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ABSTRACT

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A post-Keynesian open economy model of conflict inflation, distribution, employment, and external balance

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Abstract
Post-Keynesian conflict inflation models have received renewed attention in the course of the recent inflationary processes related to the recovery from the Covid-19 crisis in 2020 and the hike of energy prices in the context of the start of the Russian war on Ukraine in 2022. Although the basic principles of conflict inflation can be presented in a closed economy framework (e.g. Hein 2023, chap. 5), examining current sources and triggers of inflation requires open economy models. Post-Keynesian economics has presented several of these models (e.g. Blecker 2011, Vera 2014, Bastian and Setterfield 2020), which differ in the role assigned to the nominal and the real exchange rate (RER), on the one hand, and the stability of the wage and price Phillips curves, on the other hand. This paper first provides a systematic overview of post-Keynesian open economy conflict inflation models using the treatment of the RER and the stability of the Phillips curve as the main clustering criteria. Second, it provides a model including an unstable Phillips curve and a policy rule targeting a certain RER in response towards trade imbalances. The model distinguishes three equilibrium rates of employment: the goods market equilibrium rate of employment, the distribution claims equilibrium and hence stable inflation rate of employment, and finally the external balance equilibrium rate of employment. The interaction of these three rates drives the system. Finally, the model examines the conditions for an overall equilibrium and its stability.

Keywords: conflict inflation, open economy, exchange rate policy, post-Keynesian model
JEL codes: E12, E31, E61, F41

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1. Introduction

In the course of the recent inflationary processes related to the recovery from the Covid-19 crisis in 2020 and the hike of energy prices in the context of the start of the Russian war on Ukraine in 2022, post-Keynesian conflict inflation models have received renewed attention. Although the basic principles of conflict inflation can be presented in a closed economy framework (e.g. Hein 2023, chap. 5), examining current sources and triggers of inflation require open economy models. As reviewed in Hein (2024), post-Keynesian conflict inflation theory has had a long tradition, which can broadly be classified into a Keynes-Kaldor-Robinson-Marglin and a Kalecki-Rowthorn-Dutt strand. Within the latter, two modelling approaches have emerged with different consequences for the stability of the Phillips curve. First, the Blecker/Setterfield-Lavoie approach based on Dutt (1987) generates stable Phillips curves (Blecker and Setterfield 2019, Lavoie 2022, chap. 8). Second, the Hein/Stockhammer approach based on Rowthorn (1977) (Hein and Stockhammer 2010, 2011, Hein 2023, chap. 5) generates a stable inflation rate of employment (SIRE) and unstable Phillips curves whenever the economy deviates from this SIRE.[1] In both strands, open economy models have been developed with varying characteristics. Some models do not include a Phillips curve but real exchange rate (RER) targeting (Blecker 2011, Lavoie 2022) while others feature neither a Phillips curve nor RER targeting (Charles and Marie 2016, Bortz et al. 2018, 2022). We also find models that incorporate a stable Phillips curve either alongside RER targeting (Sasaki *et al.* 2013, Vera 2014, Campana 2024) or with a fully endogenous RER (Cassetti 2002, 2012, Vera 2010). Finally, we find models that feature an unstable Phillips curve paired with a fully endogenous RER (Hein 2023, chap. 5, 2024).

This paper first provides a systematic overview of post-Keynesian open economy conflict inflation models using the treatment of the RER and the stability of the Phillips curve as the main clustering criteria. Second, in order to fill a gap in the literature, the paper provides a model including an unstable Phillips curve and a policy rule targeting a certain RER in response towards trade imbalances. The model provides a novel approach based on the interaction of three types of equilibrium (un-)employment rates, which are endogenous to the RER and other variables: the goods market equilibrium, the distribution claims equilibrium, and the external balance equilibrium employment rates. The interaction of these three rates drives the system. In examining these interactions and the conditions for an overall equilibrium and stability, we find that the distribution claims equilibrium, i.e. the SIRE, is more likely to be stable in an economy with profit-led demand while, however, under some circumstances the SIRE may also be stable in wage-led economies. Taking into account the effects on the external balance rate of employment, the model shows that a stable SIRE is most likely not associated with overall equilibrium, which also requires external balance. Therefore, a RER policy is introduced, which targets external balance. In order to focus on the macroeconomic effects of such a policy, we treat the RER as a policy instrument and examine

[1] For a systematic comparison of the Blecker/Setterfield-Lavoie and the Hein/Stockhammer Kaleckian conflict inflation approaches in a closed economy framework and some variations of each, see Hein and Häusler (2024).

whether it can bring about an overall equilibrium. The analysis shows that attaining overall equilibrium via this policy rule is possible while highlighting the strict conditions that must apply. Also, the effectiveness of applying an RER policy rule in terms of stabilising an otherwise unstable SIRE is shown to be very limited. Therefore, the stabilisation of an equilibrium around the SIRE would need other policies, in particular incomes policies aligning target income shares and stabilising inflation and distribution, functional finance fiscal policies for managing aggregate demand, low long-term interest rate targeting central bank policies, coupled with fixed or managed exchange rate policies in the international arena (Hein 2023, chap. 6).

The remainder of the paper is structured as follows. Section 2 presents the systematic overview of post-Keynesian open economy conflict inflation models. Section 3 presents the basic structure of our model including the three types of equilibrium employment rates. Section 4 examines the interactions within the model caused by a positive aggregate demand shock and by an adverse external shock, followed by an analysis of the conditions for stability of the SIRE. Section 5 presents the RER policy rule and examines the conditions for reaching overall equilibrium. Section 6 discusses the findings and concludes.

2. Open economy conflict inflation models – a short review

Post-Keynesian inflation theory argues that inflation is the result of conflict over the distribution of income (Blecker and Setterfield 2019, chap. 5, Lavoie 2022, chap. 8, Hein 2023, chap. 5). Conflicting claims models present distributional targets of different economic actors, typically workers and capitalists or firms. These targets are usually the real wage or the wage or profit shares in national income, and the inconsistency among these income claims is what drives inflation. Furthermore, endogenous changes in income distribution are generated as a result of conflict and the different bargaining power of the economic actors involved.

In this chapter we focus, though not exclusively, on the 'Kalecki, Rowthorn and Dutt' post-Keynesian inflation theory tradition,[2] in which prices are set by firms in imperfectly competitive markets by cost-plus strategies, and factors that determine both the mark-up and the cost structure of firms affect their profit share claims (Hein 2024). Open economy conflict inflation models can be categorised in different ways, but for the purposes of this paper and for the remainder of this section we adopt a differentiation mainly based on the treatment of the RER. We identify two major groups of models: those that introduce an RER-targeting regime and those that include an endogenous RER. Within these groups we can then also distinguish different models with regard to the relationship between economic activity and inflation, i.e. with regard to the treatment of the Phillips curve. Here, we identify three types of approaches: first, models without any relationship between economic activity and inflation; second, models with a stable Phillips curve; and third models that present an unstable relationship between economic activity and the inflation rate.

[2] See Hein (2024) for a systematic comparison with the alternative 'Keynes, Kaldor, Robinson and Marglin' post-Keynesian inflation theory tradition.

Within the above mentioned tradition, Blecker (2011) has been a seminal contribution to the development of post-Keynesian open economy models of conflict inflation, distribution and growth. Although others have also dealt with the relationship between these issues in an open economy setting before (e.g., Cassetti 2002, Vera 2010), Blecker's work stands out as it has laid the foundations for several modifications and amendments, leading to a variety of models that have contributed to the advancement of a particular analytical framework.

Blecker's (2011) model belongs to the group of models with an RER-targeting central bank. The nominal exchange rate is thus modelled via an RER-targeting regime. A crawling peg is assumed, where the monetary authority adjusts the nominal exchange rate to reach its RER target. RER effects are introduced in both the price- and wage-setting equations of firms and workers, respectively, however in an asymmetric way. In firms' price-setting, the RER enters via its effect on the firms' target wage share, which becomes a negative function of the RER. In workers' nominal wage-setting, the RER does not affect the workers' target wage share, but it directly affects wage inflation. When facing a real depreciation, workers will hence demand higher nominal wages even though they may have reached their wage share target.[3] Blecker does not include goods market feedbacks on prices and wages, and therefore there is no Phillips or employment-dependent distribution curve. The model shows a stable equilibrium in any of its parameter configurations. The effects of a change in the target RER on aggregate demand depend on the domestic aggregate demand regime, the impact of the RER on the trade balance, and the bargaining power of workers and firms. Lavoie (2022, chap. 8) follows the model of Blecker (2011) but adopts the specification of Bastian and Setterfield (2020) for wage inflation, who argue against asymmetrical behaviour between firms and workers. Both targets are then presented as functions of the RER. More details on that model are presented further below.

Other works also include an RER-targeting regime in a conflict inflation open economy framework but integrate aggregate demand feedbacks on prices and distribution. With a similar general approach, Sasaki et al. (2013) include the RER in the target income shares of workers and firms, and they also include the rate of capacity utilisation in the former. They thus allow for feedbacks between the goods and labour markets, including a stable Phillips curve mechanism and a profit or wage squeeze distribution curve. The effects of the RER on the model variables are determined by key parameters corresponding to those of the model of Blecker (2011). Vera (2014) assumes exogenous distribution targets and a monetary authority with both external balance and inflation stabilisation objectives, and that this authority resorts to the nominal exchange rate and the interest rate as policy instruments. The conflict inflation module of the model incorporates feedback of aggregate demand through the effect on workers´ bargaining power of changes in the unemployment rate, which is a function of the RER and the nominal interest rate. RER depreciations have a positive impact on the balance of payments and increase inflation, while the final effect on employment is mediated by the monetary authority's reaction to rising prices. Morlin (2023) presents a two-

[3] Bastian and Setterfield (2020) have already pointed out this inconsistency.

sector model along a Classical-Keynesian approach with a real wage rate target for workers that includes the unemployment rate but not the RER and no explicit firms' income target. Here, the distribution conflict is between real wages and the RER target of the monetary authority, which can also be expressed as a real wage target. The RER is a key distributive variable in this model, which is determined by the interaction between nominal exchange rate changes that affect income distribution and price inflation, and the wage bargaining and inflation processes. Last, Campana (2024) proposes an alternative for the wage inflation equation that does not include the RER in the target wage share of workers. However, like Sasaki et al. (2013), he introduces the rate of capacity utilisation in the workers target, gets a stable Phillips curve and similar effects for changes in the RER.

The model by Bastian and Setterfield (2020) is the first one in our survey that does not include an RER-targeting mechanism, nor does it relate aggregate demand to income distribution. The RER is taken as exogenously given, and the nominal exchange rate acts as a residual variable that is subject to transitory shocks. Workers' and firms' income targets are affected by the RER. The introduction of endogenous changes in the bargaining power of workers after crossing a certain inflation threshold, and the consequent retaliation by firms, opens the possibility of permanent inflationary effects as a result of transitory nominal exchange rate shocks, in what they call a 'strato-inflation regime'.

In the second group of models, we then have those with an exogenously given nominal exchange rate, determined by international monetary factors or by debt dynamics, and the RER then becomes endogenous with respect to domestic inflation. Bortz et al. (2018, 2022) model the nominal exchange rate as determined by the evolution of foreign debt in the domestic economy. These models leave aside the feedback between aggregate demand and income distribution and inflation. Hence there is no Phillips curve. The latter is also true for Charles and Marie (2016), who explain the emergence of hyperinflation for a fixed nominal exchange rate in a small open economy. In their model, firms' expectations about the nominal exchange rate, related to foreign indebtedness, and wage indexation are crucial for reaching a hyperinflationary regime. Firms' reaction or anticipation of a devaluation and workers' response to it may lead to an exchange rate-inflation spiral, given that price increases could generate renewed pressure on the exchange rate that would trigger an additional reaction from firms and workers. The model of Vera (2010) introduces an external balance, an internal balance, and an aspiration equilibrium, and shows how an exogenous external shock (e.g., a sudden stop or higher external interest payments) may lead to balance of payments disequilibrium, distribution conflict and inflation. Different alternative setups are analysed: a canonical model with price-sensitive demand functions for exports and imports; an alternative trade structure with imported intermediate inputs; and flexible mark-ups that take into account international competition. Cassetti (2002) also presents a model with an endogenous RER. The target incomes of workers and firms include the rate of capacity utilisation, as in many closed economy conflict inflation models, while the RER enters the model only through the structure of trade. There is a stable Phillips curve and alternatively a profit or wage squeeze distribution curve. In Cassetti's (2012) model, the RER is endogenous while the

nominal exchange rate is fixed by the government or financially determined. Workers' and firms' targets depend on the dynamics of economic activity, i.e. employment growth and capital stock growth, respectively. With incomplete wage indexation, the model has stable Philips and profit squeeze distribution curves.

An alternative approach to conflict inflation modelling in an open economy based on the Hein/Stockhammer approach, has been put forward by Hein (2023, chap. 5, 2024). As for the closed economy version of the model, adaptive inflation expectations in the wage-setting equation are assumed, but different from the closed economy version pass-through of wage inflation to price inflation can be complete, and a 'Stable Inflation Rate of Employment' (SIRE) is derived.[4] With inconsistent claims, the model does not reach equilibrium inflation or distribution and the Phillips curve is unstable, as is the distribution curve. Furthermore, the consistent claims equilibrium becomes endogenous not only with respect to aggregate demand, but also to economic policies and the RER which affects the wage share target of firms. The nominal exchange rate is treated as exogenous which makes the RER fully endogenous to domestic price inflation. Changes in the RER have demand and employment effects, on the one hand, and distribution effects via the target wage share of the firms, on the other hand. The model can generate stable and unstable scenarios, depending on parameter values.

Table 1 summarises the main features of the different post-Keynesian open economy conflict inflation models, referred to in this section, according to the treatment of the exchange rate, the nature of the Phillips and distribution curves, the inclusion of price indexation and/or expectations, the definition of workers' and firms' income targets, and the implications for the equilibrium of the model.

In what follows, building on this review, we will integrate RER targeting into the model proposed by Hein (2023, chap. 5, 2024) with unstable Phillips and distribution curves and thus fill a gap in the literature.

[4] The concept of a SIRE must not be confused or identified with the NAIRU in the 'New Consensus Macroeconomics' framework. It is neither an exogenously given equilibrium uniquely determined by labour market and wage bargaining conditions nor can it generally be achieved by inflation targeting interest rate policies of the central bank (Hein 2006, 2023, chap. 5, Stockhammer 2008, Hein and Stockhammer 2010, 2011).

Table 1 Post-Keynesian open economy conflict inflation models

Papers / Chapters	Exchange rate	Phillips curve	Distribution curve	Price indexation / expectations	Workers' target	Firms' target	Equilibrium
Blecker (2011)	RER targeting	n.a.	No feedback of aggregate demand into distribution	No indexation	Does not include the RER, but wage inflation does	Includes the RER	Stable
Lavoie (2022, chap. 8)	RER targeting	n.a.	No feedback of aggregate demand into distribution	No indexation	Includes the RER	Includes the RER	Stable
Sasaki et al. (2013)	RER targeting	Stable	Profit or wage squeeze	No indexation	Includes the RER and the rate of capacity utilisation	Includes the RER	Stable parameter configurations
Vera (2014)	RER targeting	Stable	Profit or wage squeeze	Wages: incomplete indexation	Exogenous	Exogenous. Price inflation includes nominal exchange variations	Stable parameter configurations
Morlin (2023)	RER targeting	Stable	Profit squeeze	Wages: incomplete indexation	No RER, includes the unemployment rate	No explicit firms' target. Conflict between money wages and the RER	Stable parameter configurations
Campana (2024)	RER targeting	Stable	Profit squeeze	No indexation	No RER, includes the rate of capacity utilisation	Includes the RER	Stable parameter configurations
Bastian and Setterfield (2020)	Given RER, floating nominal exchange rate as a residual but subject to shocks	n.a.	No feedback of aggregate demand into distribution	No indexation	Includes the RER	Includes the RER	Potentially unstable, regimes
Bortz et al. (2018, 2022)	Nominal exchange rate determined by the evolution of foreign debt, endogenous RER	n.a.	No feedback of aggregate demand into distribution	No indexation	Exogenous	Incl. private foreign debt weighted by debt services and exchange rate movements	Stable parameter configurations, regimes
Charles and Marie (2016)	Fixed nominal exchange rate, endogenous RER	n.a.	n.a.	Wages: constant real wage	n.a.	No RER, includes the nominal interest rate on foreign debt. Price inflation includes nominal exchange rate expectations and excess demand	Multiple equilibria, potentially unstable
Vera (2010)	Fixed or flexible exchange rate, RER as adjusting variable	Stable	Wage squeeze or no relation	Full pass-through of nominal wage changes to prices	No RER, includes real output. The nominal wage indirectly includes the RER	No explicit firms' target, fixed or flexible mark-up	Stable parameter configurations

Papers / Chapters	Exchange rate	Phillips curve	Distribution curve	Price indexation / expectations	Workers' target	Firms' target	Equilibrium
Cassetti (2002)	Fixed or flexible nominal exchange rate, endogenous RER	Stable	Profit or wage squeeze	No indexation	No RER, includes the rate of capacity utilisation	No RER, includes the rate of capacity utilisation	Stable parameter configurations
Cassetti (2012)	Nominal exchange rate fixed by the government or financially determined, endogenous RER	Stable	Profit squeeze	Wages: incomplete indexation	No RER, includes the rate of change of employment	No RER, includes the rate of growth of capital. Price inflation includes the RER	Stable parameter configurations
Hein (2023, chap. 5)	Endogenous RER, exogenous nominal exchange rate given by monetary policies and international financial factors	Unstable	Profit squeeze	Complete indexation/adaptive expectations	No direct effect of the RER, includes the employment rate	Includes RER effects with lags, only pass through of persistent changes	Stable and unstable cases
Hein (2024)	Endogenous RER, exogenous nominal exchange rate given by monetary policies and international financial factors	Unstable	Profit squeeze	Complete indexation/adaptive expectations	No direct effect of the RER, includes the employment rate	Includes the RER, immediate pass through	Stable and unstable cases
Our model	Endogenous RER and RER targeting variations	Unstable	Profit squeeze	Complete indexation/adaptive expectations	No direct effect of the RER, includes the employment rate	Includes the RER, immediate pass through	Stable and unstable cases

Note: 'n.a.' denotes not applicable. Source: authors' presentation.

3. A basic open economy model of conflict inflation with unstable Phillips and distribution curves

The core of our model to be developed in this section is centred around three employment rates associated with different equilibria: a goods market equilibrium rate of employment (GERE) related to the IS equilibrium (e), a stable inflation rate of employment (SIRE) which constitutes a distribution claims equilibrium (e^N), and finally an employment rate associated with external balance (e^B), an external balance rate of employment (EBRE). We start by recapitulating the basic features of a Kaleckian open economy model, as presented by Hein (2023, chap. 5), based on Hein and Vogel (2008),[5] and then we will introduce our three equilibrium employment rates. We assume a small open economy which imports raw materials and semi-finished goods for production purposes and which exports part of its output to the rest of the world. Cross-border capital and labour flows are not considered. Foreign prices and the domestic technical coefficients of production are exogenously given. The nominal exchange rate is also treated as exogenously given, and is not responding to foreign trade flows. In Section 5, we will assume that the nominal exchange can be affected by exchange rate policies in order to adjust the RER.

3.1 Pricing and distribution in the open economy

Following Kalecki (1954, chaps 1–2, 1971, chaps 5–6), it is assumed that firms in industry and services set prices by a mark-up on constant unit variable costs. The mark-up is determined by the degree of price competition, overhead costs, and the bargaining power of trade unions. Changes in the real rate of interest may have an impact on the mark-up through the overhead cost effect. However, to keep the analysis as simple as possible with a focus on the open economy properties, we exclude interest rates as well as real debt effects from the model. In a basic open economy version of this model prices are thus set as:

$$(1) \qquad p = (1+m)\left(\frac{W}{Y} + p_f a \frac{M}{Y}\right) = (1+m)\left(\frac{w}{y} + p_f a \mu\right), \qquad m > 0$$

with p for domestic prices, m for the mark-up, W for nominal wages, Y for real output, a for the nominal exchange rate[6], M for imported raw materials and semi-finished products, p_f for prices of imported foreign goods in foreign currency, w for the nominal wage rate, y for labour productivity, and μ for the raw material and semi-finished products-output ratio. Defining the ratio z of unit imported material to unit labour costs as:

$$(2) \qquad z = \frac{p_f a \mu}{\frac{w}{y}}$$

[5] The foundations of Kaleckian open economy distribution and growth models can be found in particular in Blecker (1989). Also Bhaduri and Marglin (1990) have considered open economy effects for wage-/profit-led demand and growth in their model.

[6] The nominal exchange rate is defined here as the amount of domestic currency worth one unit of foreign currency. Therefore, a rise in the nominal exchange rate means a depreciation and a fall an appreciation.

the profit share (h), including overheads costs within nominal profits (Π), in domestic value added is given by:

$$(3) \qquad h = \frac{\Pi}{pY} = \frac{\Pi}{\Pi+W} = \frac{m\frac{w}{y}(1+z)}{m\frac{w}{y}(1+z)+\frac{w}{y}} = \frac{m(1+z)}{m(1+z)+1} = \frac{1}{\frac{1}{m(1+z)}+1}$$

The domestic profit share including overheads, and hence the domestic wage share of direct labour ($\Omega = 1 - h$), thus depend on:

- The mark-up and its determinants, i.e. the degree of competition, overhead costs and the bargaining power of trade unions,
- the ratio of unit imported raw material costs to unit direct wage costs, i.e. the nominal exchange rate, the foreign price level, and the domestic wage rate or nominal unit labour costs, and
- the firm composition of industries and the sectoral composition of the domestic economy, because mark-ups and z-ratios will vary across firms and sectors.

With given technical conditions of production (constant y and μ), domestic prices and profit shares will thus rise simultaneously, if the mark-up, the nominal exchange rate, or the foreign price level rise, or if the firm and sectoral composition shifts towards high profit share firms and sectors. If the increase in the profit share is caused by a fall in the nominal wage rate, it will be associated with a fall in the domestic price level.

Thus, even with a constant mark-up, a rise in the profit share is possible, either through a real devaluation of the domestic currency (falling nominal wages, rising foreign prices or a nominal devaluation), or through a change in the firm and sectoral composition of the domestic economy towards higher profit share sectors and firms.[7]

Rising workers' bargaining power and rising money wages can affect distribution at a given level of output through two main channels. First, even with a constant mark-up, rising nominal wages will raise the domestic wage share by means of lowering the z-ratio, but also increase the domestic price level, however, less than the domestic wage rate (or domestic unit labour costs, if we take into account rising labour productivity). Second, as pointed out by Kalecki (1971, chap. 14) in 'Class struggle and distribution of national income', and in line with the determinants of the mark-up listed above, an increase in money wages may squeeze the mark-up, in which case we will see an increase in the wage share and in the price level.

[7] Furthermore, with overhead labour and mark-up pricing on constant unit variable costs (or target rate of return pricing on unit normal costs), the profit share excluding overhead labour salaries varies pro-cyclically with output (Lavoie 2022, chap. 3.6, 5.5, 2024, Hein 2023, pp. 77–78). The total wage share for direct and overhead labour thus moves counter-cyclically, and the overhead labour share in total compensation of employees varies counter-cyclically, too.

3.2. Goods market, distribution claims and external balance equilibrium rates of employment

This section introduces the goods market equilibrium, the distribution claims equilibrium and the external balance equilibrium employment rates.

The goods market equilibrium rate of employment (GERE)

In this contribution, we do not explicitly model the goods market equilibrium based on saving, investment and net export functions, as in Hein (2023, chap. 5), but just use the main properties of this equilibrium derived there for our purposes. The goods market equilibrium level of income (Y) and the respective employment rate ($\mathrm{e} = \mathrm{N}/\mathrm{L}$), with N for the level of employment, are positively related to each other, because the labour force (L) and labour productivity ($\mathrm{y} = \mathrm{Y}/\mathrm{N}$) are given in the short run:

$$(4) \qquad \mathrm{e} = \frac{\mathrm{N}}{\mathrm{L}} = \frac{\mathrm{N}}{\mathrm{Y}}\frac{\mathrm{Y}}{\mathrm{L}} = \frac{\mathrm{Y}}{\mathrm{yL}} = \mathrm{qY}$$

with $\mathrm{q} = 1/(\mathrm{yL})$ as a constant.

In line with most of the empirical estimations of Kaleckian distribution and growth models applying the structural or single-equations estimation approach,[8] we have that domestic demand is wage-led and, with constant labour productivity, employment is thus wage-led, too. The RER has positive effects on aggregate demand and employment if the Marshall-Lerner condition holds and net exports are positively affected by a rise in the RER, i.e. by a real depreciation of the domestic currency.[9] However, there is also an indirect negative effect of the RER on aggregate demand and employment, because a depreciation raises the ratio z and lowers the wage share, which has a negative impact on domestic demand and hence the employment rate. Depending on the relative magnitudes of these effects, total demand and thus employment may hence either be wage- or profit-led. This yields the following for the GERE:

$$(5) \qquad \mathrm{e} = \mathrm{e}(\Omega, \mathrm{a_r}), \qquad \frac{\partial \mathrm{e}}{\partial \Omega} > 0, \ \frac{\partial \mathrm{e}}{\partial \mathrm{a_r}} > 0, \frac{\partial \mathrm{e}}{\partial \Omega}\frac{\partial \Omega}{\partial \mathrm{a_r}} < 0$$

Distribution claims equilibrium: the stable inflation rate of employment (SIRE)

Turning to distribution conflict and inflation in our model, we assume that workers first set nominal wages at the beginning of a period and then firms follow and set prices within that

[8] For multi-country studies making use of the structural estimation approach, see Naastepad and Storm (2007), Hein and Vogel (2008), Hartwig (2014), Onaran and Galanis (2014), Onaran and Obst (2016), Stockhammer and Wildauer (2018), and De Oliveira and Souza (2021). For a discussion of different estimation approaches and the different results, see Blecker (2016). See also the reviews in Stockhammer and Onaran (2013), Hein (2014, chap. 7) and Stockhammer (2017).

[9] For a balanced discussion on the empirical relevance of the RER for export and imports, see recently Blecker (2023).

period. We assume that both do so in order to reach their distribution targets in terms of wage or profit shares.[10] Worker's bargaining power and their target wage share (Ω_W^T),respectively their target profit (h_W^T), depend on the structure of the labour market and the social benefit system (union density, wage bargaining coverage, wage bargaining co-ordination, employment protection legislation, minimum wages, unemployment benefits, etc.) and is positively affected by the level of economic activity and hence the employment rate (e). For our analysis, we acknowledge that workers usually buy from domestic firms even if they consume imported goods. Therefore, the RER does not enter into the worker's target wage share, and workers' nominal wage setting will only respond when firms' price setting has taken into account changes in the RER (Hein 2024):

$$(6) \qquad \Omega_W^T = 1 - h_W^T = \Omega_0 + \Omega_1 e, \qquad 1 > \Omega_0 > 0,\ \Omega_1 \geq 0$$

with Ω_0 indicating a certain minimum wage and the related wage share and Ω_1 how much the target responds to the employment rate. Both are determined by the structural features of the labour market, the wage bargaining and the social benefits system.

From the profit share in the open economy depicted in equation (3), it follows that firms' target wage share (Ω_F^T), respectively their target profit share (h_F^T), is determined by firms' target mark-up and the ratio z. For a constant technology and nominal wage rate, z is affected by foreign inflation and the nominal exchange rate. Defining the RER (a_r) as:

$$(7) \qquad a_r = \frac{a p_f}{p}$$

assuming constant production coefficients, an increase in the ratio z is associated with a real depreciation, and a rise in the profit share even with a constant mark-up. Conversely, a decrease in the ratio z implies a real appreciation, and a fall in the profit share, again assuming a constant mark-up. Therefore, we can take firms' target wage share to be co-determined by the expected RER (a_r^e), as in the open economy models by Bastian and Setterfield (2020), Blecker (2011), Hein (2023, chap. 6) and Lavoie (2022, chap. 8), in a negative way:[11]

$$(8) \qquad \Omega_F^T = 1 - h_F^T = 1 - h_0 - h_1 a_r^e, \qquad h_0, h_1 > 0$$

[10] It should be noted that in an open economy model with constant labour productivity, targeting the wage share is not the same as targeting the real wage rate, different from a closed economy model. A rise in the RER means, cet. par., lower real domestic income. If we assume that workers are targeting a certain real wage rate, this implies they claim a higher wage share in now lower real domestic income. We opt for including the wage share as a target also for reasons of comparability and simplicity. This assumption implies that workers are targeting a certain wage share, a real depreciation means that they are willing to accept a lower real wage rate. In other words, they are willing to share the burden imposed on the economy by higher imported goods prices.

[11] It would be theoretically well-justified to also include the (expected) real interest rate as a determinant for firms' wage share target as in Hein (2023, chap. 5). However, since the real interest rate is not at the centre of this paper, as pointed out above, we refrain from doing so for the sake of keeping the model as simple as possible.

with h_0 capturing the effect of the mark-up on the target profit share and hence dependent on its determinants, while h_1 captures the positive effect of the RER on the target profit share. The expected RER is defined as follows:

$$(9) \qquad a^e_{r,t} = \frac{a^e_t p^e_{f,t}}{p^e_t} = \frac{a_{t-1} p_{f,t-1}}{p_{t-1}}$$

We assume throughout our model that foreign price inflation and the nominal exchange rate are exogenous, the latter potentially affected by currency policies, as will be seen in Section 5. Given that changes in the expected RER are influenced by expectations of both nominal exchange rate developments and foreign price inflation, as well as domestic price inflation, for consistency we consider that all these rates affect RER expectations through adaptive expectations.[12] The change in the expected real exchange thus becomes:

$$(10) \qquad \hat{a}^e_{r,t} = \hat{a}^e_t + \hat{p}^e_{f,t} - \hat{p}^e_t = \hat{a}_{t-1} + \hat{p}_{f,t-1} - \hat{p}_{t-1}$$

Hence, an increase in imported prices (or inflation), relative to domestic wages and prices (or inflation), raises the RER and lowers the firms' target wage share.

Setting workers' wage share target from equation (6) equal to that of firms from equation (8) and solving for the employment rate yields the consistent claims rate of employment, the SIRE:

$$(11) \qquad e^N = \frac{1 - h_o - h_1 a^e_r - \Omega_0}{\Omega_1}$$

At $e = e^N$, workers' and firms' targets will be equal and, as we will see, inflation will be stable. With $e > e^N$, we have a positive aspiration gap, i.e. the workers' target wage share exceeds the firms' target, and workers try to improve the wage share, for given labour productivity, by raising nominal wage inflation above expected price inflation, i.e. last period's inflation. For $e < e^N$, we have a negative aspiration gap, i.e. the workers' target wage share falls short of the firms' target, and workers are too weak to keep wage inflation in line with expected price inflation. For wage inflation in period t, we thus get:

$$(12) \qquad \hat{w}_t = \omega(e_t - e^N) + \hat{p}^e_t = \omega(e_t - e^N) + \hat{p}_{t-1}, \qquad \omega \geq 0$$

[12] The concept of adaptive expectations used here and the associated linearity represent a considerable simplification of actual expectations formation. See Woodgate (2025) for a post-Keynesian conflict inflation model for a closed economy, in which inflation expectations interact with the difference between target and actual distribution, leading to nonlinear wage and price inflation curves.

Here, ω indicates by how much nominal wage growth responds to bargaining power of workers. For excess wage inflation, $\hat{w}^x$, that is the difference between wage inflation and expected price inflation, this yields:

(13) $$\hat{w}_t^x = \hat{w}_t - \hat{p}_t^e = \hat{w}_t - \hat{p}_{t-1} = \omega(e_t - e^N)$$

For price inflation, we assume complete pass-through of total wage inflation as this does not change the main properties of the model.[13] Based on the pricing equation (1), with a constant mark up and technology, we get for price inflation:

(14) $$\hat{p}_t = \xi_1 \hat{w}_t + \xi_2(\hat{p}_{f,t} + \hat{a}_t) = \xi_1[\omega(e_t - e^N) + \hat{p}_{t-1}] + \xi_2(\hat{p}_{f,t} + \hat{a}_t)$$

with $\xi_1 = \frac{(1+m)\frac{w}{y}}{p}$, $\xi_2 = \frac{(1+m)p_f a \mu}{p}$, and hence $\xi_1 + \xi_2 = 1$. Due to $\xi_1 < 1$, wage inflation may exceed price inflation even though it is fully passed on, provided that it exceeds the sum of foreign inflation plus the growth rate of the nominal exchange rate. Unexpected inflation, $\hat{p}^u$, that is the difference between actual and expected inflation is then given by:

(15) $$\hat{p}^u = \hat{p}_t - \hat{p}_t^e = \hat{p}_t - \hat{p}_{t-1} = \xi_1 \omega(e_t - e^N) + \xi_2(\hat{p}_{ft} + \hat{a}_t - \hat{p}_{t-1})$$

If we start from a situation in which past period's domestic inflation is exactly compensated by foreign inflation and the rate of change of the nominal exchange rate, unexpected price inflation will fall short of excess wage inflation. Thus, we will see a profit-squeeze distribution curve in the employment rate-wage share space:[14]

(16) $$\Omega = \Omega(e, \Omega_0, \Omega_1, a_r^e, h_0, h_1, \hat{p}^u), \quad \frac{\partial \Omega}{\partial e}, \frac{\partial \Omega}{\partial \Omega_0}, \frac{\partial \Omega}{\partial \Omega_1}, \frac{\partial \Omega}{\partial \hat{p}^u} > 0, \frac{\partial \Omega}{\partial a_r^e}, \frac{\partial \Omega}{\partial h_0}, \frac{\partial \Omega}{\partial h_1} < 0$$

Because wage inflation is only a part of price inflation, the realised wage share will generally be affected positively by a rise in the workers' target wage share (equation 6) and negatively by a rise in firms' target profit share (equation 8). Therefore, changes in the parameters in these equations have the respective effects on the realised wage share in equation (16), with $\Omega_0, \Omega_1, h_0, h_1$ and a_r^e as shift parameters for the profit squeeze distribution curve in employment rate-wage share space. Furthermore, we include unexpected inflation among the determinants of the realised wage share to account for the rotation of the distribution curve towards the workers' target wage share that occurs when the GERE is above the SIRE, and therefore positive unexpected price inflation is surpassed by excess wage inflation, leading to

[13] In closed economy inflation models, for distribution to change, an incomplete pass-through of wage inflation onto price inflation is necessary. In open economy models this is not necessarily needed. See, for example, Hein (2023, chap. 5).

[14] For a more explicit and detailed derivation of the realised distribution function see Hein (2023, chap. 5).

an increase in the wage share.[15] Hence, this should be interpreted as the joint appearance of unexpected inflation and increases in the wage share rather than unexpected inflation causing a higher wage share.

External equilibrium: the external balance rate of employment (EBRE)

Having introduced the GERE and the SIRE, we also introduce an employment rate associated with external balance equilibrium, i.e. a balanced trade, since we do not include cross-border factor payments. We call this employment rate EBRE (e^B). To derive e^B, we look at the determinants of real net exports (NX_r), being the difference of real exports (X) and real imports (M) multiplied by the RER:

$$(17) \quad NX_r = X - a_r M = \psi a_r + \chi Y_f - \phi Y, \quad \psi, \chi, \phi \geq 0$$

Net exports are directly positively affected by the RER provided that the Marshall-Lerner condition holds, as the first term on the right-hand side shows. Furthermore, foreign income Y_f has a positive effect on net exports as it increases demand for exports, as the second term shows. Finally, net exports are negatively affected by domestic income, as it induces higher import demand.[16]

To derive e^B, we set equation (17) equal to zero and use equation (4) for the relationship between output and the employment rate:

$$(18) \quad e^B = \frac{q(\psi a_r + \chi Y_f)}{\phi}$$

The EBRE is thus positively related to the RER. Furthermore, if $e > e^B$, the economy will run a trade deficit, while $e < e^B$ is associated with a trade surplus.

4. Equilibrium, shocks and stability

4.1. Overall equilibrium

The stylised open economy model is shown in Figure 1. The upper part depicts the employment-distribution space. The employment function (5) has a positive slope since we have wage-led domestic demand in our model economy. The RER affects the employment curve as a shift parameter. We also have the target wage share curves of workers and firms from equations (6) and (8), and the profit-squeeze distribution curve from equation (16). The

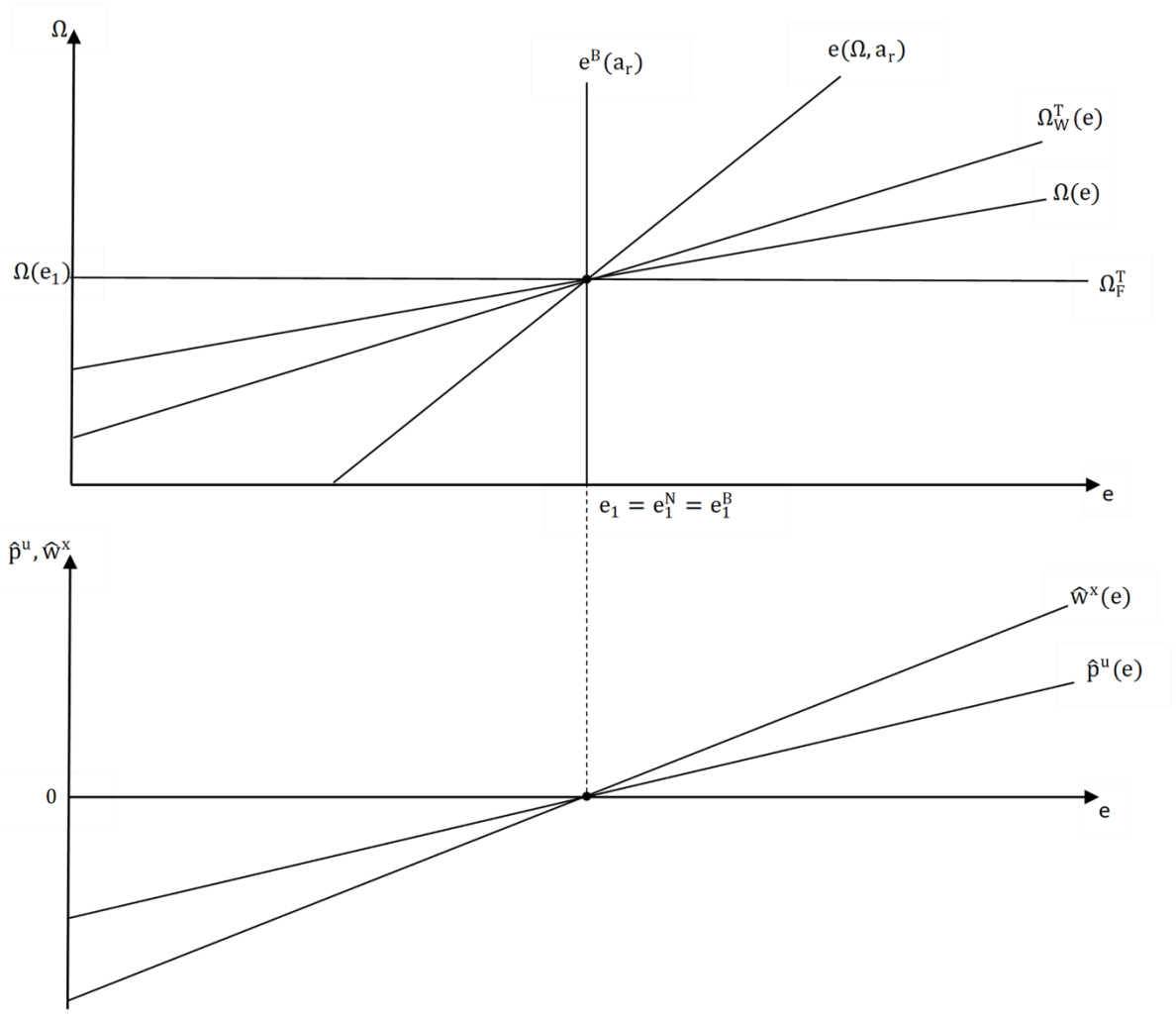
[15] Of course, also an employment rate below the SIRE will rotate the distribution curve towards the workers' target curve since excess wage inflation will be lower that unexpected price inflation.

[16] Ψ captures the Marshall-Lerner condition and indicates the marginal effect of changes in the real exchange rate on the level of net exports. It is thus positively affected by exports' and imports' price sensitivity. The coefficients χ and ϕ are conceptually close to the income elasticities of import and export demand, respectively, as they both relate changes in income to changes in import or export demand. However, χ and ϕ indicate the marginal effects of changes in the level of both variables while income elasticities describe the effect of growth rates of income on the growth rates of demand.

intersection of the target wage share curves of workers and firms determines the distribution claims equilibrium, the SIRE (e^N), while the intersection of the employment curve and the distribution curve determine a temporary distribution-employment equilibrium at the GERE. The stability of the latter requires the employment curve to be steeper than the distribution curve, as shown by Blecker and Setterfield (2019, pp. 225–229). Finally, the EBRE (e^B) is determined by exogenous factors and the endogenous RER as a shift parameter and is thus a vertical line in the employment-distribution space. In Figure 1, the economy is 'by a fluke' in overall equilibrium, thus we have $e_1 = e_1^N = e_1^B$.

Meanwhile, the lower part of Figure 1 depicts the employment-inflation space in terms of excess wage inflation and unexpected price inflation from equations (13) and (15) which are each zero if $e = e^N$. Both are upward sloping, with excess wage inflation being steeper and thus higher (lower) than unexpected inflation when actual employment is above (below) the SIRE.

Figure 1: An open economy model of conflict inflation –overall equilibrium



Before exploring shocks, we should clarify the sequencing in our model again. First, demand and employment arise based on autonomous demand and expected, thus last period's, realised inflation and hence distribution and the RER. This employment level forms the basis of the wage and price setting process, along with workers' and firms' expectations about inflation, the RER, and the resulting distribution targets, which determine the economy's SIRE. If the actual employment rate is equal to the SIRE, no unexpected inflation will arise. However, if actual employment differs from the SIRE, we will see unexpected inflation and changes in distribution and the RER, resulting in demand and employment effects that give rise to the period's final employment rate and wage share.[17]

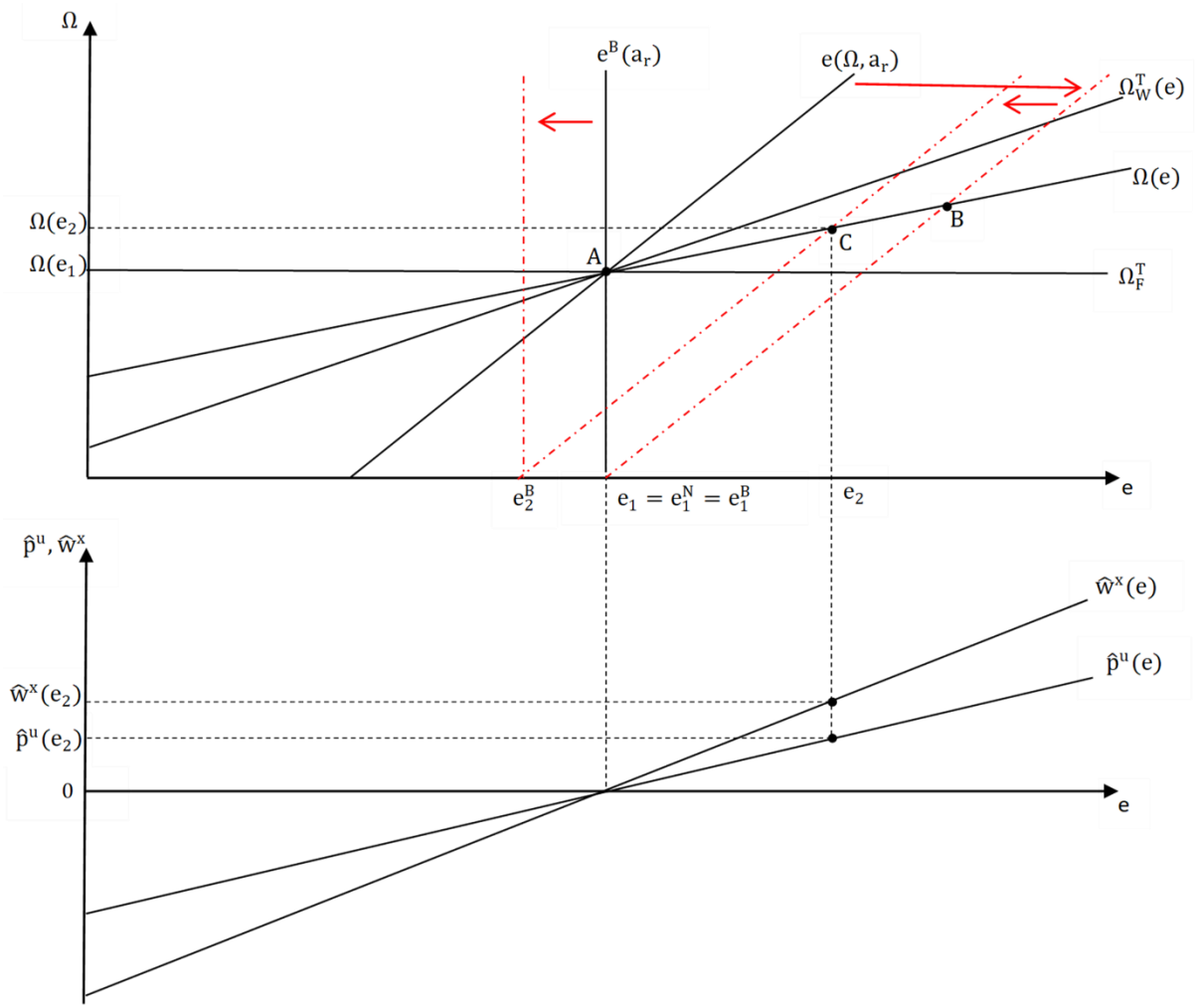
Next, we will analyse two kinds of shocks to the model: 1) a positive aggregate demand shock and 2) an adverse external shock. We will see that the position of the new equilibrium depends crucially on whether the endogenous distribution equilibrium is stable, i.e. whether deviations of actual employment from the distribution equilibrium will lead back to the SIRE endogenously. The last sub-section analyses the condition for stability formally.

4.2. Positive aggregate demand shock

First, we analyse a positive aggregate demand shock triggered, for instance, by a rise in autonomous investment. In the upper part of Figure 2, starting from the overall equilibrium in point A, this leads to a rightward shift of the employment curve. The increase in employment leads to an increase in the bargaining power of workers. To achieve their higher wage share target, workers increase nominal wage inflation above expected price inflation so that positive excess wage inflation emerges. Although firms pass higher wage costs fully onto prices, unexpected inflation falls short of excess wage inflation and the wage share rises. Hence, the positive demand shock increases demand not only directly but also further through its positive effect on the wage share so that the economy arrives at point B. Since in point B the GERE is greater than the SIRE, unexpected inflation arises. As foreign price inflation and the nominal exchange are assumed to be constant, also the RER is affected. Consequently, the economy experiences a real appreciation. Assuming the Marshall-Lerner condition to hold, this loss in international price competitiveness shifts the employment curve to the left and the economy arrives at a temporaray employment-distribution equilibrium in point C at e_2 and $\Omega(e_2)$. Finally, the real appreciation triggered through the unexpected inflation also lowers the EBRE from e_1^B to e_2^B in Figure 2. Hence, after the first period following the positive aggregate demand shock, our economy finds itself in point C at e_2, that is a higher GERE than initially, accompanied by a higher wage share, positive excess wage inflation and unexpected inflation, the GERE hence exceeds the SIRE, and the economy presents an appreciated real exchange associated with a trade deficit as the GERE is also higher than the EBRE. We therefore have GERE > SIRE > EBRE.

[17] This procedure of analysis has been introduced by Hein and Stockhammer (2010) and is also explained in detail in Hein (2023, chap. 5), distinguishing between ex ante (beginning of the period) equilibrium based on adaptive expectations regarding inflation and ex post (end of period) equilibrium including realised inflation, associated re-distribution of income and the respective demand effects.

Figure 2: An open economy model of conflict inflation – positive aggregate demand shock: initial reaction



Note: The red broken lines show the initial effect of a positive aggregate demand shock.

For what happens in the following periods, we distinguish a stable from an unstable case. We start with the stable case depicted in Figure 3 where the black lines indicate the position of the economy one period after the shock, as depicted in Figure 2. First, we have to account for the change in the expected RER following the real appreciation due to positive unexpected inflation, which cheapens imported raw material and semi-finished products in relative real terms. Accordingly, firms raise their target wage share as indicated by equation (8), thus also the SIRE rises (equation (11)), and we get a higher realised wage share for every employment rate (equation (16)). In Figure 3, this shows as an upward shift of the Ω_F^T and the Ω-curve and an increase from e_1^N to e_2^N. Furthermore, the distribution curve rotates towards the workers' target wage share curve as for any $e > e^N$ excess wage inflation surpasses unexpected inflation and thus leads to a rising wage share for any employment rate exceeding the SIRE. The rise in the SIRE also shows in the lower part of Figure 3 where the unexpected price (15) and excess wage (13) inflation curves shift downwards. Due to the unexpected inflation

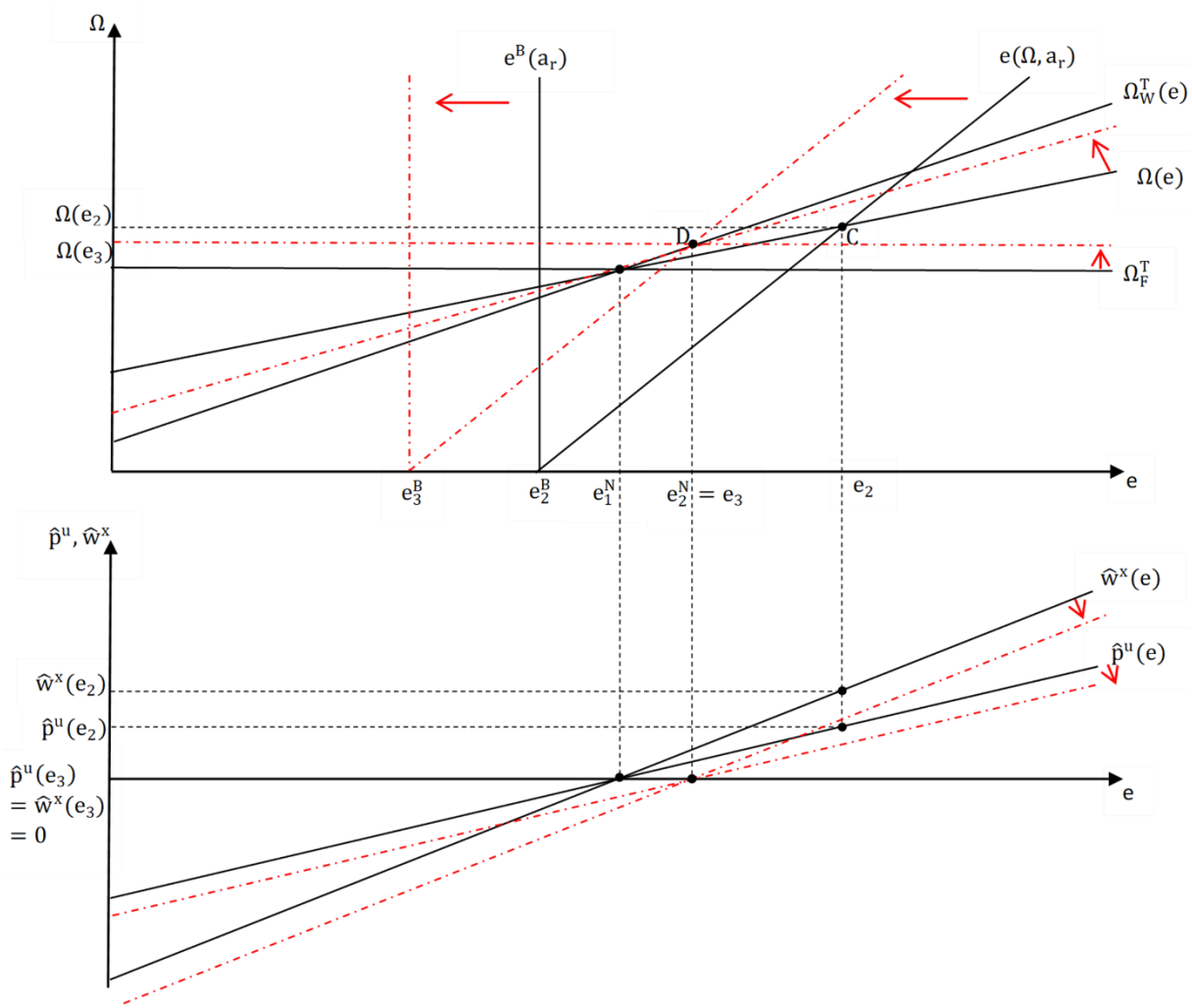
experienced at e_2, leading to domestic price inflation exceeding the sum of constant foreign price inflation and the zero-growth rate of the nominal exchange rate, real appreciation occurs and the employment curve shifts to the left. Employment thus falls and the economy moves towards the new SIRE, which itself increases due to the rise in the firms' target wage share as long as the real appreciation continues. Finally, a new equilibrium will be established at which the GERE is equal to the new SIRE. The ultimate position of this new equilibrium depends on the relative strength of the effects and the speeds of adjustment of both the GERE and the SIRE. In Figure 3, this new equilibrium is depicted in point D at $e_2^N = e_3$.[18] Unexpected inflation and excess wage inflation then disappear and wage and price inflation will be equal to the sum of foreign inflation and the rate of change of the nominal exchange rate again. In other words, with a constant nominal exchange rate, domestic price inflation will adjust to the exogenously given foreign price inflation again. Therefore, the RER will cease to appreciate and be constant again.

However, due to the appreciation along the way, the RER will be on a lower, i.e. a more appreciated, level than in the initial equilibrium. This means the EBRE will be lower. In Figure 3 this is depicted by the leftward shift of e^B, leading to a fall from e_2^B to e_3^B. Hence, although the economy finds itself ultimately in a simultaneous goods market and distribution claims equilibrium again, it will incur a trade deficit and hence an external disequilibrium.

In the stable case of Figure 3, the stabilising forces, which dampen actual employment through real appreciation via the net export channel and increase the SIRE through a higher firms' target wage share, outweigh the destabilising forces that move actual employment further away from the SIRE. These destabilising forces work through the positive effect of a higher wage share on domestic demand. This increase in the wage share has two components: First, the increase in the SIRE associated with the rise in the firms' target wage share curve induced by the real appreciation of the domestic currency means an upward shift in the distribution curve. Second, at a given SIRE, an employment rate exceeding the SIRE means that excess wage inflation exceeds unexpected price inflation and that the distribution curve rotates towards the workers' target wage share curve.

[18] This notation does not imply that the new equilibrium in the stable case establishes in the immediate period following the shock, but it may be the result of several periods.

Figure 3: An open economy model of conflict inflation – positive aggregate demand shock: stable case

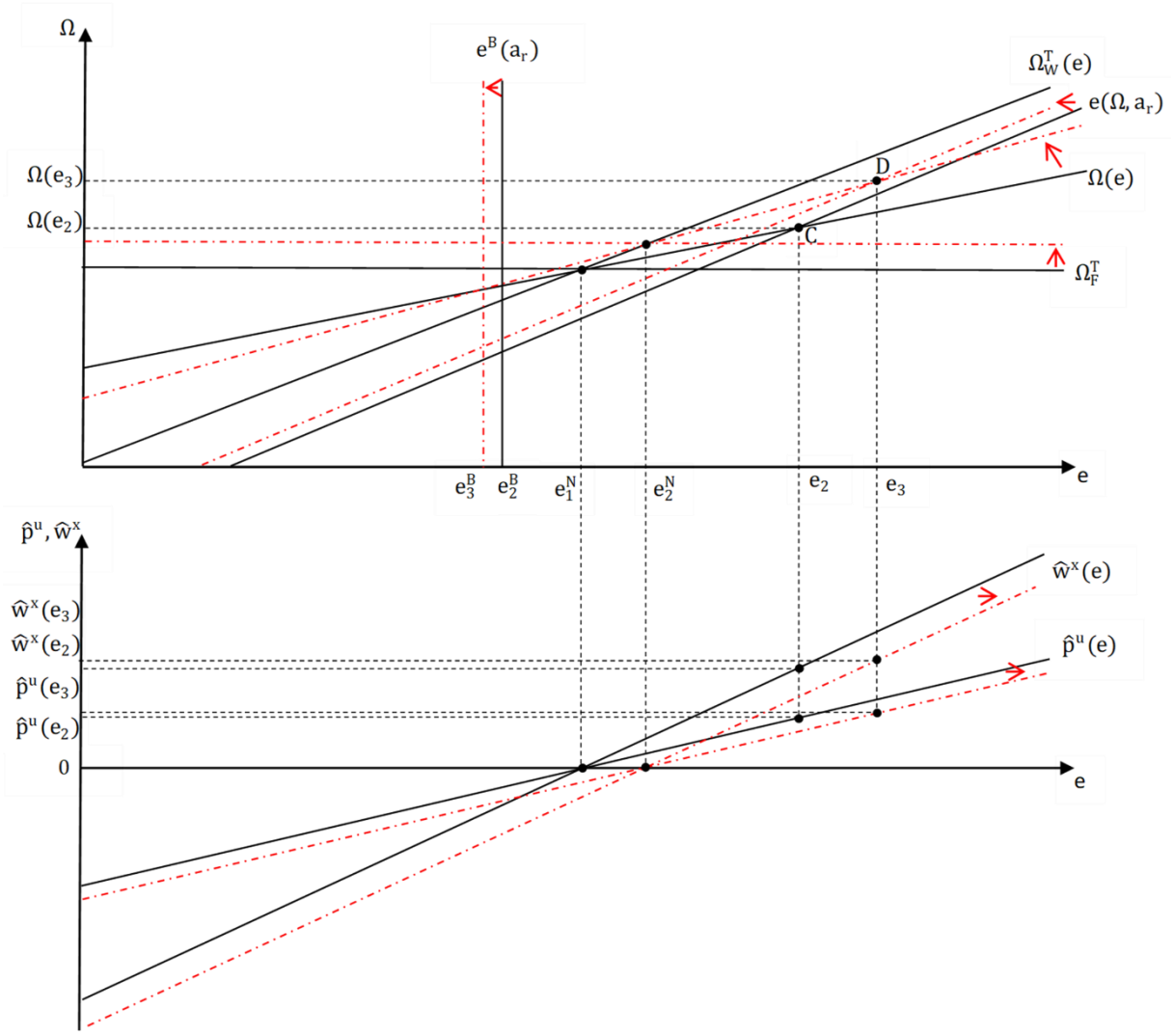


Note: The red broken lines show the responses after a positive aggregate demand shock.

In the unstable case, depicted in Figure 4, these destabilising forces dominate. The starting point is again C, the initial position following the shock depicted in Figure 2. As in the stable case, at e_2, firms increase their target wage share bringing the SIRE to e_2^N while the distribution curve shifts up and rotates towards workers' wage share target curve. The unexpected inflation and excess wage inflation curves shift to the right in the lower panel accordingly to the rise in the SIRE. Positive unexpected inflation causes real appreciation and shifts the employment curve to the left. However, different from the stable case, the new intersection of the employment and distribution curve in point D at e_3 is at a GERE higher than e_2 and the distance to the new SIRE has widened, thus, actual employment moves away from the SIRE. Since e_3 does not constitute a distribution claims equilibrium, unexpected inflation and real appreciation will persist. Graphically, this qualitatively different result is achieved by having a flatter employment curve the shift of which is less sensitive to changes in the RER. Put differently, while domestic demand is wage-led, both in the stable case in Figure 3 and in the

unstable case in Figure 4, total demand including the effects on net exports in Figure 3 turns profit led, while total demand in Figure 4 remains wage led. However, we will show in Section 4.4 while dealing with the general stability conditions of the SIRE, that even a slightly overall wage-led economy may display a stable SIRE, if the rise in the SIRE is stronger than the rise in the GERE, and the gap between the two closes over several periods. Finally, the economy in the unstable case is characterised by increasing trade deficits as the real appreciations continuously lower the EBRE, as shown in Figure 4 through the fall from e_2^B to e_3^B.

Figure 4: An open economy model of conflict inflation – positive aggregate demand shock: unstable case



Note: The red broken lines show the responses after a positive aggregate demand shock.

4.3. Adverse external supply shock

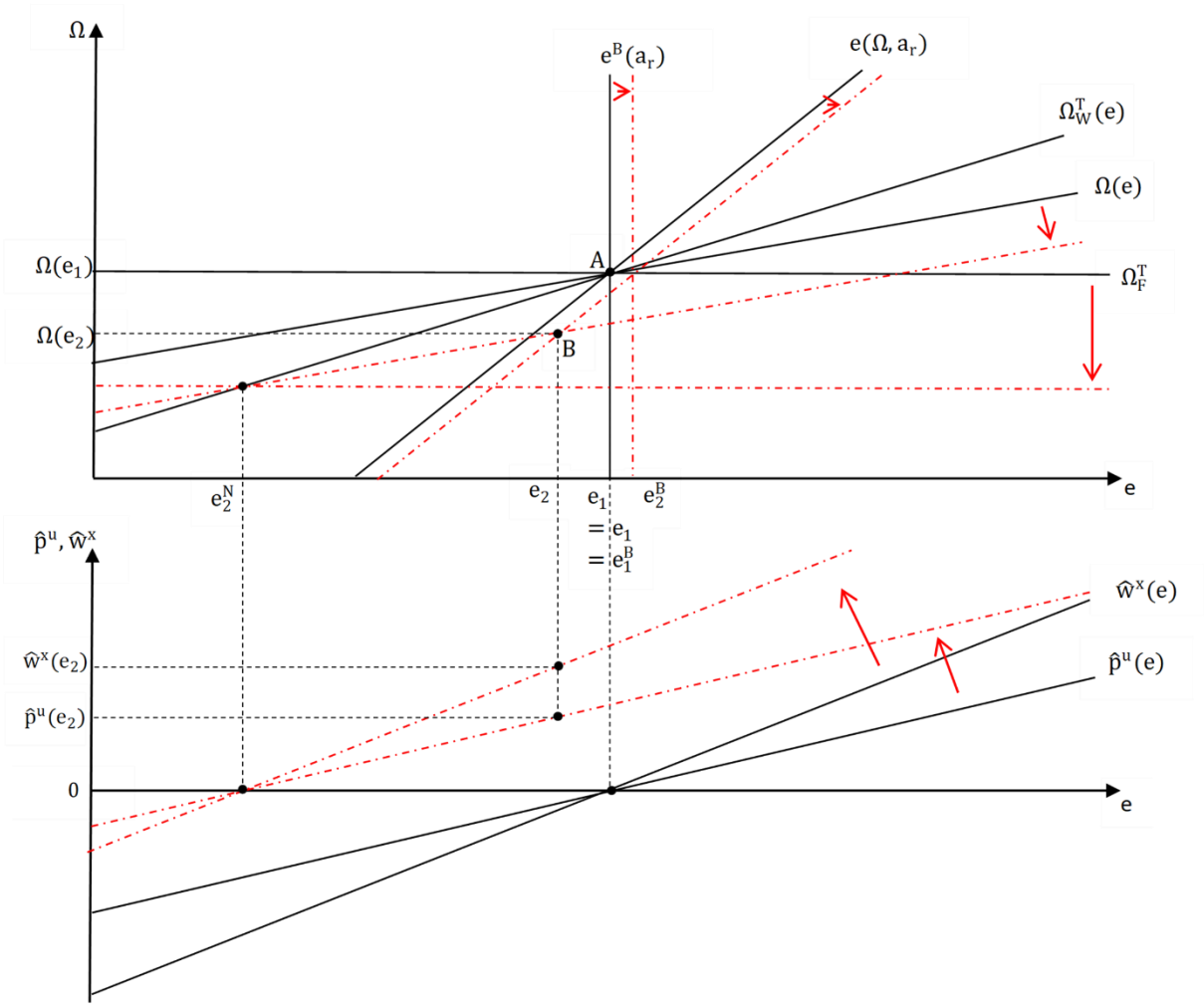
We now turn to the analysis of an adverse external supply shock, here a permanent increase in foreign inflation. Since we assume that workers do not directly import foreign consumption goods, the initial effect will depend on firms' behaviour. We assume that firms do not only

shift the increase in imported material prices to final output prices (equations (14) and (15)), but are also marking up these additional unit variable costs. In that case, the increase in the ratio z is associated with a constant mark-up on total unit variable costs and the target wage share of firms will fall, as will the SIRE (equation (8) and (11)).[19]. In the upper part of Figure 5, this shows as a downward shift of firms' target wage share and the distribution curve, as well as a fall of the SIRE from e_1^N to e_2^N. In the lower part, the fall in the SIRE means a leftward shift of the unexpected price inflation curve (15) and – with a lag – of the excess wage inflation curve (13).[20] In the upper part of Figure 5, the employment curve shifts rightwards due to the increase in international price competitiveness, since higher foreign inflation means a real depreciation of the domestic currency. If this expansionary effect is weak, as in Figure 5, the economy finds itself at temporary employment-distribution equilibrium in point B with a GERE at e_2, which is below the initial GERE and SIRE, but above the new SIRE at e_2^N. Finally, the real depreciation increases the EBRE from e_1^B to e_2^B. As $e_2 < e_2^B$ the economy will exhibit a trade surplus.

[19] Alternatively, one could assume that firms only pass through the extra costs to their output prices without marking them up. This would imply that the average mark-up over total unit variable costs is falling and, although the ratio z is rising, firms' target wage share remains constant. The SIRE will thus not change and inflation at the SIRE will rise according to the rise in foreign inflation or the rate of depreciation. In Hein (2023, chap. 5) it is assumed that firms initially respond like this, and only after some periods move to the behaviour analysed here, which is assumed in Hein (2024).

[20] In the very same period of the increase in foreign price inflation, only the unexpected inflation curve shifts to the left, while the excess wage inflation curve only shifts in the next period. While finally both curves shift left due to the fall in the SIRE, the rise in foreign inflation has a direct positive effect on unexpected inflation (15) but not on excess wage inflation (13), as wage inflation only responds to current employment and expected domestic inflation (12). This is what brings about the fall in the wage share in the initial period of the shock, although employment is above the new SIRE.

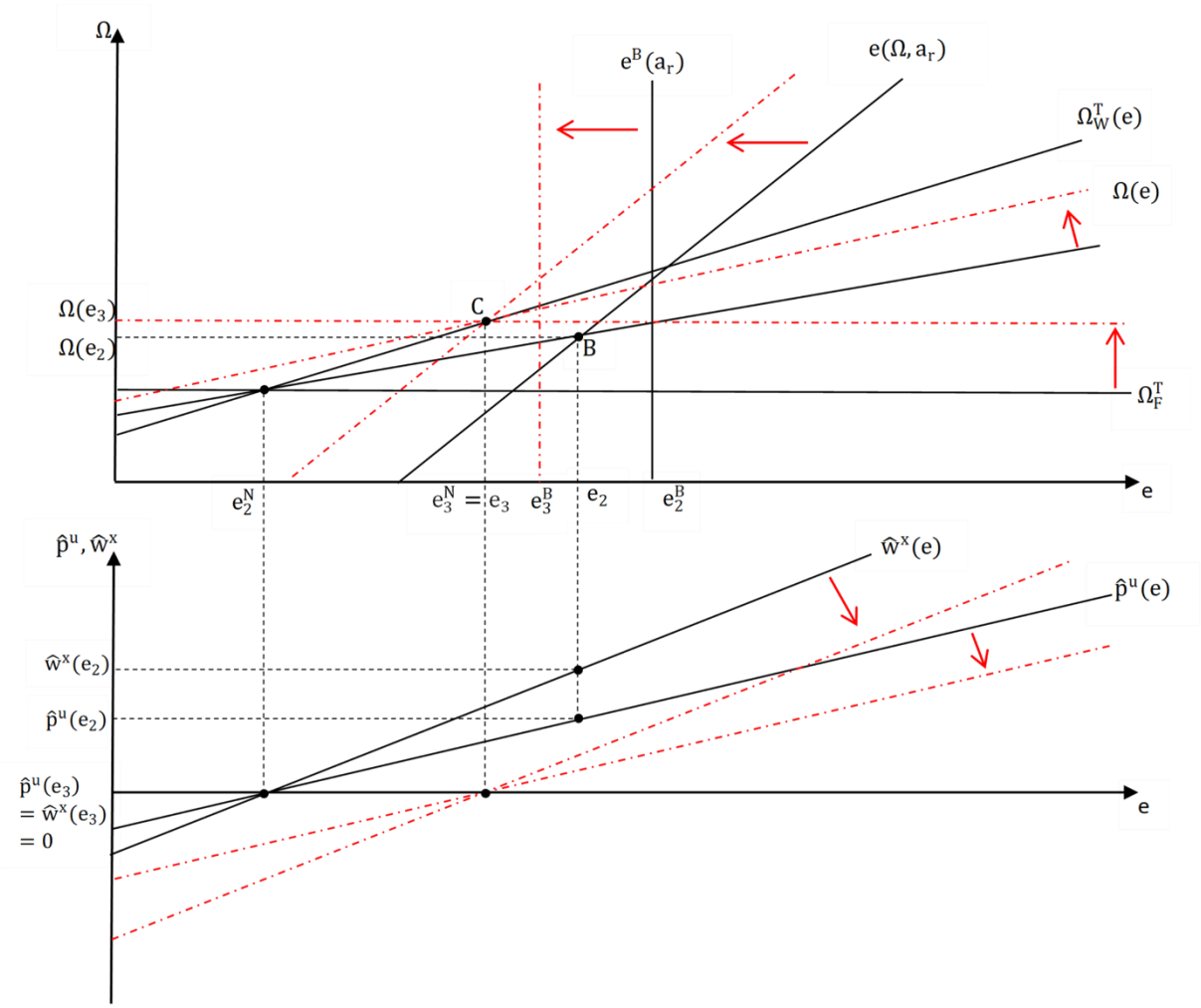
Figure 5: An open economy model of conflict inflation – adverse external shock: initial reaction



Note: The red broken lines show the initial effect of an adverse external shock.

As e_2 in point B is not at the SIRE, e_2^N, excess wage inflation and unexpected price inflation arise and we have again to distinguish between a stable and unstable case. In the stable case, depicted in Figure 6, where the black curves indicate the position following the shock, the GERE and the SIRE, each of them endogenously determined, will converge to each other. With the GERE above the SIRE, unexpected inflation prevails. After the initial shock, the sum of foreign price inflation and the nominal exchange rate's growth rate stays constant. Hence, domestic inflation will eventually surpass them leading to real appreciation. Given our pricing equation, the appreciation means that firms increase their wage share target leading to the upward shift of the respective curve. Consequently, the SIRE rises from e_2^N to e_3^N. The distribution curve not only shifts up due to the appreciation but also rotates towards the workers' target wage share as excess wage inflation surpasses unexpected price inflation for every employment level above the SIRE, which is also visible in the lower part of Figure 6.

Figure 6: An open economy model of conflict inflation – adverse external shock: stable case



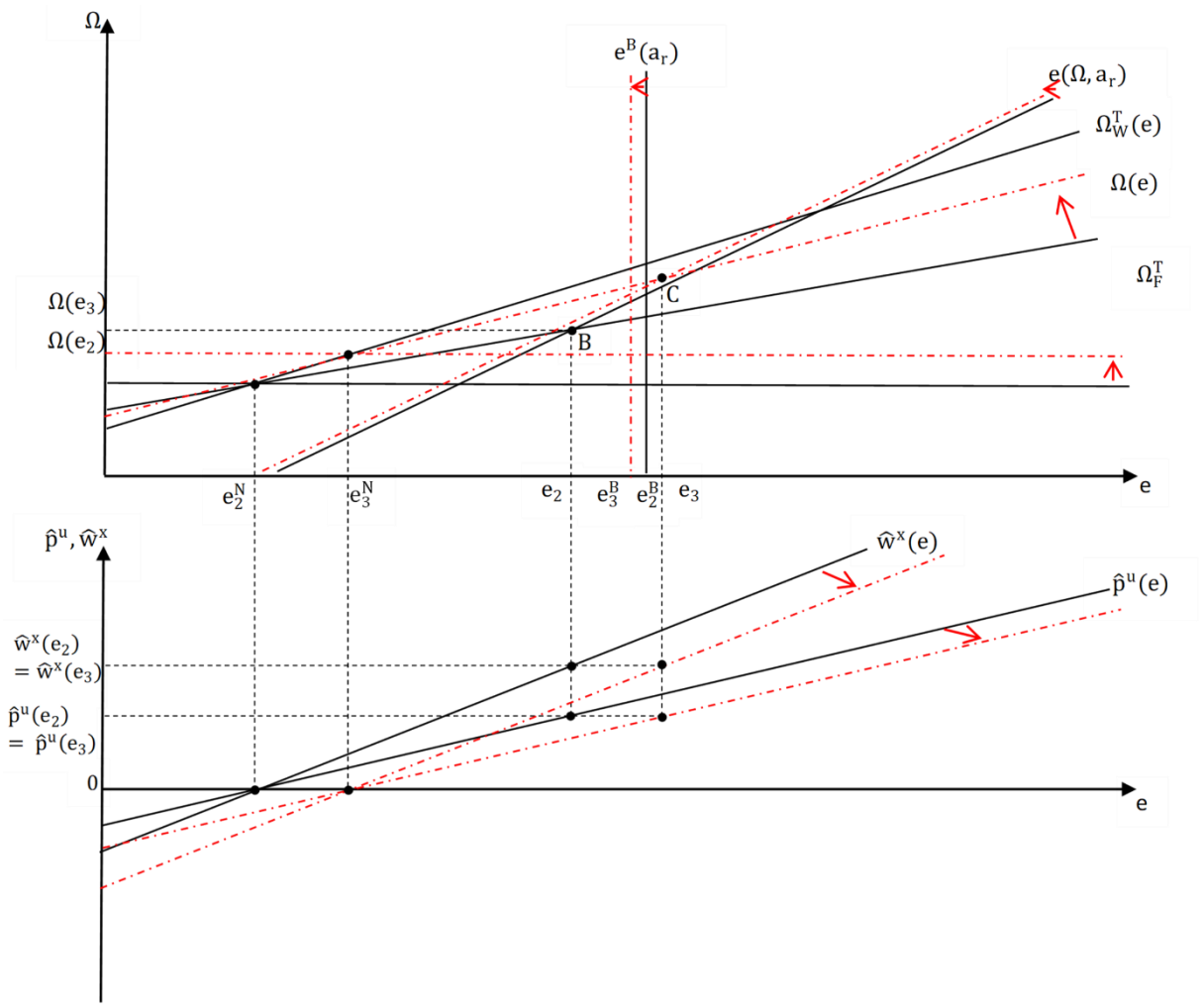
Note: The red broken lines show the responses after an adverse external shock.

The appreciation that occurs as employment is above the SIRE also shifts the employment curve leftward. Hence, the GERE and the SIRE move towards each other. In Figure 6, equality between the SIRE and the GERE is reached in point C at $e_3^N = e_3$, with constant distribution and inflation, the latter determined by foreign inflation and the rate of change in the nominal exchange rate.[21] With a constant nominal exchange rate, domestic inflation will adjust towards exogenous foreign inflation. Overall, aggregate demand and employment are profit-led in this stable case, i.e. the fall in the GERE towards the SIRE is associated with a rise in the realised wage share. Again, in Section 4.4 we will show that also a slightly overall wage-led economy may have a stable equilibrium at the SIRE. The real appreciation that drives the convergence of the GERE towards the SIRE affects the EBRE in a negative way as well. Hence, e^B also has

[21] We do not imply that equality between the goods market equilibrium employment rate and the SIRE in the stable case is necessarily reached in the immediate period following the shock. For illustrative purposes, we focus on the tendency that emerges over several periods.

the tendency to move towards the new equilibrium at which $e = e^N$. However, there is no guarantee that ultimately an overall equilibrium emerges. The ultimate position of $e = e^N$ and e^B will depend on the relative strengths of the different effects and the relative speeds of adjustments. In Figure 6, point C at $e_3^N = e_3$ is associated with a trade surplus since it is below the new EBRE at e_3^B.

Figure 7: An open economy model of conflict inflation – adverse external shock: unstable case



Note: The red broken lines show the responses after an adverse external shock.

By contrast, in the unstable case shown in Figure 7, the GERE increases beyond e_2 to e_3 in point C, as the expansionary effects on demand through a higher wage share outweigh the contractionary effects through real appreciation and loss in international price competitiveness. Total demand and the GERE are thus wage led. While real appreciation also contributes to a higher firms' target wage share and the SIRE moves from e_2^N to e_3^N, it does not catch up to the GERE so that the unstable forces persist. Meanwhile, the EBRE falls in the course of the real appreciation so that the situation of trade surpluses after the shock eventually becomes one of trade deficits as the EBRE falls below the GERE.

4.4. Stability conditions for the SIRE

In the preceding sections, we have shown graphically that the SIRE is not necessarily a stable equilibrium, hence, if the GERE deviates from the SIRE forces may arise that lead to further divergence. These forces stem from the effect of excess wage inflation and unexpected price inflation on distribution and demand. For constant foreign price inflation and a constant nominal exchange rate, excess wage inflation and unexpected price inflation are associated with a rise in the wage share and a real appreciation of the domestic currency. Table 2 summarises these effects:

Table 2: Unexpected inflation, the wage share and the RER

	$\hat{w}^x, \hat{p}^u$	$d\Omega$	$\hat{a}_r$
$e = e^N$	$\hat{w}^x = \hat{p}^u = 0$	$d\Omega = 0$	$\hat{a}_r = 0$
$e > e^N$	$\hat{w}^x > \hat{p}^u > 0$	$d\Omega > 0$	$\hat{a}_r < 0$
$e < e^N$	$\hat{w}^x < \hat{p}^u < 0$	$d\Omega < 0$	$\hat{a}_r > 0$

From Table 2, equation (5) and equation (16), it follows that the effect of unexpected inflation via the wage share and domestic demand is destabilising the SIRE because it increases the GERE if it is above the SIRE and depresses it further in the case it falls below: $\frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial \hat{p}^u} > 0$. However, the effect of unexpected inflation on the GERE through the RER and net foreign demand is a stabilising force around the SIRE: $\frac{\partial e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u} < 0$.[22] These are however not the only effects to consider. Through affecting the RER, unexpected inflation also causes changes in the expected RER altering the firms' target wage share (equation (8)), the SIRE (equation (11)) and the distribution curve (equation (16)). Since we have adaptive expectations, changes in the realised RER translate one-to-one onto the expected RER. On the one hand, a fall in the expected RER stemming from real appreciation caused by positive unexpected inflation causes the SIRE to rise: $\frac{\partial e^N}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u} > 0$. This mechanism was depicted in the Figures 3, 4, 6, and 7 through the upward shift of the firms' target wage share curve and the associated rise of the SIRE. Conversely, in the case of negative unexpected inflation the SIRE would fall through this channel. In both cases, this effect is stabilising as it leads to a movement of the GERE and SIRE towards each other. On the other hand, the change in the expected RER by affecting firms' target wage share also affects realised distribution and thereby actual employment in the following way: $\frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u} > 0$. Hence, through affecting the expected RER the destabilising first-round effect of unexpected inflation on employment via the wage share gets excacerbated.

[22] Even if unexpected inflation formally is not a determinant of the RER function, it could be derived as a determinant using its definition: $\hat{a}_r = \hat{a} + \hat{p}_f - \hat{p} = \hat{a} + \hat{p}_f - \hat{p}^e - \hat{p}^u$.

For stability of the SIRE we thus need the converging effects on actual employment and the SIRE to outweigh the diverging ones. Thus we arrive at the following stability condition:

$$(19) \quad \left|\frac{\partial e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}\right| + \left|\frac{\partial e^N}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}\right| > \left|\frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial \hat{p}^u}\right| + \left|\frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}\right|$$

which can be re-written as:

$$(19') \quad \left|\frac{\partial e^N}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}\right| > \left|\frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial \hat{p}^u}\right| + \left|\frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}\right| - \left|\frac{\partial e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}\right|$$

Stability of the SIRE thus requires that for any deviation of the GERE from the SIRE the value of the concomitant effects of unexpected inflation on the SIRE is stronger than the one on the GERE. The effect of unexpected inflation on the SIRE is via the RER and the expected RER and hence firms' target wage share. The effect on the GERE is composed, first, of the direct relationship of unexpected inflation with the wage share and employment, second, the indirect effect of unexpected inflation on the wage share and employment via the RER, the expected RER and firms' target wage share, and third, the negative effect of unexpected inflation on the GERE via the RER.

The results for our open economy Kaleckian/post-Keynesian conflict inflation model thus contradict those from open economy textbook New Consensus Macroeconomics (NCM) models, where the changes of the RER triggered by unexpected inflation have uniquely stabilising effects for the NAIRU and relieve the burden on inflation-targeting central bank interest rate policies (Carlin and Soskice 2015, chap. 9). There, only the direct effect of unexpected inflation induced changes of the RER on the GERE are considered, but the direct and indirect effects on distribution and on the SIRE/NAIRU are ignored. The stability condition (19) is thus always fulfilled, as long as there is a direct effect of unexpected inflation and the RER on net exports and employment.

However, in our model we have further conditions. The stability condition is more likely to be fulfilled the less wage-led the domestic economy is (the steeper the employment curve), the weaker the relationship between unexpected inflation and the wage share, hence the higher the share of wage costs in total variable costs, i.e. the larger ξ_1 (the weaker the rotation of the distribution curve), and the stronger the unexpected inflation induced effect of the RER is directly on aggregate demand and employment, on the one hand, and indirectly on the firms' target wage share, on the other hand. An overall profit-led economy via net exports will meet the stability condition, but also a slightly overall wage-led economy may stabilise around an endogenous SIRE, if unexpected inflation and the related change in the expected RER have a considerable effect on the SIRE. Generally, the stability condition is more likely to be reached in a small, open economy with highly price sensitive exports.

If the stability condition (19) holds, no policy intervention would be required for the adjustment of the GERE and the SIRE to each other, as shown in Figures 3 and 6. However, the

stabilisation process partly works through changes in the RER thus affecting the EBRE (equation (18)) which is then potentially at odds with the GERE-SIRE equilibrium. The next section thus examines an RER policy rule applied by economic policy authorities to reach again overall equilibrium. We will also check whether an RER policy rule may contribute to the stabilisation of an unstable SIRE.

5. An RER policy rule for reaching the EBRE

5.1 The RER policy rule

So far, we have analysed the conditions under which the GERE and SIRE converge to each other, and we have found that a stable convergence is usually not in line with a convergence to the EBRE, too. Therefore, if $e = e^N > e^B$, the economy will run a trade deficit while $e = e^N < e^B$ is associated with a trade surplus. For most economies a permanent trade (and current account) deficit associated with $e = e^N > e^B$ may not be sustainable in the long run, because of the build-up of external debt, especially if that debt is denominated in foreign currency. The EBRE may therefore be seen as a short-term equivalent of Thirlwall's (1979) balance-of-payments constrained growth rate. A permanent trade (and current account) surplus associated with $e = e^N < e^B$ may be less problematic from the perspective of the individual country, because it may add to resilience against external financial shocks since it allows for accumulating foreign reserves and/or reducing external debt. However, it implies that unemployment is higher than what the external balance requires, and it leads to lower growth rates than the external constraint would allow for. Furthermore, export-led mercantilist strategies aiming at persistent and rising trade and current account surpluses contribute to regional and global current account imbalances, indebtedness problems for the counterpart trade and current account deficit countries and global financial fragility, and they impose a stagnationary impact on growth at the global scale (Hein 2019).

Therefore, we treat achieving the EBRE as a policy goal and, for the sake of simplicity, we assume that the central bank's (and the government's) instrument to attain this goal is the RER, which can be directly controlled. This means we assume that the central bank controls the nominal exchange rate and adjusts this rate during each period such that it reaches its target RER at any point in time during the period. This target and the actual RER are then adjusted at the end of the period according to the RER policy rule, so that the following period starts with the RER set by the central bank affecting pricing, distribution, aggregate demand and employment. Therefore, we assume here that in practice the central bank is able to fully sterilise its foreign exchange market interventions when raising the nominal exchange rate to increase the RER (Aizenman and Glick 2009), and that it always has enough foreign reserves to lower the nominal exchange rate in order to decrease the RER. We are making these simplifying assumptions in order to focus on the effects of RER policy, and acknowledge that in the real world such a policy might face severe limits, in particular since it might involve effects on the interest rate which would have to be taken into account in a more complex model.

In our model, the RER affects the three equilibrium employment rates in the following way:

(20) $$\frac{\partial e}{\partial a_r} > 0, \frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r} < 0, \frac{\partial e^N}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r} < 0, \frac{\partial e^B}{\partial a_r} > 0$$

The RER affects the GERE positively through increasing net exports (equation (5)). However, the positive effect of the RER on the GERE is attenuated – or even reversed – as it also affects the expected RER and thereby firms' target wage share, as well as the realised wage share negatively (equations (8) and (16)). Likewise, the RER affects the SIRE negatively (equation (11)). Finally, the RER affects the EBRE positively because a real depreciation dampens imports and fosters exports (equation (18)). From equation (20) it follows that $\frac{\partial e}{\partial a_r} + \frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r} < \frac{\partial e^B}{\partial a_r}$, because $\frac{\partial e}{\partial a_r} = \frac{\partial e^B}{\partial a_r}$. Thus, a change in the RER has a weaker effect on the GERE than on the EBRE. Therefore, we arrive at the following policy rule:

(21) $$\dot{a}_r = a_r \beta (e - e^B), \qquad \beta > 0$$

If $e < e^B$, we have trade surpluses and the central bank will bring about a real appreciation. This unambigously decreases e^B while e either rises, remains constant or falls to a lesser extent so that theoretically $e = e^B$, can be achieved. Conversely, with $e > e^B$, we have trade deficits, and the central bank generates a real depreciation so that e^B rises while e either falls, remains constant or rises to a lesser extent.

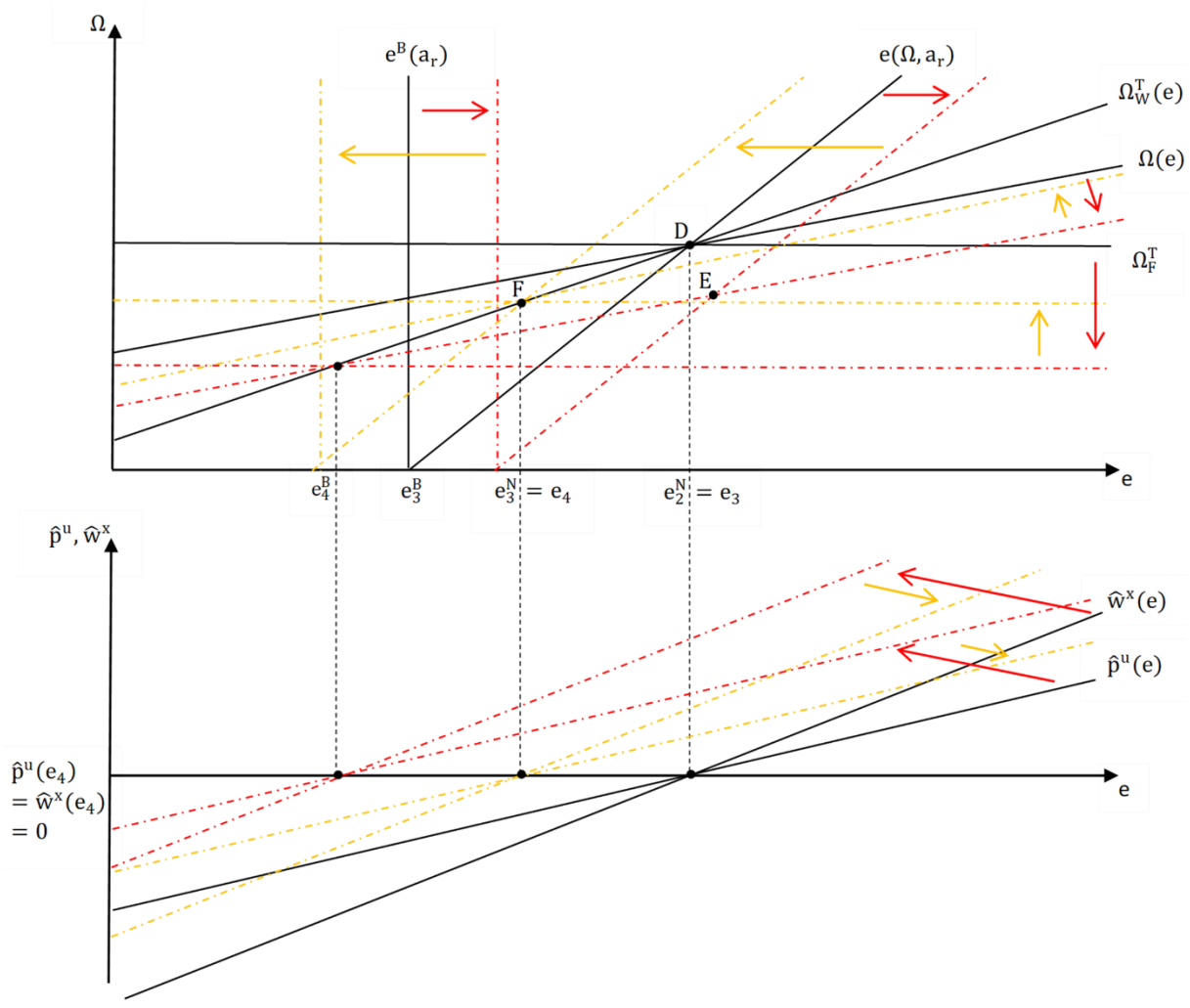
In what follows, we will first apply the exchange rate policy according to equation (21) to the cases of a stable SIRE discussed in the previous section (Figures 3 and 6). We will thus assume that, following a shock, the GERE and the SIRE have converged towards each other, but that this equilibrium deviates from the EBRE. First, we will investigate the application of the policy rule graphically for the positive aggregate demand shock, as well as for the adverse external shock presented in Section 4. Subsequently, we analytically investigate the conditions that need to hold for the policy rule being able to bring about overall equilibrium. Finally, we will discuss whether exchange rate policies can stabilise an otherwise unstable SIRE and bring about a joint equilibrium of the GERE, the SIRE and the EBRE.

5.2 Applying the policy rule to a positive aggregate demand shock

In Figure 8, after the positive aggregate demand shock, in the stable case, the central bank observes in point D constant inflation associated with a trade deficit. Following the policy rule in equation (21), to attain $e = e^B$, the central bank induces a real depreciation. Figure 8 shows the initial effect of the central banks' RER policy through the broken red lines. Being in the stable case with overall profit-led demand, both rates, e and e^B, will rise but the EBRE will do so to a greater extent. On the one hand, the real depreciation leads to a rightward shift of the EBRE and of the employment curve. On the other hand, the real depreciation shifts down firms' wage share target leading to a fall of the SIRE. Also the distribution curve shifts down.

Hence the policy rule leads to fall in the SIRE and a rise in the GERE to point E. In the lower part of the figure, the excess wage inflation and unexpected price inflation curves shift leftward. Due to the rise in the GERE and the fall in the SIRE, positive unexpected inflation will occur. In Figure 8, the effects following unexpected inflation are shown through broken yellow lines. Unexpected inflation will cause real appreciation, hence, firms' target wage share increases and the SIRE increases. Simultanouesly, the distribution curve shifts up and, due to the GERE above the SIRE, it rotates towards the workers' target wage share curve. The real appreciation also has a negative effect on net exports shifting the employment curve, as well as the EBRE to the left. As shown above and in Figure 3 for the stable case, this leads us to a GERE-SIRE equilbrium in point F at $e_4 = e_3^N$ and an EBRE at e_4^B.

Figure 8: An open economy model of conflict inflation – real exchange rate policy following a positive aggregate demand shock: stable case



Note: The red broken lines show the initial response towards exchange rate policies, here raising the real exchange rate. Yellow broken lines show the result of the endogenous adjustment of GERE and SIRE via unexpected inflation and the associated redistribution.

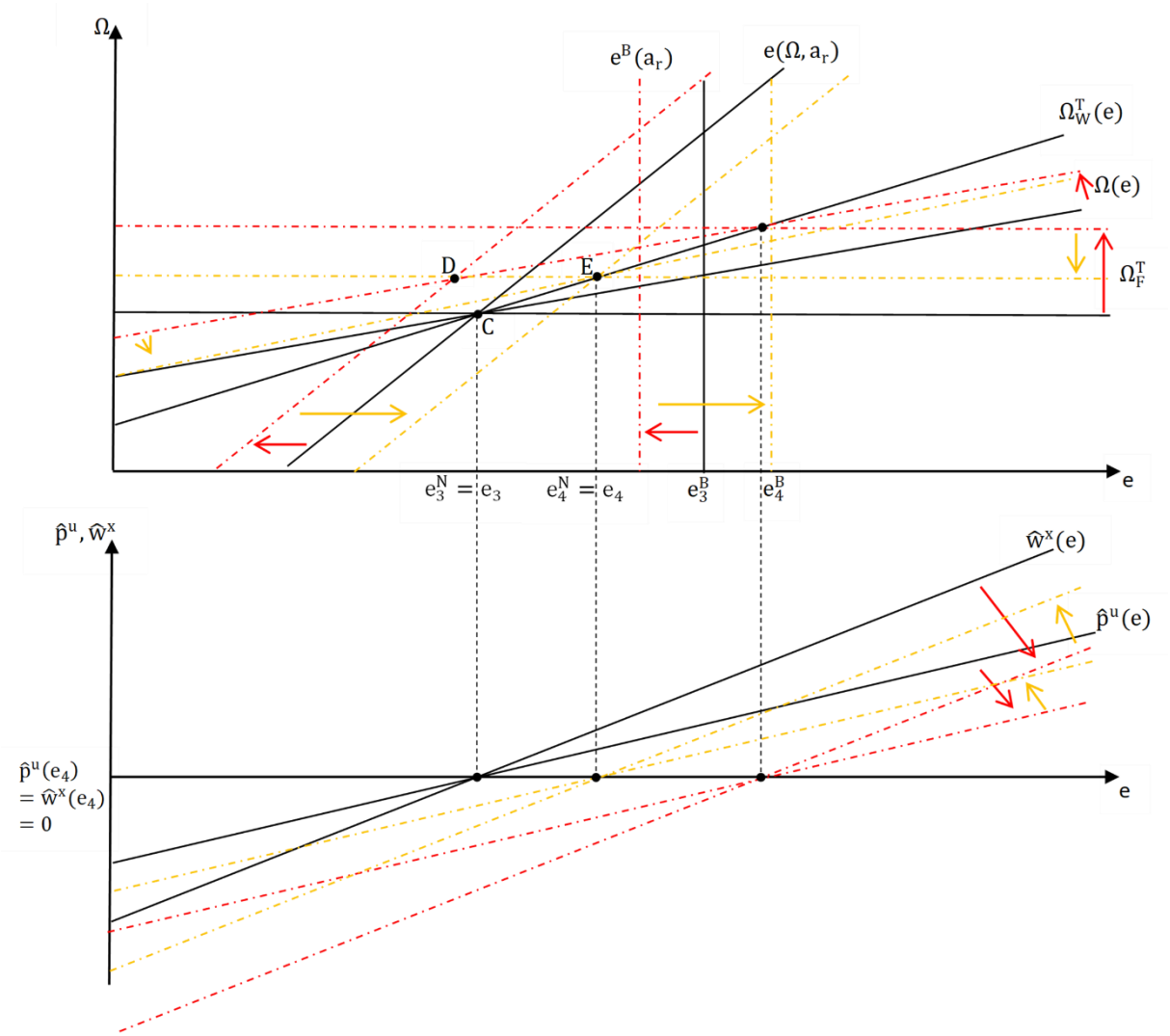
For the policy rule to be effective, its net effect, the combined effect of the policy rule and of unexpected inflation triggered by the policy rule application, has to reduce the gap between the GERE (= SIRE) and the EBRE. For Figure 8, we would need $e_4 - e_4^B < e_3 - e_3^B \Leftrightarrow e_4 - e_3 < e_4^B - e_3^B$. The net effect on the EBRE has to be more positive (or less negative) than on the GERE (= SIRE). In fact, this constellation prevails in Figure 8. This implies that attaining overall equilibrium through multiple applications of the policy rule in equation (21) seems in principle possible. In Section 5.4 we will complement this graphical analysis with a formal one in order to derive the general conditions for the policy rule to be effective.

5.3 Applying the policy rule to an adverse external shock

In Figure 9, in the stable SIRE case of the adverse external shock, the central bank observes constant inflation associated with a trade surplus at point C . Following the policy rule in equation (21), to attain $e = e^B$, the central bank induces a real appreciation. Figure 9 shows the initial effect of the central banks' RER policy through the broken red lines. Being in the stable case with overall profit-led demand, both rates, e and e^B, will fall but the EBRE will do so to a greater extent. On the one hand, the real appreciation leads to a leftward shift of the EBRE and of the employment curve. On the other hand, the real appreciation shifts up firms' wage share target and the distribution curve bringing about a rise of the SIRE. Hence the policy rule leads to rise in the SIRE and a fall in the GERE to point D. In the lower part of the figure, the excess wage inflation and unexpected inflation curves shift rightward. As the GERE has fallen and the SIRE has increased, negative unexpected inflation occurs at point D. In Figure 9, the final results for the stable SIRE case (Figure 6) following unexpected inflation are shown through broken yellow lines. Negative unexpected inflation will cause real depreciation, hence, firms' target wage share and the SIRE fall and we finally arrive at e_4^N. Simultanouesly, the distribution curve shifts down and, due to the GERE below the SIRE, it rotates towards the workers' target wage share curve. The real depreciation also has a positive effect on net exports, shifting both the employment curve and the EBRE to the right. Consequently, we arrive in point E at $e_4 = e_4^N$ and e_4^B , respectively.

Again, for the policy rule to be effective its net effect has to reduce the gap between the GERE (= SIRE) and the EBRE: $e_4^B - e_4 < e_3^B - e_3 \Leftrightarrow e_4^B - e_3^B < e_4 - e_3$. This implies that in this case, since the EBRE is exceeding the GERE (= SIRE), the net effect on the EBRE has to be less positive (or more negative) than on the GERE (= SIRE). Figure 9 shows a constellation where this is the case. This implies that the policy makers would be able to attain overall equilibrium through the repeated application of the policy rule stated in equation (21). The following section assess the conditions for attaining overall equilibrium formally and more generally.

Figure 9: An open economy model of conflict inflation – real exchange rate policy following an adverse external shock: stable case



Note: The red broken lines show the initial response towards exchange rate policies, here lowering the real exchange rate. Yellow broken lines show the result of the endogenous adjustment of GERE and SIRE via unexpected inflation and the associated redistribution.

5.4 Overall stability conditions

For attaining overall equilibrium, the application of the policy rule has to narrow the gap between the EBRE and the GERE, taking into account the adjustment of the GERE and the SIRE to each other in the stable case. While the graphical analysis suggests that reaching overall equilibrium seems possible, formally, we arrive at the following equilibrium conditions:

(22a) $\mathrm{de}(a_r, \hat{p}^u) < \mathrm{de}^B(a_r, \hat{p}^u), \qquad \text{if } e = e^N > e^B$

and

(22b) $\mathrm{de}(a_r, \hat{p}^u) > \mathrm{de}^B(a_r, \hat{p}^u), \qquad \text{if } e = e^N < e^B$

If $e = e^N > e^B$, the policy rule in equation (21) implies a real depreciation. While the EBRE should rise initially but may then even fall, taking into account unexpected inflation in the adjustment process of GERE and SIRE, the GERE and the SIRE will rise less or fall more. If condition (22a) is met, the initial effect of the policy rule will not be contradicted by the convergence between the GERE and the SIRE, and the gap between GERE = SIRE and the EBRE will become smaller. Further applications of the policy rule can then bring about an overall equilbrium with $e = e^N = e^B$.

If $e = e^N < e^B$, the policy rule in equation (21) implies a real appreciation. While the EBRE should fall initally, but may then even rise taking into account unexpected inflation, the GERE and the SIRE should fall less or rise more. If condition (22b) is met, the gap between GERE = SIRE and the EBRE will become smaller. Further applications of the policy rule can then bring about an overall equilbrium with $e = e^N = e^B$.

Decomposing condition (22a) and (22b) into the single effects that changes in the RER and unexpected inflation have on e^B and e respectively, we arrive at the following:

(22a') $$\frac{\partial e}{\partial a_r} + \frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r} + \frac{\partial e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u} + \frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u} + \frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial \hat{p}^u} < \frac{\partial e^B}{\partial a_r} + \frac{\partial e^B}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}$$

and

(22b') $$\frac{\partial e}{\partial a_r} + \frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r} + \frac{\partial e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u} + \frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u} + \frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial \hat{p}^u} > \frac{\partial e^B}{\partial a_r} + \frac{\partial e^B}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}$$

For $\partial a_r, \partial \hat{p}^u < 0$, as we will be applying the policy rule in equation (21) for $e = e^N < e^B$, condition (22b') will change signs and turn to condition (22a'), so that we can continue with this. Since : $\frac{\partial e}{\partial a_r} = \frac{\partial e^B}{\partial a_r}$ and $\frac{\partial e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u} = \frac{\partial e^B}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}$, condition (22a') simplifies to:

(22a'') $$\frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r} + \frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u} + \frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial \hat{p}^u} < 0$$

and further to:

(22a''') $$\frac{\partial e}{\partial \Omega}\left(\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r} + \frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u} + \frac{\partial \Omega}{\partial \hat{p}^u}\right) < 0$$

With $\frac{\partial e}{\partial \Omega} > 0$, $\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r} < 0$, $\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u} > 0$ and $\frac{\partial \Omega}{\partial \hat{p}^u} > 0$, inequality (22a''') holds if

(22a'''') $$\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r} + \frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u} + \frac{\partial \Omega}{\partial \hat{p}^u} < 0$$

which requires:

(23) $$\left|\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\right| > \left|\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}\right| + \left|\frac{\partial \Omega}{\partial \hat{p}^u}\right|$$

If $e = e^N > e^B$, for RER policies according to equation (21) to be effective in aligning the GERE, the SIRE and the EBRE, raising the RER and thus depreciating the currency, taking into account rising inflation rates as a temporarily consequence of a deviation of the GERE from the SIRE, they will have to decrease the GERE (= SIRE) relative to the EBRE. According to condition (23), this will only happen if the value of the negative effect of the initial increase in the RER on the wage share (via a decline in firms' target wage share) is higher than the directly and indirectly positive effects of the following unexpected inflation on the wage share.

If $e = e^N > e^B$, for RER policies according to equation (21) to be effective in aligning the GERE, the SIRE and the EBRE, lowering the RER and appreciating the currency, taking into account falling inflation rates as a temporary consequence of a deviation of the GERE from the SIRE, they will have to increase the GERE (= SIRE) relative to the EBRE. According to condition (23), this will only happen if the value of the positive effect of the initial fall in the RER on the wage share (via a decline in firms' target wage share) is higer than the directly and indirectly negative effects of the following unexpected disinflation (negative unexpected price inflation) on the wage share.

Let us finally check how condition (23) is related to the condition for the stability of the SIRE, which we have implicitly assumed in our argumentation. For the sake of comparison, we can rewrite this stability condition from equation (19), as:

(19'') $$\left(\left|\frac{\partial e}{\partial a_r}\right| + \left|\frac{\partial e^N}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\right|\right)\left|\frac{\partial a_r}{\partial \hat{p}^u}\right| > \left|\frac{\partial e}{\partial \Omega}\right|\left(\left|\frac{\partial \Omega}{\partial \hat{p}^u}\right| + \left|\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}\right|\right)$$

which can be turned into:

(24) $$\frac{\left(\left|\frac{\partial e}{\partial a_r}\right| + \left|\frac{\partial e^N}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\right|\right)\left|\frac{\partial a_r}{\partial \hat{p}^u}\right|}{\left|\frac{\partial e}{\partial \Omega}\right|} > \left|\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}\right| + \left|\frac{\partial \Omega}{\partial \hat{p}^u}\right|$$

Overall stability requires conditions (23) and (24) to hold simultaneously. This requires small direct (via the rotation of the distribution curve) and indirect (via the RER and firms target real wage) effects of unexpected price inflation on the realised wage share. Furthermore, condition (23) is more likely to be fulfilled the stronger the negative effect of the change in the RER associated with the policy rule on the wage share is. Condition (24) is more likely to hold the stronger the (negative) effect of unexpected price inflation on the RER is, the stronger the direct effect the RER has on the GERE (via net exports) and on the SIRE through the expected RER, as well as the weaker the direct effect of the wage share on the employment rate is, i.e. the steeper the employment curve, or the weaker the wage-led nature of domestic demand and employment.

Hence, the formal analysis supports what has been shown graphically: The policy rule in equation (21) is able to bring about overall equilibrium if condition (23) and (24) hold simultaneously. Overall, this requires only weakly wage-led domestic demand, profit-led or only weakly overall wage-led demand, strong effects of the RER on the GERE and the SIRE and strong effects of unexpected inflation on the RER, but only weak effects on the wage share.

5.5 Can an RER policy rule also reach the EBRE with an unstable SIRE?

So far, we have analysed the conditions for RER policies aligning the GERE, SIRE and EBRE. For this, we have assumed that GERE and SIRE automatically adjust to each other, assuming the stable cases and the general stability condition for the SIRE derived in Section 4 to hold. However, as pointed out above, the conditions for this are quite restrictive. Therefore, we will now examine the effects of an RER policy according to equation (21) for an unstable SIRE.

As pointed out above, different from the NCM model, in our model, we may have that the unexpected-inflation-induced changes in the RER are insufficient to align GERE and SIRE. This is so, because we do not only have direct effects of unexpected inflation on the GERE via net exports, but also directly and indirectly via distribution and domestic demand, which work in the opposite direction, and there are also effects on the SIRE. From equation (19'), instability of the SIRE implies:

$$(25) \quad \left|\frac{\partial e^N}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}\right| < \left|\frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial \hat{p}^u}\right| + \left|\frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}\right| - \left|\frac{\partial e}{\partial a_r}\frac{\partial a_r}{\partial \hat{p}^u}\right|$$

and hence:

$$(25') \quad \left(\left|\frac{\partial e^N}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\right| + \left|\frac{\partial e}{\partial a_r}\right| - \left|\frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r}\right|\right)\frac{\partial a_r}{\partial \hat{p}^u} < \left|\frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial \hat{p}^u}\right|$$

If $e > e^N$, unexpected inflation raises the SIRE through a decline of the expected RER and an increase in firms' target wage share, but it raises the GERE even more, via the direct relationship with the wage share (rotation) and the shift in the distribution curve via an increase in firms target wage share, taking into account the negative effect via the RER and international price competitiveness.

If $e < e^N$, unexpected dis-inflation lowers the SIRE through an increase in the expected RER and hence a fall in firms' target wage share, but it lowers the GERE even more, via the direct relationship with the wage share (rotation) and the shift in the distribution curve via a fall in firms' target wage share, taking into account the positive effect via the RER and international price competitiveness.

If the change in the exchange rate triggered by unexpected inflation is not sufficient to stabilise the SIRE, what about the effect of our RER policies according to equation (21)? Recalling the effects of changes in the RER on our equilibrium employment rates from equation (20)

(20) $\frac{\partial e}{\partial a_r} > 0, \frac{\partial e}{\partial \Omega}\frac{\partial \Omega}{\partial a_r^e}\frac{\partial a_r^e}{\partial a_r} < 0, \frac{\partial e^B}{\partial a_r} > 0$

we have to consider different sub-cases for 1) $e > e^B$, which according to equation (21) will trigger a rise in the RER, and for 2) $e < e^B$, which will triger a fall in the RER:

In the case 1a) with $e^N > e > e^B$, an increase in the RER to adjust the GERE and the EBRE will lower the SIRE and shift it towards them, and thus will contribute to an overall equilibrium, if it is sufficient to over-compensate the destabilisng effects of unexpected disinflation on the GERE and the SIRE and turn the sign in condition (25). Transforming the instability condition (25) into the stable one (19') is in principle possible in this constellation as the policy rule (21) and unexpected inflation affect the RER in the same manner. Hence, the policy rule amplifies the destabilising effects via the wage share, as well as, the stabilising effects of the real exchnage on the GERE and on the SIRE, all depicted on the left-hand side of equation (25'). Meanwhile, the destabilising direct effect of unexpected inflation on the wage share, shown on the right-hand side of equation (25'), is unaffected by the policy rule making it possible for it to turn the sign of the instability condition.

In the case 1b) with $e > e^N > e^B$, the increase in the RER will reduce the SIRE and raise the EBRE, thus contribute to a convergence between these two. Overall equilibrium will be possible if the GERE falls in response to the real depreciation but the GERE might also rise (less than the EBRE), and hence not contribute to an overall equilbrium. In the case 1c) with $e > e^B > e^N$, the increase in the RER will raise the EBRE and (less so) the GERE, but lower the SIRE, and hence not contribute to an overall equilibrium

In the case 2a) with $e^N < e < e^B$, lowering the RER should lower the EBRE, and less so the GERE, and raise the SIRE, which will contribute to an overall equilibrium, if it is sufficient to overcome the destabilising effects of the unexpected inflation and turn the sign in condition (25). As for the reasons given in case 1a), turning the sign of the instability condition is in principle possible. In the case 2b) with $e < e^N < e^B$, lowering the RER reducing the EBRE and raising the SIRE will make these two rates converge. Overall equilibrium will be possible if the GERE rises in reponse to the real appreciation, which, however, may also lead to but it may a fall in the GERE (less than the EBRE), and hence not contribute to an overall equilibrium. In the case 2c) with $e < e^B < e^N$, lowering the RER raises the EBRE and (less so) the GERE, but it lowers the SIRE, and thus does not contribute to an overall equilbrium.

Therefore, only in the special cases of 1a) and 2a), as well as, 1b) and 2b), provided that in the latter two cases the real depreciation (appreciation) leads to a fall (rise) in the GERE, may the application of the RER policy rule also contribute to stabilising an otherwise unstable SIRE. Except from these special cases such a stabilisation cannot be expected. Therefore, the stabilisation of an equilibrium around the SIRE would need other policies, in particular a combination of functional fiscal policies mainly affecting the GERE and a distrbutional claims coordinating incomes policies mainly focussing on the SIRE (Hein 2023, chap. 6). Inflation targeting interest rate policies by the monetary authorities, as advocated by the NCM, are generally not considered to be effective, because of asymmetric effectiveness in the short run

and detrimental effects via the interest cost channel on conflicting claims in the medium to long run (Hein 2023, chap. 5).

6. Discussion and conclusions

The systematic review of post-Keynesian open economy conflict inflation models shows that despite their shared theoretical origin these models differ in many respects. Some models do not include a Phillips curve but RER-targeting (Blecker 2011, Lavoie 2022) while others feature neither a Phillips curve nor RER-targeting (Charles and Marie 2016, Bortz et al. 2018, 2022). We also find models that incorporate a stable Phillips curve either alongside RER-targeting (Sasaki *et al.* 2013, Vera 2014, Campana 2024) or with a fully endogenous RER (Cassetti 2002, 2012, Vera 2010). Finally, we find models that feature an unstable Phillips curve paired with a fully endogenous RER (Hein 2023, chap. 5, 2024). The present model explicitly extends the Hein/Stockhammer modelling approach in the open economy context building on Hein (2023, chap. 5, 2024). The novel element is the introduction of the EBRE, on top of the SIRE and the GERE already present in previous models, and the introduction of an RER policy rule to stabilise the economy around the EBRE.

Our very simple Kaleckian open economy model shows that aligning these three equilibrium employment rates, the GERE, the SIRE and the EBRE, is not an easy task. This is true even for a stable GERE-SIRE equilibrium, which requires the very special condition of an overall profit-led or only weekly wage-led demand regime. However, as the stabilisation process depends on the effects of unexpected inflation, either positive or negative, the RER will not stay unaffected. Consequently, the new, endogenous and stable SIRE may contradict the EBRE, and the economy may find itself in a position of constant inflation and distribution but also external disequilibrium. To combat this, the present model has introduced an RER policy rule that, in the case of a stable SIRE, may under certain parameter constellations bring about overall equilibrium. These require only weakly wage-led domestic demand, profit-led or only weakly wage-led overall demand, strong effects of the RER on the GERE and the SIRE and strong effects of unexpected inflation on the RER, but only weak effects on the wage share. Moreover, in the case of an unstable SIRE, the RER policy rule will only be able to bring about an overall macroeconomic equilibrium under even more restrictive conditions, as we have outlined.

These theoretical findings raise some general doubts regarding the RER as a macroeconomic policy tool for stabilising the open economy. Due to the specific conditions required, the empirical relevance is severely constrained. Most empirical estimations based on Kaleckian distribution and growth models, in particular those based on the structural or single equation estimation approach, find overall wage-led demand for advanced capitalist economies. Overall profit-led demand is more likely in smaller, open economies with price sensitive exports, thus, often to be found in developing and emerging economies (Hein 2014, chap. 7, Onaran and Galanis 2014, Jungmann 2023).[23] Of course, our stability analysis has

[23] See also our references further above in footnote 8.

shown that also for the case of a slightly overall wage-led economy, the endogenous SIRE may still be stable if unexpected inflation and the related change in the expected RER have a considerable effect on the firms' target wage share and hence on the SIRE. In any case, policy makers must take into account these structural properties of their economy as the effectiveness of the presented policy rule critically hinge on them.

Among the models we reviewed, Blecker (2011) and Lavoie (2022, chap. 8) show a stable equilibrium for RER-targeting regimes for any parameter configurations. These results differ from ours, because they do not include any feedback effect of aggregate demand on inflation and distribution. Vera (2014), Sasaki et al. (2013) and Campana (2024) include such a feedback effect. Consequently, these contributions find only few parameter configurations which yield a stable equilibrium. But their approach differs from our model in that they include a stable Phillips curve. In a model with both external balance and inflation stabilisation objectives for the monetary authority, Vera (2014) finds that the RER-targeting reaction to an external shock may leave inflation stabilisation unattended and in need of complementary interest rate and income policies. Sasaki et al. (2013) and Campana (2024) use Blecker's (2011) nominal exchange rate policy rule and find that, if the impact of the RER on the trade balance is small, a profit-led domestic demand regime and a profit-squeeze distribution curve would yield a stable equilibrium. Hence, for stability, the parameter configuration is crucial, too, in these models – and the empirical relevance is again rather limited. This illustrates that the basic problem in using the RER to attain macroeconomic policy goals stems from the multitude of different channels through which the RER works in open economy conflict inflation models, as the one presented here. Policy makers in economies that do not meet the conditions for overall stable equilibrium are either faced with a policy dilemma having to choose between one of the two goals (or even three, if the SIRE is unstable), or they have to opt for different policy instruments. We have already pointed out that from a post-Keynesian perspective some coordinated macroeconomic policies might be required. These include incomes policies aligning target income shares and stabilising inflation and distribution, functional finance fiscal policies for managing aggregate demand, low long-term interest rate targeting central bank policies, coupled with fixed or managed exchange rate policies in the international arena (Hein 2023, chap. 6).

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