Twin Deficits, Openness, and the Business Cycle*

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November 20, 2007

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 ten OECD countries we find that the correlation of the two time series is negative but is less so in more open economies. Moreover, for the United States the cross-correlation function is S-shaped. We analyze these regularities from the perspective of international business cycle theory. First, we show

*We are grateful to Roel Beetsma, Massimo Giuliodori, Franc Klaassen, Tommaso Monacelli, and Roberto Perotti as well as seminar participants at the EEA Meeting in Budapest, Goethe University Frankfurt, and the Reserve Bank of Australia for helpful comments. The usual disclaimer applies. Please address correspondence to giancarlo.corsetti@eui.eu or muellerg@wiwi.uni-frankfurt.de

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

JEL-Classification : F41, F42, E32

1 Introduction

The notion of "twin deficits" emerged in the mid-1980s following the observation that the U.S. trade balance moved into deficit at a time of increasing government budget deficits, suggesting that fiscal expansions caused the positive co-movement.[1] 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.[2]

Any assessment of the co-movement of the budget and the trade balance 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.[3]

[1] 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 drain the budget are bound to worsen the trade deficit.

[2] See e.g. Backus et al. (2006), who dismiss the relevance of the twin deficits hypothesis on the grounds of this observation.

[3] 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 that focuses on the transmission of fiscal shocks. See Erceg et al. (2005) for an analysis using a general equilibrium model; for vector autoregresssion models see Kim and Roubini (2003), Corsetti and Müller (2006), Monacelli and Perotti (2006) and Beetsma et al. (2007).

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 ten 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, so budget surpluses are associated with trade deficits; (ii) the correlation is less negative, the more open countries are to trade; and (iii) the cross-correlation for the budget balance and the trade balance in the U.S. resembles a stretched letter S.

Second, we ask whether a standard international real business (IRBC) model can account for these regularities. For the sake of transparency, we draw on the classical contribution by Backus et al. (1994), henceforth BKK, assuming shocks to technology as well as government spending. In order to analyze government's behavior in balancing the budget, we assume that government purchases are financed either through issuing debt or by taxing the income of domestic residents.[4]

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 con-

[4]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.

ditional 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 OCED countries covering the post–Bretton Woods period 1973–2005. Table 1 displays several statistics of the cyclical component obtained from applying the Hodrick–Prescott filter to net exports, nx, the primary government budget balance, bb, and real output, y.[5]

[5]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 as a percentage of GDP is available at quarterly frequency for the following OECD ten 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 available only from 1975 and 1980, respectively. In the working paper version we also compute statistics using annual time series for sixteen countries; see Corsetti and Müller (2007).

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

	Standard deviation			Autocorrelation			Correlation		
	nx	*y*	*bb*	*nx*	*y*	*bb*	(*nx*,*bb*)	(*nx*,*y*)	(*bb*,*y*)
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; Standard deviation measured in %; nx: trade balance, bb: primary government budget balance (both scaled by GDP), y: real GDP.

The first two panels of Table 1 show that standard deviations and autocorrelations display considerable variation across the ten 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. We find that the correlation between the primary budget balance and output is positive in all

countries, whereas the correlation between the trade balance and output is generally negative, as stressed in the early IRBC literature.

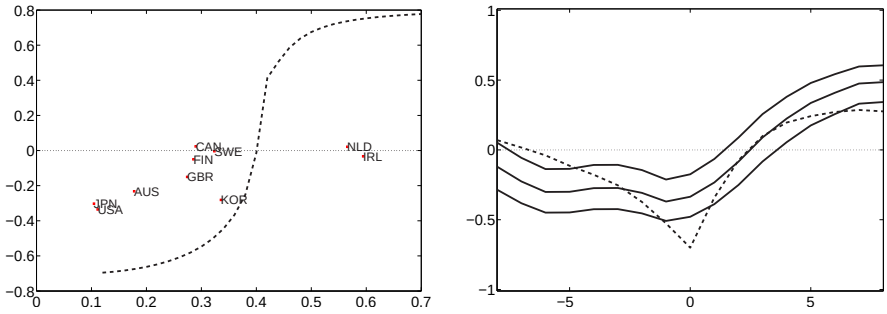

Figure 1: Correlation of trade balance, nx, and budget balance, bb; left panel: contemporaneous correlation vs. average import share for ten OECD countries and model (dashed line); right panel: ccf for U.S. data (solid line together with 95% confidence bounds) and model (dashed line, baseline calibration), 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 U.S., plotting the cross-correlation function (ccf) of bb_t and nx_{t+k} for $k = -8, \ldots, 8$ in the right panel of Figure 1. Our third finding is that, for the United States, the ccf resembles a stretched S.

3 The model

Can the empirical regularities established so far be accounted for by a standard international business cycle model? Are the facts inconsistent with the twin deficit hypothesis? In the rest of this paper we address these questions by adopting a parsimonious specification of the BKK model.[6] 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 expression

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

Households supply labor and rent capital to a representative firm that 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

[6]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 income tax rate, which adjusts to the level of government debt.

existing capital stock in the following way:

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

where δ is the depreciation rate. Households' labor and capital income are both taxed at the same rate, τ_{it}. Households maximize (1) subject to equation (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 production function

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

where z_{it} is an exogenous technology shock. Defining $\boldsymbol{z}_{t+1} = [z_{1t}\ z_{2t}]'$, we assume $\boldsymbol{z}_{t+1} = \boldsymbol{A}\boldsymbol{z}_t + \boldsymbol{\varepsilon}^z_{t+1}$, where $\boldsymbol{\varepsilon}^z_{t+1}$ 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:

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

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

Government purchases, g_{it}, are purely dissipate and are financed by taxing income or by issuing risk-free debt, d_{it}. Letting R_t denote the risk-free interest

rate, we may write the period budget constraint of the government as

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

Government spending is determined exogenously as follows:

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

where g_i denotes government spending in steady state, ρ_g captures the persistence of deviations from steady state, and ε_{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:

$$\tau_{it} = \tau_i + \phi\frac{d_{it}}{y_i}, \tag{7}$$

where ϕ measures the debt elasticity of the tax rate. In the analysis to follow, we take the perspective of country 1 and 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, $(a_{2t} - p_t b_{1t})/y_{1t}$. We use p_t to denote 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 a log-linear approximation of the equilibrium conditions near a symmetric zero-debt steady state.[7]

[7]The statistics reported here 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, we

In calibrating the model we follow BKK with regard to the parameters governing preferences and technology and to the forcing processes in technology and government spending. Note that, because government spending is assumed to fall entirely on domestically produced goods, assuming an import share of 15% in final goods ($\omega = 0.85$) implies an import share of 12% of GDP, the average value in U.S. time-series data.[8] To pin down ϕ, we aim at matching the autocorrelation of the budget balance in U.S. data, which is equal to 0.81, subject to the constraint that the path of government debt is nonexplosive. We find that the constraint is binding at $\phi = 0.0143$, implying that the tax rate adjusts very slowly 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 U.S. 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

also apply the Hodrick–Prescott filter to the simulated time series.

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

sign. The theoretical standard deviation of the trade balance is somewhat below the values that characterizing U.S. 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			Autocorrelation			Correlation		
	nx	*y*	*bb*	*nx*	*y*	*bb*	(*nx*,*bb*)	(*nx*,*y*)	(*bb*,*y*)
U.S. data	0.45	1.59	1.12	0.78	0.88	0.81	−0.34	−0.45	0.74
Baseline	0.30 (0.04)	1.33 (0.15)	0.28 (0.03)	0.63 (0.08)	0.66 (0.07)	0.67 (0.06)	−0.70 (0.09)	−0.73 (0.06)	0.93 (0.02)
Only g_1	0.01 (0.00)	0.04 (0.00)	0.09 (0.01)	0.68 (0.05)	0.70 (0.05)	0.69 (0.05)	1.00 (0.00)	−0.99 (0.00)	−0.99 (0.00)
Only z_1	0.21 (0.02)	1.27 (0.13)	0.26 (0.03)	0.62 (0.08)	0.65 (0.07)	0.65 (0.07)	−0.82 (0.04)	−0.79 (0.05)	1.00 (0.00)
Only g_1, z_1	0.21 (0.02)	1.27 (0.13)	0.27 (0.03)	0.62 (0.07)	0.65 (0.07)	0.65 (0.07)	−0.75 (0.05)	−0.80 (0.05)	0.93 (0.02)

First row reports data moments for United States (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 between budget and trade bal-

ance. 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 United States. Our numerical results show 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 3 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.[9]

[9]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 and thus illustrate how domestic technology shocks dominate the unconditional correlation.

The model predicts a strong positive correlation between trade and budget balance, conditional on government spending shocks, but this 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 (dashed line), which is identical to the baseline case except for a higher import share of 30%.

In the first column we show the responses to an increase of government spending by 1% of GDP: it decreases consumption and investment, and it raises output by about 0.5% on impact (baseline economy). The trade balance falls, although its movement is quite contained (about 0.1%), while the budget balance moves into a significant deficit (about 0.85%). So even though while the conditional correlation of the trade and the budget balance is nearly perfect, only a small fraction of the fiscal expansion is reflected in the trade balance.

The picture changes considerably in economies that are more open to trade. In this case, the effect of fiscal shocks on the trade balance increases significantly, a result analyzed in detail by Corsetti and Müller (2006) and Corsetti et al. (2007). We observe that the response of output is virtually unaltered but that 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 response to a domestic technology shock: because government spending remains constant and the tax rate responds slowly to government debt, tax revenues move in proportion with domestic output. Domestic technology shocks thus induce a negative correlation of budget and trade balance but less so, the more open the economy.[10]

[10]The correlation becomes less negative in economies that are more open 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 ϕ and find some effect on the response of nx to fiscal shocks. As a result, the correlation between the trade balance and the budget balance conditional on spending shocks falls for higher values of ϕ but remains positive.

5 Conclusion

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

Our analysis highlights two points that may be 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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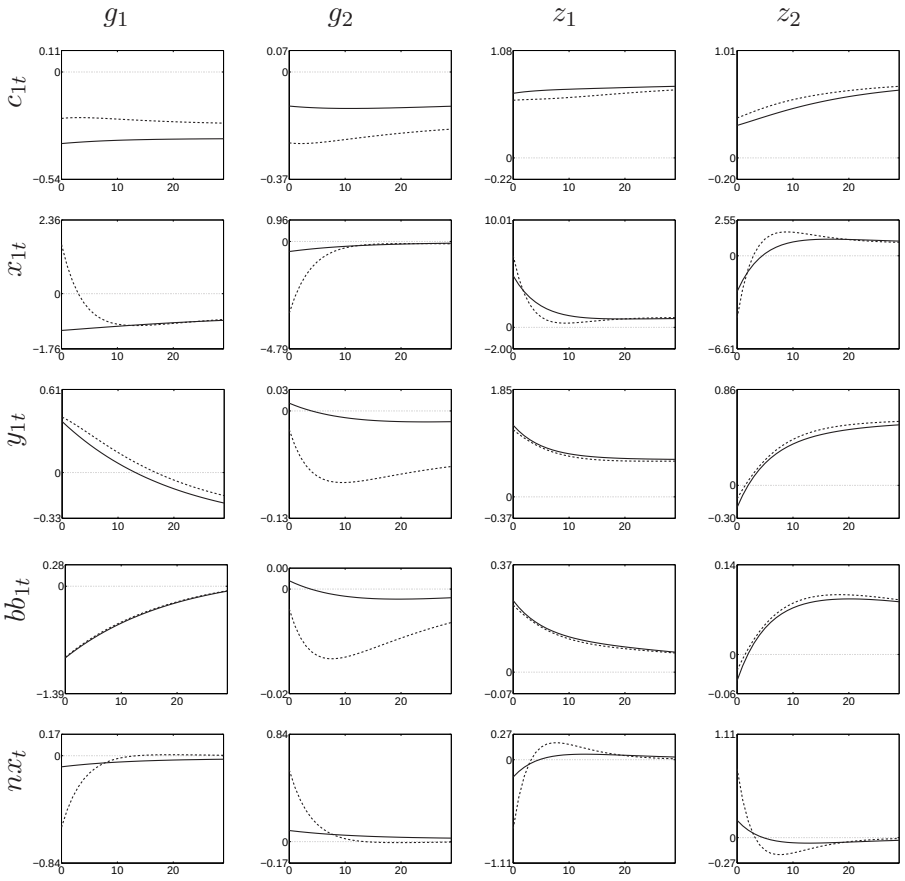

Figure 2: Shock transmission in theoretical economies. Notes: Columns 1-4 show, in turn, effect of shocks to domestic and foreign government spending and domestic and foreign technology; solid lines display responses of baseline economy (12% import share: $\omega = 0.85$), dashed lines correspond to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