

Macroeconomic imbalances in an open economy stock-flow consistent model

Dirk H. Ehnts*

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Abstract

The recent global financial crisis was preceded by macroeconomic imbalances between the US and China and also inside the euro area. While they have not caused the crisis, they are nevertheless problematic because of their impact on employment. In both cases a fixed exchange rate regime played a role. I use a stock-flow consistent model with an exchange rate rule to show how macroeconomic imbalances can be kept in check. I also show that expansionary fiscal policies can be used by countries with a sovereign currency. These result in a rise in income but a fall in per capita income as production expands and import prices rise. Given that a nation has a sovereign currency and government denominated in that currency fiscal space is no issue. The use of nominal exchange rates for international adjustment of macroeconomic imbalances can be recommended.

Keywords: stock-flow consistent models, exchange rates, macroeconomic imbalances, fiscal policy, fiscal space

JEL classification: F41, E12, E17

*Berlin School of Economics and Law, www.hwr-berlin.de, dirk@hwr-berlin.de.

1 Introduction

Macroeconomic imbalances have returned to the international policy agenda. They built up between China and the US and Germany and the countries at the euro zone's periphery.¹ Borio and Disyatat (2011) unlink the Great Financial Crisis (GFC) from sustained macroeconomic imbalances in the preceding years and claim that capital flows are the driving force behind the GFC. They attack the view of the global - or, Asian - savings glut proposed by Bernanke (2005). As it stands, macroeconomic imbalances are still relatively high. Oil exporters, Japan and Germany are almost exclusively constituting the group of net exporters, with the rest of the world in net importer position.

When the GFC hit the world economy, governments rallied behind a fiscal stimulus programme. Following economics textbooks, an increase in government spending was advocated to increase aggregate demand. There were some voices that warned that not all countries could participate. Among them, Lin (2009, 1) writes that 'many emerging countries may not be in the position to afford counter-cyclical policies due to their lack of fiscal space or constraints on foreign exchanges'. In this paper I want to examine whether macroeconomic imbalances can be tamed through the use of the nominal exchange rate. I also want to examine whether an increase in government spending in conjunction with a simple exchange rate rule allows for discretionary government spending or.

There already is a literature on open economy stock-flow consistent models. It mostly builds on chapters six and twelve in Godley and Lavoie (2007a). Barbosa de Carvalho (2012) focus on China and the US. A rise of reserve accumulation leads to capital gains in the US, thus increasing consumption. Three-country models have been developed by Lavoie and Zhao (2010) and Mazier and Tiou-Tagba Aliti (2012). These authors model a fixed exchange rate between China and the US and a flexible between the euro zone vis-a-vis the others. Given that China is a net exporter, a portfolio shift of the Chinese central bank's foreign reserves then causes an appreciation of the euro. Godley and Lavoie (2007b) model three economies, two of which are members of the eurozone which trade with the United States. The authors show somewhat presciently that the central bank has to shift its portfolio towards the assets of the 'weak' euro zone country, otherwise independent fiscal policies cannot be sustained.

¹Note that these are not bilateral imbalances.

Mazier and Saadaoui (2012) develop a model which focusses on gross balance sheets and build a bridge towards the financialization literature. Valdecantos Halporn and Zezza (2013) examine the reform of the international monetary system into something resembling the Bancor plan of Keynes. They incorporate a variety of financial assets in their model. Duwicquet and Mazier (2010) explicitly model banks in a two-country framework that resembles the euro zone. The focus on stability issues. Godley and Lavoie (2006) develop a two-country model and focus on closure of flexible and fixed exchange rate systems, challenging the results of the Mundell-Fleming model regarding fiscal policy with flexible exchange rates.

While many of those papers - especially the last contribution - touch on fiscal policy and macroeconomic imbalances, the focus of this paper is on the combination of the two. In order to highlight the adjustment in the real economy the role of the financial sector is reduced to a minimum. While this might seem awkward in times of financialization, the effect of capital gains does not seem to play a large role in reality. When foreign assets are held by sovereign wealth funds, central banks and pension and insurance funds there is no expectation of mark-to-market rules and instant changes in behavior due to observed capital gains. The literature on this comes up with contradictory answers. Ludvigson et al. (2002, 117) at the Federal Reserve Bank of New York find 'little or no sign of a consumption-wealth channel', while the Sousa (2009, 5) at the ECB shows that 'financial wealth effects are relatively large and statistically significant'. However, the recent returns of stock market indices to new record levels has yet to be followed by a boom in consumption. Anecdotal evidence seems to indicate that for the moment the wealth channel does not play an important role in the transmission of monetary policy.

In the next chapter, the model is developed. In chapter 3 the results of the model are laid out and discussed, chapter 4 concludes.

2 The model

The model presents two open economies that features households, government and the external sector. builds on the simple SFC model from Godley and Lavoie (2007, ch. 3). One country is called Eurozone and uses the euro, the other is called USA and uses the dollar. The accounting matrix is shown in Table 1. Since both

countries are symmetric, the eurozone's sectors will be discussed while the same holds for the US.

Households engage in production and earn their wage bill $+WB$ for offering their labour services, which they use for consumption C , saving $-\Delta e$ and paying taxes T . Government consists of a treasury and a central bank. The treasury issues money with which it finances its spending

Table 2 shows the behavioral matrix of the eurozone.

The model is defined by twentyone equations. Total income Y consists of domestic consumption C_d , exports and government spending. Note that the construction of domestic consumption means that imports are not part of the equation.

$$y = c_d + x + g \quad (1)$$

The government levies taxes t on household income, i.e. the wage bill wb . This is done by a marginal tax which is fixed at rate *trate*.

$$t = \text{trate} \cdot wb \quad (2)$$

All income Y comes from wage income wb , since there are no interest-earning assets in this model.

$$wb = y \quad (3)$$

The amount of labour n used is equal to income y divided by productivity pr .

$$n = y/pr \quad (4)$$

The wage for one worker is equal to the total wage bill

$$\text{wage} = wb/n \quad (5)$$

Table 1: Accounting (transaction) matrix

	Households	Firms	Govt	exch. rate	Households	Firms	Govt	Sum
	Eurozone (€)				USA (\$)			
1. Domestic consumption	$-C^e$	$+C^e$			$-C^\$$	$+C^\$$		0
2. Govt. expenditures		$+G^e$	$-G^e$			$+G^\$$	$-G^\$$	0
3. Exports = [Output]		$+EX^e$		$xr^\$$		$-EX^\$$		0
4. Imports		$[Y^e]$				$[Y^\$]$		
5. Factor income (wages)	$+WB^e$	$-IM^e$		xr^e	$+WB^\$$	$+IM^\$$		0
6. Taxes	$-T^e$	$-WB^e$	$+T^e$		$-T^\$$	$-WB^\$$	$+T^\$$	0
7. Changes in euros	$-\Delta \text{€}$		$+\Delta \text{€}$					0
8. Changes in dollars					$-\Delta \$$		$+\Delta \$$	0
9. Changes in international euros		$-\Delta \text{€}^*$				$+\Delta \text{€}^*$		0
Σ	0	0	0		0	0	0	0

Table 2: Behavioral (transaction) matrix of the eurozone

	1. HH	2. Firms	3. Gov	Ext	Σ
1. Domestic consumption	$-C_d$	$+C_s$			0
2. Govt. expenditures		$+G_s$	$-G_d$		0
3. Exports		$+EX_s$		$-EX_d$	0
= [Output]		[Y]			
4. Imports		$-IM_d$		$+IM_d$	0
5. Factor income (wages)	$+W \cdot N_s$	$-W \cdot N_d$			0
6. Taxes	$-T_s$		$+T_d$		0
7. Changes in money	$-\Delta H_h$		$+\Delta H_s$		0
8. Changes in foreign wealth		$-\Delta F$		$+\Delta F$	0
Σ	0	0	0	0	0

The government deficit $gdef$ is equal to government spending g minus tax income t .

$$gdef = g - t \quad (6)$$

Real income yk equals real domestic consumption cdk plus real government spending gk plus real exports xk .

$$yk = cdk + gk + xk \quad (7)$$

Real disposable income ydk equals the wage bill wb minus taxes t divided by the constant domestic price level $pcons$.

$$ydk = (wb - t)/pcons \quad (8)$$

Disposable income yd equals real disposable ydk multiplied with the domestic consumer price level $pcons$.

$$yd = ydk \cdot pcons \quad (9)$$

Imports m equal the real value of imports multiplied by the foreign prices and the exchange real rate.

$$m = mk \cdot pf \cdot xr \quad (10)$$

Domestic consumer prices consists of 90 percent of domestic good prices p and 10 percent of foreign goods prices times the real exchange rate.

$$pcons = 0.9 \cdot p + 0.1 \cdot pf \cdot xr \quad (11)$$

Real imports mk equal the marginal propensity to import $mp1$ out of real disposable income ydk plus the marginal propensity to import $mp2$ out of last period's money holdings of households $hd(-1)$ plus the marginal propensity to import $mp3$ times foreign prices pf divided by the domestic prices.

$$mk = mp1 \cdot ydk + mp2 \cdot hd_{-1}/pcons + mp3 \cdot pf \cdot xr/p + 1 \quad (12)$$

Real exports xk equal the marginal propensity to import $mp1$ out of foreign real disposable income yfk plus the marginal propensity to import $mp2$ out of last period's money holdings of foreign households $hfd(-1)$ minus the marginal propensity to import $mp3$ times foreign prices pf divided by the domestic prices.

$$xk = mp1 \cdot yfk + mp2 \cdot hfd_{-1}/pfcons - mp3 \cdot pf \cdot xr/p - 1 \quad (13)$$

Real domestic consumption cdk equals parameter α_1 times real disposable income ydk plus parameter α_2 times last period's household wealth $hd(-1)$ divided by consumer prices $pcons$ minus parameter α_3 times parameter $mp3$ times foreign prices pf times the exchange rate xr divided by p

$$cdk = \alpha_1 \cdot ydk + \alpha_2 \cdot hd(-1)/pcons - \alpha_3 \cdot mp3 \cdot pf \cdot xr/p \quad (14)$$

The domestic nominal values of consumption, government spending and exports equal their real value multiplied by the domestic producer goods price level.

$$cd = cdk \cdot p \quad (15)$$

$$g = gk \cdot p \quad (16)$$

$$x = xk \cdot p \quad (17)$$

Domestic money held by domestic households equals last period's value plus disposable income minus domestic consumption minus imports.

$$hd = hd_{-1} + (yd - cd - m) \quad (18)$$

Foreign money held by domestic households equals last period's value plus exports minus imports.

$$hf = hf_{-1} + x - m \quad (19)$$

The domestic monetary aggregate equals last period's value plus the government deficit.

$$hs = hs_{-1} + gdef \quad (20)$$

The following three equations show the change relative debt positions of the three sectors private, public and external.

$$gov = t - g \quad (21)$$

$$trade_inv = m - x \quad (22)$$

$$sav = yd - cd - m \quad (23)$$

The following is the exchange rate rule used by the central bank. If the value of foreign reserves divided by the value of last period's imports is below two the exchange rate is devalued by 35 percent. If the ratio surpasses the value of three the exchange rate is revalued by 35 percent.

$$xr = xr_{-1} + (hf_{-1}/m_{-1} < 6.18415) \cdot 0.01 + (hf_{-1}/m_{-1} > 6.588415) \cdot (-0.01) \quad (24)$$

Next to the equations the model uses a variety of parameters and initial values that can be found in the Annex.

The missing equation that closes the model but need not be provided explicitly is the fact that the change in money that is issued or retracted each period by the central bank is equal to the change in foreign and domestic holdings of money combined.

$$d(hd) = (d(hs) + d(hf)) \quad (25)$$

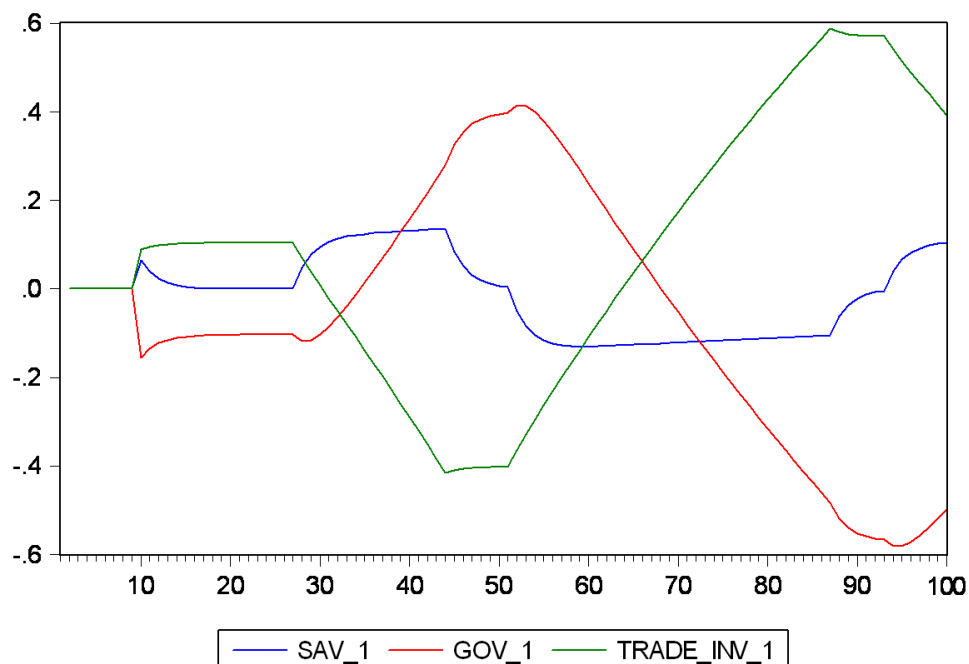
3 Results

The model will now be subjected to a shock in the sense that government spending by country A increases by 2 percent while country B does not change its fiscal stance. The model is put into the steady state and in period 10 the policy intervention is enacted.

Figure 1 shows the effect on the three sectoral balances. After the policy change the government sector moves to a deficit position (red line). The private sector sees its savings rise in the beginning (blue line). However, a current account deficit arises and drains holdings of foreign reserves (green line, inverted). Finally, around period 30, foreign reserves fall under the threshold and the exchange rate adjustment is triggered.

As a result, the import bill increases and households consume less imports but also less of their domestic consumption products. Exports increase because the purchasing power of foreign income has increased. The quantity of imports starts falling, but not as fast as the imports prices increase. For the next 15 periods the exchange rate is devalued every period until finally the current account deficit turns into a surplus and foreign reserves rise above the threshold again. Savings in the private sector increase and the government deficit comes down as a result

Figure 1: Sectoral balances of country A after a 2% rise in government spending in period 10

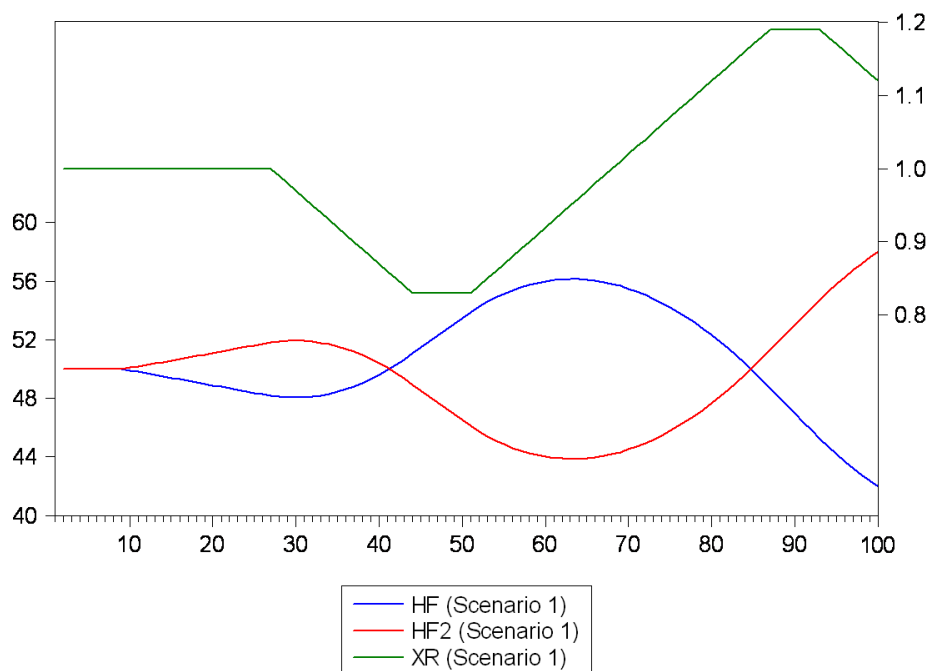


of the increase in incomes and taxes. A little bit later, the exchange rate starts rising as the position of a net exporter has led reserves to move above the upper threshold. This process goes on and on but does not explode.

Figure 2 shows the development of the exchange rate (green line, right axis) and the holdings of foreign reserves (left axis). In a two country model, the rise in reserves of one country as a result of macroeconomic imbalances obviously leads to a fall in the reserves of the other country. Total reserves in the world economy sum up to one hundred at every moment. Since net exporting triggers exchange rate adjustment, the exchange rate lags behind the macroeconomic imbalances.

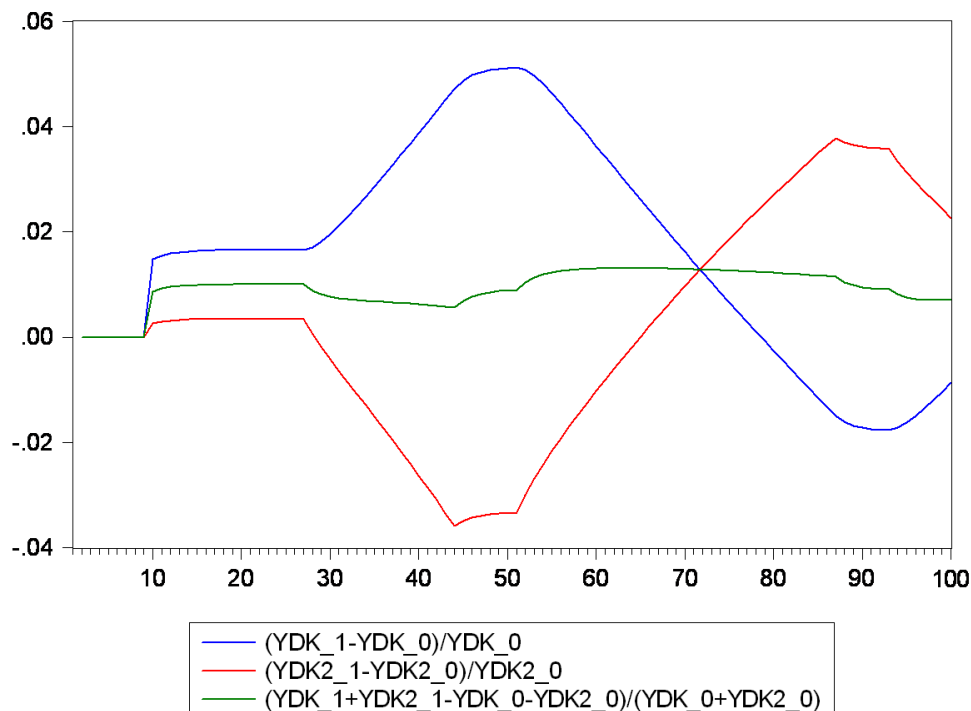
Figure 3 shows the growth rates of real disposable income in both countries and the world economy they constitute. The growth rates are positive because the rise

Figure 2: Sectoral balances (left axis) and exchange rate (right axis) after a 2% rise in government spending in period 10



in aggregate demand that was triggered by the fiscal stimulus in country A feeds itself through the world economy, increasing employment in both countries. Per capita real disposable income growth is flat on average, and in both countries. This means that the fiscal stimulus does not lead to higher real disposable income per capita. Therefore, fiscal stimulus does not lead workers to be better off and thus they are not happier than before - although there are now more of them. Expansionary fiscal policy does not take away the incentive to increase productivity in the economy, which would lead to higher real disposable income on the per capita level.

Figure 3: Sectoral balances (left axis) and exchange rate (right axis) after a 2% rise in government spending in period 10



4 Conclusion

Under the assumptions three results were established. First, macroeconomic imbalances can be kept in check by adjustment of the nominal exchange rate. Second, governments do have the power to use discretionary government spending even in the face of macroeconomic imbalances. Since the assumptions are compatible with most developing countries that keep their exchange rate fixed against the US-dollar, that have considerable foreign reserves in the form of low yielding US-dollar denominated assets and have no significant amount of foreign debt, the lessons of the model might have some relevance for this group. Last but not least the use of fiscal policy should not crowd out policies aimed at increasing

productivity in the economy since workers are not better off per capita.

Annex

Since the two countries are symmetric all values are the same except where state otherwise.

```
series cd = 20
series m = 10
series x = 10
series g = 29.76666666
series y = cd+x+g
series wb = y
series trate = 0.5
series t = trate*wb
series pr = 1
series n = y/pr
series wage = wb/n
series gdef = g - t
series cab = x -m series p=1
series pf=1
series xr=1
series cdk = cd/p
series mk = m/(xr*pf)
series xk = x/p
series gk = g/p
series yk=cdk+xk+gk
series pcons=0.9*p+0.1*pf*xr series alpha1 = 0.6
series alpha2 = 0.4
series alpha3 = 1
series mp1 = 0.25
series mp2 = 0.05
series mp3 = -1
series hd = 7.7
series hf = 50
series hs = 13.88518
series pfcons =1
series xr0=xr
```

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