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Gender issues in Kaleckian distribution and growth models: On the macroeconomics of the gender wage gap

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Gender issues in Kaleckian distribution and growth models: On the macroeconomics of the gender wage gap*

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Abstract
We introduce a gender wage gap into basic one-good textbook versions of the neo-Kaleckian distribution and growth model and examine the effects of improving gender wage equality on income distribution, aggregate demand, capital accumulation and productivity growth. For the closed economy model, reducing the gender wage gap has no effect on the profit share, and a gender equality-led regime requires the propensity to save out of female wages to fall short of the propensity to save out of male wages. For the open economy model this condition is modified by the effects of improved gender wage equality on exports and – through changes of the profit share – on domestic demand. Finally for the open economy with productivity growth we find an unambiguously expansionary effect of narrowing the gender wage gap on long-run equilibrium capital accumulation and productivity growth if the demand growth regime is gender equality-led. A gender equality-burdened demand growth regime, however, may generate different long-run effects of improving gender wage equality on capital accumulation and productivity growth: expansionary, intermediate or contractionary.

Key words: gender wage gap, distribution, growth, Kaleckian model
JEL code: E11, E21, E22, O40, O41

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1. Introduction

Post-Keynesian models of distribution and growth, and Kaleckian models in particular, have historically focused on the class division of society. The analysis has been concerned with the distribution of income (and partly wealth) between capital and labour and on the relationship of the distribution between profits and wages with capital accumulation and economic growth.[1] In some contributions, a distinction has been made between direct labour and overhead labour, thus allowing for differentiation of the working class into managers and workers.[2] Then, explicitly introducing finance, interest and credit into post-Keynesian models of distribution and growth has led to the distinction of the capitalist class into creditors and debtors,[3] or into rentiers/shareholders, on the one hand, and corporations run by managers, on the other hand, when the focus turned towards the macroeconomics of finance-dominated capitalism.[4] In the latter context, and in order to explain different demand and growth regimes in finance-dominated capitalism, and the debt-led private demand boom regime in particular, several models have been proposed allowing for a division of the working class into high and low wage earners, the latter emulating consumption behaviour of the former financed by increasing indebtedness.[5] Whereas these developments have involved a broad range of researchers in the post-Keynesian academic community, a smaller group of authors, so far, has been concerned with integrating gender issues into post-Keynesian/Kaleckian macroeconomic models thus linking two heterodox schools of thought, post-Keynesian economics and feminist economics.[6]

These approaches have included the reproduction of labour into macroeconomic models, focusing on the disproportional share of women as compared to men in unpaid reproductive and care work (Braunstein et al. 2011, 2020). Most feminist post-Keynesian macroeconomic models have examined the effects of gender inequality on growth for developing countries, further taking into account the specific structural features of these economies, like a dual production structure, segregated labour markets, the balance-of-payments constraint, and partly also the role of economic policies (Blecker/Seguino 2002, Seguino 2010, 2012, 2019a).[7] Recently, Onaran (2015) and Onaran et al. (2019) have integrated several of these features into a more general gendered macroeconomic model on Kaleckian grounds, which has then also been estimated for the UK. This model integrates three dimensions of inequalities—functional income distribution between wages and profits, gender inequality, and wealth concentration, and their interactions. It includes the impact of fiscal policies, in particular the effects of government spending on social and physical

[1] See, for example, Blecker/Setterfield (2019, Chapters 3-4), Hein (2014, Chapters 4-8) and Lavoie (2014, Chapter 6).
[2] See, for example, Lavoie (1995a, 1996, 2009) and Rowthorn (1981).
[3] See, for example, Hein (2008, 2014, Chapter 9) and Lavoie (1995b).
[4] See, for example, Hein (2012, 2014, Chapter 10).
[5] See, for example, Hein (2017) and Hein/Prante (2020).
[6] See Seguino (2019b) for several arguments, why post-Keynesians should be concerned with more general stratification issues in macroeconomics, with gender being an important one among them. On the relevance and the contribution of stratification for the explanation of economic development and financial and economic crises, see, for example, Berik et al. (2009) and Fukuda-Parr et al. (2013).
[7] See Onaran (2015) and Onaran et al. (2019), and in particular Seguino (2019a) for a more comprehensive review of the feminist macroeconomic literature.

infrastructure, as well as different types of taxation. And it analyses both the demand and supply-side effects on output and employment.

Our ambition in this paper is more modest, basic and mainly didactic and pedagogical. We will focus on the introduction of a gender wage gap into a basic textbook neo-Kaleckian distribution and growth model, focusing on distribution, aggregate demand, growth and productivity effects. In Section 2, we will first examine the impact of closing the gender wage gap for a closed economy model, and then look at a model for an economy which is open for foreign trade (but not for international capital or labour movements) in Section 3. In the last step, in Section 4, we will integrate endogenous productivity growth into the model. For each version of the one-good model, the effects of improving gender wage equality on distribution, equilibrium capacity utilisation and growth will be analysed. Section 5 will summarise and conclude.

2. The closed economy model

2.1 Basic structure

The closed economy version of our model builds on the basic neo-Kaleckian model in the tradition of Dutt (1984, 1987) and Rowthorn (1981), as presented in Hein (2014, Chapter 6), and it includes a gender wage gap into this model. We assume a closed economy without a government sector, which is composed of two classes, capitalists and workers. We now assume that workers are split into male workers (L_M) and female workers (L_F), whereas no gender division is assumed for the capitalist class. The labour force (L) thus consists of a male ($\theta = L_M/L$) and a female share ($1-\theta = L_F/L$):

$$L = \theta L + (1-\theta) L . \tag{1}$$

Male and female labour is generally in excess supply and poses no constraint to output. Capitalists own the means of production, hire male and female labour, organize the production process and decide about investment in and expansion of the capital stock. Capitalists receive profits, which they partly consume and partly save—buying assets issued by the corporate sector and thus the capitalists themselves or depositing parts of the profits with a banking sector, which is also owned by the capitalists. We do not model the financial sector here, but only assume, as usual in post-Keynesian distribution and growth models, that capitalists have access to (initial) finance, i.e. credit, generated by the financial sector 'out of nothing', for investment purposes. Therefore, investment in the capital stock is not constrained by saving at the macroeconomic level, although corporate saving, i.e. retained earnings, may have a positive impact on creditworthiness of firms and thus on their ability to finance investment expenditures at the microeconomic level. However, we will not consider this here.[8]

We assume that a homogenous output (Y) for consumption and investment purposes is produced combining direct male or female labour and a non-depreciating capital stock (K).

[8] See Hein (2008, 2014, Chapter 9) for respective models.

We thus ignore overhead labour, costs of raw materials and intermediate products, as well as capital stock depreciations. We assume a fixed coefficient production technology without technical progress and set the capital-potential output ratio equal to one ($K/Y^p = 1$), such that the rate of capacity utilisation is given by the actual output-capital ratio ($u = Y/K$). Male and female workers operate the same technology and thus have the same labour productivity ($y = Y/L$):

$$(2) \qquad \frac{Y}{L} = \frac{Y_M}{L_M} = \frac{Y_F}{L_F} = y = y_M = y_F ,$$

with Y_M and Y_F denoting male and female output, respectively, each produced in combination with the respective (fraction of the homogenous) capital stock. The assumption of equality of male and female labour productivity allows us to focus on true gender wage gaps. Because of historically, socially and institutionally given discrimination of women, nominal wages for female work (w_F) will only be a fraction of nominal wages for male work (w_M):[9]

$$(3) \qquad w_F = \varepsilon y_M , \qquad 0 < \varepsilon \leq 1 .$$

Therefore, we have ε as a gender equality parameter and (1-ε) for the gender wage gap. We will assume that this parameter is determined by gender conflict, history, institutions etc.., and we will treat this parameter as an exogenous variable, which can be affected by policies, and examine the macroeconomic effects of changes in this parameter.

Nominal income (pY), i.e. real income/output multiplied by the price level, in our model economy is distributed between male wages (W_M), female wages (W_F) and profits (Π):

$$(4) \qquad pY = W_M + W_F + \Pi = w_M L_M + w_F L_F + rpK = w_M \left[\theta + \varepsilon(1-\theta)\right] L + rpK .$$

The rate of profit on the capital stock can be decomposed into the rate of capacity utilisation and the profit share ($h = \Pi/pY$):

$$(5) \qquad r = \frac{\Pi}{pK} = \frac{\Pi}{pY}\frac{Y}{K} = hu .$$

2.2 Pricing and distribution

Income distribution, both between capital and labour and between male and female workers, can be derived starting from firms' mark-up pricing in incompletely competitive goods market. Following Kalecki (1954, Chapter 1), we assume that firms mark-up unit

[9] The assumption of equal male and female labour productivity but lower female wages may raise the question, why, in our one-good economy, firms should hire male labour at all. However, it should be clear that this model is an extreme simplification of a more complex world determined by historical, social and institutional features. One of these features is a male dominated labour force.

labour costs, consisting of male and female wage costs per unit of output, and the mark-up (m) is determined by the degree of price competition in the goods market and the relative strength of capital and labour in the labour market:

$$(6) \qquad p = (1+m)\frac{W_M + W_F}{Y} = (1+m)\frac{w_M L_M + w_F L_F}{Y} = (1+m)\frac{w_M\left[\theta+\varepsilon(1-\theta)\right]}{y}, \; m > 0 .$$

For the further analysis we assume the determinants of the mark-up to be constant. From equation (6) we get that profits are given by:

$$(7) \qquad \Pi = m\left(w_M L_M + w_F L_F\right) = m w_M\left[\theta+\varepsilon(1-\theta)\right]L .$$

For the profit share in nominal income we thus obtain:

$$(8) \qquad h = \frac{\Pi}{pY} = \frac{\Pi}{W_M + W_F + \Pi} = \frac{m w_M\left[\theta+\varepsilon(1-\theta)\right]L}{(1+m) w_M\left[\theta+\varepsilon(1-\theta)\right]L} = \frac{m}{1+m} .$$

For the aggregate wage share (Ω) this means:

$$(9) \qquad \Omega = 1-h = \frac{W_M + W_F}{pY} = \frac{W_M + W_F}{W_M + W_F + \Pi} = \frac{w_M\left[\theta+\varepsilon(1-\theta)\right]}{(1+m) w_M\left[\theta+\varepsilon(1-\theta)\right]} = \frac{1}{1+m} .$$

These are the well-known results from the very basic Kaleckian model without intermediate products, overhead labour and so on: Functional income distribution is only determined by the mark-up in firms' pricing (Hein 2014, Chapter 6). But now we also have to determine the male (Ω_M) and the female (Ω_F) share of wages in national income:

$$(10) \qquad \Omega_M = \frac{W_M}{pY} = \frac{W_M}{W_M + W_F + \Pi} = \frac{w_M \theta}{(1+m) w_M\left[\theta+\varepsilon(1-\theta)\right]} = \Omega\frac{\theta}{\theta+\varepsilon(1-\theta)} .$$

$$(11) \qquad \Omega_F = \frac{W_F}{pY} = \frac{W_F}{W_M + W_F + \Pi} = \frac{w_M \varepsilon(1-\theta)}{(1+m) w_M\left[\theta+\varepsilon(1-\theta)\right]} = \Omega\frac{\varepsilon(1-\theta)}{\theta+\varepsilon(1-\theta)} .$$

The wage shares of male and female workers therefore depend on the overall wage share and the respective gender shares in this overall wage share. These shares are affected by the share of male and female workers in the total labour force and by the gender wage equality parameter, and hence by the gender wage gap. An improvement towards gender wage equality and a reduction in the gender wage gap will have the following effects on income distribution:

(8a) $$\frac{\partial h}{\partial \varepsilon} = 0,$$

(9a) $$\frac{\partial \Omega}{\partial \varepsilon} = 0,$$

(10a) $$\frac{\partial \Omega_M}{\partial \varepsilon} = \frac{-\Omega\theta(1-\theta)}{\left[\theta+\varepsilon(1-\theta)\right]^2} = \frac{-\theta(1-\theta)}{(1+m)\left[\theta+\varepsilon(1-\theta)\right]^2} < 0,$$

(11a) $$\frac{\partial \Omega_F}{\partial \varepsilon} = \frac{\Omega\theta(1-\theta)}{\left[\theta+\varepsilon(1-\theta)\right]^2} = \frac{\theta(1-\theta)}{(1+m)\left[\theta+\varepsilon(1-\theta)\right]^2} > 0.$$

In this simple model, an improvement towards gender wage equality and a reduction of the gender wage gap will thus have no effect on the profit share and on the aggregate wage share, but it will improve the female wage share at the expense of the male wage share. An increase in the female nominal wage rate, keeping the male nominal wage rate constant, thus reducing the gap between them, will increase the price level, because we assume a constant mark-up and constant labour productivity. This increase in the price level, however, will be less than proportional since male nominal costs remain constant, such that the female real wage rate and the female wage share will rise, and it will make the male real wage rate and wage share fall accordingly.

2.3 Distribution, aggregate demand and growth

Aggregate demand in our model without a government and a foreign sector consists of investment and consumption demand. For the goods market equilibrium we thus have to look at investment and saving, i.e. income not consumed. For investment we assume the most basic neo-Kaleckian investment function,[10] according to which the firms' decisions to invest depend on animal spirits (α), i.e. the 'spontaneous urge to action rather than inaction' (Keynes 1936, p. 161), and on the rate of capacity utilisation. On the one hand, a high rate of capacity utilisation induces firms to increase productive potential by means of investment in

[10] Different from the investment function in the neo-Kaleckian model used here, in the post-Kaleckian model proposed by Bhaduri/Marglin (1990) and Kurz (1990), there is also a direct positive effect of the profit share in the investment function. In the post-Kaleckian model, this slight change allows for wage- or profit-led demand and growth regimes for the closed economy, depending on model parameters, whereas in the neo-Kaleckian model used here, we only obtain wage-led regimes for the closed economy. In the neo-Kaleckian model, profit-led regimes only become possible for the open economy, as already shown by Blecker (1989) and as we will see in Section 3. Several estimations based on the post-Kaleckian model for OECD but also for emerging market economies have found that domestic demand is usually wage-led, and only through the inclusions of distribution effects on net exports some countries turn profit-led overall. See Hartwig (2014), Hein (2014, Chapter 7), Onaran/Galanis (2014) and Onaran/Obst (2016) for recent estimation results, and Blecker (2016) and Stockhammer (2017) for clarifying discussions. These empirical findings have induced us to choose the neo-Kaleckian model as the basis for our analysis. Giovanazzi (2018), following Braunstein et al. (2011), has proposed a simple closed economy model including gender wage gaps into a basic post-Kaleckian model, however, abstracting from different saving propensities out of male and female wages and only focussing on distribution and productivity effects of narrowing the gender wage gap.

the capital stock. On the other hand, a high rate of capacity utilisation has a positive effect on the rate of profit, for a given profit share (equation 5), and thus also on retained earnings, for a given retention ratio. This also improves the creditworthiness of the firm when it comes to obtaining external investment finance in the credit market, according to Kalecki's (1937) 'principle of increasing risk'. From these considerations, we get the following determination of the rate of capital accumulation (g), relating real investment (I) to the real capital stock:

$$(12) \qquad g = \frac{I}{K} = \alpha + \beta u, \qquad \alpha, \beta > 0 .$$

Aggregate saving (S) consists of saving out of profit (S_Π), saving out of male workers' wages (S_{WM}) and saving out of female workers' wages (S_{WF}). Each saving aggregate is determined by the respective propensity to save and the respective income, with s_Π denoting the propensity to save out profits, s_{WM} the propensity to save out of male wages and s_{WF} the propensity to save out of female wages. We therefore obtain for the saving rate, relating aggregate saving to the nominal capital stock:

$$(13) \qquad \sigma = \frac{S}{pK} = \frac{S_\Pi + S_{WM} + S_{WF}}{pK} = \left(s_\Pi h + s_{WM}\Omega_M + s_{WF}\Omega_F\right) u, \qquad 0 \leq s_{WM}, s_{WF} < s_\Pi \leq 1 .$$

Since saving out of profits contains retained earnings of corporations, which cannot be consumed and are thus saved by definition, and since profits usually go to the high-income households, we assume the propensity to save out of profits to exceed each of the two propensities to save out of wages.[11] Whether the propensity to save out of female wages is higher or lower than the propensity to save out of male wages is an open question. On the one hand, female wages are lower than male wages and, according to Keynes's (1936, Chapter 8) absolute income hypothesis, we would expect a higher propensity to consume and thus a lower propensity to save out of female wages than out of male wages, as also expected by Onaran (2015). On the other hand, it has been found by Seguino/Sagrario Floro (2003) for semi-industrialised countries that higher relative income and more bargaining power of women increase aggregate saving rates, because women's income is more unstable and women's expenditures are dominated more by pre-cautionary motives. Interestingly, the estimations by Onaran et al. (2019) for the UK support the notion that the

[11] Since we assume the propensity to save out of male and female wages to be positive, it means that both types of workers accumulate financial assets and become co-owners of or creditors to the firms, and thus will also receive part of the profits generated in the firm sector. We will not follow this up, and therefore we have to be careful not to confuse the propensity to save of female and male workers with the propensity to save out of female and male wages. In essence, what we assume here is that male and female workers have two different propensities to save each: A higher one out of their profits and a lower one out of the wages they receive. This may be justified by the fact that profits to large parts are not paid out to households but are rather retained, increasing the value of the firms and thus also the wealth of the owners of the firms, who will be capitalists and also those workers who save. In a more elaborated model we should therefore also include consumption out of accumulated wealth. For the sake of simplicity we ignore this here and leave it for future modelling exercises.

propensity to save out of female wages is higher than out of male wages.[12] In our following analysis, we will therefore consider both cases, $s_{WM} > s_{WF}$ and $s_{WM} < s_{WF}$.

Plugging in the determination of the male and female wage shares from equations (10) and (11) into equation (13) we obtain:

$$(14) \qquad \sigma = \left\{ h\left[s_{\Pi} - \frac{s_{WM}\theta + s_{WF}\varepsilon(1-\theta)}{\theta + \varepsilon(1-\theta)} \right] + \left[\frac{s_{WM}\theta + s_{WF}\varepsilon(1-\theta)}{\theta + \varepsilon(1-\theta)} \right] \right\} u .$$

The average propensity to save out of wages (s_W) is the weighted average of the propensity to save out of male and female wages, with weights given by the male and female share in wages:

$$(15) \qquad s_W = \frac{S_W}{W} = \frac{S_{WM} + S_{WF}}{W_M + W_F} = \frac{s_{WM}\Omega_M pY + s_{WF}\Omega_F pY}{\Omega pY} = \frac{s_{WM}\theta + s_{WF}\varepsilon(1-\theta)}{\theta + \varepsilon(1-\theta)} .$$

Using equation (15), the equation for the saving rate thus turns to:

$$(16) \qquad \sigma = \left\{ h\left[s_{\Pi} - s_W(\varepsilon) \right] + s_W(\varepsilon) \right\} u .$$

The propensity to save out of wages is here endogenous with respect to the degree of gender wage equality and thus the gender wage gap:

$$(15a) \qquad \frac{\partial s_W}{\partial \varepsilon} = \frac{-(1-\theta)\theta(s_{WM} - s_{WF})}{\left[\theta + \varepsilon(1-\theta)\right]^2} .$$

An improvement towards gender wage equality and a decline in the gender wage gap will thus reduce the average propensity to save out of wages, if the propensity to save out of female wages falls short of the propensity to save out of male wages. It will raise the average propensity to save out of wages, if the propensity to save out of female wages is higher than out of male wages.

For the goods market equilibrium we need the equality of planned saving and investment:

$$(17) \qquad g = \sigma .$$

For the stability of the goods market equilibrium, it is required that saving responds more elastically than investment towards a change in the endogenous variable, which is the rate of capacity utilisation:

[12] See also Seguino (2019a) on the unclear results regarding different saving propensities of men and women.

(18) $$\frac{\partial \sigma}{\partial u} - \frac{\partial g}{\partial u} > 0 \quad \Rightarrow \quad h\left(s_{\Pi} - s_W\right) + s_W - \beta > 0.$$

Aggregate demand adjusts to supply, and saving adjusts to investment, by means of changes in the rate of capacity utilisation. We receive the equilibrium rate of capacity utilisation (u*) plugging equations (12) and (16) into equation (17):

(19) $$u^* = \frac{\alpha}{h\left(s_{\Pi} - s_W\right) + s_W - \beta}.$$

Inserting this value into equations (12) and (5) we also obtain the equilibrium rates of capital accumulation and growth (g*), equal to the equilibrium saving rate (σ*), as well as the equilibrium rate of profit (r*):

(20) $$g^* = \sigma^* = \frac{\alpha\left[h\left(s_{\Pi} - s_W\right) + s_W\right]}{h\left(s_{\Pi} - s_W\right) + s_W - \beta},$$

(21) $$r^* = \frac{h\alpha}{h\left(s_{\Pi} - s_W\right) + s_W - \beta}.$$

For this basic neo-Kaleckian model with positive saving out of wages it is well known that the paradox of saving applies, i.e. a higher propensity to save out of any type of income will lower all the endogenous variables, the rates of capacity utilisation, accumulation and growth, as well as the rate of profit (Hein 2014, Chapter 7.2.1). Furthermore, demand and growth in the economy are wage-led. A rise in the aggregate wage share, and thus a fall in the profit share, will lead to higher equilibrium rates of capacity utilisation, and accumulation/growth. The paradox of costs, i.e. a lower profit share generating a higher equilibrium profit rate, which will emerge if there is no saving out of wages, may but will not necessarily apply in the model with positive saving out of wages.

For the improvement towards gender wage equality and a reduction in the gender wage gap, we obtain:

(19a) $$\frac{\partial u^*}{\partial \varepsilon} = \frac{\alpha(1-h)(1-\theta)\theta\left(s_{WM} - s_{WF}\right)}{\left\{\left[h\left(s_{\Pi} - s_W\right) + s_W - \beta\right]\left[\theta + \varepsilon(1-\theta)\right]\right\}^2},$$

(20a) $$\frac{\partial g^*}{\partial \varepsilon} = \frac{\beta\alpha(1-h)(1-\theta)\theta\left(s_{WM} - s_{WF}\right)}{\left\{\left[h\left(s_{\Pi} - s_W\right) + s_W - \beta\right]\left[\theta + \varepsilon(1-\theta)\right]\right\}^2},$$

(21a) $$\frac{\partial r^*}{\partial \varepsilon} = \frac{h\alpha(1-h)(1-\theta)\theta(s_{WM}-s_{WF})}{\left\{\left[h(s_{\Pi}-s_W)+s_W-\beta\right]\left[\theta+\varepsilon(1-\theta)\right]\right\}^2}.$$

If the propensity to save out of female wages is lower than out of male wages, a reduction in the gender wage gap, and thus an increase in the female wage share at the expense of the male wage share, will be expansionary and lift the equilibrium rates of capacity utilisation, accumulation/growth and profit. The economy will thus be 'gender equality-led'. In the opposite case, however, if the propensity to save out of female wages exceeds the one out of male wages, a reduction in the gender wage gap will reduce the equilibrium rates of capacity utilisation, accumulation/growth and profit. The economy will thus be 'gender equality-burdened'. In the next section we will examine, if and how these results change in an economy which is open to foreign trade.

3. The open economy model

3.1 Basic structure

The open economy version of our model is based on the open economy analysis in Bhaduri/Marglin (1990) concerning the relationship between distribution, the real exchange rate, as an indicator of international price competitiveness, and demand and growth regimes, as well as on the analysis of the relationship between domestic redistribution and international competitiveness contained in Blecker (1989). Our modelling strategy follows Hein (2014, Chapter 7.3), but instead of a post-Kaleckian investment function we will make use of the neo-Kaleckian investment function from the previous section. We will include gender wage inequality and a gender wage gap into the model, following our analysis of the previous section.

We assume an economy without economic activity of the state, which is open to foreign trade, but not to international movements of capital and labour. The economy depends on imported inputs for production purposes and its output competes in international markets. We take the prices of imported inputs and of the competing foreign final output to be exogenously given. If they are changing, they are moving in step. The nominal exchange rate, here the relationship between domestic currency and foreign currency or the price of a unit of foreign currency in domestic currency, is determined by monetary policies and international financial markets and is also considered to be exogenous for our purposes. Foreign economic activity is also taken to be exogenously given.

3.2 Pricing, distribution and international competitiveness

We keep the assumptions regarding capital and labour inputs, the capital-potential output ratio and the labour productivity of male and female labour from the previous section. But now we also consider imported raw material and semi-finished product inputs and assume that firms mark-up unit variable costs, consisting of unit labour costs and unit semi-finished product and material costs. We denote unit raw material and semi-finished product inputs per unit of output by μ, the nominal exchange rate by e and the price of a unit of imported

foreign goods in foreign currency by p_f. The pricing equation for domestically produced goods thus becomes:

$$(22) \qquad p = (1+m)\left\{\frac{w_M\left[\theta+\varepsilon(1-\theta)\right]}{y} + p_f e\mu\right\}, \qquad m > 0\,.$$

For further analysis, it is convenient, following Kalecki (1954, Chapter 1), to define a ratio between unit material and semi-finished product costs and unit labour costs, denoted by z:

$$(23) \qquad z = \frac{p_f e\mu y}{w_M\left[\theta+\varepsilon(1-\theta)\right]}\,.$$

Therefore, the price equation (22) can also be written as:

$$(24) \qquad p = (1+m)\frac{w_M\left[\theta+\varepsilon(1-\theta)\right]}{y}(1+z)\,.$$

The profit share in domestic value added, consisting of domestic profits, male and female wages, is given by:

$$(25) \qquad h = \frac{\Pi}{W_M + W_F + \Pi} = \frac{(1+z)m}{1+(1+z)m}\,.$$

The profit share in the open economy is hence determined by the mark-up and by the ratio of unit costs for imported material and semi-finished products to unit labour costs, consisting of male and female labour costs. The aggregate wage share is given by,

$$(26) \qquad \Omega = 1-h = \frac{W_M + W_F}{W_M + W_F + \Pi} = \frac{1}{1+(1+z)m}\,,$$

and the male and female wage shares are determined by:

$$(27) \qquad \Omega_M = \frac{W_M}{W_M + W_F + \Pi} = \Omega\frac{\theta}{\theta+\varepsilon(1-\theta)} = \frac{\theta}{\left[1+(1+z)m\right]\left[\theta+\varepsilon(1-\theta)\right]}\,,$$

$$(28) \qquad \Omega_F = \frac{W_F}{W_M + W_F + \Pi} = \Omega\frac{\varepsilon(1-\theta)}{\theta+\varepsilon(1-\theta)} = \frac{\varepsilon(1-\theta)}{\left[1+(1+z)m\right]\left[\theta+\varepsilon(1-\theta)\right]}\,.$$

The ratio of unit material and semi-finished product costs to unit wage costs in equation (23) is now affected by the gender wage equality parameter:

(23a) $$\frac{\partial z}{\partial \varepsilon} = \frac{-p_f e \mu y (1-\theta)}{w_M \left[\theta + \varepsilon(1-\theta)\right]^2} = \frac{-(1-\theta) z}{\left[\theta + \varepsilon(1-\theta)\right]} < 0 .$$

Therefore, any change in the gender wage gap will not only affect the distribution of wages between males and females, as in the closed economy case, it will also have an impact on the overall wage share and the profit share in the open economy case:

(25a) $$\frac{\partial h}{\partial \varepsilon} = \frac{-m(1-\theta) z}{\left[1+(1+z)m\right]^2 \left[\theta + \varepsilon(1-\theta)\right]} < 0 ,$$

(26a) $$\frac{\partial \Omega}{\partial \varepsilon} = \frac{(1-\theta) mz}{\left[1+(1+z)m\right]^2 \left[\theta + \varepsilon(1-\theta)\right]} > 0 ,$$

(27a) $$\frac{\partial \Omega_M}{\partial \varepsilon} = \frac{-(1-\theta)\theta(1+m)}{\left\{\left[1+(1+z)m\right]\left[\theta + \varepsilon(1-\theta)\right]\right\}^2} < 0 ,$$

(28a) $$\frac{\partial \Omega_F}{\partial \varepsilon} = \frac{(1-\theta)\left\{\theta(1+m) + mz\left[\theta + \varepsilon(1-\theta)\right]\right\}}{\left\{\left[1+(1+z)m\right]\left[\theta + \varepsilon(1-\theta)\right]\right\}^2} > 0 .$$

An improvement of gender wage equality by narrowing the gender wage gap will improve the female wage share and reduce the male wage share for the same reasons as mentioned above for the closed economy. Furthermore, however, it will also raise the aggregate wage share and reduce the profit share in national income, because an increase in female wages, everything else constant, will lower the ratio of unit material and semi-finished product costs to unit labour costs.

Before we will be able to analyse the effects of gender wage inequality on aggregate demand and growth, we have to clarify the effects on international price competitiveness because the latter will affect exports and net exports. Following Bhaduri/Marglin (1990), we choose the real exchange rate (e^r) as an indicator for international competitiveness:

(29) $$e^r = \frac{e p_f}{p} .$$

An increase in the real exchange rate implies increasing international price competitiveness of domestic producers. From equation (29), it follows for the respective growth rates:

(30) $$\hat{e}^r = \hat{e} + \hat{p}_f - \hat{p} .$$

Therefore, higher price competitiveness can be caused by an increasing nominal exchange rate, hence a nominal depreciation of the domestic currency, increasing foreign prices or declining domestic prices. The effect of changes in profit and wage shares on international competitiveness will depend on the cause of distributional change, as has been analytically shown in Hein/Vogel (2008) and Hein (2014, Chapter 7.3). If, everything else constant, the profit share rises because of an increase in the mark-up, domestic prices will rise and the real exchange rate and international price competitiveness of domestic producers will fall. If, however, the profit share rises because of an increase in the ratio of unit material and intermediate product cost to unit labour costs, which may be driven by a fall in nominal wages, a rise in foreign prices or a rise in the nominal exchange rate, hence a depreciation of the domestic currency, international price competitiveness of domestic producers will rise.

The reduction of the gender wage gap and a rise of the gender wage equality parameter have a uniquely negative effect on international price competitiveness, because it means a reduction in z, according to equation (23a). The effect of an increase in ε on the real exchange rate is:

$$(29a) \quad \frac{\partial e^r}{\partial \varepsilon} = \frac{-(1-\theta)p_f e \mu y}{(1+m)w_M\left\{(1+z)\left[\theta+\varepsilon(1-\theta)\right]\right\}^2} = \frac{-(1-\theta)e^r}{(1+z)\left[\theta+\varepsilon(1-\theta)\right]} < 0 .$$

The explanation is straightforward: With constant male nominal wages, constant labour productivity and constant mark-ups, a reduction in the gender wage gap means an increase in the female nominal wage rate. This will raise average unit wage costs and domestic prices, although less than proportional, such that female real wages and wage shares rise by more than male real wages and wage shares fall. Therefore, the profit share falls simultaneously with international price competitiveness of domestic producers. The effects on aggregate demand and growth will be examined in the next section.

3.3 Distribution, aggregate demand and growth

In order to analyse the effects of changes the gender wage gap on aggregate demand, economic activity and capital accumulation, we start with the goods market equilibrium condition for an open economy without economic activity of the state: Planned saving has to be equal to planned nominal investment and nominal net exports (NX), the difference between nominal exports (pX) and nominal imports ($ep_f M$) of goods and services:

$$(31) \quad S = pI + pX - ep_f M = pI + NX .$$

Dividing equation (31) by the nominal capital stock, we get the following goods market equilibrium relationship between the saving rate, the accumulation rate and the net export rate (b = NX/pK):

$$(32) \quad \sigma = g + b .$$

We can use the saving function (16) and the accumulation function (12) from the closed economy model, and specify the net export function as follows:

(33) $b = \psi e^{r}(\varepsilon) - \varphi u + \zeta u_f, \qquad \psi, \varphi, \zeta > 0.$

The net export rate is positively affected by international price competitiveness of domestic producers, provided the Marshall-Lerner condition can be assumed to hold and the sum of the absolute values of the price elasticities of exports and imports exceeds unity. Under this condition, the real exchange rate will have a positive effect on net exports. However, net exports also depend on the relative developments of foreign and domestic demand. If domestic demand increases (decreases), ceteris paribus, net exports will decline (increase), because imports will rise (fall). Moreover, if foreign demand rises (falls), ceteris paribus, net exports will rise (fall). Net exports will thus depend on the real exchange rate, domestic capacity utilisation indicating domestic demand, and foreign capacity utilisation (u_f) representing foreign demand. The latter is considered to be exogenous for the purpose of our analysis. The coefficients on domestic and foreign utilisation are affected by the income elasticities of the demand for imports and exports.

Stability of the goods market equilibrium in equation (32) requires that saving responds more elastically towards a change in the endogenous variable, the rate of capacity utilisation, than investment and net exports do together:

(34) $\frac{\partial \sigma}{\partial u} - \frac{\partial g}{\partial u} - \frac{\partial b}{\partial u} > 0 \qquad \Rightarrow \qquad h\left(s_{\Pi} - s_W\right) + s_W - \beta + \varphi > 0.$

Plugging equations (12), (16) and (33) into equation (32) and solving for capacity utilisation and then using equilibrium capacity utilisation to determine the equilibrium rates of capital accumulation, profit and net exports, yields the following results:

(35) $u^{*} = \frac{\alpha + \psi e^{r} + \zeta u_f}{h\left(s_{\Pi} - s_W\right) + s_W - \beta + \varphi},$

(36) $g^{*} = \frac{\alpha\left[h\left(s_{\Pi} - s_W\right) + s_W - \beta + \varphi\right] + \beta\left[\psi e^{r} + \zeta u_f\right]}{h\left(s_{\Pi} - s_W\right) + s_W - \beta + \varphi},$

(37) $r^{*} = \frac{h\left(\alpha + \psi e^{r} + \zeta u_f\right)}{h\left(s_{\Pi} - s_W\right) + s_W - \beta + \varphi},$

(38) $b^{*} = \frac{\left(\psi e^{r} + \zeta u_f\right)\left[h\left(s_{\Pi} - s_W\right) + s_W - \beta\right] - \alpha\varphi}{h\left(s_{\Pi} - s_W\right) + s_W - \beta + \varphi}.$

For the effects of an improvement towards gender wage equality and a reduction in the gender wage gap, we obtain:

$$\text{(35a)} \quad \frac{\partial u^*}{\partial \varepsilon} = \frac{\frac{\partial e^r}{\partial \varepsilon}\psi - u^*\left[\frac{\partial h}{\partial \varepsilon}\left(s_\Pi - s_W\right) + \frac{\partial s_W}{\partial \varepsilon}\left(1-h\right)\right]}{h\left(s_\Pi - s_W\right) + s_W - \beta + \varphi},$$

$$\text{(36a)} \quad \frac{\partial g^*}{\partial \varepsilon} = \frac{\beta\left\{\frac{\partial e^r}{\partial \varepsilon}\psi - u^*\left[\frac{\partial h}{\partial \varepsilon}\left(s_\Pi - s_W\right) + \frac{\partial s_W}{\partial \varepsilon}\left(1-h\right)\right]\right\}}{h\left(s_\Pi - s_W\right) + s_W - \beta + \varphi},$$

$$\text{(37a)} \quad \frac{\partial r^*}{\partial \varepsilon} = \frac{h\left\langle\frac{\partial e^r}{\partial \varepsilon}\psi - u^*\left\{\frac{\partial h}{\partial \varepsilon}\left[s_\Pi - s_W - \frac{1}{h}\left(h\left(s_\Pi - s_W\right) + s_W - \beta + \varphi\right)\right] + \frac{\partial s_W}{\partial \varepsilon}\left(1-h\right)\right\}\right\rangle}{h\left(s_\Pi - s_W\right) + s_W - \beta + \varphi},$$

$$\text{(38a)} \quad \frac{\partial b^*}{\partial \varepsilon} = \frac{\frac{\partial e^r}{\partial \varepsilon}\psi\left[h\left(s_\Pi - s_W\right) + s_W - \beta\right] + \varphi u^*\left[\frac{\partial h}{\partial \varepsilon}\left(s_\Pi - s_W\right) + \frac{\partial s_W}{\partial \varepsilon}\left(1-h\right)\right]}{h\left(s_\Pi - s_W\right) + s_W - \beta + \varphi}.$$

Each of the equations (35a) – (38a) is written in a way that the different channels through which an improvement in gender wage equality affects the endogenous variables of the model are clearly visible. First, we have the channel via international price competitiveness of domestic producers ($\partial e^r/\partial \varepsilon$) which affects foreign demand for domestically produced goods and hence exports. Second, we have the channel via the profit share ($\partial h/\partial \varepsilon$) and third via gender wage distribution and the average propensity to consume out of wages ($\partial s_W/\partial \varepsilon$), which will each affect domestic demand. For the interpretation of our results, we have to remember that we assume the stability condition for the goods market equilibrium in (34) to hold, which means that the denominators in equations (35a) – (38a) are positive each. From equation (25a) we have $\partial h/\partial \varepsilon < 0$ and from equation (29a) we know that $\partial e^r/\partial \varepsilon < 0$. Furthermore, from equation (15a) we know that $\partial s_W/\partial \varepsilon < 0, \text{ if } s_{WM} > s_{WF}$ and $\partial s_W/\partial \varepsilon > 0, \text{ if } s_{WM} < s_{WF}$.

Let us start with the case in which the propensity to save out of female wages is lower than out of male wages, hence that $s_{WM} > s_{WF}$ and $\partial s_W/\partial \varepsilon < 0$. In this case, domestic demand will clearly rise whenever the gender wage gap is reduced, because the profit share falls and also the average propensity to save out of wages declines. However, the effect on foreign demand and exports will be negative, because of a declining real exchange rate. The effect on total demand, the rate of capacity utilisation and the rate of accumulation and growth will depend on the relative strengths of these effects. If the expansionary effect on domestic demand dominates the contractionary effect on foreign demand, the numerators

in equations (35a) and (36a) will be positive, equilibrium capacity utilisation and accumulation/growth will rise and will hence be gender equality-led. This is the more likely:

- the lower the price elasticity of exports,
- the lower the effect of reducing the gender wage gap is on the real exchange rate,
- the higher the differential in the propensities to save out profits and out of aggregate wages are,
- the lower the profit share,
- and the stronger the negative effects of an improvement of the gender wage equality are on the profit share and on the average propensity to save out of wages.

If the opposite conditions hold, we may have that the contractionary effect of an improvement of gender wage equality on foreign demand dominates the expansionary effect on domestic demand. In this case, the numerator in equations (35a) and (36a) may turn negative, and the equilibrium rates of capacity utilisation and capital accumulation/growth will decline. The economy will thus be gender equality-burdened.

If the economy is gender equality-led, and the equilibrium rates of capacity utilisation and accumulation/growth rise in the face of a reduction in the gender wage gap, the profit rate is likely to improve, too, but not necessarily so, as can be seen in equation (37a). Furthermore, the net export rate will certainly fall, as can be seen in equation (38a). In the gender equality-burdened case, in which the equilibrium rates of capacity utilisation and accumulation/growth fall in the face of a reduction in the gender pay gap, the profit rate will also fall, and the net export rate may rise or fall, depending on the relative effects of decreasing exports (via the reduction in the real exchange rate) and decreasing imports (via the fall in domestic income and demand).

Turning to the case in which the propensity to save out of female wages is higher than out of male wages, hence $s_{WM} < s_{WF}$ and $\partial s_W / \partial \varepsilon > 0$, it is obvious that a gender equality-led demand and growth regime becomes less likely, although not impossible. The effect of lowering the gender wage gap on domestic demand may now already be negative, if the dampening effect via the increase in the average propensity to save out of wages exceeds the expansionary effect via the reduction in the profit share. In this case, the term $(\partial h/\partial \varepsilon)(s_\Pi - s_W) + (\partial s_W/\partial \varepsilon)(1-h)$ in the numerators of equations (35a) and (36a) will turn positive, which will make the numerators negative and we will see lower equilibrium rates of capacity utilisation and capital accumulation. Demand and growth will be gender equality-burdened, and we will also see depressive effects on the equilibrium profit rate. The effect on the equilibrium net export rate may be positive or negative, as already mentioned above.

Although a gender equality-led regime is logically not impossible, if the propensity to save out of female wages is higher than out of male wages, it is less likely in this case. If the propensity to save out of female wages is lower than out of male wages, a gender equality-led regime is a very likely outcome, in particular if the depressive real appreciation-export effect is not too strong relative to the expansionary domestic demand effect.

4. The open economy model with productivity growth

4.1 Basic structure

Although the effect of closing gender wage gaps may not necessarily stimulate aggregate demand and demand-determined growth in the first place, we may expect positive effects on productivity growth and thus on long-run potential growth of the economy, as several authors have argued focusing on various channels (Braunstein et al. 2011, 2020, Giovanazzi 2018, Seguino 2010, 2012, 2019a, Onaran et al. 2019). Therefore, we finally turn to this issue in our basic neo-Kaleckian modelling framework. Following a procedure initially proposed by Setterfield/Cornwall (2002), then applied by Naastepad (2006), Hein/Tarassow (2010) and Hartwig (2013, 2014), as well as in Hein (2014, Chapter 8),[13] we will first amend the open economy demand and growth model from the previous section by exogenous productivity growth. This will yield the 'demand growth regime'. Then we will introduce productivity growth as a function of exogenous demand growth and income distribution, in particular the gender wage gap, which will yield the 'productivity growth regime'. Finally, in the third step, we will examine the interaction of the demand growth and the productivity growth regimes and explore the effects of closing gender wage gaps on the long-run overall regime.

As will be seen below, we will focus on the effects of distribution, and of gender wage inequality in particular, on the demand growth and productivity growth regimes, and on their interaction. For this purpose, we will ignore potential direct effects of technical change and productivity growth on distribution, both between labour and capital and between male and female workers.[14] For the demand effects of technical change and productivity growth, we will focus on investment in the capital stock. We will abstract from potential effects of technical change on consumption, i.e. an effect on the propensity to consume and thus to save through the innovation of new products, for example. We will also ignore potential effects of technical change on exports, i.e. product innovation which might affect the income elasticity of demand for exports. Finally, regarding the type of technical change, we assume that it is labour saving and capital embodied, and hence 'Harrod-neutral'. Technical progress is hence associated with rising labour productivity. And since we keep the assumption that productivity of male and female labour is the same, it also means that they grow at the same rate. The capital-labour ratio [$k = K/(L_M+L_F)$] increases at the same rate as male and female labour productivity does, and the capital-potential output ratio therefore remains constant, and for simplicity we continue assuming that it is equal to one ($K/Y^p = 1$). For the material and intermediate product-output ratio (μ) we also assume that this is not affected by technical progress and thus remains constant, too.

[13] However, in Hein (2018, Chapter 8), as well as in Naastepad (2006), Hein/Tarassow (2010) and Hartwig (2013, 2014), a post-Kaleckian model has been used, and, of course, gender wage inequality has not been of any concern.

[14] See Naastepad (2006) and Hartwig (2013, 2014) for models in which productivity growth negatively affects the wage share. Giovanazzi (2018) has proposed a model in a similar vein, in which a reduction in the gender wage gap promotes productivity growth and reduces the overall wage share. See Hein (2014, Chapter 8) for a critical assessments of such approaches and the underlying assumption – basically that real wage growth does not keep pace with labour productivity growth, which means some implicit long-run productivity illusion of workers.

For our model from the previous section these assumptions imply that technical change has no direct effect on the mark-up and on the ratio of unit material and intermediate product costs to unit wage costs (z) (equation (23)). This also implies that the male nominal wage rate (w_M), as well as the female wage rate ($w_F = \varepsilon w_M$) rise at the same rate as labour productivity, we thus have productivity-oriented wage increases, such that neither distribution nor the domestic price level is affected by technical change, ceteris paribus. As productivity growth does not affect the domestic price level, and we rule out, somewhat unrealistically, an improvement of the income elasticity of exports by means of technical progress, then also the real exchange rate (e^r) and exports are not directly affected by domestic technical change.

With these assumptions, we can keep for the model in the current section the equations (25)-(28) determining income distribution, equation (29) for the real exchange rate and international price competitiveness of domestic producers, as well as the saving function in equation (16) and the net export function in equation (33).

4.2 Demand growth regime with exogenous productivity growth

For the determination of the demand growth regime, we use the saving function in equation (16), the net export function in equation (33), the equilibrium condition (32) and the goods market equilibrium stability condition (34). Technical progress, which for the time being is assumed to be exogenous, only affects investment in our simple model. Since technical progress is embodied in the capital stock, it will stimulate investment. Firms have to invest in new machines and equipment in order to gain from productivity growth, which is made available by new technical knowledge. This effect on investment will be the more pronounced the more fundamental technical change is: The invention of new basic technologies will have a stronger effect on real investment than marginal changes in technologies already in existence. With these considerations, we can extend the investment function (12) by a term indicating the positive effect of (potential) productivity growth ($\hat{y}$):

$$g = \alpha + \beta u + \omega \hat{y}, \qquad \beta, \omega > 0. \tag{39}$$

With this new investment function, our equilibrium rates of capacity utilisation and capital accumulation become:

$$u^* = \frac{\alpha + \omega \hat{y} + \psi e^r + \zeta u_f}{h\left(s_\Pi - s_W\right) + s_W - \beta + \varphi}, \tag{40}$$

$$g^* = \frac{\left(\alpha + \omega \hat{y}\right)\left[h\left(s_\Pi - s_W\right) + s_W - \beta + \varphi\right] + \beta\left(\psi e^r + \zeta u_f\right)}{h\left(s_\Pi - s_W\right) + s_W - \beta + \varphi}. \tag{41}$$

Since productivity growth is still considered to be exogenous, the effects of changes in the gender wage gap are the same as analysed in the previous section:

$$\text{(40a)} \quad \frac{\partial u^*}{\partial \varepsilon} = \frac{\frac{\partial e^r}{\partial \varepsilon}\psi - u^*\left[\frac{\partial h}{\partial \varepsilon}\left(s_\Pi - s_W\right) + \frac{\partial s_W}{\partial \varepsilon}\left(1-h\right)\right]}{h\left(s_\Pi - s_W\right) + s_W - \beta + \varphi},$$

$$\text{(41a)} \quad \frac{\partial g^*}{\partial \varepsilon} = \frac{\beta\left\{\frac{\partial e^r}{\partial \varepsilon}\psi - u^*\left[\frac{\partial h}{\partial \varepsilon}\left(s_\Pi - s_W\right) + \frac{\partial s_W}{\partial \varepsilon}\left(1-h\right)\right]\right\}}{h\left(s_\Pi - s_W\right) + s_W - \beta + \varphi}.$$

Considering only stable goods market equilibria, the demand growth regime may be gender equality-led or -burdened, depending on the parameters, as explained in the previous section.

4.3 Productivity growth regime with exogenous capital accumulation

Our productivity growth regime is based on Kaldor's (1957, 1961) technical progress function, according to which productivity growth is positively affected by the growth of capital intensity, because technical progress is capital embodied.[15] By means of investing in the capital stock, firms turn potential technical progress (developed in the R&D departments) into actual productivity growth. Apart from capital accumulation, we will consider a second determinant of productivity growth, which has been taken into account in recent theoretical and empirical work based on Kaleckian models. Making use of an idea proposed by Marx (1867) and Hicks (1932), we introduce a wage-push variable into the productivity growth equation. An increase in wages and pressure towards a rising wage share and falling profit share, associated with narrowing the gender wage gap, will accelerate firms' efforts to improve productivity growth in order to prevent the profit share from falling, for example through the acceleration of the diffusion of innovations (Dutt 2006). Taking into account both determinants yields the following equation for labour productivity growth:

$$\text{(42)} \quad \hat{y} = \eta(\varepsilon) + \rho g - \gamma h(\varepsilon), \qquad \eta, \rho, \gamma > 0.$$

Independently of capital stock growth and functional income distribution, productivity growth is also affected by several institutional circumstances, like government technology and education policies, and also by 'learning by doing' effects. Here we can include another effect of improving gender wage equality on productivity growth, which has been explored by Braunstein et al. (2011, 2020) and highlighted by Onaran et al. (2019) and Seguino

[15] Another possibility would have been Kaldor's (1966) application of Verdoorn's law, according to which the growth rate of labour productivity in industrial production is positively associated with the growth rate of output. This can be explained by static and dynamic economies of scale: The expansion of aggregate demand, sales and hence the market allows for increasing rationalisation and mechanisation and favourably affects technical progress and productivity growth. See Hein (2014, Chapter 8) for the introduction of this possibility and a review of the empirical estimations of such a productivity growth equation.

(2019a) in the context of gender (in)equality effects on social reproduction. Since female expenditures seem to focus more on the education of children, narrowing the gender wage gap will raise long-run productivity growth through enhanced human capacities.

Summing up, the productivity growth regime in our model is always gender equality-led. A lower gender wage gap will be associated with higher productivity growth because of the associated wage-push effects, on the one hand, and the social reproduction and human capacities effect, on the other hand:

(42a) $$\frac{\partial \hat{y}}{\partial \varepsilon} = \frac{\partial \eta}{\partial \varepsilon} - \gamma \frac{\partial h}{\partial \varepsilon} > 0 .$$

4.3 Overall long-run growth regime

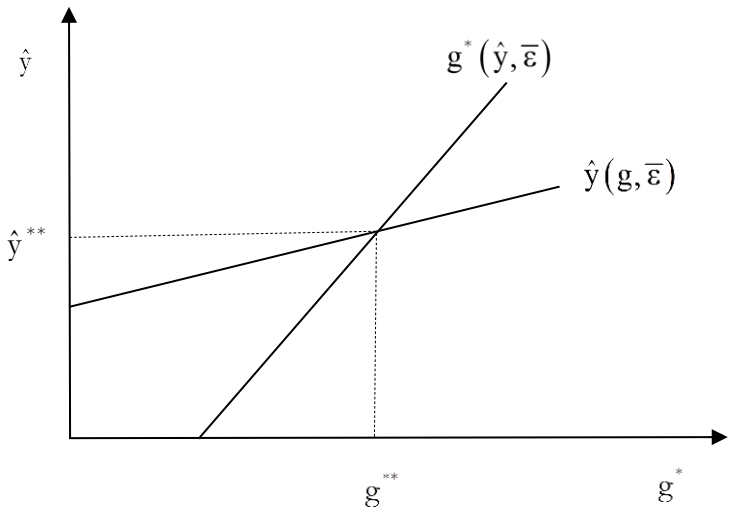
In order to include the interaction between the demand growth regime and the productivity growth regime, we plug equation (42) into (41) and receive the long-run overall equilibrium rate of capital accumulation:

(43) $$g^{**} = \frac{\left[\alpha + \omega(\eta - \gamma h)\right]\left[h(s_\Pi - s_W) + s_W + \varphi\right] + \beta\left[\psi e^r + \zeta u_f\right]}{(1 - \omega\rho)\left[h(s_\Pi - s_W) + s_W + \varphi\right] - \beta} .$$

Inserting equation (41) into (42) provides the long-run equilibrium rate of labour productivity growth:

(44) $$\hat{y}^{**} = \frac{(\alpha\rho + \eta - \gamma h)\left[h(s_\Pi - s_W) + s_W + \varphi\right] + \beta\left[\psi e^r + \zeta u_f - \eta + \gamma h\right]}{(1 - \omega\rho)\left[h(s_\Pi - s_W) + s_W + \varphi\right] - \beta} .$$

Figure 1: Long-run growth equilibrium with endogenous productivity growth



Graphically, this long-run endogenous growth equilibrium can be seen in Figure 1, which presents equilibrium capital accumulation of the demand growth regime from equation (41) as a function of productivity growth, and productivity growth from equation (42) as a function of capital accumulation. The existence and the stability of the overall equilibrium require that the slope of the graph for the capital accumulation equation exceeds the slope of the graph representing the productivity growth equation. Assuming the goods market stability condition (34) to hold, for the existence of positive long-run overall equilibrium values of the rates of capital accumulation and productivity growth in equations (43) and (44), and for the stability of this equilibrium, we also need:

(45) $\omega\rho < 1$.

Since the derivatives of the long-run overall equilibrium values in equations (43) and (44) with respect to the gender wage equality parameter turn quite cumbersome, we provide a graphical analysis of the long-run overall equilibrium effects of a reduction in the gender wage gap. Figure 2 shows the case in which the demand growth regime is gender equality-led. A reduction in the gender wage gap shifts the curve of the equilibrium rate of capital accumulation (g*) to the right. Without considering the human capacities and the wage push effects, each associated with narrowing the gender wage gap, the economy would thus move from equilibrium A to equilibrium B, i.e. a higher rate of capital accumulation and a higher rate of productivity growth because of higher capital accumulation. Including the human capacities and wage push effects on productivity growth, however, also shifts the productivity growth function to the left, so that the economy will end up in equilibrium C, with much higher rates of capital accumulation and productivity growth.

Figure 2: Decreasing gender wage gap in a gender equality-led demand growth regime

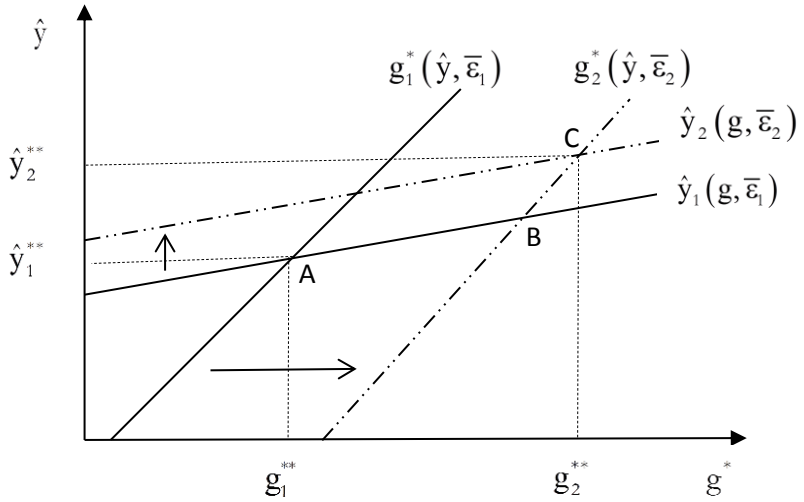
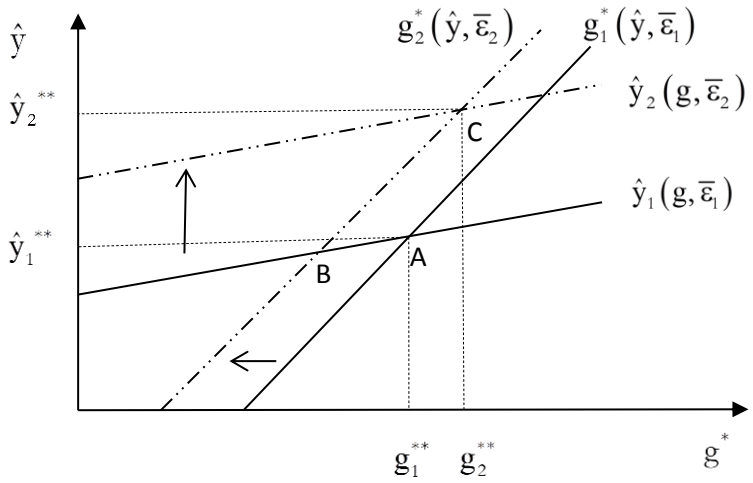
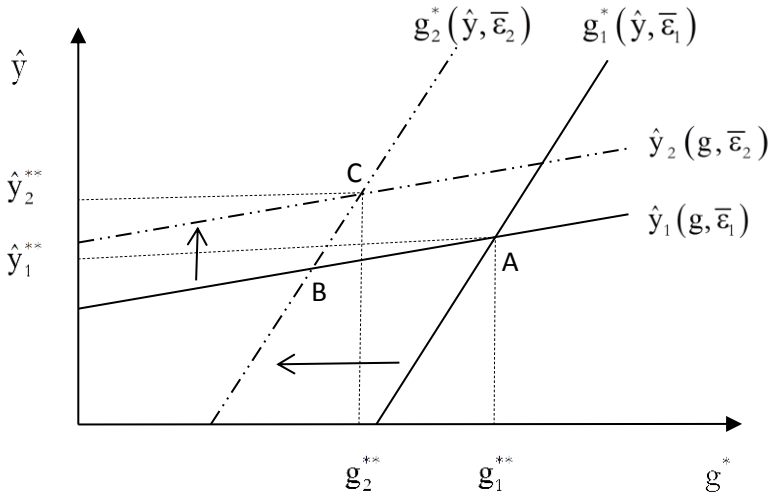


Figure 3: Decreasing gender wage gap in a gender equality-burdened demand growth regime

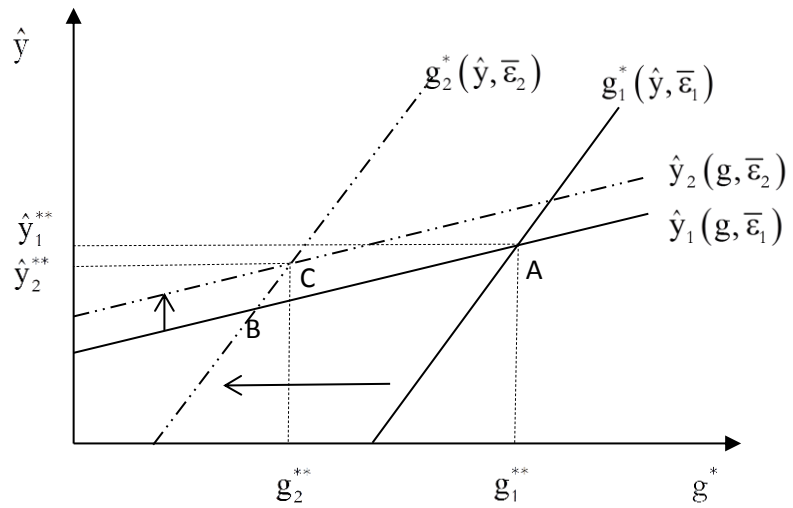
a) expansionary long-run overall regime



b) Intermediate long-run overall regime



c) Contractionary long-run overall regime



Whereas the effect of reducing the gender wage gap in the case of a gender equality-led demand growth regime is uniquely positive, this is no longer the case if the demand growth regime is gender equality-burdened, as can be seen in Figures 3a-3c. With only a weakly negative effect on the demand growth regime but a strong positive effect through the human capacities and wage push channels on the productivity growth regime, the effect on the long-run overall growth regime might still be expansionary (Figure 3.a). However, with strongly negative effects on the demand growth regime and only weakly positive effects on the productivity regime, the effect of closing the gender wage gap on the long-run overall growth regime will be contractionary (Figure 3.c). Finally, with intermediate effects on both sub-regimes, the effect of narrowing gender wage gaps on the long-run overall regime might be mixed or intermediate: Whereas the effect on the accumulation rate in the long-run equilibrium is negative, the effect on the productivity growth rate may nonetheless be positive (Figure 3.b). Table 1 summarises the different responses.

Table 1: Effects of a decline in the gender wage gap (dε > 0) on the long-run overall growth regime

	Gender equality-led demand growth regime $\left(\partial g^{*} / \partial \varepsilon\right) > 0$	Gender equality-burdened demand growth regime $\left(\partial g^{*} / \partial \varepsilon\right) < 0$		
$\partial g^{**} / \partial \varepsilon$	+	+	–	–
$\partial \hat{y}^{**} / \partial \varepsilon$	+	+	+	–
Overall	expansionary	expansionary	intermediate	contractionary

5. Conclusions

We have introduced a gender wage gap into basic one-good textbook versions of the neo-Kaleckian distribution and growth model. We have examined the effects of improving gender wage equality on income distribution, aggregate demand, capacity utilisation, capital accumulation and productivity growth.

In a stepwise process, gradually raising the complexity of the models, we have started with a closed economy model. Here, narrowing the gender wage gap will not affect income distribution between profits and wages, but only improve the female wage share at the expense of the male wage share. If the propensity to save out of female wages falls short of the propensity to save out of male wages, aggregate demand and growth will be gender equality-led, and if the propensity to save out of female wages is higher than out of male wages, the demand and growth regime will be gender equality-burdened.

In the open economy model, narrowing the gender wage gap will also affect profit and aggregate wage shares. The female wage share will rise more than the male wage share falls, raising the aggregate wage share and lowering the profit share accordingly. This will be associated with a loss in international price competitiveness of domestic producers, which will have a negative impact on foreign demand. If the propensity to save out of female wages is lower than out of male wages, reducing the gender wage gap will have an

unambiguously expansionary effect on domestic demand, and if the effect on net exports is small, the total regime will be gender equality-led. Even if the propensity to save out of female wages is higher than out of male wages, and the effect on net exports remains weak, a gender equality-led regime is still possible, because of the rise in the aggregate wage share and the fall in the profit share. However, with high positive differentials between female and male propensities to save out of wages and stronger net export effects, we will rather see a gender equality-burdened regime.

In the final model we have included endogenous productivity growth driven by capital stock growth, human capacities and wage-push effects. We have found that with a gender equality-led demand growth regime, the overall regime will be expansionary: Reducing the gender wage gap will improve long-run demand growth and productivity growth. With a gender equality-burdened demand growth regime, the overall regime may still be expansionary, if improving gender wage equality generates strong productivity growth effects. If this is not the case, we will see intermediate or contractionary regimes. In the latter, reducing the gender wage gap will generate lower demand and productivity growth.

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