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Excessive Imbalance Procedure in the EU:
a Welfare Evaluation

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Andrzej Torój*

We develop a framework for assessing the welfare implications of the new EU's Excessive Imbalance Procedure (EIP) to be implemented in 2012, with a special focus on the current account (CA) constraint. For this purpose, we apply a New Keynesian 2-region, 2-sector DSGE model, using the second order Taylor approximation of the households' utility around the steady state as a standard measure of welfare. The compliance with the CA criterion is ensured by modifying the policymakers' loss function in line with Woodford's (2003) treatment of the zero lower bound of nominal interest rates. The introduction of EIP threshold on CA balance results in a welfare loss equivalent to steady-state decrease in consumption of 0.105% after the euro adoption or 0.033% before that. If we consider the 4% threshold on current plus capital account (rather than current account alone), this cost decreases to 0.019 under the euro and approximately a half of that without the euro. This suggests that − given other indicators not considered here − the welfare cost for the converging economies may be higher. EIP can also be seen as a factor augmenting the cost of euro adoption.

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1 Introduction

One of the underlying reasons for the escalation of the euro area crisis was the extent to which internal and external imbalances have built up since the euro area creation. After this experience, the entire European Union faced critique for concentrating on fiscal imbalances (operationalised in *Excessive Deficit Procedure*) and ignoring macroeconomic imbalances. The EU's response to this critique was first proposed in September 2010 by the European Commission and entered into force in late 2011 in the form of *Excessive Imbalance Procedure* (EIP, European Parliament and Council Of The European Union, 23.11.2011b,1).

The application of EIP comprises several stages and originates from the analysis of a scoreboard of macroeconomic indicators with their respective thresholds. Although the European Commission emphasises that its reading would not run mechanically and the essential role in the assessment of a country's imbalances would be played by an in-depth economic analyses, the significance of the scoreboard is twofold. Firstly, its reading takes place before the in-depth analysis and hence may seriously impact on the market's perceptions and expectations. Secondly, and even more importantly, the scoreboard is a non-discretionary component of the procedure (as opposed to in-depth analysis) and the ongoing euro-crisis seems to already have shown that discretion in such procedures should be minimised.

From this point of view, one could expect that the EIP scoreboard should be prepared carefully and have solid analytical underpinnings. These are, as yet, missing and this paper aims to contribute to filling this gap. In particular, we concentrate here on the thresholds for the current account balance set at -4% and +6% of GDP. We treat them as a constraint imposed on the macroeconomic policy and calculate the welfare consequences of this constraint, as well as the modifications in policies necessary to attain the new requirement. Understandably, there are substantial differences between states that do and do not belong to the euro area in terms of feasible policy instruments and we treat the two cases separately, asking also for the difference in welfare cost of EIP for EA and non-EA countries (or, inversely, whether it is more costly to adopt the euro with or without EIP).

We also focus on the -4% threshold (rather than +6% of GDP) as it seems to be binding for a number of converging economies. The intertemporal approach to the current account determination treats deficits as equilibrium phenomena in such economies, but the scoreboard treats all EU Member States homogeneously in this respect. This may imply running into another "one-size-fits-all" problem in Europe and this is why we reconsider here the choice of indicator against a possible alternative: current account plus capital account. This would not affect the big, advanced, surplus economies but could significantly relax the constraint for small, catching-up economies in a fundamentally justified way.

Our welfare analysis is rooted in the strand of literature originated by the seminal contribution of Lucas (1987) on the welfare cost of the business cycle. In the context of the European integration, a similar approach has been adopted i.a. by Gradzewicz and Makarski (2009) to evaluate the welfare consequences of the euro adoption in Poland due to abandoning the autonomous monetary policy and the resulting increase in business cycle's amplitude. As the EIP thresholds imply explicit numerical constraints on macroeconomic variables, we apply here the methodology of Woodford (2003, ch. 6) developed for the treatment of the optimum monetary problem under the problem of zero lower bound for the interest rates. Lipińska (2008, 2009) applied Woodford's framework to evaluate the welfare cost of compliance with monetary Maastricht criteria in the Czech and Polish economy.
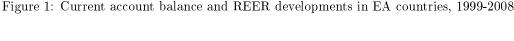
The rest of the paper is organised as follows. Section 2 summarises the stylised facts about external imbalances in the European Union and the problems that the EIP attempts to tackle. Section 3 presents the New Keynesian DSGE model that serves the purpose of our welfare evaluation. Section 4 demonstrates how we apply Woodford's framework to implement the EIP-related constraints into
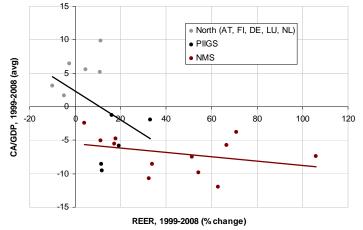
the model. Section 5 analyses the resulting welfare loss and compares how the fiscal (and possibly monetary) policy responses differ when EIP-compliant policies are taken into account. Section 6 concludes.

2 External imbalances in the EU and the euro area: stylized facts

Before the outbreak of the recent crisis, external adjustment within the euro area was expected to take place via realignments in competitiveness. Once an asymmetric positive demand shock, say, pushed one country's output gap and inflation rate on the upper side of the equilibrium, the automatic real appreciation should have first deteriorated its competitiveness, which would produce a recession, which in turn would lead to real depreciation (see European Commission, 2006, for a literature survey). Obviously, this reasoning also applies to non-EA countries of EU, but they additionally have autonomous monetary and exchange rate policy as adjustment instruments.

These expectations have turned out to be overly optimistic. "Internal" real devaluation by means of price and wage decreases, once it was necessary in the Southern Europe (Greece, Italy, Spain, Portugal), hit massive social and consequently political resistance. Agents were not rational enough (cf. Torój, 2010b) to smooth out boom-bust cycles by not allowing competitiveness-detrimental real appreciation to materialize. Also, the governments afforded a decade of low reform intensity (Bednarek-Sekunda et al., 2010) that resulted in relatively high rigidities – an environment highly supportive of imbalances. As Barnes (2010) points out, it was all the matter of inertia and persistence that inhibited the competitiveness channel.

Figure 1: Current account balance and REER developments in EA countries, 1999-2008

Source: author, Eurostat data.

The external imbalances themselves emerged along the border between Northern and Southern Europe. Existing research (i.a. Zemanek et al., 2009; Barnes, 2010; Jaumotte and Sodsriwiboon, 2010; Waysand et al., 2010) unanimously confirms that (i) the euro area's current account was almost balanced, so the individual countries' imbalances are an internal phenomenon of the EA, (ii) it was the "core" or "North" of the euro area (Germany, Netherlands, Austria, Luxembourg, Finland) that were depreciating and lending and the "GIIPS" (Southern countries plus Ireland) that were appreciating and borrowing (see Figure 1).

The Excessive Imbalance Procedure, introduced in late 2011 as part of the "six-pack" of EU regulations (i.e. in two EU Council and European Parliament regulations, see European Parliament and Council Of The European Union, 23.11.2011b,1) is intended to provide incentives for governments to avoid such developments. We pay here particular attention to the external aspect of the regulations, i.e. the constraint on the current account balance.

The preventive arm of EIP comprises at first an alert mechanism. A scoreboard of indicators (see Table 1), along with their economic reading, is evaluated by the European Commission in an annual report. There are thresholds set for every indicator (in some cases differentiated between euro area and other countries), also certain combinations of indicators should be regarded as particularly risky (e.g. remarkable appreciation of REER, deterioration of the current account balance, falling export market share, growing labour cost dynamics, as well as negative and sizable net international investment position. The set of indicators was constructed with the intention to reflect i.a. the principles of simplicity, parsimony and forward-looking orientation. The Eurogroup and Ecofin Council discuss this report, and − as a conclusion − Member States with potential macroeconomic risks are identified.

If risks of imbalances are identified, an in-depth review is prepared. As the European Commission states, "the countries identified [by means of the "flashes" in scoreboard] are investigated in detail, by means of a wide set of indicators and analytical tools". 3 outcomes are possible: (i) no imbalance problems are identified, (ii) some (moderate) imbalance is identified and EC/Council recommendations are released as part of the June package, (iii) severe imbalance is identified. The last possibility launches the corrective arm by EC/Council recommendation on the existence of an excessive imbalance.

In the corrective arm, Member States are obliged to submit to EC corrective action plans. The EC and EU Council can either assess this plan as sufficient and endorse it, listing the adequate corrective actions and their respective deadlines, or as insufficient, asking for a resubmission. If two successive corrective action plans are evaluated as insufficient, a fine is imposed on the Member State under procedure. Countries have to update the plans every 6 months. The monitoring of an agreed corrective action plan's implementation requires regular reports by the Member State. Based on these reports, the EC/Council repeatedly assesses the undertaken corrective actions and the plan itself. If a Member State fails to implement the plan within envisaged deadlines, the EC/Council adopts the decision on non-compliance, set new deadlines and impose an interest-bearing deposit of 0.1% GDP. In case of two successive decisions on non-compliance, this deposit becomes a (yearly) fine.

In this paper, we focus our attention on the first stage (scoreboard) and on one indicator in particular, i.e. current account balance. In our view, solid analytical underpinnings for the scoreboard are essential

Table 1: Excessive Imbalance Procedure – scoreboard for alert mechanism

Imbalance	Indicator	Thresholds	Additional indicators
external	**current account balance (3 year average, as a % of GDP)**	**-4% to 6%**	**net lending/borrowing vis-à-vis rest of the world (CA+KA)**
	net international investment position (as a % of GDP)	>-35%	net external debt
	real effective exchange rate (% change over 3 years, HICP-deflated, relative to 35 industrial countries)	+/-5% for €, +/-11% for non-€	REER vis-à-vis rest of the euro area
internal	export market shares (% change over 5 years)	>-6%	export market shares based on volumes of goods, labour productivity, trend TFP growth
	nominal unit labour cost (% change over 3 years)	<9% for €, <12% for non-€	nominal ULCs (changes over 1, 5, 10 years), effective ULC relative to rest of euro-area
	deflated house prices (y-o-y % change)	<+6%	real house price, nominal house price, residential construction
	private sector credit flow (as % of GDP)	<+15%	financial liabilities of the non-consolidated financial sector, debt/equity ratio
	private sector debt (as % of GDP)	<160%	private sector debt based on consolidated data
	general government debt (as % of GDP)	<60%	–
	unemployment rate (3 year average)	<10%	–

Source: European Commission (8.11.2011).

for the credibility of the entire EIP. The reading of the scoreboard will probably focus much of the markets' attention and may adversely affect the sovereign's financing conditions once the indicators are flashing even though the (later) economic analysis may play down the previous reading. Also, the experience with the application of EDP suggests that non-discretionary components are essential for efficient procedures, whereby the in-depth analysis – as formulated before – contains more discretion, by nature and by intention (whereby the latter is understandably for the sake of flexibility). However, in its documents, the European Commission emphasises the lack of comprehensive analytical frameworks underlying the design of the scoreboard, e.g. the thresholds were set as order statistics from panel historical distributions.

In this context, another essential problem is related to the fact that all EU countries face a homogeneous treatment in the EIP, regardless of their level of development. Although the in-depth analysis may take account of the catching-up process, for the abovementioned reasons it would also be comfortable to consider it in the design of the scoreboard. Under the intertemporal approach, current account balance exhibits deficits for fundamental reasons and therefore the EIP scoreboard may be more restrictive for the New Member States of the EU. Figure 1 shows that their performance in terms of CA deficit does not fit into the previously discussed North-South dichotomy of the EA-12 group. NMS were all experiencing CA deficit, in spite of highly varying scale of real appreciation (cf. flatter regression line
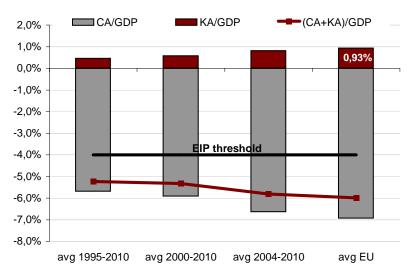
Figure 2: Current account and capital account balance in the EU NMS

avg EU = average of NMS-12 over the period of their EU membership; **avg** = average of NMS-12 plus Croatia and Turkey calculated with all available data over a given period.
Source: author, Eurostat data.

in Figure 1).

Current account deficits in the catching-up Europe range approximately between 6% and 7% of GDP, depending on the period and group of countries in consideration (see Figure 2). This definitely violates the threshold of minimum -4% GDP. However, one could think of a measure that takes into account – at least partly – the catching-up effects and leaves aside the part of current account deficit that can be financed in a relatively safe way. If, for example, we focus on the joint balance of current and capital account (see Figure 2), we could partly relax the NMS' constraint by almost one percentage point without significantly changing the scoreboard's mechanics for the EA-12 group.

Our further analysis aims at calculating the welfare consequences of imposing the binding constraint, illustrated in Figure 2, along with illustrating the changes in policy necessary to comply with this constraint.

3   New Keynesian DSGE model

We analyse the welfare impact of EIP introduction by means of a New Keynesian DSGE model of a 2-region economy. The model builds strongly upon multi-region currency union models with possible heterogeneity, such as e.g. ones considered in the works by Benigno (2004), Lombardo (2006), Brissimis and Skotida (2008), Blessing (2008), Kolasa (2009) or Torój (2010b,a).

The whole economy of the monetary union is represented by the interval $\langle 0; 1 \rangle$, whereby the first region

(say, home economy) is indexed over $\langle 0; w \rangle$ (relative size of the region: w), and the second (foreign economy) is indexed over $\langle w; 1 \rangle$. Both economies consist of two sectors. Each of them is characterized by price rigidities, modelled with Calvo (1983) mechanism. Conventionally, consumers in each region maximize their utility and producers in each sector – their present and discounted future profits. International exchange of goods implies that external adjustment via competitiveness take place and allows us to define the current account balance (simplified here to trade balance).

Henceforth, parameters of the foreign economy are denoted analogously to home economy and marked with an asterisk, e.g. σ and σ^*. Lowercase letters denote the log-deviations of their uppercase counterparts from the steady-state values.

3.1 Household decisions

3.1.1 Intratemporal allocation of consumption

Households get utility from consumption and disutility from hours worked. In addition, utility from consumption depends on consumption habits formed in the previous period (see Smets and Wouters, 2003; Kolasa, 2009). The constant relative returns to scale utility function takes the following form (compare Galí, 2008):

$$U_t\left(C_t, N_t, H_t\right) = \varepsilon_{d,t} \frac{\left(C_t - H_t\right)^{1-\sigma}}{1-\sigma} - \varepsilon_{l,t} \frac{N_t^{1+\phi}}{1+\phi} \tag{1}$$

where C_t – consumption at t, H_t – stock of consumption habits at t, N_t – hours worked at t, $\sigma > 0$ and $\phi > 0$. Consumption habits are assumed to be proportional to consumption at $t-1$ (see Fuhrer, 2000; Smets and Wouters, 2003):

$$H_t = hC_{t-1} \tag{2}$$

with $h \in [0; 1)$ The overall consumption index aggregates the tradable and nontradable consumption bundles:

$$C_t \equiv \left[\left(1-\kappa\right)^{\frac{1}{\delta}} C_{T,t}^{\frac{\delta-1}{\delta}} + \kappa^{\frac{1}{\delta}} C_{N,t}^{\frac{\delta-1}{\delta}}\right]^{\frac{\delta}{\delta-1}} \tag{3}$$

where $\kappa \in (0; 1)$ characterizes the share of nontradables in the home economy and $\delta > 0$ is the elasticity of substitution between the goods produced in both sectors.

The domestic consumption of tradables at t consists of goods produced at home, $C_{H,t}$, and abroad, $C_{F,t}$:

$$C_{T,t} \equiv \left[\left(1-\alpha\right)^{\frac{1}{\eta}} C_{H,t}^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} C_{F,t}^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}} \tag{4}$$

8

An analogous relationship holds for the foreign economy. Given this, α is an intuitive measure of degree of openness and $1 - \alpha$ – home bias in consumption. $\eta > 0$ is the elasticity of substitution between home and foreign tradables.

The consumption of domestic tradable goods in the home economy $(C_{H,t})$ and in the foreign one $(C^*_{H,t})$ is defined as:

$$
C_{H,t} \equiv \left[\left(\frac{1}{w} \right)^{\frac{1}{\varepsilon_T}} \int_0^1 \left(\int_0^w C^j_{H,t,k} dj \right)^{\frac{\varepsilon_T - 1}{\varepsilon_T}} dk \right]^{\frac{\varepsilon_T}{\varepsilon_T - 1}} \qquad C^*_{H,t} \equiv \left[\left(\frac{1}{w} \right)^{\frac{1}{\varepsilon_T}} \int_0^1 \left(\int_0^w C^{j*}_{H,t,k} dj \right)^{\frac{\varepsilon_T - 1}{\varepsilon_T}} dk \right]^{\frac{\varepsilon_T}{\varepsilon_T - 1}}
$$

$$(5)$$

The parameter $\varepsilon_T > 1$ measures the elasticity of substitution between various types of goods in international trade, k indexes the variety of goods, and j − the households (integral over j reflects the difference in both economies' size).

The nontradable consumption bundles, domestic $(C_{N,t})$ and foreign $(C_{N*,t})$, are characterized in a similar fashion as:

$$
C_{N,t} \equiv \left[\left(\frac{1}{w} \right)^{\frac{1}{\varepsilon_N}} \int_0^1 \left(\int_0^w C^j_{N,t,k} dj \right)^{\frac{\varepsilon_N - 1}{\varepsilon_N}} dk \right]^{\frac{\varepsilon_N}{\varepsilon_N - 1}} \qquad C_{N*,t} \equiv \left[\left(\frac{1}{1-w} \right)^{\frac{1}{\varepsilon_{N*}}} \int_0^1 \left(\int_w^1 C^{j*}_{N*,t,k} dj \right)^{\frac{\varepsilon_{N*} - 1}{\varepsilon_{N*}}} dk \right]^{\frac{\varepsilon_{N*}}{\varepsilon_{N*} - 1}}
$$

Consequently, ε^N and ε^{N*} is defined as elasticity of substitution between various types of nontradable goods.

Households maximize at t the discounted flow of future utilities:

$$
E_t \sum_t^{\infty} \beta^t U \left(C_t, N_t, H_t \right) \rightarrow \max_{C,N} \tag{6}
$$

where $\beta \in (0,1)$ is households' discount factor. Maximization of (6) is subject to a sequence of standard period budget constraints faced by a representative household. It leads to the standard first order conditions that define the demand for various types of goods as a declining function of their relative prices and the demand for the bundle to which this good belongs.

3.1.2 Intertemporal allocation of consumption

The standard condition of intertemporal optimality, i.e. equality between marginal loss in utility due to buying a security at t instead of allocating this money to consumption and the discounted payoff at $t + 1$, also expressed in terms of marginal growth of future utility, lead to the following log-linearized dependence (Euler equation for consumption):

$$c_t = \frac{h}{1+h}c_{t-1} + \frac{1}{1+h}E_t c_{t+1} - \frac{1-h}{(1+h)\sigma}(i_t - E_t\pi_{t+1} - \rho) + \frac{1-h}{(1+h)\sigma}(\varepsilon_{d,t} - E_t\varepsilon_{d,t+1}) \quad (7)$$

where i_t denotes short-term nominal interest rate at t, $E_t\pi_{t+1}$ – expected domestic consumer price growth, $\rho = -ln\beta$ – natural interest rate corresponding to the households' discount factor β.

3.1.3 Labour market rigidity

We apply a simplified version of a labour market rigidity mechanism described by Erzeg et al. (2000) and used i.a. by Kolasa (2009). It allows the marginal rate of substitution between consumption and leisure, mrs_t, to equal the real wage, $w_t - p_t$, but only in the long run. In the short run, we let nominal wages be sticky and behave according to the Calvo scheme. Only a fraction of households, $1 - \theta^w \in (0;1)$, can renegotiate their wages in every period. This fraction remains constant and households allowed to reoptimize are selected at random. In particular, the probability of being allowed to renegotiate the wage does not depend on the amount of time elapsed since the last change. Other households partly index their their wages to past consumer inflation. Their fraction is represented by the parameter $\omega^w \in (0;1)$. Under monopolistic competition in the labour market, individual domestic and foreign households supply differentated types of labour services with the elasticity of substitution ε_w.

Solving households' optimization problem leads to the following (home) wage dynamics equation (an analogous solution holds for the foreign economy):

$$\pi_t^w = \beta E_t\pi_{t+1}^w + \frac{(1-\theta^w)(1-\beta\theta^w)}{\theta^w[1+\phi\varepsilon_w]}[mrs_t - (w_t - p_t)] - \omega^w(\beta\pi_t - \pi_{t-1}) \quad (8)$$

3.2 International prices

Define bilateral terms of trade between the home and foreign economy as:

$$S_t \equiv \frac{P_{H,t}}{P_{F,t}} \quad (9)$$

Also, define internal terms of trade as price ratio between tradables and nontradables:

$$X_t \equiv \frac{P_{T,t}}{P_{N,t}} \quad (10)$$

3.3 International risk sharing

Household can smooth their consumption not only in time, but also in international financial markets (Blessing, 2008; Galí, 2008; Kolasa, 2009; Lipińska, 2008). Under complete markets, equation (7) holds for both home and foreign economy. This allows to derive the following log-linearized relation between home and foreign consumption and the real exchange rate q_t (see also Chari et al., 2002):

$$\frac{\sigma}{1-h}\left(c_t - hc_{t-1}\right) - \varepsilon_{d,t} = \frac{\sigma^*}{1-h^*}\left(c_t^* - h^*c_{t-1}^*\right) - \varepsilon_{d,t}^* - q_t \tag{11}$$

3.4 Producers

3.4.1 Real marginal costs

The producers of variety k in the tradable or nontradable bundle face a single-factor production function with constant returns to scale (see Galí, 2008). Following Clarida et al. (1999), we assume away the price deviations of individual varieties within a sector as of second-order importance in the proximity of the steady state.

The real marginal cost (as log-deviation from the steady-state) is calculated as a difference between the wage level in the region (w_t) and the sectoral producer price log-level plus the log of marginal labour product (mpn) (see Galí and Monacelli, 2005), which can be expressed in both sectors as:

$$mc_t^H = \left(w_t - p_t\right) - \alpha s_t - \kappa x_t - \left(a_t^H + \varepsilon_t^H\right) \tag{12}$$

$$mc_t^N = \left(w_t - p_t\right) + \left(1 - \kappa\right) x_t - \left(a_t^N + \varepsilon_t^N\right) \tag{13}$$

with supply shocks in both sectors denoted as ε_t^H and ε_t^N respectively. a_t^H and a_t^N are log labour productivities.

3.4.2 Pricing decisions

There are nominal price rigidities in the economy. Following the usual approach in the New Keynesian literature, we model them by means of the Calvo (1983) scheme. In a given period, a fraction θ of producers are not allowed to reoptimise their prices in reaction to economic innovations and must sell at the price from the previous period. The probability of being allowed to reoptimise the price is equal across producers: $1 - \theta$ in each period, independently of the amount of time elapsed since the last price change.

Some of the producers (fraction ω of reoptimisers) allowed to change their price do not really reoptimize. Following Galí and Gertler (1999) we assume that the change in price is partly implemented as an indexation to past inflation. This mechanism leads to a hybrid Phillips curve (see Galí and Gertler, 1999; Galí et al., 2001), commonly considered to outperform the purely forward-looking specifications in terms of empirical goodness-of-fit. Inflation is modelled separately in the tradable and nontradable sector.

The abovementioned assumptions lead to the following hybrid Phillips curve in the H sector:

$$\pi_t^H = \frac{\omega^H}{\theta^H + \omega^H\left[1 - \theta^H\left(1 - \beta\right)\right]}\pi_{t-1}^H + \frac{\beta\theta^H}{\theta^H + \omega^H\left[1 - \theta^H\left(1 - \beta\right)\right]}E_t\pi_{t+1}^H + \\ + \frac{\left(1 - \omega^H\right)\left(1 - \theta^H\right)\left(1 - \beta\theta^H\right)}{\theta^H + \omega^H\left[1 - \theta^H\left(1 - \beta\right)\right]}mc_t^H \tag{14}$$

and analogously for N.

3.5   Market clearing conditions

Equilibrium on the world markets of individual goods requires equality of overall production and consumption of every variety k in the basket of domestically produced tradables. This implies the following log-linearized relationships:

$$y_t^H \quad = \quad \tilde{w}c_t + (1-\tilde{w})\,c_t^* - [\tilde{w}\alpha\eta + (1-\tilde{w})\,(1-\alpha^*)\,\eta^*]\,s_t - \tilde{w}\kappa\delta x_t - (1-\tilde{w})\,\kappa^*\delta^* x_t^* \qquad (15)$$

$$y_t^{F*} \quad = \quad \tilde{w}^* c_t + (1-\tilde{w}^*)\,c_t^* + [\tilde{w}^*\,(1-\alpha)\,\eta + (1-\tilde{w}^*)\,\alpha^*\eta^*]\,s_t - \tilde{w}^*\kappa\delta x_t - (1-\tilde{w}^*)\,\kappa^*\delta^* x_t^* \quad (16)$$

whereby:

$$\tilde{w} = \frac{w\,(1-\alpha)\,(1-\kappa)}{w\,(1-\alpha)\,(1-\kappa) + (1-w)\,\alpha^*\,(1-\kappa^*)} \qquad \tilde{w}^* = \frac{w\alpha\,(1-\kappa)}{w\alpha\,(1-\kappa) + (1-w)\,(1-\alpha^*)\,(1-\kappa^*)} \quad (17)$$

Market clearing conditions for the nontradable sector can be written as:

$$y_t^N = (1-\kappa)\,\delta x_t + c_t + g_t \quad y_t^{N*} = (1-\kappa^*)\,\delta^* x_t^* + c_t^* \qquad (18)$$

whereby g_t denotes the demand resulting from the domestic government's purchases.

3.6   Policy frameworks

In this paper, we consider 2 policy frameworks:

(a) two countries form a **monetary union**;

(b) both regions represent **autonomous monetary regimes**.

To accommodate the latter case in the model, one needs to adjust the above setup it in three ways (cf. Torój, 2011):

- there are separate home and foreign interest rates in home and foreign Euler equations for consumption (7);

- terms of trade dynamics (9) is additionally affected by the nominal exchange rate dynamics;

- nominal exchange rate evolves according to a standard UIP equation, depending on the interest rate disparity and an UIP shock.

Regardless of the regime, the domestic government pursues Ramsey optimum macroeconomic policy under commitment in a timeless perspective, maximising a measure of domestic agents' welfare. It performs this optimisation task with respect to either one instrument (g_t – government expenditures, in a monetary union) or two instruments (g_t and i_t – domestic nominal interest rate, in an autonomous monetary regime).

3.6.1   Foreign economy

The foreign economy's (or monetary union's) central bank's monetary policy is described with a Taylor (1993) rule with smoothing, which is commonly applied in the literature and empirically tested as an adequate tool for both the euro area (see e.g. Sauer and Sturm, 2003). The common nominal interest rate is set according to the equation:

$$i_t = \rho + (1 - \gamma_\rho)\left(\gamma_\pi \tilde{\pi}_t + \gamma_y \tilde{y}_t\right) + \gamma_\rho i_{t-1} + \varepsilon_t^i \tag{19}$$

where i_t – central bank policy rate at t, $\tilde{y}_t$ – the output gap in a currency union, $\tilde{\pi}_t$ – inflation rate in a currency union, $\gamma_\rho \in (0;1)$ – smoothing parameter, $\gamma_\pi > 1$, $\gamma_y > 0$ – parameters of central bank's response to deviations of inflation and output from the equilibrium levels. The condition $\gamma_\pi > 1$ is necessary to satisfy the Taylor principle (Taylor, 1993), leading to a unique equilibrium.

In the case of two separate monetary regimes, $\tilde{y}_t$ and $\tilde{\pi}_t$ are simply the respective values for the foreign economy. For the monetary union, both variables aggregate the values for individual regions, according to their size. Consequently, if the home economy is small, "foreign" and "unionwide" monetary policy is conducted in almost the same way.

As we do not focus on the foreign economy, we assume a neutral foreign fiscal policy with balanced budget at all times.

3.6.2   Home economy

Domestic fiscal (or monetary and fiscal) policy maximises the measure of welfare developed as second order Taylor expansion of the utility function around the steady state $\bar{C}$:

$$W_0 = \bar{C}^{1-\sigma} E_0 \sum_{t=0}^{\infty} \beta^t \left(\mathbf{A_v}\hat{\mathbf{v}}_t + \tfrac{1}{2}\hat{\mathbf{v}}_t'\mathbf{A_{vv}}\hat{\mathbf{v}}_t + \hat{\mathbf{v}}_t'\mathbf{A_{v\epsilon}}\epsilon_t\right) + tip\left(\epsilon_t\right) + O\left(\|\epsilon\|^3\right) \tag{20}$$

where $\hat{\mathbf{v}}_t$ denotes the vector of log-linearised model's variables, ϵ_t – vector of structural shocks, $\mathbf{A_v}, \mathbf{A_{vv}}, \mathbf{A_{v\epsilon}}$ – coefficient matrices (see Appendix 1), $tip\left(\epsilon_t\right)$ – terms independent of policy (but only on the state of nature ϵ_t and hence irrelevant for the ranking of alternative policies) and $O\left(\|\epsilon\|^3\right)$ – terms of order 3 or higher.

The maximisation task is performed with respect to g_t (or g_t and i_t), subject to constraints given by log-linearised structural equations of the model. Note that there are linear terms in equation (20) due

to the presence of i.a. open economies and monopolistic competition. Benigno and Woodford (2005) argue that such terms may result in inaccurate welfare ranking of alternative policies. Following i.a. Lipińska (2008, 2009), we apply the method by Benigno and Woodford proposed to eliminate these linear terms and replace them with appropriate quadratic terms by exploiting 2nd order approximations to structural equations.

3.6.3 Excessive Imbalance Procedure – constrained current account balance

In order to incorporate the constraint on the current account balance resulting from the EIP scoreboard into the model, we define the current account balance as:

$$ca_t = y_t^H - (1 - \kappa) \, c_t \tag{21}$$

i.e. the difference between home tradable output and the (average) share of consumption of tradable goods times current consumption. As these log-linearised variables are expressed as log-deviations (i.e. percentage differences) from the steady state level, one can think of this difference as an approximate relation of current account to (steady-state) output ratio and hence constrain it as follows:

$$-4 \leq ca_t \leq 6 \tag{22}$$

Alternatively, if we constrain the joint current-capital account balance $(ca_t + ka_t)$ instead:

$$-4 \leq ca_t + ka_t \leq 6$$

and bearing in mind that for the NMS-12 sample $ka_t \approx 1$ on average (see Section 2):

$$-4 \leq ca_t + 1 \leq 6$$

we obtain another (counterfactual) constraint for the NMS:

$$-5 \leq ca_t \leq 5 \tag{23}$$

3.7 Model calibration

Table 2 describes the calibration of the model, based on three sources. Most parameters (elasticities of substitution between home and foreign tradables, Calvo probabilities, parameters of indexation, habit persistence, disutility from labour and the Taylor rule) were estimated with full information maximum likelihood method by Torój (2010a). They were chosen so as to represent a „median" euro area country, i.e. as a median over the estimates in the group of 12 euro area countries. In the study of Torój (2010a), the model's parameters were estimated in 12 country pairs, in which the home economy

represented one of the 12 countries under consideration and the foreign economy represented the rest of the monetary union. This median country has a relative size of 3.4% of the union. Country weight, as well as α, β and κ, were calibrated in a standard way in the same article and also represent a median over the 12 countries.

Inverse intertemporal elasticity of substitution (σ) and elasticity of substitution between the tradables and nontradables (δ) were calibrated in line with Stockman and Tesar (1995). Finally, the parameters describing the stochastic properties of the disturbance vector (serial correlations and variances) are based on the values obtained by Kolasa (2009) for the euro area. Wherever possible, the home and foreign economy are described by the same parameter values.

Table 2: Calibration of the model

parameter	value	parameter	value	parameter	value
η	1.666	$\rho_d = \rho_d^*$	0.65	$\phi = \phi^*$	0.841
η^*	1.275	$\rho_H = \rho_F$	0.62	γ_ρ	0.704
$\omega_H = \omega_F$	0.391	$\rho_N = \rho_N^*$	0.70	γ_π	1.795
$\omega_N = \omega_N^*$	0.147	$\rho_W = \rho_W^*$	0.62	γ_y	0.482
$\omega_W = \omega_W^*$	0.098	$\rho_i = \rho_i^*$	0	$\beta = \beta^*$	0.995
$\theta_H = \theta_F$	0.447	$\sigma_d^2 = \sigma_d^{2*}$	2.34^2	α	0.443
$\theta_N = \theta_N^*$	0.698	$\sigma_H^2 = \sigma_F^2$	2.08^2	α^*	0.047
$\theta_W = \theta_W^*$	0.518	$\sigma_N^2 = \sigma_N^{2*}$	0.91^2	$\kappa = \kappa^*$	0.765
$h = h^*$	0.770	$\sigma_W^2 = \sigma_W^{2*}$	5.5^2	w	0.034
$\delta = \delta^*$	0.5	$\sigma_i^2 = \sigma_i^{2*}$	0.09^2	ε^W	3.000
$\sigma = \sigma^*$	2.0				

Source: author.

4   Constrained macroeconomic policy under EIP

Given the model's calibration described in Subsection 3.7, theoretical standard deviation of current account balance equals 2.93 with the euro and 3.18 without it (due to higher terms of trade volatility under nonzero variance of UIP premium). With a zero steady state[1], a double of this clearly exceeds the -4 bound on ca_t and − by a narrower margin − also the hypothetical -5 bound (resulting from the same constraint imposed on $ca_t + ka_t$). This is why we can regard the unconstrained optimum policy as violating the EIP thresholds.

In operationalising this constraint, we refer to Woodford's (2003, ch. 6) treatment of the problem with zero lower bound on the interest rates. The idea behind this is to ensure that a variable does not hit the constraint by keeping its average at least k standard deviations away from the bound. Let $k = 2$ (implying the fulfilment of the EIP condition approximately 95% of the time). Also let $K = 1 + k^{-2}$

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[1]Zero steady state in this model is rather illustrative and simplifying than adequate for the NMS. In the intertemporal model of the catching-up process, the mid-term equilibrium value should be negative and empirical data in Figure 2 reflect this. In this case, EIP would be even more restrictive for the NMS. It remains, however, an open question what this equilibrium value exactly would be and hence we leave further consideration of this for future research.

Table 3: Current account constraint in EIP scoreboard versus theoretical standard deviation of ca_t

policy regime	standard deviation (sd) of ca_t	lower bound on ca_t	lower bound on $ca_t + ka_t$	steady state (ss)	$ss - 2 \cdot sd$	result
€	2.93	-4	-5	0	-5.85	violated
no €	3.18	-4	-5	0	-6.37	violated

Source: author.

and denote the lower bound on ca_t as LB. The condition (22) or (23) reformulated in this way can be written as:

$$(1 - \beta) E_0 \sum_{t=0}^{\infty} \beta^t (LB + ca_t)^2 \leqslant K \left[(1 - \beta) E_0 \sum_{t=0}^{\infty} \beta^t (LB + ca_t) \right]^2 \tag{24}$$

Consider (20) as $W_0 = \bar{C}^{1-\sigma} E_0 \sum_{t=0}^{\infty} \beta^t W_t + tip(\boldsymbol{\epsilon}_t) + O\left(\|\boldsymbol{\epsilon}\|^3\right)$, i.e. the welfare measure W_0 as a discounted stream of one-period welfare W_t. Denote one-period loss as its opposite, i.e. $L_t \equiv -W_t$. In line with Proposition 6.9 by Woodford (2003, p. 428) and Proposition 1 by Lipińska (2008), one can show that the optimum policy constrained by (24) is characterised by the following loss function:

$$\tilde{L}_t \equiv L_t + \Phi_C \left(ca_t - ca^T \right)^2 \tag{25}$$

whereby:

- the target value for ca_t can be expressed as $ca^T = -LB + K \cdot (1 - \beta) \sum_{t=0}^{\infty} \beta^t (ca_t + LB) > 0$;

- policy coefficient $\Phi_C \geqslant 0$ and $\Phi_C > 0$ iff the additional constraint is binding (see Table 3).

Strictly positive values of the additional loss function coefficient under EIP, Φ_C, can be found iteratively. They should be increasing from 0 until the constraint (24) is hit, but no more, in order to attain maximum feasible welfare. For the parameter set in consideration, both policy regimes and both versions of EIP indicator in question, Φ_C ranges from 1.53 to 14.77. The loss function is the most aggressively corrected in response to EIP when the more restrictive (factual) version of the indicator is in force, i.e. $CA \geq -4\%$, as well as after the euro adoption, when less policy tools are available. Also, the policy response to current account deviations is more aggressive under the euro with less

Table 4: Additional loss function coefficient Φ_C − value under different policy regimes

Φ_C	$CA \geq -4\%$	$CA + KA \geq -4\%$
euro	14.77	5.11
non-euro	3.60	1.53

Source: author.

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Table 5: Welfare ranking of different policy regimes

Welfare estimate	without EIP	$CA \geq -4\%$	$CA + KA \geq -4\%$
euro	-4437.9	-5489.5	-4632.0
non-euro	1562.2	1231.6	1464.5

Timeless perspective, in $[\%^2]$, up to a constant. Higher number implies higher welfare ranking (absolute or relative differences not directly interpretable).

Source: author.

restrictive (counterfactual) version of the indicator (i.e. $CA + KA \geq -4\%$) than without the euro and with more restrictive indicator. That is, the euro-dimension probably matters more for the welfare ranking than the indicator-dimension.

It is also worth mentioning that the inclusion of the lower bound threshold is resulting in a slight bias towards targeting a CA surplus $(0, 2 - 0, 4\%$ GDP). It is higher under the more restrictive EIP version, as well as under flexible exchange rate (to keep a buffer for nominal rate fluctuations).

5   Welfare and policy responses under EIP

As expected, the introduction of policy targeting to comply with the EIP thresholds for the CA balance has turned out to be welfare-decreasing, although to a lesser extent if the alternative formulation of the indicator ($CA + KA \geq -4\%$) is taken into account (see Table (5)). This is true for both policy regimes in question, i.e. in the euro area and in an autonomous monetary policy regime. At the same time, and in line with previous research, the welfare measures in the economy that participates in the monetary union are lower than the analogous values for a non-euro economy.[2]

 The values of welfare (in Table 5) are approximated up to a constant and not directly interpretable, either in absolute or relative terms. It is therefore a common practice to focus on their differences expressed in an alternative metric, i.e. as an equivalent shift in steady state consumption (cf. Lucas, 1987; Gradzewicz and Makarski, 2009; Lipińska, 2008, 2009):

$$\Delta = (1 - \beta) \frac{W_U - W_C}{\bar{C}^{1-\sigma}} \tag{26}$$

where W_U, W_C − welfare under unconstrained and constrained policy (respectively) under comparison. The value of Δ in (26) can be interpreted as the fraction of consumption that consumers would give up on a permanent basis, which would make them equally unhappy as the transition from unconstrained to constrained policy regime (or, in other words, the maximum fraction of their consumption that they would give up to avoid this transition).

In this setup, the introduction of EIP threshold on CA balance results *ceteris paribus* (i.e. taking into account this threshold only) in a welfare loss equivalent to steady-state decrease in consumption of

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[2]Like Gradzewicz and Makarski (2009), we do not take into account possible benefits from the euro adoption in Poland and focus exclusively on the cost of different business cycle properties.

Table 6: Shift to constrained policy: equivalent decline in steady-state consumption

Unconstrained policy		Constrained policy*		% change in $\bar{C}$	(no €→€=100)
€	EIP	€	EIP		
€	no EIP	€	**CA ≥ −4%**	0.1051	17.5
no €		no €		0.0331	5.5
€	no EIP	€	**CA + KA ≥ −4%**	0.0194	3.2
no €		no €		0.0098	1.6
no €	no EIP	€	**CA ≥ −4%**	0.7052	117.5
			CA + KA ≥ −4%	0.6194	103.2
no €	no EIP	€	no EIP	0.6000	100
	$CA ≥ −4\%$		$CA ≥ −4\%$	0.6721	112.0
	$CA + KA ≥ −4\%$		$CA + KA ≥ −4\%$	0.6097	101.6

* − imposed policy constraint marked in bold. Source: author.

0.105% after the euro adoption or 0.033% before that. These numbers are generally comparable with their counterparts from the previous literature on the welfare cost of business cycles: Lucas (1987) estimated the cost of business cycle itself at approximately 0.05%, Lipińska (2009) − the cost of Poland's fulfilment of the Maastricht criteria at 0.016%, and Gradzewicz and Makarski (2009) − the cost of euro adoption in Poland at 0.055%). If we consider the 4% threshold on current plus capital account (rather than current account alone), this cost decreases to 0.019 under the euro and approximately a half of that without the euro.

Interestingly, the estimated cost of the EIP threshold is substantially lower than the cost of euro adoption. From a different perspective, however, one can see the introduction of CA threshold under EIP as a factor augmenting the cost of euro adoption. Under the less restrictive version of the indicator, this rise is low (1.6%), but if we take into consideration the factual threshold of −4% for the CA alone, the cost of euro adoption rises by a factor of 1.12.

The analysis of impulse-response functions of the government's policy variables gives more insight into the nature of constrained policy. After a positive demand shock in the home economy (Figure 3), the domestic producers quickly lose competitiveness and the fiscal policy steps in with an offsetting increase in spending for nontradable output. This policy response is the most aggressive without EIP (black line). If the −4% threshold is introduced on CA balance, the fiscal policy cannot afford such an active intervention and the response remains limited (dark red line). Imposing the limit on CA+KA balance constituted the intermediate scenario between these two.

Without the euro adoption, the profile of government expenditures is initially different: they are reduced at impact as the loss in competitiveness is not immediate. Once it occurs, however, the response pattern is analogous, i.e. the fiscal policy is also the most aggressive without EIP and the least aggressive with its more restrictive version, i.e. with a limit on CA alone. Note that in this case, the main burden of adjustment is thrust upon the monetary policy tightening (right panel of 3) and that all the paths of fiscal response remain moderate as compared to the case of monetary union membership, where g is the only available instrument. Also note that without the euro, the three EIP-related scenarios are very similar.
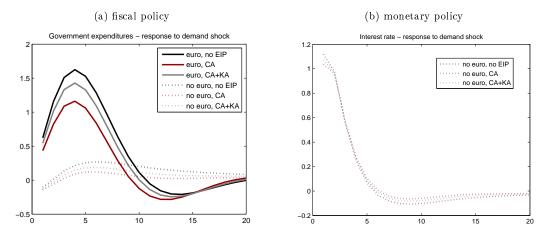
Figure 3: Home policy response to positive demand shock

(a) fiscal policy

(b) monetary policy

Inversely, in the case of a positive supply shock in the tradable sector, the fiscal (and possibly monetary) policy remains the most aggressive under EIP in its most restrictive version. The current account balance quickly improves, boosting the output. The monetary policy steps in with some tightening to contain it, and the fiscal policy – with some expansion to increase consumption. They are both more aggressive under EIP as they target to keep these two variables possibly close to each other in order to avoid a high surplus in CA (or a high deficit, in a symmetric case of adverse supply shock in the tradable sector). In this case, however, an aggressive policy is producing more volatility rather than offseting it and the welfare decreases. Supply shocks in the nontradable sector do not translate into immediate shifts in international competitiveness, and hence the CA (or CA+KA) constraint does not matter for the adjustment policy.

After an adverse labour supply shock, fiscal policy response is slightly more persistent under EIP. Monetary policy, however, remains more moderate and prefers to allow for some overshooting and oscillatory adjustment rather than react in an optimum manner at the beginning. These effects, however, are of second order in terms of economic significance.

6 Conclusions

In this paper, we consider welfare consequences of imposing the threshold on current account balance in the Excessive Imbalance Procedure currently introduced in the European Union. To operationalise this idea, we apply Woodford's (2003) framework of constrained optimum policy, designed for the treatment of zero lower bound on interest rates.

The introduction of EIP threshold on CA balance results in a welfare loss equivalent to steady-state decrease in consumption of 0.105% after the euro adoption or 0.033% before that. These numbers are generally comparable with their counterparts from the previous literature on the welfare cost
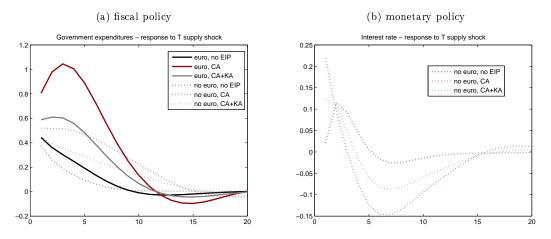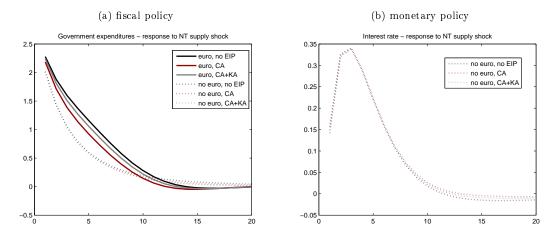
Figure 4: Policy response to positive supply shock in T sector

(a) fiscal policy

(b) monetary policy

Figure 5: Policy response to positive supply shock in NT sector

(a) fiscal policy

(b) monetary policy

Figure 6: Policy response to adverse labour supply shock

(a) fiscal policy

Government expenditures – response to labour supply shock

(b) monetary policy

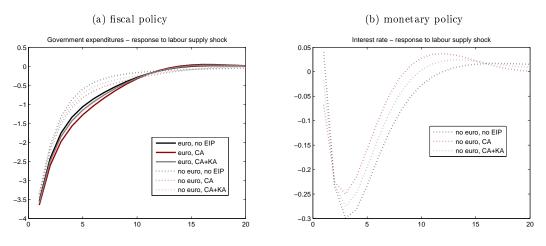Interest rate – response to labour supply shock

of business cycles: Lucas (1987) estimated the cost of business cycle itself at approximately 0.05%, Lipińska (2009) – the cost of Poland's fulfilment of the Maastricht criteria at 0.016%, and Gradzewicz and Makarski (2009) – the cost of euro adoption in Poland at 0.055%). If we consider the 4% threshold on current plus capital account (rather than current account alone), this cost decreases to 0.019 under the euro and approximately a half of that without the euro.

The abovementioned differences seem to stem mainly from (i) less aggressive (and hence less volatility-containing) fiscal policy responses to demand shocks under EIP and (ii) more aggressive (but sub-optimum, and hence volatility-increasing) responses of fiscal (and – if available – monetary) policy to tradable supply shocks.

The estimated cost of the EIP threshold seems to be substantially lower than the cost of euro adoption. From a different perspective, however, one can see the introduction of CA threshold under EIP as a factor augmenting *ceteris paribus* the cost of euro adoption by a factor of approximately 1.12.

This analysis should be supplemented with a number of aspects in further research. More insight should be taken into the model's calibration, including also testing the sensitivity to parameter values. The process of real convergence was simplified here, i.e. the capital account was exogenously set to its sample average and the steady-state current account was set to zero; instead, the catching-up process in terms of productivity should be modelled. Going beyond the CA threshold, further indicators of the EIP scoreboard should be included in the analysis. This should also be analysed jointly with the EDP requirements, as EIP-constrained fiscal policy might find it more difficult to comply with EDP (or inversely). Finally, further research should attempt to confront the welfare cost of CA threshold in EIP with possible benefits from increased macroeconomic stability.

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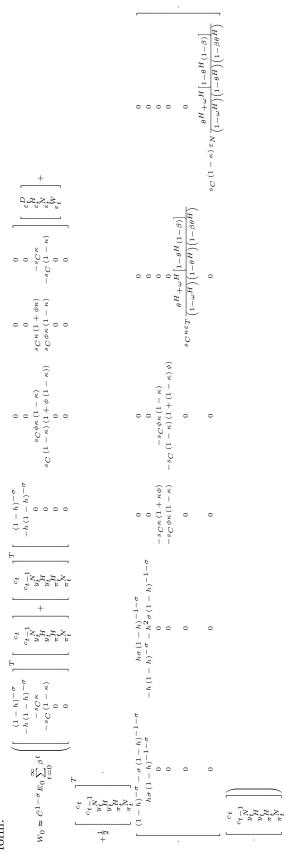
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Appendix 1: Welfare measure

The measure of welfare, defined as 2nd order Taylor expansion of the utility function around the steady state (20), takes the following form:

$$
W_0 \approx \tilde{C}^{1-\sigma} E_0 \sum_{t=0}^{\infty} \beta^t \left(\begin{bmatrix} c_t \\ c_{t-1} \\ y_t^N \\ y_t^H \\ \pi_t^H \\ \pi_t^N \end{bmatrix}^T \begin{bmatrix} (1-h)^{-\sigma} \\ -h(1-h)^{-\sigma} \\ -s_C\kappa \\ -s_C(1-\kappa) \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} c_t \\ c_{t-1} \\ y_t^N \\ y_t^H \\ \pi_t^H \\ \pi_t^N \end{bmatrix}^T \begin{bmatrix} (1-h)^{-\sigma} & 0 & 0 & 0 \\ -h(1-h)^{-\sigma} & 0 & 0 & 0 \\ 0 & s_C\phi\kappa(1-\kappa) & s_C\kappa(1+\phi\kappa) & -s_C\kappa \\ 0 & s_C(1-\kappa)(1+\phi(1-\kappa)) & s_C\phi\kappa(1-\kappa) & -s_C(1-\kappa) \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \varepsilon_t^D \\ \varepsilon_t^H \\ \varepsilon_t^N \\ \varepsilon_t^W \end{bmatrix} + \right.
$$

$$
\left. + \frac{1}{2} \begin{bmatrix} c_t \\ c_{t-1} \\ y_t^N \\ y_t^H \\ \pi_t^H \\ \pi_t^N \end{bmatrix}^T \begin{bmatrix} (1-h)^{-\sigma}-\sigma(1-h)^{-1-\sigma} & h\sigma(1-h)^{-1-\sigma} & 0 & 0 & 0 & 0 \\ h\sigma(1-h)^{-1-\sigma} & -h(1-h)^{-\sigma}-h^2\sigma(1-h)^{-1-\sigma} & 0 & 0 & 0 & 0 \\ 0 & 0 & -s_C\kappa(1+\kappa\phi) & -s_C\phi\kappa(1-\kappa) & 0 & 0 \\ 0 & 0 & -s_C\phi\kappa(1-\kappa) & -s_C(1-\kappa)(1+(1-\kappa)\phi) & 0 & 0 \\ 0 & 0 & 0 & 0 & s_C\kappa\varepsilon_T\frac{\theta^H+\omega^H\left[1-\theta^H(1-\beta)\right]}{(1-\omega^H)(1-\theta^H)(1-\beta\theta^H)} & 0 \\ 0 & 0 & 0 & 0 & 0 & s_C(1-\kappa)\varepsilon_N\frac{\theta^H+\omega^H\left[1-\theta^H(1-\beta)\right]}{(1-\omega^H)(1-\theta^H)(1-\beta\theta^H)} \end{bmatrix} \begin{bmatrix} c_t \\ c_{t-1} \\ y_t^N \\ y_t^H \\ \pi_t^H \\ \pi_t^N \end{bmatrix} \right)
$$

s_C denotes the steady-state ratio of domestic labour income to consumption and is assumed to equal 1.