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Does the Steindl-Dutt Investment Function Rule Out Profit-Led Expansion?

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Abstract

Bhaduri and Marglin (1990) had argued that an investment function which has the profit rate and the capacity utilization rates as the two determinants of investment imposes unwarranted restrictions on the macroeconomic model and rules out profit-led expansion. In this paper, I show that this critique only holds in a closed economy model. In an open economy model, such an investment function does not rule out profit-led expansion. I argue that the problem was less in the investment function itself than in the larger model within which it was embedded, in particular the saving behavior of the macroeconomy entailed by the model.

Keywords: structuralist model; investment function; profit-led expansion.
JEL Codes: E12; B51.

1 Introduction

One of the key features that distinguishes structuralist from neoclassical approaches to macroeconomics is the role that the former accords to independent investment functions. The structuralist position derives from the understanding that saving and investment decisions are not coterminous. In fact, different economic agents make those decisions, and there is only a partial overlap in those decision making processes. Hence, an independent investment function should be an essential component of any macroeconomic model of the capitalist economy.[1]

A popular version of an investment function that was used in the heterodox macroeconomic literature until the 1980s was what Basu and Das (2016) have called the Steindl-Dutt investment function, where investment is specified to be a function of the profit rate and the

*Department of Economics, University of Massachusetts Amherst. I would like to thank Debarshi Das for ongoing discussion on this issue and on heterodox macroeconomics more generally. The usual disclaimers apply.

[1] For a discussion of the evolution of the independent function in the heterodox macroeconomics literature, see Basu and Das (2016, section 2).

capacity utilization rate (Rowthorn, 1981; Taylor, 1983; Dutt, 1984). In their seminal paper, Bhaduri and Marglin (1990) offered a critique of this investment function arguing that such a specification imposes unwarranted restrictions on the responsiveness of investment to the two components of profit rate - the capacity utilization rate and the profit share. The problem is that such a restriction rules out a profit-led expansion, i.e. where a shift in income away from wages leads to a rise in capacity utilization and the growth rate of the capital stock.

> Observe that this influence of existing capacity on investment cannot be captured satisfactorily by simply introducing a term for capacity utilization ... along with the rate of profit ... as the arguments in the investment function ... The problem with this procedure is that it imposes unwarranted restrictions on the relative response of investment to the two constituents of the profit rate ... with the result that the possibility of profit-led expansion is ruled out ... (Bhaduri and Marglin, 1990, pp. 380).

Since there is no reason to rule out a profit-led regime *a priori*, it led to the suggestion that the Steindl-Dutt investment function should be avoided. The force of this critique seems to have been one of the reasons for the shift by heterodox macroeconomists to the alternative investment function that Bhaduri and Marglin (1990) proposed. Such an investment, which Basu and Das (2016) called the Bhaduri-Marglin investment function, uses the profit share (instead of the profit rate) and the capacity utilization rate as determinants of investment. This specification is now the workhorse of heterodox macroeconomics (Taylor, 2006; Blecker, 2010).

In this paper, I revisit the Bhaduri-Marglin critique of the Steindl-Dutt investment function. I illustrate the argument in a simple one sector structuralist closed economy model. I show that the critique does not hold when the model is opened up to trade.[2] Hence, the problem of the Steindl-Dutt investment function was less in the restrictions it imposed on the responsiveness of investment to the two components of the profit rate than in the larger model within which it was embedded. In particular, what is crucial is the saving behaviour associated with the macroeconomic model. As long as savings is responsive to some exogenous parameter that also impacts income distribution, a macroeconomic model with the Steindl-Dutt investment function does not rule out profit-led expansion. A standard one sector open economy structuralist model offers this possibility. Hence, even though the Steindl-Dutt investment function should be avoided in closed economy models, it can be used in structuralist models of the open economy.

Before I present the analysis of this paper, it is important to clarify what I understand by the term 'profit-led growth'. Much, but not all, of the contemporary heterodox macroeconomics literature has used it loosely to mean a situation where the local responsiveness of the growth rate of the capital stock to the profit share (as a measure of income distribution between classes) is positive. In most heterodox models, the profit share and the growth rate are both endogenous variables. Hence, equilibrium values of both are determined jointly by

[2]The models build on the discussion in Taylor (1983, ch. 2).

the values of exogenous variables in the model. Thus, the local responsiveness of the growth rate to the profit share is not very informative or useful as has been rightly argued by Skott (2017).

In this paper, I avoid this problem. When I use the term 'profit-led growth' (or expansion) I mean by that a situation where a change in some *exogenous* parameter leads to an increase in the profit share *and* the growth rate. In particular, I will use changes in the mark-up rate, which is an exogenous parameter in the model, to investigate changes in the profit share and the growth rate. This means that, in the particular case that I will study, the ultimate cause of changes in both the profit share and the growth rate are changes in the mark-up rate. But it is also true that while changes in the equilibrium profit share (itself caused by changes in the mark-up rate) is one of the mechanisms through which the equilibrium growth rate changes, there is no reciprocal channel through which changes in the equilibrium growth rate (itself caused by changes in some exogenous parameters) can impact the equilibrium profit share. It is this asymmetry which might allow us to talk meaningfully of a profit-led expansion, even when both variables are endogenous.

The rest of the paper is organized as follows. In section 2, I demonstrate the Bhaduri-Marglin critique of the Steindl-Dutt investment function in a simple one sector structuralist closed economy model. In section 3, I show that the critique no longer holds in an open economy model and highlight the key role of saving behavior in driving the result. I conclude the paper in section 4, and in an appendix, I present the Bhaduri-Marglin argument in the specific terms used in Bhaduri and Marglin (1990) for comparison and reference.

2 Closed Economy Model

Consider an open capitalist economy without the government sector. Production of commodities is carried out with labour, and accumulated stocks of commodities known as "capital". Let b units of labour be required to produce 1 unit of the output. Since this is a one sector model, the underlying assumption is that the economy produces one "good' which can be consumed, saved or invested.

2.1 Mark-up Pricing

The economy is characterised by the existence of excess productive capacity. Hence, the marginal cost of production is constant. Let the nominal wage rate be w, so that the marginal cost is given by wb. We assume that firms have monopoly power, and so their profit-maximising behavior leads them to set prices as a mark-up over the fixed marginal cost. Hence,

$$P = (1 + \tau) wb \tag{1}$$

where P is the price of the industrial commodity, and $\tau > 0$ is the fixed mark-up rate. The mark-up rate derives from and captures the degree of monopoly in the economy.

2.2 Profitability and Capacity Utilization

Let K denote fixed capital in physical terms and X denote output in physical terms. Then, the profit rate, r, is given by

$$r = \frac{PX - wbX}{PK}. \tag{2}$$

A little algebraic manipulation of (1) shows that the expression for the profit rate can be written as

$$r = \left(\frac{\tau}{1+\tau}\right)\frac{X}{K}.$$

As long as there is excess capacity, the ratio X/K can be used as a measure of the rate of capacity utilization, u, i.e.,

$$u = \frac{X}{K} \tag{3}$$

so that we get

$$r = \frac{\tau}{1+\tau}u. \tag{4}$$

2.3 Income Distribution

The distribution of income between the classes is captured by the share of profits in national income, h. The mark-up rate, which captures the monopoly power of capitalist firms, directly determines the share of profits as follows

$$h = \frac{\tau}{1+\tau} \tag{5}$$

so that $dh/d\tau > 0$. Thus, a rise in the mark-up rate leads to a distribution of income towards profits.

2.4 Savings

The part of income that is not consumed is saved. Since there are two types of income streams in the domestic economy, profits and wages, there can be domestic savings out of either or both. But we work with the classical savings assumption that all wage income in consumed. Hence, domestic savings comes out of profit income and is given by

$$s_r rPK,$$

where s_r is the average savings rate out of profit income, rPK.

Since we are considering a closed economy, domestic savings is also total savings, which is given by

$$S = s_r rPK$$

Dividing through by PK gives us the savings function normalized by the capital stock (as a function of the rate of profit) as

$$\frac{S}{PK} \equiv s = s_r r \tag{6}$$

2.5 Investment

Let $g = PI/PK$, the ratio of investment normalized by the capital stock, denote the growth rate of the capital stock. We will use a Steindl-Dutt specification of the investment function, where the growth rate of the capital stock is a function of the rate of profit, r, and the capacity utilization rate, u,

$$PI/PK \equiv g = I(r, u). \tag{7}$$

The responsiveness of investment to changes in the profit rate, I_r (the partial derivative of the investment function with respect to the profit rate), and to changes in the capacity utilization rate, I_u (the partial derivative of the investment function with respect to the capacity utilization rate), are parameters of the model, and we assume, that

$$I_r > 0, I_u > 0. \tag{8}$$

A linear specification of the Steindl-Dutt investment function would be the following:

$$PI/PK \equiv g = z_0 + z_1 r + z_2 u = z_0 + \left(z_1 + z_2 + \frac{z_2}{\tau}\right) r, \tag{9}$$

where $z_0, z_1, z_2 > 0$.

2.6 Real Wage Rate

The real wage rate, ω is given by

$$\omega = \frac{w}{P} = \frac{w}{(1+\tau)\, wb}$$

which, simplifies to the following:

$$\omega = \frac{1}{b\,(1+\tau)}. \tag{10}$$

2.7 Macroeconomic Balance

Macroeconomic balance requires the equality of demand and supply, which can be re-stated as the requirement for the equality of saving and investment. Hence, the condition for macroeconomic balance is

$$s = g \tag{11}$$

To summarize, the one sector structuralist model laid out above has 6 endogenous variables: savings (normalized by the capital stock), s, investment (normalized by the capital stock), g, the rate of profit, r, the capacity utilization rate, u, the profit share, h, and the real wage rate, ω. The 6 relationships among the 6 endogenous variables, captured by (4), (5), (6), (7), (10), and (11), are impacted by the following parameters: τ, s_r, I_r, I_u, b. The 6 equations can be solved to arrive at equilibrium values of the endogenous variables in terms of the parameters.

2.8 Wage-Led Bias

To see that this model has a wage-led bias, and that it rules out profit-led expansion, all we need to do is to work out the comparative statics of an *exogenous parameter* that can affect the income distribution. Such a parameter, in this model, is the mark-up rate, τ, which captures the degree of monopoly power of firms. By (5), an increase in the mark-up rate will lead to an increase in the profit share, i.e. a redistribution of income away from wage incomes. Hence, a comparative static exercise of an increase in the mark-up rate would be one of the ways in which we can investigate the possibilities of wage-led and profit-led expansions in this model.[3]

To carry out the comparative statics of an increase in the mark-up rate, we do not need to solve for the equilibrium values of all the endogenous variables. We only need to compute the derivative of the equilibrium values of the capacity utilization rate and the growth rate with respect to the mark-up rate, τ. Suppose r^* and u^* denotes the profit rate and the capacity utilization rate in equilibrium. Then, using (11), we see that the following should be satisfied

$$s_r r^* = I(r^*, u^*)$$

so that,

$$s_r \frac{dr^*}{d\tau} = I_r \frac{dr^*}{d\tau} + I_u \frac{du^*}{d\tau}.$$

Using (4), we see that

$$\frac{du^*}{d\tau} = \left(1 + \frac{1}{\tau}\right) \frac{dr^*}{d\tau} - \frac{r^*}{\tau^2}$$

so that,

$$s_r \frac{dr^*}{d\tau} = I_r \frac{dr^*}{d\tau} + I_u \left\{ \left(1 + \frac{1}{\tau}\right) \frac{dr^*}{d\tau} - \frac{r^*}{\tau^2} \right\}.$$

Upon rearrangement, we get

$$\frac{dr^*}{d\tau} = -\frac{I_u r^*}{\Delta \tau^2} < 0 \tag{12}$$

where

$$\Delta = s_r - \left(I_r + I_u + \frac{I_u}{\tau}\right) > 0$$

by the Keynesian stability condition.[4] Since

$$\frac{du^*}{d\tau} = \left(1 + \frac{1}{\tau}\right) \frac{dr^*}{d\tau} - \frac{r^*}{\tau^2}$$

[3] What policies could be adopted to increase the mark-up rate? A combination of policies that includes subsidizing profits and redistributing income away from wage earners (through reduction of direct income transfers) would result in a rise in the mark-up rate.

[4] The derivative in (12) gives us the local slope of profit rate defined as an implicit function of the parameters, including τ, by (11), and is computed by the use of the implicit function theorem (IFT). We are justified in using the IFT because $\Delta > 0$. Whenever I refer to 'slope' it will always mean the local slope in the neighbourhood of the equilibrium.

we see, using (12), that the partial effect of a change in the mark-up rate on the equilibrium capacity utilization rate is given by

$$\frac{du^*}{d\tau} = -\left(1 + \frac{1}{\tau}\right)\frac{I_u r^*}{\Delta\tau^2} - \frac{r^*}{\tau^2} < 0. \tag{13}$$

If g^* denotes the growth rate of the capital stock in equilibrium, we have

$$\frac{dg^*}{d\tau} = I_r\frac{dr^*}{d\tau} + I_u\frac{du^*}{d\tau}$$

so that, using (12) and (13), we see that

$$\frac{dg^*}{d\tau} = I_r\frac{dr^*}{d\tau} + I_u\frac{du^*}{d\tau} < 0 \tag{14}$$

because $I_r, I_u > 0$. Let us summarise the above discussion as

Claim 1. *In a one sector structuralist closed economy model with a Steindl-Dutt investment function, captured by (4), (5), (6), (7), (10), and (11), the possibility of profit-led expansion is ruled out by construction.*

Proof. This follows from an inspection of (12) and (14). □

What is the intuition for Claim 1? I illustrate the argument using a linear specification of the investment function in Figure 1. The savings function in (6) and a linear specification of the investment function in (9) is depicted in Figure 1, where the horizontal axis measures the rate of profit and the vertical axis measures saving and investment (both normalised by the capital stock). The intersection of the two curves determine the equilibrium level of the profit rate and the corresponding levels of savings and investment.[5]

Starting from a situation of macroeconomic balance, with the equilibrium profit rate, r_1, when there is an increase in the mark-up rate, τ, it leads to fall in the slope of the investment function, because the slope of the investment function is $(z_1 + z_2 + z_2/\tau)$. Hence, the investment function rotates in a clockwise direction: the investment function moves from AB to AB'. This means that the amount of investment demand is lower at the original equilibrium profit rate. But, and this is key, the savings function in (6) remains unchanged. Hence, the only way to restore macroeconomic balance is for the economy to move to an equilibrium with a lower profit rate, r_2, and a correspondingly lower level of investment. That is why the economy moves to a lower growth rate in the new equilibrium: the original equilibrium had the growth rate OF, and the new equilibrium growth rate is given by OG.

From the above analysis, it emerges that the possibility of profit-led expansion is being ruled out not because of the Steindl-Dutt investment function in (9) but because of the savings function in (6). For the new equilibrium to have a higher growth rate, the model would need to allow a change in the saving schedule, either a rotation or a vertical shift or

[5] I assume that $z_0 > 0$, which ensures existence of the equilibrium, and that $s_r > z_1 + z_2 + z_2/\tau$, which ensures local stability of the equilibrium.

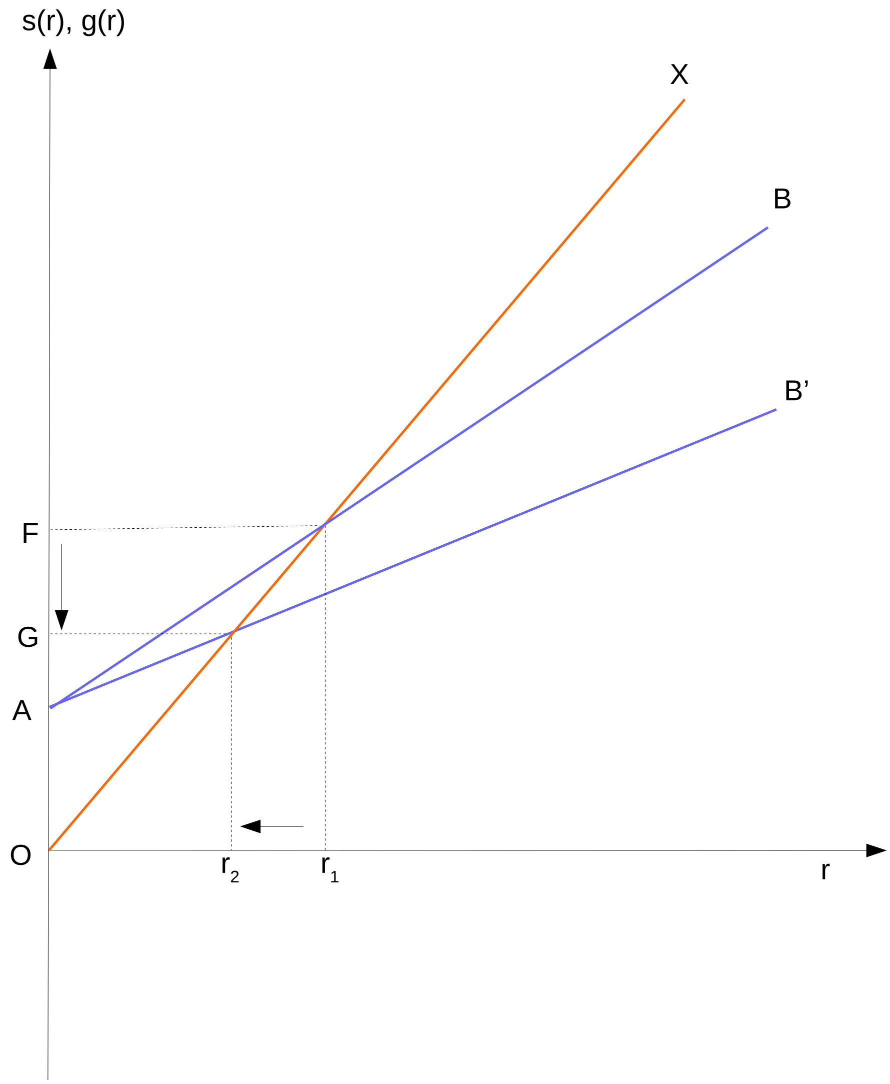

Figure 1: Comparative statics of an increase in the mark-up rate in a one sector closed economy structuralist model with a linear specification of the Steindl-Dutt investment function. The savings function is given by: $s(r) = s_r r$; the investment function is given by $g(r) = z_0 + (z_1 + z_2 + z_2/\tau)\, r$. The equilibrium profit rate falls from r_1 to r_2 and the corresponding equilibrium growth rate falls from OF to OG.

both. But the saving function in (6) rules out both types of change. To underline this point, I will now show that the result about the impossibility of profit-led growth no longer holds when we work with an open economy model. This is because in the open economy, total saving is the sum of domestic and foreign saving, and the latter allows both the slope and the intercept of the saving schedule to be responsive to changes in the mark-up rate. This restores the possibility of profit-led expansion.

3 Open Economy Model

Let us now open up the economy to foreign trade with all other features of the model remaining unchanged. Production of commodities is carried out with labour, *imported* intermediate inputs and accumulated stocks of commodities known as "capital". Let b units of labour and a_0 units of intermediate inputs be required, respectively, to produce 1 unit of the output.

3.1 Mark-up Pricing

Let the nominal exchange rate (domestic currency per unit of foreign currency) be e, and the foreign currency price of the imported intermediate input be P^*. Then, the marginal cost is given by $wb + eP^*a_0$. Hence,

$$P = (1+\tau)\left(wb + eP^*a_0\right) \tag{15}$$

where P is the price of the industrial commodity, and $\tau > 0$ is the fixed mark-up rate.

3.2 Profitability and Capacity Utilization

Let K denote fixed capital in physical terms and X denote output in physical terms. Then, the profit rate, r, is given by

$$r = \frac{PX - wbX - eP^*a_0X}{PK}. \tag{16}$$

A little algebraic manipulation of (16) shows that the expression for the profit rate can be written, just as in the closed economy model, as

$$r = \frac{\tau}{1+\tau}u. \tag{17}$$

It is also worth noting that the expression for the share of profit in national income, h, remains unchanged as a function of the mark-up rate

$$h = \frac{\tau}{1+\tau} \tag{18}$$

so that $dh/d\tau > 0$ remains true. Thus, a rise in the mark-up rate, in the open economy model, would also lead to a distribution of income towards profits. Hence, we would be justified in carrying out the same comparative static exercise - of an increase in the mark-up rate, as in the closed economy case.

3.3 Savings

Domestic savings comes out of profit income and is given by

$$s_r rPK,$$

where s_r is the average savings rate out of profit income, rPK.

The new and key element is foreign savings, which is equal to the trade deficit, i.e. the difference between imports and exports. In this model, there are two types of imports: intermediate inputs and final goods and services. On the other hand, there is only one type of exports: final goods and services. Hence, the trade deficit is given by the difference of intermediate imports and net exports (of final goods and services)

$$eP^*a_0X - PE$$

where E denotes net exports of *final goods* in real terms. Hence total savings, which is the sum of domestic and foreign savings, is given by

$$S = eP^*a_0X - PE + s_r rPK$$

Dividing through by PK gives us the savings function normalized by the capital stock (as a function of the rate of profit) as

$$\frac{S}{PK} \equiv s = -\epsilon + \left(\frac{\phi}{\tau} + s_r\right) r \tag{19}$$

where

$$\phi = \frac{eP^*a_0}{wb + eP^*a_0}$$

is the share of intermediate imported inputs in the marginal cost of production, so that $0 \leq \phi \leq 1$, and

$$\epsilon = \frac{E}{K}$$

is net exports of final goods and services as a ratio of the capital stock.

In (19), domestic saving is given by the term $s_r r$, and foreign saving is captured by the term $-\epsilon + (\phi r)/\tau$. It is worth pointing out the crucial role of foreign savings in this analysis. It will be recalled that the main problem in the closed economy model was that it did not allow the slope or the intercept of the saving schedule to be responsive to changes in the mark-up rate. With the foreign saving term in (19), the model restores that possibility. Now, both the slope and the intercept is impacted by changes in the mark-up rate. Hence, this creates the possibility of profit-led growth, a point that will emerge in the discussion below.

3.4 Investment

The specification of the investment function remains unchanged:

$$g = I(r, u), I_r > 0, I_u > 0. \tag{20}$$

3.5 Real Wage Rate

The real wage rate, ω is given by

$$\omega = \frac{w}{P} = \frac{w}{(1+\tau)\left(wb + eP^{*}a_0\right)} = \frac{1}{b(1+\tau)}\left(\frac{wb}{wb + eP^{*}a_0}\right)$$

which, using the expression for the share of imported intermediate inputs in the marginal cost of production, ϕ, becomes

$$\omega = \frac{1-\phi}{b\,(1+\tau)} \tag{21}$$

3.6 Macroeconomic Balance

The macroeconomic balance requires the equality of savings and investment:

$$s = g. \tag{22}$$

To summarize, the one sector structuralist open economy model has 6 endogenous variables: savings (normalized by the capital stock), s, investment (normalized by the capital stock), g, the rate of profit, r, the capacity utilization rate, u, the profit share, h and the real wage rate, ω. The 6 relationships among the 6 endogenous variables, captured by (17), (18), (19), (20), (22), and (21), is impacted by the following parameters: $\epsilon, \phi, \tau, s_r, I_r, I_u, b, a_0$. The 6 equations can be solved to arrive at equilibrium values of the endogenous variables in terms of the parameters.

3.7 Possibility of Profit-Led Expansion

Just as before, we do not need to solve for the equilibrium values of all the endogenous variables. All we need to do is to compute derivatives of the equilibrium values of the capacity utilization rate and the growth rate with respect to the mark-up rate, τ. Suppose, as before, r^{*} and u^{*} denotes the profit rate and the capacity utilization rate in equilibrium. Let

$$\lambda = -\left(\frac{\tau^{2}d\epsilon}{r^{*}d\tau}\right) > 0 \tag{23}$$

capture the effect of a change in the mark-up rate on the net exports of goods and services (normalised by the capital stock) at the equilibrium of the economy, where the ratio τ^{2}/r^{*} is multiplied for easing up the algebraic manipulation. Since the increase in the mark-up rate increases the domestic price level and thereby reduces the net exports of goods and services - because exports fall and imports rise - and the equilibrium profit rate will be positive (for a viable capitalist economy), we will have $\lambda > 0$ as long as the Marshall-Lerner condition holds.[6]

[6] To see this, let $\eta = (eP^{*})/P = (eP^{*})/\left[(1+\tau)\left(wb + eP^{*}a_0\right)\right]$ denote the real exchange rate. Hence, $d\eta/d\tau < 0$. Then, $d\epsilon/d\tau = (d\epsilon/d\eta) * (d\eta/d\tau)$. Since the Marshall-Lerner condition implies that $d\epsilon/d\eta > 0$, we see that $d\epsilon/d\tau < 0$.

Using (22), we see that in equilibrium, the following should be satisfied

$$-\epsilon + \left(\frac{\phi}{\tau} + s_r\right) r^* = I(r^*, u^*).$$

Differentiating both sides of the above with respect to τ, we get

$$\left(\frac{\phi}{\tau} + s_r\right) \frac{dr^*}{d\tau} - \left(\frac{r^*\phi}{\tau^2} + \frac{d\epsilon}{d\tau}\right) = I_r \frac{dr^*}{d\tau} + I_u \frac{du^*}{d\tau}.$$

The relationship between the capacity utilization rate given by (17) implies, just as in the closed economy model, that

$$\frac{du^*}{d\tau} = \left(1 + \frac{1}{\tau}\right) \frac{dr^*}{d\tau} - \frac{r^*}{\tau^2}$$

so that,

$$\left(\frac{\phi}{\tau} + s_r\right) \frac{dr^*}{d\tau} - \left(\frac{r^*\phi}{\tau^2} + \frac{d\epsilon}{d\tau}\right) = I_r \frac{dr^*}{d\tau} + I_u \left\{\left(1 + \frac{1}{\tau}\right) \frac{dr^*}{d\tau} - \frac{r^*}{\tau^2}\right\}.$$

Upon rearrangement, we get

$$\frac{dr^*}{d\tau} = \frac{r^*}{\Gamma\tau^2} (\phi - I_u - \lambda) \tag{24}$$

where, I have used (23), and

$$\Gamma = \left(\frac{\phi}{\tau} + s_r\right) - \left(I_r + I_u + \frac{I_u}{\tau}\right).$$

Since

$$\frac{du^*}{d\tau} = \left(1 + \frac{1}{\tau}\right) \frac{dr^*}{d\tau} - \frac{r^*}{\tau^2}$$

using (24) and a little algebraic manipulation, we get the impact of a change in the mark-up rate on the equilibrium capacity utilization rate:

$$\frac{du^*}{d\tau} = \frac{r^*}{\Gamma\tau^2} \left\{\phi + I_r - s_r - \lambda\left(1 + \frac{1}{\tau}\right)\right\}. \tag{25}$$

If g^* denotes the growth rate of the capital stock in equilibrium, we have

$$\frac{dg^*}{d\tau} = I_r \frac{dr^*}{d\tau} + I_u \frac{du^*}{d\tau}. \tag{26}$$

This gives us the main result of the paper.

Claim 2. *In a one sector structuralist open economy model with a Steindl-Dutt investment function, represented by (17), (18), (19), (20), (22), and (21), if the Keynesian stability condition holds, i.e.*

$$\Gamma = \left(\frac{\phi}{\tau} + s_r\right) - \left(I_r + I_u + \frac{I_u}{\tau}\right) > 0 \tag{27}$$

and if

$$I_r + I_u - \frac{\lambda}{\tau} > s_r \tag{28}$$

then an increase in the mark-up rate, which leads to an increase in the profit share, causes a rise in the capacity utilization rate and a rise in the growth rate of the capital stock. Hence, demand and growth are both profit-led.

Proof. Note that the Keynesian stability condition in (27) implies that

$$\phi > \tau I_r + \tau I_u + I_u - \tau s_r.$$

Hence,

$$\phi - I_u - \lambda > \{\tau I_r + \tau I_u + I_u - \tau s_r\} - I_u - \lambda = \tau \left\{ I_u + I_r - s_r - \frac{\lambda}{\tau} \right\} > 0$$

where the last inequality comes from the condition in (28). Using (24), this shows that

$$\frac{dr^*}{d\tau} > 0.$$

Moreover,

$$\begin{aligned} \phi + I_r - s_r - \lambda \left(1 + \frac{1}{\tau}\right) &> \{\tau I_r + \tau I_u + I_u - \tau s_r\} + I_r - s_r - \lambda \left(1 + \frac{1}{\tau}\right) \\ &= (1+\tau) \left\{ I_u + I_r - s_r - \frac{\lambda}{\tau} \right\} > 0. \end{aligned}$$

where the last inequality comes from the condition in (28). Using (25), this shows that

$$\frac{du^*}{d\tau} > 0.$$

Hence, demand is profit-led.

Using the expression for the derivative of the equilibrium growth rate in (26), this immediately shows that

$$\frac{dg^*}{d\tau} = I_r \frac{dr^*}{d\tau} + I_u \frac{du^*}{d\tau} > 0$$

because $I_r, I_u > 0$. Hence, growth is profit-led. □

To understand the intuition for this result, I follow the analysis of the closed economy model by illustrating the argument in the open economy model using a linear specification of the Steindl-Dutt investment function in Figure 2. The initial situation of equilibrium is represented by the intersection of the saving schedule EX and the investment schedule AB. The equilibrium profit rate is r_1. Starting from a situation of equilibrium, when the investment schedule rotates clockwise due to a rise in the mark-up rate, the economy need not restore macroeconomic balance at a lower level of investment.[7] Instead, macroeconomic balance *can* be restored at a higher level of the profit rate where the level of investment and saving is higher than in the original equilibrium. This is because the saving schedule shifts up and also rotates in a clockwise direction when τ rises. This can happen because the intercept of the saving schedule, $-\epsilon$, and the slope of the saving schedule, $(\phi/\tau + s_r)$, are now responsive to changes in the mark-up rate.[8]

In the situation depicted in Figure 2, the new investment curve is AB' and the new saving curve is $E'B'$, so that the equilibrium profit rate increases from r_1 to r_2. At the higher level of profit rate, investment is higher, and the economy is able to generate the additional saving to restore macroeconomic balance at the higher level of investment because of the responsiveness of foreign savings to changes in the domestic mark-up - which is represented by the vertical shift *and* the clockwise rotation of the saving schedule. This is precisely the mechanism that restores the possibility of a profit-led expansion in the open economy structuralist model. Hence, the corresponding levels of the equilibrium growth rate increase from OF to OG.

How do we understand the specific conditions given in (27) and (28)? The restrictions in (27) refers to the Keynesian stability condition. It specifies that the responsiveness of savings to changes in the profit rate be higher than the responsiveness of investment to the profit rate. In terms of Figure 2, if this condition holds, it ensures that the investment schedule intersects the savings schedule from above.

On the other hand the restriction in (28) forces the responsiveness of investment to changes in the capacity utilization rate, I_u, to be lower than the share of imported intermediate inputs in the marginal cost, ϕ, after accounting for the change on net exports of final goods and services (captured by λ). This is because $\phi - I_u - \lambda > \{\tau I_r + \tau I_u + I_u - \tau s_r\} - I_u - \lambda = \tau \{I_u + I_r - s_r - \lambda/\tau\} > 0$, where the last inequality follows from (28). Since $\lambda > 0$, this implies that $\phi > I_u$. Hence, this relates to the relative magnitudes of the *responsiveness of the slopes* of the saving and investment schedules to changes in the mark-up rate. Note that the slope of the investment schedule is given by $(I_r + I_u + I_u/\tau)$ so that the responsiveness of this slope to the mark-up rate is $-(I_u/\tau^2)$. Similarly, the slope of the savings schedule is given by $(\phi/\tau + s_r)$, so that its responsiveness to changes in the mark-up rate is $-(\phi/\tau^2)$. Hence, the condition in (28) imposes the restriction that the responsiveness of the slope of the savings schedule to changes in the mark-up rate is larger than the corresponding responsiveness of the slope of the investment function to changes in the mark-up rate. In addition, the term λ/τ in (28) is the way the model takes account of the fact that changes in the mark-up rate lead to a vertical shift of the saving schedule, in addition to its clockwise rotation. Taken together, the condition in (28) imposes the restriction that the joint effect of the vertical shift and clockwise rotation of the saving schedule should be less than the effect of the clockwise rotation of the investment schedule on the growth rate. This is also

[7] The slope of the investment function is the same as before: $z_1 + z_2 + z_2/\tau$. Hence, a rise in τ leads to a fall in the slope.

[8] Recall that $\lambda = -\left(\frac{\tau^2 d\epsilon}{r^* d\tau}\right) > 0$ captures the effect of changes in the mark-up rate on the net exports of final goods and services at the equilibrium.

what we see intuitively from Figure 2: if the investment schedule rotated out too far in the clockwise direction, due a rise in the mark-up rate, the profit-led expansion would not be possible. One such possibility is depicted in Figure 2 through the investment schedule AB''.

4 Conclusion

In this paper, I have revisited the critique of the Steindl-Dutt investment function - where investment is specified as a function of the profit rate and the capacity utilization rate - given in Bhaduri and Marglin (1990). The Bhaduri-Marglin critique suggested that the Steindl-Dutt investment function imposed unwarranted restrictions and ruled out profit-led expansion. I have demonstrated that this critique is slightly misplaced.

The problem of using the Steindl-Dutt investment function lies not in the specification of the investment function itself but in the larger macroeconomic model within which it is embedded. Most importantly, it is the conjunction of the investment function and the saving behaviour that jointly impose unwarranted restrictions and rules out profit-led expansion. While the Steindl-Dutt investment function rules out profit-led expansion in a closed economy model, it does not do so in an open economy model. Therefore, it seems that the key restrictions come from the saving behavior and not from the specification of the investment function.

Appendix

In this appendix, I reproduce the argument as developed in Bhaduri and Marglin (1990). The model refers to a closed capitalist economy without government. Hence, with the classical savings assumption, the flow of savings comes out of profit income only, so that

$$S = s_r R = s_r \frac{R}{X} \frac{X}{X^c} X^c$$

where S is savings, s_r is the average savings rate out of profit income, R is profit income, X is actual output, and X^c is potential (or full-capacity) output. Since the model is about the short run, X^c remains unchanged and can be normalized to 1. Hence,

$$S = shu \tag{29}$$

where $h = R/X$ and $u = X/X^c$ refer to the profit share and the capacity utilization rate, respectively.

Investment is a function of the profit share and the capacity utilization rate, so that

$$I = I(h,u), I_h > 0, I_u > 0. \tag{30}$$

Macroeconomic balance requires the equality of savings and investment, $S = I$, which defines the IS curve in the $h - u$ plane as an implicit function

$$shu - I(h,u) = 0.$$

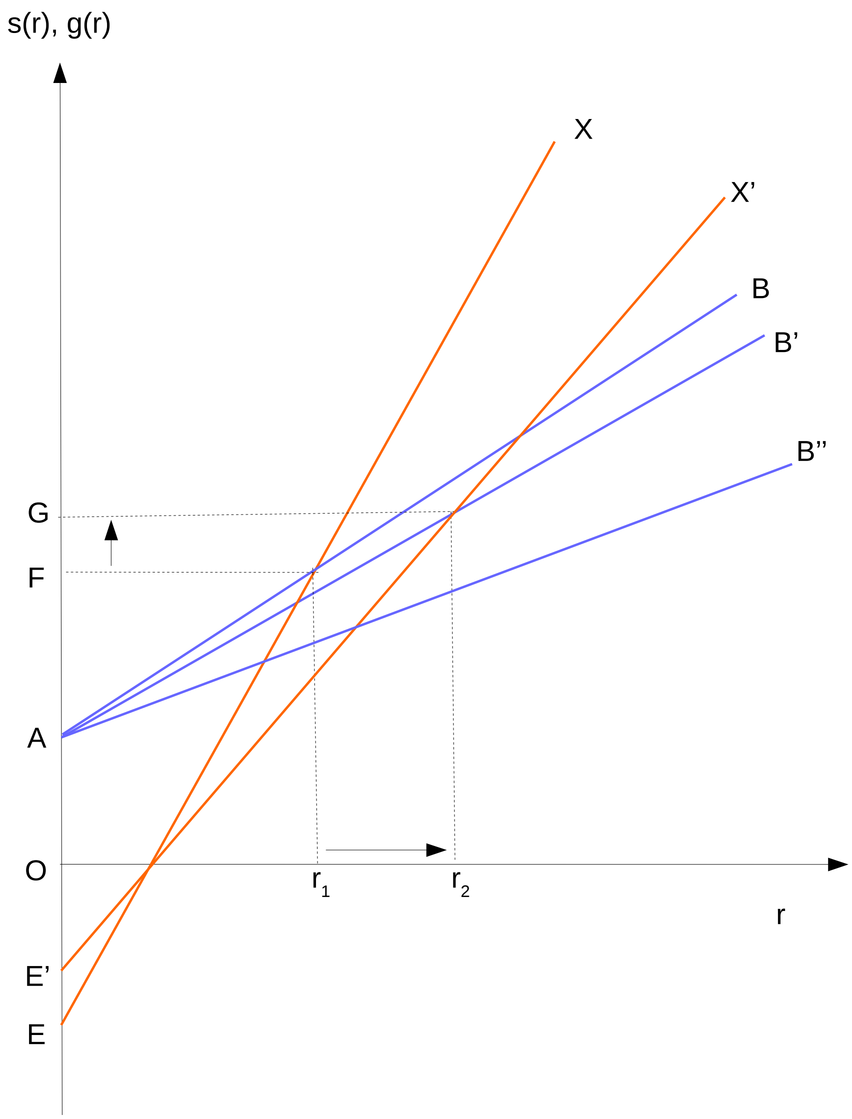

Figure 2: Comparative statics of an increase in the mark-up rate in a one sector open economy structuralist model with a linear specification of the Steindl-Dutt investment function. The savings function is given by: $s(r) = -\epsilon + (\phi/\tau + s_r)\, r$; the investment function is given by $g(r) = z_0 + (z_1 + z_2 + z_2/\tau)\, r$. The equilibrium profit rate increases from r_1 to r_2 and the corresponding equilibrium growth rate rises from OF to OG.

The local slope of the IS curve is given by

$$\frac{du}{dh} = \frac{I_h - su}{sh - I_u}$$

The standard Keynesian stability condition is that savings is more responsive to changes in capacity utilization than investment, which translates into $I_u < sh$. This assumption ensures that the denominator in the expression for the local slope of the IS curve is positive. Hence, the sign of the slope of the IS curve depends on the sign of the numerator.

When the numerator is negative, i.e. $I_h - su < 0$, the IS curve is negatively sloped and the economy is in a stagnationist (wage-led) regime. This is because an increase in the profit share is associated with a decline in the capacity utilization rate (because the local slope of the IS curve is negative). When the opposite happens, i.e. $I_h - su > 0$, the IS curve is positively sloped and the economy is in an exhilarationist (profit-led) regime. This is because an increase in the profit share is associated with an increase in the capacity utilization rate.

The analysis in Bhaduri and Marglin (1990, Appendix A) shows that if, instead of (30), we use the following investment function

$$I = I(r, u),$$

which is what Basu and Das (2016) call a Steindl-Dutt investment function, then we will have

$$uI_u > hI_h \tag{31}$$

This implies that $I_h < (u/h)I_u$. If we take the Keynesian stability condition, $I_u < sh$, and multiply through by u, we get $(u/h)I_u < su$. Using this in conjunction with (31), we see that

$$I_h < (u/h)I_u < su.$$

Hence, the Steindl-Dutt investment function rules out the exhilarationist (profit-led) regime, because such a regime requires that $I_h > su$.

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