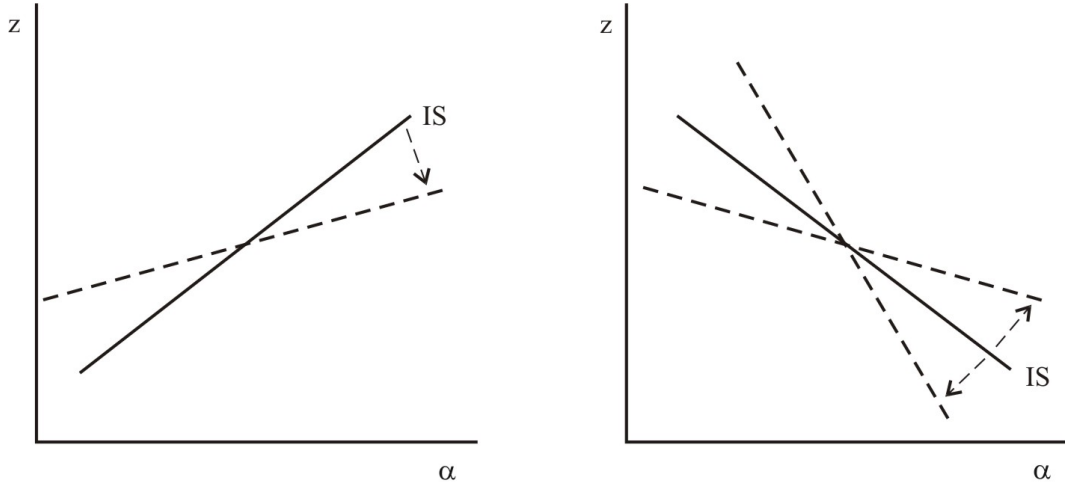
ization efforts) and then the fall in the profit share after the initial rise in demand (via a large rise in workers' wage aspirations).

<sup>11</sup>The corresponding derivative is given by

$$\frac{\partial\left(\frac{dz}{d\alpha}\right)}{\partial\varepsilon_{\lambda,\omega}} = - \left[ \left( sz - \frac{\partial I}{\partial h} \right) \psi - \frac{1}{\lambda\mu} \frac{\partial NX}{\partial e} \right] \frac{\left[ sh - \frac{\partial I}{\partial z} - \frac{\partial NX}{\partial z} \right] + \left[ \left( sz - \frac{\partial I}{\partial h} \right) \psi - \frac{1}{\lambda\mu} \frac{\partial NX}{\partial e} \right] \frac{\omega}{\lambda} \frac{\partial \lambda}{\partial z}}{\left[ dS/dz - dNX/dz - dI/dz \right]^2}$$

Its sign is ambiguous in the profit-led demand regime and negative in the wage-led demand regime.

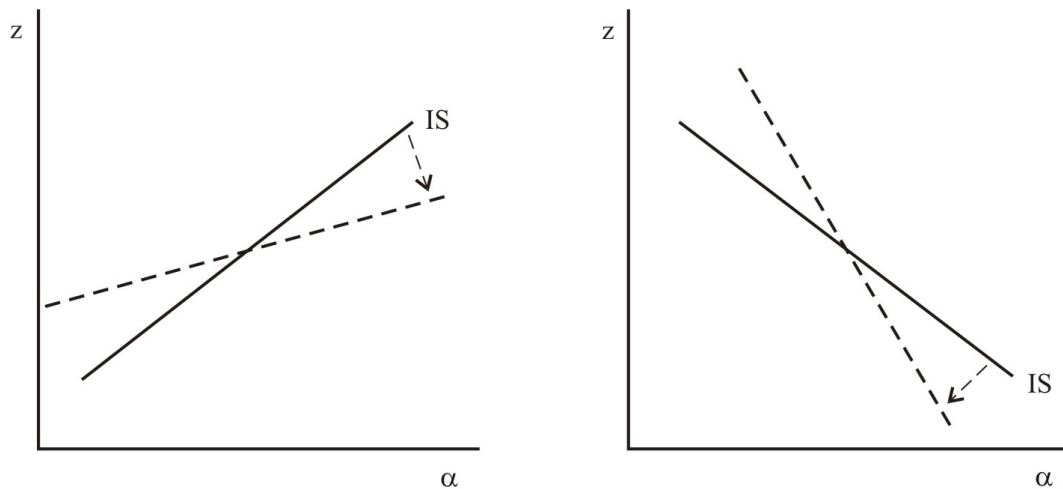
real wages (by reducing firms' incentives to rationalize), reducing the positive impact on output. On the other hand, as output increases after the real wage decline and real wages begin to increase again (through  $\beta$ ) because the bargaining position of workers improves, a higher  $\varepsilon_{\lambda,\omega}$  partly compensates for this negative effect on  $h$  as it increases productivity. The sum of these effects on the slope of the IS-curve can be positive or negative.



**Figure 2:** *The effect of a rise in  $\varepsilon_{\lambda,\omega}$  on the slope of the IS-curve: When  $\varepsilon_{\lambda,\omega}$  increases, this decreases the slope of the IS-curve in the wage-led regime (left) and has an ambiguous effect in the profit-led regime (right).*

The extent to which the profit share is pro-cyclical (the last square bracket in the denominator) is also important for the result. Such differences across countries could be due to different wage bargaining structures and labor union strengths (affecting the response of real wages to a change in capacity utilization), different degrees of desired rates of capacity utilization across countries (if firms tend to hold smaller excess capacities, a rise in demand will lead to lower realized productivity gains) or different employment protection laws (stronger protection against dismissal may lead to a larger reaction of productivity to changes in output because firms cannot adjust the number of employees so easily). In a profit-led demand regime, the regime becomes more profit-led ( $dz/d\alpha$  gets more negative) as the profit-share becomes more pro-cyclical. The reason is that initial gains in output due to real wage restraint lead to a further rise in the profit share and a further increase in demand. In a wage-led demand regime, the degree to which it is wage-led decreases as the profit share becomes more pro-cyclical ( $dz/d\alpha$  decreases). Here the initial fall in output due to real wage restraint leads to a fall in the profit share in the second round, which has a positive impact on aggregate demand. The result is a smaller fall in output after real wages have gone down (Figure 3).

It has so far been illustrated that the second round effects of a change in output can be quite important for the overall result. Since recently there has been substantial empirical work on Kaleckian models, we also have to discuss the implications



**Figure 3:** *The effect on the slope of the IS-curve as the profit share becomes more pro-cyclical: A very pro-cyclical profit share decreases the slope of the IS-curve in the wage-led regime (left) and increases it in a profit-led regime (right).*

of our results for this field of research.<sup>12</sup> Of the recently estimated models, the one that comes closest to what we have been calling the basic model in this paper can be found in Stockhammer et al. (2009). In their paper they refer to the numerator, which is pretty similar to the numerator in equation (12), as private excess demand. From their estimates they calculate the effect of a change in the profit share on private excess demand (i.e. the numerator), but when it comes to calculating the total effect of this reallocation (i.e. also considering the denominator, which is similar to the denominator in (12)), they are very cautious about their results, saying that these calculations have to be interpreted with care since exogeneity assumptions become much more restrictive in this context. This relativization is correct, since in contrast to the effect on private excess demand, the total effect is an equilibrium effect and occurs within a longer time period. The longer the time period, the stronger the exogeneity assumptions, i.e. the stronger the assumption that certain variables do not change. Among those variables assumed exogenous in Stockhammer et al. (2009) is the distribution of income. In this sense, the present paper may be relevant for future empirical work as it provides a theoretical foundation which could be used to estimate total effects more precisely. Furthermore, it also shows the direction in which results for total effects could be biased, if the relationships represented by equations (14) and (15) do exist, when holding on to these assumptions.

## 4 Conclusions

This paper started by introducing a basic Kaleckian model building on the work by Bhaduri and Marglin (1990) and adapting it to the open economy. This gave the

<sup>12</sup>For recent empirical work see Stockhammer and Onaran (2004), Onaran and Stockhammer (2005), Naastepad (2006), Naastepad and Storm (2006), Hein and Tarassow (2008), Hein and Vogel (2008) and Stockhammer et al. (2009).

standard result known from the literature that real wage restraint can only boost output when investment and net exports are more responsive to changes in the profit share than saving.

Labor productivity was then allowed to be influenced by the rate of utilization of the capital stock and the real wage rate. Additionally, real wages were made a function of the rate of capacity utilization to reflect changes in the bargaining position of labor unions. It was shown that, when taking these relations into account, the conditions for wage-led or profit-led demand regimes do not change, but with a pro-cyclical profit share, the negative effect of real wage restraint on output in a wage-led economy is smaller than in the basic framework, i.e. the IS-curve is flatter. The reasons for this are the redistributive effects of the decrease in productivity due to lower innovation efforts by firms and the second round fall in the profit share after the initial fall in output. For the profit-led demand regime, the result is ambiguous. The positive impact of real wage restraint on output can either be larger or smaller than in the basic model, depending on whether the negative productivity effect (due to lower rationalization pressure) or the positive second round effect of the pro-cyclical profit share dominates.

A higher responsiveness of labor productivity to changes in the real wage rate reduces the strength of a wage-led demand regime and has an ambiguous effect on the profit-led regime. Furthermore, it was illustrated that as the profit share gets more pro-cyclical, the strength of a profit-led regime increases while that of a wage-led regime decreases. Differences in the reaction of the profit-share to changes in output across countries could be due to different wage bargaining structures and labor union strengths, different degrees of desired rates of capacity utilization or different employment protection laws.

Furthermore, the implications for future empirical work on these kinds of models have been discussed. Including the discussed relationships may enable empirical research to receive more precise results about the total effects of real wage restraint on demand. This means being more specific about the magnitude of the slope of the IS-curve and not just its sign.

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