

# Twin Deficits, Openness and the Business Cycle\*

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## Abstract

In this paper, we study the co-movement of the government budget balance and the trade balance at business cycle frequencies. In a sample of 10 OECD countries we find that the correlation of the two time series is negative, but less so in more open economies. Moreover, for the US the cross-correlation function is S-shaped. We analyze these regularities taking the perspective of international business cycle theory. First, we show that a standard model delivers predictions broadly in line with the evidence. Second, we show that conditional on spending shocks the model predicts a perfect correlation of the budget balance and the trade balance. Yet, the effect of spending shocks on the trade balance is contained if an economy is not very open to trade.

*Keywords:* Fiscal Policy, Twin deficits, Openness, Business Cycle

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# 1 Introduction

The notion of ‘twin deficits’ emerged in the mid-1980s following the observation that the US trade balance moved into deficit at a time of increasing government budget deficits, suggesting that fiscal expansions caused the positive co-movement.<sup>1</sup> On the other hand, in the debate on the need for fiscal consolidation to correct external imbalances, it has been observed that the correlation between the two time series is actually very small, or even negative in the data.<sup>2</sup>

Any assessment of the co-movement of the budget and the trade balance, however, should take into account that both variables adjust endogenously not only to fiscal shocks but to the entire state of the economy. Therefore, we study the transmission of both fiscal and productivity shocks onto the government budget and net exports, taking the perspective of international business cycle theory.<sup>3</sup>

We proceed in two steps. First, we document three regularities concerning the co-movement of the trade and the budget balance. Using quarterly time series for 10 OECD countries during the period 1973-2005, we show that: i) the contemporaneous correlation between the budget and the trade balance (both scaled by GDP) is typically negative at business cycle frequencies: budget surpluses are associated with trade deficits; ii) the correlation is less negative, the more open countries are to trade; iii) the cross-correlation for the budget balance and the trade balance in the US resembles a stretched ‘S’.

Second, we ask whether a standard international real business (IRBC) model can account for the above regularities. For the sake of transparency, we draw on the classical contribution by Backus, Kehoe, and Kydland [1994], henceforth BKK, assuming shocks to technology as well as government spending. To analyze the behavior of the government budget balance, we assume that government purchases are financed either through issuing debt or by taxing the income of domestic residents.<sup>4</sup>

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<sup>1</sup>Recall that national accounting implies: current account deficit = budget deficit + private investment - private saving. Hence, unless fiscal shocks cause large swings in private net savings, policies that deteriorate the budget are bound to worsen the trade deficit.

<sup>2</sup>See e.g. Backus, Henriksen, Lambert, and Telmer [2006] who dismiss the relevance of the twin deficits hypothesis on the ground of this observation.

<sup>3</sup>By explicitly taking into account non-fiscal shocks for the co-movement of the budget and the trade balance, this paper complements a line of research which focuses on the transmission of fiscal shocks; see Erceg, Guerrieri, and Gust [2005] for an analysis using a general equilibrium model and Kim and Roubini [2003], Corsetti and Müller [2006], Monacelli and Perotti [2006] and Beetsma, Giuliodori, and Klaasen [2007] using VAR models.

<sup>4</sup>Note that we adopt a parsimonious model setup in order to convey our main argument in a transparent and efficient way; namely that non-fiscal shocks are important for the co-movement of the trade and the budget balance. Clearly, quantitative aspects of our analysis might be refined using richer specifications.

We find that the model is able to replicate the empirical regularities, notably the negative correlation of the budget and the trade balance. However, simulating the model for each shock in isolation shows that the correlation is perfect conditional on domestic government spending shocks: consistent with the notion of twin deficits, fiscal expansions cause a joint deterioration of the budget and the trade balance. Yet, an almost perfect correlation does not translate into an economically significant effect: we find only a very small effect of fiscal shocks on the trade balance if an economy is relatively closed.

## 2 Properties of the data

In this section we characterize the business cycle properties of the primary budget balance and the trade balance. We consider quarterly time series for 10 OECD countries covering the post-Bretton Woods period 1973-2005. Table 1 displays several statistics of the HP-filtered series of net exports,  $nx$ , the primary government budget balance,  $bb$ , and real output,  $y$ .<sup>5</sup>

Table 1: Properties of net exports, output and the budget balance

	Standard deviation			Autocorrelation			Correlation		
	(percent)			nx	y	bb	(nx,bb)	(nx,y)	(bb,y)
	nx	y	bb						
AUS	1.06	1.38	1.04	0.76	0.74	0.87	-0.23	-0.21	0.62
CAN	0.94	1.46	1.29	0.72	0.89	0.78	0.02	0.05	0.63
FIN	1.67	2.14	1.67	0.44	0.87	0.94	-0.05	-0.30	0.67
GBR	0.99	1.49	1.32	0.66	0.85	0.71	-0.15	-0.34	0.31
IRL	1.95	1.66	1.27	0.79	0.77	0.92	-0.03	-0.17	0.17
JPN	0.75	1.38	0.71	0.85	0.81	0.92	-0.30	-0.42	0.45
KOR	2.90	2.55	0.97	0.73	0.84	0.90	-0.28	-0.43	0.52
NLD	0.90	1.15	0.99	0.45	0.76	0.89	0.02	-0.03	0.35
SWE	1.10	1.38	2.08	0.45	0.69	0.92	-0.00	-0.09	0.57
USA	0.45	1.59	1.12	0.78	0.88	0.81	-0.34	-0.45	0.74

HP-filtered quarterly data 1973-2005. Source: OECD Economic Outlook;  $nx$ : trade balance,  $bb$ : primary government budget balance (both scaled by GDP),  $y$ : real GDP.

<sup>5</sup>We use a smoothing parameter of 1600. All data are obtained from the OECD economic outlook database (Economic Outlook 81, Annual and Quarterly data, Vol. 2007 release 1). The primary budget balance in percent of GDP is available at quarterly frequency for the following OECD 10 countries: Australia, Canada, Finland, Ireland, Japan, Republic of Korea, Netherlands, Sweden, United Kingdom, United States. The trade balance is computed as the difference of exports and imports scaled by GDP, at current prices. Data for Korea and the Netherlands are only available from 1975 and 1980, respectively. In the working paper version of this paper we also compute statistics using annual time series for 16 countries, see Corsetti and Müller [2007].

The first two panels of Table 1 show that standard deviations and autocorrelations display considerable variation across the 10 countries in our sample. However, the contemporaneous correlation of the trade balance and the budget balance, shown in the third panel of the table, is negative everywhere except in the Netherlands and Canada, where it is nonetheless close to zero. The correlation between the primary budget balance and output is positive in all countries, while the correlation between the trade balance and output is generally negative, as stressed by the early IRBC literature.

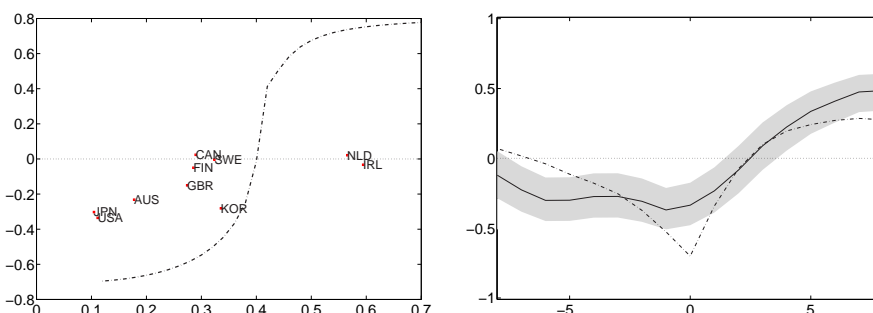


Figure 1: Correlation of trade balance,  $nx$ , and budget balance,  $bb$ ; left panel: contemporaneous correlation vs. average import share for 10 OECD countries and model (dashed line); right panel: ccf for US data (solid line and shaded area for 95 percent confidence bounds) and model (dashed line, baseline calibration), vertical axis:  $\rho(bb_t, nx_{t+k})$ , horizontal axis:  $k$ .

Next, we ask whether the correlation of the budget and the trade balance vary with the degree of openness of a country, as measured by the import share in GDP (openness). The left panel of Figure 1 plots these two variables against each other for the countries in our sample. As our second finding, we note that, by and large, the correlation is less negative, the more open an economy.

Finally, we focus on the dynamic relationship between the budget balance and the trade balance in the US, plotting the cross-correlation function (ccf) of  $bb_t$  and  $nx_{t+k}$  for  $k = -8 \dots 8$  in the right panel of Figure 1. As our third finding, we note that for the US the ccf resembles a stretched 'S'.

### 3 The model

Can the empirical regularities established above be accounted for by a standard international business cycle model? Are these facts inconsistent with the twin deficit hypothesis? In the rest of this paper we address these questions by adopt-

ing a parsimonious specification of the BKK model.<sup>6</sup> The main features of the model are as follows. Letting  $c_{it}$  denote consumption and  $n_{it}$  the amount of labor supplied, the preferences of the representative household in country  $i$  ( $i = 1, 2$ ) are given by the following expression

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{1}{1-\gamma} [c_{it}^\mu (1-n_{it})^{1-\mu}]^{1-\gamma}. \quad (1)$$

Households supply labor and rent capital to a representative firm which produces a country-specific intermediate good, denoted by  $a$  and  $b$ , in country 1 and 2, respectively. Labor and capital are internationally immobile; households in each country own the capital stock  $k_{it}$  of that country. Investment,  $x_{it}$ , increases the existing capital stock in the following way,

$$k_{it+1} = (1-\delta)k_{it} + x_{it}, \quad (2)$$

where  $\delta$  is the depreciation rate. Households' labor and capital income are both taxed at the same rate,  $\tau_{it}$ . Households maximize (1) subject to (2), a no-Ponzi-game condition and a budget constraint, where we allow for international trade in a complete set of state-contingent securities.

Intermediate goods are produced using the following production function

$$y_{it} = e^{z_{it}} k_{it}^\theta n_{it}^{1-\theta}, \quad (3)$$

where  $z_{it}$  is an exogenous technology shock. Defining  $\mathbf{z}_{t+1} = [z_{1t} \ z_{2t}]'$ , we assume  $\mathbf{z}_{t+1} = \mathbf{A}\mathbf{z}_t + \boldsymbol{\varepsilon}_{t+1}^z$ , where  $\boldsymbol{\varepsilon}_{t+1}^z$  is a bivariate vector of innovations to technology. The law of one price holds for intermediate goods  $a$  and  $b$ . Final goods,  $f_{it}$ , are assembled on the basis of the following technology

$$f_{it} = \begin{cases} \left[ \omega^{1/\sigma} a_{it}^{(\sigma-1)/\sigma} + (1-\omega)^{1/\sigma} b_{it}^{(\sigma-1)/\sigma} \right]^{\sigma/(\sigma-1)}, & \text{for } i = 1 \\ \left[ (1-\omega)^{1/\sigma} a_{it}^{(\sigma-1)/\sigma} + \omega^{1/\sigma} b_{it}^{(\sigma-1)/\sigma} \right]^{\sigma/(\sigma-1)}, & \text{for } i = 2 \end{cases} \quad (4)$$

where  $\sigma$  is the elasticity of substitution between goods  $a$  and  $b$  and  $\omega$  measures the home bias in final goods. Firms are operating under perfect competition both at the intermediate and final good level. Domestic households thus earn the entire domestic intermediate output as income.

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<sup>6</sup>The model differs from BKK in two respects: First, we assume that government spending falls entirely on domestic goods, because of the evidence discussed in Corsetti and Müller [2006] suggesting that the import content in government spending is generally less than half the import content in private spending. As a first approximation it is thus reasonable to assume zero import content in government spending. Second, we assume that governments have no access to lump-sum taxes but instead levy a flat tax rate on income, which adjusts to the level of government debt.

Government purchases,  $g_{it}$ , are purely dissipate and financed by taxing income or by issuing risk-free debt,  $d_{it}$ . Letting  $R_t$  denote the risk-free interest rate, the period budget constraint of the government is given by

$$d_{it+1}R_t^{-1} - d_{it} = g_{it} - \tau_{it}y_{it}. \quad (5)$$

Government spending is determined exogenously as follows

$$g_{it} = (1 - \rho_g)g_i + \rho_g g_{it-1} + \varepsilon_{it}^g, \quad (6)$$

where  $g_i$  denotes government spending in steady state and  $\rho_g$  captures the persistence of deviations from steady state.  $\varepsilon_{it}^g$  is an exogenous innovation to government spending. The tax rate adjusts to the level of debt scaled by steady state output,  $y_i$ :

$$\tau_{it} = \tau_i + \phi \frac{d_{it}}{y_i}, \quad (7)$$

where  $\phi$  measures the debt-elasticity of the tax rate. In our analysis below, taking the perspective of country 1, we focus on the co-movement of the primary budget balance scaled by GDP,  $(\tau_{1t}y_{1t} - g_{1t})/y_{1t}$  and the trade balance  $(a_{2t} - p_t b_{1t})/y_{1t}$ , where  $p_t$  denotes the terms of trade measured as the price of good  $b$  relative to the price of good  $a$ .

## 4 Properties of theoretical economies

We study the business cycle properties of the model using log-linear approximation of the equilibrium conditions near a symmetric zero-debt steady state.<sup>7</sup> To calibrate the model we follow BKK, as regards both the parameters governing preferences and technology, and the forcing processes in technology and government spending. Note that as government spending is assumed to fall entirely on domestically produced goods, assuming an import share of 15 percent in final goods ( $\omega = 0.85$ ) implies an import share of 12 percent of GDP, the average value in US time series.<sup>8</sup> To pin down  $\phi$ , we aim at matching the degree of autocorrelation of the budget balance in US data, which is equal to 0.81, subject to the constraint that the path of government debt is non explosive. We find that the constraint is binding at  $\phi = 0.0143$ , implying that the tax rate adjusts very slowly

<sup>7</sup>The statistics reported below are the average over 20 simulations of 132 quarters each. We use 500 observations to initialize the model. In accordance with the statistics reported in section 2 above we also apply the HP filter to the simulated time series.

<sup>8</sup>See Corsetti and Müller [2007] for a list of the parameter values used in the baseline specification and sensitivity analyses showing the robustness of our results with respect to alternative specifications.

to government debt. As a result, fluctuations in government spending and output induce persistent movements in the government budget balance.

In a first step, we assess the ability of the calibrated model to account for the key features of the data regarding twin deficits, openness and the business cycle. In Table 2 we compare second moments of US time series (first line) with those generated by the model under our baseline calibration (second line). The contemporaneous correlation of the ‘twins’ is negative. The budget and trade balance show a stronger correlation with output than in the data, but of the right sign. The theoretical standard deviation of the trade balance is somewhat below those characterizing in US time series; the model does slightly better in matching the volatility of output, but not as well as regards the budget balance. By the same token, the three variables show less persistence in the model than in the data.

Table 2: Properties of Key Variables in Theoretical Economies

	Standard deviation (percent)			Autocorrelation			Correlation		
	nx	y	bb	nx	y	bb	(nx,bb)	(nx,y)	(bb,y)
US data	0.45	1.59	1.12	0.78	0.88	0.81	-0.34	-0.45	0.74
Benchmark	0.30	1.33	0.28	0.63	0.66	0.67	-0.70	-0.73	0.93
	(0.04)	(0.15)	(0.03)	(0.08)	(0.07)	(0.06)	(0.09)	(0.06)	(0.02)
Only $g_1$	0.01	0.04	0.09	0.68	0.70	0.69	1.00	-0.99	-0.99
	(0.00)	(0.00)	(0.01)	(0.05)	(0.05)	(0.05)	(0.00)	(0.00)	(0.00)
Only $z_1$	0.21	1.27	0.26	0.62	0.65	0.65	-0.82	-0.79	1.00
	(0.02)	(0.13)	(0.03)	(0.08)	(0.07)	(0.07)	(0.04)	(0.05)	(0.00)
Only $g_1, z_1$	0.21	1.27	0.27	0.62	0.65	0.65	-0.75	-0.80	0.93
	(0.02)	(0.13)	(0.03)	(0.07)	(0.07)	(0.07)	(0.05)	(0.05)	(0.02)

First row reports data moments for US, see Table 1; consecutive rows contain theoretical counterparts for different assumptions on forcing process; for theoretical moments standard deviations are in parentheses.

In Figure 1 we assess the performance of the model in two additional dimensions. In the left panel the dashed line plots the contemporaneous correlation of the trade and the budget balance against openness. The model is able to replicate a key feature characterizing the cross-section of the data, namely the positive association between openness and the correlation of the budget and the trade balance. In the right panel, the dashed line displays the ccf implied by the baseline calibration of the model, which is close to the empirical cross-correlation function for the US. In light of our numerical results, we find that, overall, the model is able to provide a satisfactory account of the empirical regularities characterizing the co-movement of the budget and trade balance.

We thus turn to counterfactual experiments and simulate the model drawing from the distribution of each shock in isolation. Results are shown in rows 2 to 5 of Table 2, which report the second moments predicted by the model for the main variables of interest, conditional on specific shocks.

Three observations are in order. First, the contemporaneous correlation of the trade and the budget balance conditional on domestic government spending shocks is perfect (third row). This squares well with the notion of twin deficits whereby fiscal shocks induce co-movement of the budget and the trade balance. Second, the correlation is strongly negative conditional on technology shocks (fourth row). Third, technology shocks seem to dominate the unconditional correlation which is close to the correlation conditional on technology shocks. Put differently, government spending shocks and foreign technology shocks have only a limited effect on the unconditional moments of the simulated data.<sup>9</sup>

The strong positive correlation of the trade and the budget balance that the model predicts conditional on government spending shocks, however, does not necessarily imply a strong economic effect of fiscal shocks on the trade balance. To clarify this issue, we display in the columns of Figure 2 the impulse responses to each of the four shocks, both for the baseline economy (solid line) and a model economy which is identical to the baseline case except for a higher import share of 30 percent (line with diamonds).

In the first column we show the responses to an increase of government spending by one percent of GDP: it decreases consumption and investment, and raises output by about 0.5 on impact (baseline economy). The trade balance falls, but its movement is quite contained (about 0.1 percent), while the budget balance moves into a significant deficit (about 0.85 percent). So, while the conditional correlation of the trade and the budget balance is virtually perfect, only a small fraction of the fiscal expansion is reflected in the trade balance.

The picture changes considerably in economies which are more open to trade. In this case, the effect of fiscal shocks on the trade balance increases significantly, a result which is analyzed in detail by Corsetti and Müller [2006] and Corsetti, Meier, and Müller [2007]. We observe that the response of output is virtually unaltered, but the responses of investment and consumption increase relative to the baseline scenario. Hence, the trade balance falls significantly.

Figure 2 also reports the effect of an increase in foreign government spending, displayed in the second column: domestic consumption and investment fall; yet the economy experiences mild trade and budget surpluses. To complete our analysis, columns three and four show the effects of technology shocks in the domestic country and abroad. As in BKK, a domestic technology shock worsens the trade balance, because investment and consumption rise more than output in the short run. Symmetrically, the trade balance improves if the technology shock originates in the foreign country. The budget balance improves persistently in re-

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<sup>9</sup>The last row of Table 2 reports the moments conditional on both domestic shocks. In Corsetti and Müller [2007] we also report the conditional ccf illustrating how domestic technology shocks dominate the unconditional correlation.

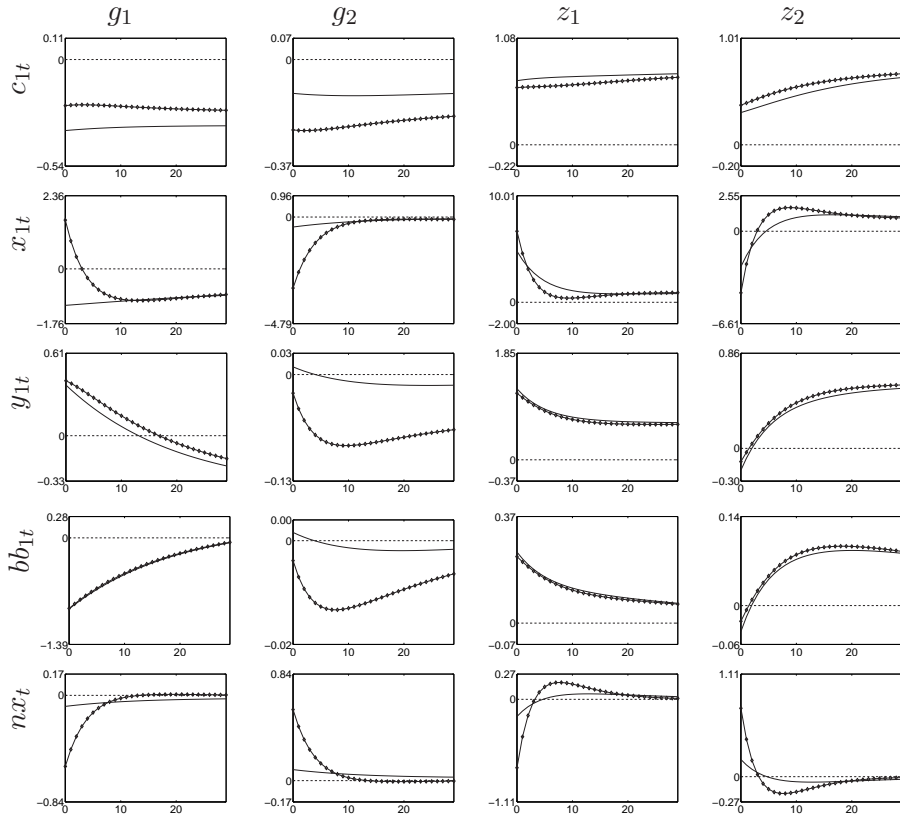


Figure 2: Shock transmission in theoretical economies. Notes: Columns 1-4 show, in turn, effect of shocks to domestic and foreign government spending and domestic and foreign technology; solid lines display responses of baseline economy (12 percent import share:  $\omega = 0.85$ ), line with diamonds corresponds to an economy with import share of 30 percent ( $\omega = 0.625$ ). vertical axis: percent of GDP, horizontal axis: quarters.

response to a domestic technology shock: as government spending is constant and the tax rate responds slowly to government debt, tax revenues move proportional to domestic output. Domestic technology shocks thus induce a negative correlation of budget and trade balance, but less so, the more open the economy.<sup>10</sup>

<sup>10</sup>The correlation becomes less negative in more open economies, because the terms of trade depreciation following the technology shock alters the intertemporal margin governing investment decisions, see Corsetti and Müller [2006] for a discussion of the underlying mechanism in the context of fiscal shocks. Corsetti and Müller [2007] consider alternative values for  $\phi$  finding some effect on the response of  $nx$  to fiscal shocks. As a result, the correlation between the trade and the budget balance conditional on spending shocks falls for higher values of  $\phi$ , but remains positive.

## 5 Conclusion

In this paper we reconsider the notion of twin deficits in light of empirical evidence from a sample of 10 OECD countries, and quantitative results from a standard international business cycle model.

Our analysis highlights two points which are potentially relevant for the policy debate on twin deficits. First, the negative correlation found in the data is not inconsistent with the twin deficit hypothesis: our results suggest that conditional on fiscal shocks, the budget and the trade balance co-move strongly, although their overall correlation is determined by other shocks driving the business cycle. Second, even if conditional on fiscal shocks the correlation between the two deficits is positive and strong, the quantitative response of the trade balance may still be quite contained, especially in economies with a low import share in GDP.

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