

FISCAL, FOREIGN, AND PRIVATE NET BORROWING: WIDELY ACCEPTED THEORIES DON'T CLOSELY FIT THE FACTS

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Abstract: There are three important “deficits” in any economy – private, government, and foreign flows of net borrowing (or investment minus saving) which as a matter of accounting must sum to zero. Widely accepted doctrines about how open macroeconomies operate focus on these deficit or surplus (net lending = saving minus investment) positions. Twin deficits (TD) and rational expectations/Ricardian equivalence (RE) models are widespread in mainstream literature, while development and heterodox economists often favor a structural gap (SG) explanation of external balance. We investigate here whether these worldviews have empirical support in data for the United States and developing countries.

Keywords: Twin Deficits, Ricardian Equivalence, Structural Gaps

Sumário: Existem três “déficits” importantes em qualquer economia – privado, público e externo (ou investimento menos poupança) que devido a uma restrição contábil necessariamente somam zero. As principais teorias sobre o funcionamento de economias abertas são focadas nestes déficits ou superávits financeiros (superávit = poupança menos investimento). Os modelos de Déficit Gêmeos (Twin Déficit ou TD) e Expectativas Racionais com Equivalência Ricardiana (Ricardian Equivalence ou RE) predominam na literatura convencional, enquanto que economistas heterodoxos ou estudiosos do desenvolvimento econômico favorecem uma explicação do déficit externo em termos de hiatos estruturais. Neste artigo nós investigamos se estas visões de mundo têm ou não suporte empírico com base nos dados dos Estados Unidos e países em desenvolvimento.

Palavras chave: Déficit Gêmeos, Equivalência Ricardiana, Hiato Estruturais

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There are three important “deficits” in any economy -- private, government, and foreign flows of net borrowing (or investment minus saving) which as a matter of accounting must sum to zero. Widely accepted doctrines about how open macroeconomies operate focus on these deficit or surplus (net lending = saving minus investment) positions. Twin deficits (TD) and rational expectations/Ricardian equivalence (RE) models are widespread in mainstream literature, while development and heterodox economists often favor a structural gap (SG) explanation of external balance. We investigate here whether these worldviews have empirical support in data for the United States and developing countries.

With regard to twin deficits, the results indicate that fiscal and foreign net borrowing do not usually move in mutually offsetting fashion as the theory predicts. The main observed exception is an decrease in government borrowing when extra foreign exchange is made available by a resource bonanza (as discussed below, Russia and the Middle East are recent examples).

More frequent are synchronized partially offsetting shifts of private and foreign or private and government net borrowing flows. The latter combination -- simultaneous increases in government net borrowing (or lending) and private net lending (or borrowing) -- is superficially consistent with rational expectations consumption theory and Ricardian equivalence as well as a structural foreign gap. However, its detailed patterns appear to contradict the theory underlying both forms of RE.

In the US, the private sector does *not* increase its net lending as output increases, contrary to about 70 years of theorizing about private saving behavior and in clear contrast to the core rational expectations prediction that households engage in “consumption smoothing.” Rather, private net borrowing leads the business cycle. Nor does it adjust fully to offset changes in fiscal borrowing -- the core prediction of Ricardian equivalence analysis.

Structural gap models are based on the premise that an economy’s current external account is more or less fixed. (Several rationales have been proposed, as discussed below.) Because net deficits must sum to zero, if the external position is constant then any change in either private or fiscal net borrowing must be offset by an opposite-signed change in the other flow. This pattern appears in some but not all developing regions.

One immediate policy conclusion is that if shifts in private and government net borrowing are mutually offsetting, then counter-cyclical fiscal policy is a mirror image of the pro-cyclical private sector net borrowing pattern mentioned above. The fiscal contribution to demand must be counter-cyclical to stabilize the system, as in fact it is.

Secondly, if the economic authorities feel a need to reduce the external gap, they should be cautious about cutting the fiscal deficit as a means to that end. In developing economies, austerity often seems to reflect itself into higher household net borrowing rather than an improvement in the balance of payments. Under a binding structural gap, lower fiscal net

borrowing cuts aggregate demand and relieves a supply constraint on the private sector. Private demand may increase enough in response to keep output close to available aggregate supply. If it does not, the ensuing recession will usually reduce the foreign deficit, forcing fiscal and/or private net borrowing to contract.

We start with a brief sketch of the relevant theories, then go on to empirical results.

1. Received Theories

In development macroeconomics, the twin deficits hypothesis traces back at least to the International Monetary Fund economist Jacques Polak's (1957) blueprint for the "financial programming" exercises that to this day are the linchpin of IMF stabilization packages worldwide. The recipe for action – in terms of billions of people affected surely the most important piece of macroeconomics since Keynes -- is to cut the fiscal deficit which is supposed to improve the economy's external position.

Polak, of course, was drawing on a long tradition of monetarist analysis of the balance of payments, from the philosopher David Hume's busman's holiday into economics in the late 18th century to the present day. In one variant, the idea is that unless the private sector chooses to increase its saving (or, more precisely, reduce its net borrowing as discussed below) then a higher fiscal deficit must be paid for by domestic money creation. Aggregate demand consequently goes up. Under tacit assumptions that all resources are fully employed and the domestic price level is tied to foreign prices by arbitrage in foreign trade (purchasing power parity or PPP applies), the higher demand has to spill over into a bigger trade deficit. In the US debate, such was the rationale for the co-movements of the foreign and fiscal deficits during the presidency of Ronald Reagan.

The foundation of Ricardian equivalence is the idea that the private sector smooths its consumption over the cycle, borrowing more at troughs and lending more at peaks to stabilize its spending profile over time. So its net lending should vary pro-cyclically. The most popular rationale is in terms of rational expectations perfect foresight models of consumption behavior, but the notion traces back to Keynes.¹ Contemporary models are just the culmination of a sequence of consumption theories that emerged after WWII – ratchet effects, life-cycle savings, and the permanent income hypothesis (Taylor, 2004). They all predicted counter-cyclical net borrowing.

Ricardian equivalence per se (Barro, 1974) emerges from dynamic optimal savings models postulating that all resources are fully employed and that households are fully rational. It plays a far more central role in contemporary mainstream macroeconomics than Polak's

¹ Consumption-smoothing is not a major theme in the *General Theory*, but Keynes thought it "probably" would happen: "The marginal propensity to consume is not constant for all levels of employment, and it is probable that ... when real income increases ... the community will wish to consume a gradually diminishing proportion of it" (Keynes, 1936, p. 120).

somewhat dated monetarism (though, as we will see below, Polak sans PPP can help explain recent interactions between public and private sector deficits in several developing regions).

The doctrine broadly asserts that a change in fiscal net borrowing will be offset by an equal shift in private net lending. In an open economy context, any one country's external position then has to be determined by inter-temporal trade-offs between consumption and saving with all countries in the world hypothetically producing the same good (Obstfeld and Rogoff, 1997).² Traditional counter-cyclical fiscal policy does not play a role in this context.

As noted above, the TD and RE stories are not compatible because they assign different roles to private and foreign net borrowing. As explained more fully in the appendix, under TD private borrowing is "neutral" in that it does not respond to shifts in the foreign or fiscal positions. Under RE, the current account is neutral with regard to fiscal shifts while private and government borrowing adjust to assure macroeconomic balance. Finally, causality can also be interpreted as running the other way – from the foreign to the fiscal and/or private sector financial gap. Perhaps the external deficit is "structural" and will persist in the face of plausible domestic policy changes (not excluding currency devaluation). In the global macroeconomics debate today, authors such as Bernanke (2005) and Wolf (2005) assert that current account repercussions of "excess saving" by the rest of world force an external deficit upon the US economy.³

More in line with development and heterodox macroeconomics, structure may also be built into foreign trade. Within "reasonable" ranges of real exchange rate values and the level of economic activity, the trade deficit (or surplus, say for China or Germany) will not change by very much. It need not be close to zero because of lacking (or excess) competitiveness of domestic producing sectors.⁴

SG analysis resembles full employment RE in that its binding external gap imposes a supply constraint on the system. Particularly in a developing country context, the question becomes how does effective demand adjust to meet the commodity supply permitted by available imports? To hold demand stable, any shift in the private or public sector net borrowing position has to be reflected into an offsetting change in the other domestic gap (as under RE).

² A post Keynesian variant is Thirlwall's (1979) "law" which asserts that the growth rate of output is equal to the export growth rate divided by the income elasticity of import demand. This formula follows easily from the accounting developed in the following section, on the sufficient conditions that trade is balanced and that the members of two pairs of variables – private investment and government spending, and private saving and tax revenues – respectively crowd each other out 100% just as under RE.

³ The Bernanke-Wolf scenario is an obvious riff on the "Dutch Disease" literature which argued that an influx of foreign exchange forces exchange rate appreciation on the economy, to ratify a big external deficit apart from the source of bonanza (the idea is ancient, with the contemporary label coming from natural gas discoveries in The Netherlands). With exchange rates nowadays largely determined in capital markets, the trade-related empirical relevance of the excess saving thesis is not very clear.

⁴ Blecker (1992) presents a clear argument along these lines for the US. Two decades earlier, the New Cambridge School advanced similar ideas for the UK, e.g. Cripps and Godley (1978).

Mechanisms that can make this happen are sketched below. If private net borrowing is neutral, than a shift in the external gap will be reflected into the fiscal deficit – TD with causality reversed.

It becomes interesting to see what patterns emerge from the data.

2. Accounting Preliminaries

To put some numbers on these ideas, it is helpful to follow Godley and Cripps (1983) and ultimately a long tradition in national accounting by analyzing net borrowing by an economy's "institutional sectors," say households, "business" or the rest of the private sector, government, and the rest of the world. From any such sector's income-expenditure statement,

$$\text{Net Borrowing} = \text{Expenditures} - \text{Revenues} = \text{Investment} - \text{Saving}$$

If a sector's spending exceeds its income, then after offsetting its current consumption against income flows, its investment must exceed its saving. To pay for the excess it must be increasing net liabilities or reducing net assets, that is borrowing in net terms. Negative borrowing by the rest of the world is the same thing as positive lending to the home economy, or a current account deficit on the balance of payments.

In a fully closed accounting system, any one sector's increase in assets (say) must be matched by increases in liabilities of other sectors. The sum of all sectors' net borrowing flows must therefore be equal to zero. This accounting restriction is crucial to the interpretation of several results to follow.

In the numbers for the US presented immediately below, we approximated investment of the household sector by total residential capital formation and derived investment of the business sector as a residual. Such a breakdown was not feasible for the developing regions discussed in section 3, so there the sectoral breakdown is just private, government, and the rest of the world. Data for the US are on a quarterly basis, and annual for the developing regions.

3. Net Borrowing Flows in the US Economy 1947-2004

Figure 1, taken from Barbosa-Filho et. al. (2005), presents net borrowing flows for the post-WWII US economy, normalized by trend GDP.⁵ The shaded areas represent periods of cyclical peak- to-trough output downswings (recessions) according to the well-known National Bureau of Economic Research (NBER) chronology.

[Figure 1]

Looking first at broad trends, four patterns (or lack of same) stand out:

The US usually ran a current account surplus until around 1980 when the economy embarked upon an external deficit with a strongly increasing trend after 1991. The transient external recovery beginning in the mid-1980s was due to dollar devaluation (the Plaza accords), a recession, and American export of military services during the Gulf War. It did not persist.

⁵ The trend was calculated by applying the "Hodrick-Prescott filter" (a standard method for smoothing time series) to real GDP. This procedure produces a weighted moving average of GDP, and we define potential output as the smoothed series. Results are not notably different if the borrowing flows are normalized by actual GDP.

Before 1980, increasing household net lending (more negative levels of net borrowing across business cycles) offset the mildly upwardly trended government and business deficits to support the surplus on current account.

Swings in household net borrowing tended to offset movements in the external current account after the early 1980s. For that period, formal statistical tests indicate that personal net borrowing was the main domestic counterpart to secularly increasing lending from abroad.

Finally, there is scant support for the TD hypothesis. Fiscal and foreign net borrowing flows are shown together in Figure 2. Clear coincidences of movements in the government and foreign deficits only occurred during the Reagan and second Bush presidencies. Also, peaks in the current account deficit followed peaks in the fiscal deficit, but the length of the lag varied considerably over time, from two quarters to four years.

Twinned external and government deficits would be vertical mirror images of one another. Apart from the government borrowing upswing of the 1980s and just possibly after 2003 recession, this pattern did not hold. In only 10 of the 60 years plotted in Figure 2 did the fiscal and foreign deficits move in the same direction. Twin deficits are the exception, not the rule.⁶

[Figure 2 here]

To decide whether rational expectations or Ricardian equivalence is relevant for the US economy, it is helpful to look at cyclical behavior of the net borrowing series. Especially prior to 1980, household borrowing *led* the business cycle. Increasingly negative net borrowing (higher net lending) occurred during or just after recessions with lending dropping off ahead of the cyclical peak. Households borrowed less at the bottom of the output cycle, and more near the top.

Movements in both residential investment and personal saving contributed to this pattern, but it runs distinctly counter to the notions of inter-temporal optimization and “consumption smoothing” built into rational expectations models. Personal saving, in particular, is strongly *counter*-cyclical, with its maximum shares of potential output occurring at NBER output troughs and minima toward the end of an output expansion.⁷ This pattern cannot emerge from fundamental rational expectations theory.

Like households in the US, business sets its net borrowing levels pro-cyclically. However, non-residential investment and business saving track together much more closely than the corresponding flows for households. Throughout the post-war period, troughs in business net

⁶ As discussed more formally in the appendix, this observation is buttressed by the fact that over the sample period only about half of the variance of foreign net borrowing is “explained” by the covariance of foreign and government borrowing. Under the accounting restriction that net borrowing flows must sum to zero, the rest of the statistical explanation must come from the covariance of foreign and private borrowing.

⁷ As shown in the appendix, the covariance of private net borrowing and capacity utilization is strongly positive, just opposite to what the theory predicts.

borrowing shares tended to coincide with or lag output troughs, while maximum shares coincided with or led output peaks.

Unsurprisingly, US current account surpluses (or at least lower current account deficits in the recent period) appeared to track output troughs and analogously, peaks in foreign net lending shares tended to coincide with output peaks in the US. The lengths of the lags, however, were quite variable across cycles.

So where does all this leave government net borrowing? From the accounting discussed above it must be equal in magnitude with opposite sign to the sum of household, business, and foreign flows. If all three vary pro-cyclically then as a “theorem of accounting” the fiscal deficit must be counter-cyclical, in line with the government’s traditional function of stabilizing output fluctuations by operating on aggregate demand (under Keynesian assumptions, at least!).

The standard RE models consolidate households and business into a portmanteau private sector. Figure 3 shows how private and government net borrowing flows have varied over time.⁸ Consistent with the household behavior discussed above, increases in private net borrowing shares have tended to lead the cycle. The fiscal deficit share drops off as output rises, with the peak in net borrowing typically occurring at the beginning of cyclical recoveries. Automatic stabilizers (including rising transfers to households which help offset their pro-cyclical behavior) help explain this phenomenon. Lows in net borrowing shares coincide with or lead the output peak, as the tax take rises.

The bottom line is that fluctuations in private and public net borrowing tend to offset one another, but *not* for the reasons emphasized by RE doctrine. The private sector does not appear to “smooth consumption” while the fiscal deficit moves counter-cyclically as traditionally it should. The upshot is the pattern shown in Figure 3. Moreover, the two domestic sectors’ net borrowing flows do not offset one another fully. As noted above, lending to the US from abroad is pro-cyclical.⁹

[Figure 3 here]

4. Net Borrowing Flows in Developing Regions 1980-2002

Now we turn to net private, government, and foreign borrowing flows (normalized by current real GDP) in 12 regional groups including 57 developing and transition countries.¹⁰ The groups are rapidly growing East Asian economies (or the “Tigers”), Southeast Asia, China, South Asia, semi-industrialized “Latin America” (including South Africa and Turkey with economic structures similar to their counterparts in the Western Hemisphere), the Andean countries,

⁸ Referring back to Figure 1 shows that a plot of household vs. government net borrowing would follow a similar pattern.

⁹ As discussed in the appendix, the covariance of capacity utilization and foreign net borrowing is positive, whereas a value of zero would be required for Ricardian equivalence to hold.

Central America and the Caribbean, Eastern Europe, Russia and Ukraine representing the former USSR, “representative” and “other” countries in sub-Saharan Africa¹¹, and the Middle East. Nations in each group are listed in the Appendix. Generally, borrowing behavior of individual countries within each group resembles the pattern for the whole.

Several borrowing styles can be identified. Figure 4 shows what happened for three rapidly growing East Asian regions. The Tigers, China, and Southeast Asia had opposing co-movements between private and foreign net borrowing with government borrowing maintaining a relatively constant (Tigers), mildly fluctuating (Southeast Asia), or slightly trended (China) share of GDP. The private and foreign co-movements were relatively large, with swings up and down exceeding 10% of GDP in the Tigers and Southeast Asia. Maintaining very high per capita income growth over a 25-year period with the macro economy subject to such extreme fluctuations is a feat perhaps unprecedented historically.

The fiscal net borrowing position did not appear to play much of a role in this achievement – there is no support for TD from the East Asian data. In the Tigers and Southeast Asia, rising trade deficits and falling household net lending coincided with upswings in output. RE consumption-smoothing was conspicuous by its absence. A more plausible scenario is that private sector spending generated an output boom which was then cut off. In the Tigers, for example, initial expansion after the Plaza accords was led by rising private net borrowing and a falling external surplus until around 1990. Growth was then maintained with relatively stable borrowing shares until the Asian crisis when the external surplus shot up again. With a collapse in investment, private net borrowing became strongly negative in response.

[Figure 4 here]

Figure 5 shows the history for two regions with persistently high levels of government net borrowing – rapidly growing South Asia (dominated by India) and economically stagnant middle income Latin America. All three series in South Asia remained nearly flat with a government deficit, sustained private net lending (negative net borrowing), and a balanced external account. The private net lending share resembles China’s, except that in South Asia the private surplus financed a fiscal deficit while in China the external account was in surplus. The region’s large fiscal deficit evidently did not create an equally large external gap. With foreign net lending stable at two percent of GDP for 20 years beginning in the early 1980s, net borrowing trade-offs had to involve government and the private sector, consistent with SG analysis. Steady output growth after India’s external crisis in the early 1990s was not accompanied by an upward trend in private sector net lending, as RE theory would suggest.

¹⁰ This section is based on Rada and Taylor (2006). The countries were grouped to keep the discussion within bounds.

¹¹ The representative group is made up of four countries often discussed in the development literature, and the others are included essentially on grounds of availability of data.

Except for the latter part of the recessionary “lost decade” of the 1980s, Latin America appeared to have a more or less structural external deficit. In line with the SG hypothesis, note the wide offsetting swings in the government and private borrowing. There was no twinning between fiscal and foreign deficits, with the two domestic borrowing series more or less offsetting one another. The 1990s were slightly more prosperous than the preceding decade, ushered in during the late 1980s by rising household net borrowing as the fiscal deficit was cut back.

[Figure 5]

In Figure 6, the Andean economies, Central America and the Caribbean, Eastern Europe, and representative Africa all appear to have persistent structural external deficits. In all cases the fiscal deficit was reduced (in the 1980s in Latin America and Africa and the 1990s in Eastern Europe) as IMF-sponsored stabilization programs were wheeled into place. Rather than reductions in external deficits, there were increases in the private net borrowing, with subsequent oscillations between private and government positions. TD analysis clearly did not apply, while private and public net borrowing had to offset one another to make the accounting add up.

[Figure 6]

Finally, Figure 7 presents patterns in the Middle East, Russia/Ukraine, and other Africa (dominated by Nigeria). In the Middle East from around 1980 until the mid-1990s, a trend reduction in the fiscal deficit was accompanied by a falling foreign deficit; a similar pattern showed up in the former USSR after the mid-1990s. In both regions, the “structural” factor was almost certainly the external position, with the fiscal accounts accommodating as governments collected natural resource rents – TD with causality reversed. The ex-Soviet private sector was a net lender, while private net borrowing rose in the Middle East. The pattern in the African region is less clear, with apparent co-movements of private and foreign borrowing.

[Figure 7]

5. Interactions

Interactions among net borrowing flows clearly differ across time and space – economies with different structures perform differently. A few examples:

India’s large fiscal deficit could never spill over into the balance of payments until very recently because hard currency was not available to pay for expanded imports. The private sector was the only possible source of finance for the fisc’s net borrowing.

Seemingly structural current account deficits or surpluses characterize many developing and transition regions, again forcing a trade-off between private and government net borrowing which had little to do with RE notions. Reductions in fiscal deficits along IMF lines did not lead to a better balance of payments but rather to higher private net borrowing. Improvements in the fiscal position as in Russia/Ukraine and the Middle East were probably driven by a better balance of payments, rather than the other way `round. The standard TD pattern does not seem to apply.

In East Asia, the fiscal role was rather passive, with major adjustments taking place between private and foreign net borrowing. Big reductions in external deficits were forced from abroad in the 1997 crisis, but upswings tended to be associated with falling private saving and rising import propensities. Consumption smoothing has not been apparent.

Causal links among all four net borrowing flows probably characterize the US economy and would be extremely difficult to trace. But a persistent direct linkage from government to external net borrowing clearly does not exist and cyclical borrowing patterns do not satisfy RE logic.

6. Interpretations

With regard to TD, an immediate conclusion is that if the economic authorities feel a need to reduce the external deficit, they should take a recommendation to cut the fiscal deficit as a tool to that end with a dose of salt. In the diagrams for several developing regions presented here, austerity reflected itself into higher household net borrowing rather than improved external balance. What were the mechanisms involved?

Crowding-out of private demand by higher public demand under a binding external constraint that holds output roughly constant is a familiar story. Harking back to the monetarist analysis with which we began, if prices are not stabilized by PPP then they may begin to rise in response to higher effective demand. Inflation tax and forced saving mechanisms can kick in, reducing real demand by the private sector (Taylor, 2004). In Figures 5 and 6, such processes also appear to work in reverse. Austerity relaxes the squeeze on the private sector, and its demand goes up by enough to keep output close to the limit imposed by a structural external gap.

If the SG restriction on output is lifted by an external bonanza, Figure 7 suggests that governments know how to reduce their net borrowing enough to absorb the proceeds of extra resource rents.

With regard to RE, in the US and several of the developing regions there is no evidence suggesting the presence of consumption-smoothing in the sense that private sector net lending rises in response to higher output. Causality running from higher private net borrowing (investment minus saving rises) to output and the external deficit is a more plausible interpretation. But then fiscal net borrowing should adjust counter-cyclically to stabilize the system, as in fact it appears to do. In other words, the data are consistent with a traditional Keynesian point of view.

Appendix 1: Statistical Analysis of the Variance-Covariance Restrictions on the Net Borrowing Series

In the text we criticized twin deficit and Ricardian equivalence theories as explanations for the foreign deficit mostly through graphical analysis. In this appendix we develop somewhat more formal statistical tests to verify our conjectures. The restriction imposed by national accounting on borrowing behavior allows us to reject both TD and RE theories.

Consider the net borrowing identity with three institutional sectors: government (g), private (p) and foreign (f), and let σ_j be the variance of j and σ_{kj} be the covariance between variables k and j . Basic accounting imposes:

$$g + p + f = 0 \quad . \quad (1)$$

$$\text{Given that } \text{var}\left(\sum_i a_i x_i\right) = \sum_i a_i^2 \text{var}(x_i) + 2 \sum_j \sum_i a_j a_i \text{cov}(x_j, x_i)$$

we have:

$$\sigma_g = \sigma_p + \sigma_f + 2\sigma_{pf} \quad , \quad (2)$$

$$\sigma_p = \sigma_g + \sigma_f + 2\sigma_{gf} \quad , \quad (3)$$

and

$$\sigma_f = \sigma_p + \sigma_g + 2\sigma_{pg} \quad . \quad (4)$$

The net borrowing identity allows us to obtain the covariance (and correlation) between each pair of series from the variances of the three series.

If we substitute (3) into (2) and re-arrange we derive

$$\sigma_{fg} = -\sigma_f - \sigma_{fp} \quad (5)$$

and substituting (4) into (3) gives

$$\sigma_{fg} = -\sigma_g - \sigma_{gp} \quad . \quad (6)$$

Similar reasoning is valid for σ_{gp} and σ_{fp} .

Equations (5) and (6) can be used to test the twin deficit hypothesis. According to TD the foreign deficit is caused by the fiscal deficit only. There should be no relationship between foreign and private net borrowing or σ_{fp} should be equal to zero in (5). Similarly, fiscal and private net borrowing should not be related in (6), or $\sigma_{gp} = 0$. In both cases, the covariance between government and foreign net borrowing should be negative and equal in absolute value to the variance of the foreign net borrowing. In sum, the twin deficit null hypothesis can be represented as $\sigma_{fp} = 0$ or $\sigma_{gp} = 0$.

The variance-covariance sample matrix for the US is as follows:

	FOR	GOV	PRIVATE
FOR	0.000275	-0.00014	-0.00012
GOV	-0.00014	0.00056	-0.00028
PRIVATE	-0.00012	-0.00028	0.000368

Clearly, the absolute value of the covariance of government and foreign net borrowing is less than the variance of foreign borrowing, or part of foreign borrowing is “explained” by private net borrowing. Moreover, $\sigma_{fp}=-0.00012$ and $\sigma_{gp}=-0.00028$. These figures do not allow a direct test of the null hypotheses, as we do not know their significance values. What we can do is check the significance levels of correlation coefficients (r). By definition: $r_{xy} = \frac{\sigma_{xy}}{\sqrt{\sigma_x\sigma_y}}$, so that if correlation coefficients are not significant, then the corresponding covariances will be insignificant as well. To this end we use the “E-Views” table of cross correlations, which also provides a test of significance. In particular we are interested in the correlation coefficient with zero lags or leads:

GOV,PRIVATE(-i)	GOV,PRIVATE(+i)	i	Lag	lead
***** .	***** .	0	-0.6135	-0.6135
FOR,PRIVATE(-i)	FOR,PRIVATE(+i)	i	lag	lead
**** .	**** .	0	-0.3818	-0.3818

Correlations of both foreign and government net borrowing with private net borrowing are negative and significant. Both versions of the twin deficit null hypothesis can be rejected.

Now, to test Ricardian equivalence, from equation (1) we have that for any variable z ,

$$\sigma_{pz} + \sigma_{fz} + \sigma_{gz} = 0 \quad (7)$$

Given the constraint that the sum of net borrowings must be equal to zero, the change in one or more net borrowings due (or related) to a change in an exogenous variable needs be offset by opposing changes in the remaining net borrowings to satisfy the constraint in the new state. Let z be an index of the level of economic activity (say, capacity utilization).

The foundation of Ricardian equivalence is the idea that the private sector “smooths” its consumption over the cycle, borrowing more at troughs and lending more at peaks to stabilize its spending profile over time. So its net borrowing should vary anti-cyclically or $\sigma_{pz} < 0$.

Alternatively, the private sector could modify its own borrowing to offset the vagaries of fiscal policy. In that case, foreign net borrowing should not be influenced by the business cycle, or the null hypothesis can be stated as $\sigma_{fz} = 0$.

The variance- covariance matrix for the three net borrowing series and an index of capacity utilization¹² is

	CAPACITY	FOR	GOV	PRIVATE
CAPACITY	0.000288325	-1.68E-05	-0.00017	9.99E-05

¹² Capacity utilization (z) is measured as $z = (y - x) / x$, where y is actual GDP and x is the GDP trend calculated using the standard Hodrick-Prescott filter.

FOR	-1.68E-05	0.000275	-0.00014	-0.00012
GOV	-0.000168724	-0.00014	0.00056	-0.00028
PRIVATE	9.99E-05	-0.00012	-0.00028	0.000368

The requirement that $\sigma_{pz} < 0$ looks unlikely as we have $\sigma_{pz} = 9.99E-05$. As our previous analysis suggests, both households and business borrowing are pro-cyclical which is hard to reconcile with the idea of consumption smoothing. In fact, the correlation coefficient between private net borrowing and capacity utilization turns out to be positive and significant.

CAPACITY,PRIVATE(-i)	CAPACITY,PRIVATE(+i)	i	lag	lead
. ***	. ***	0	0.3067	0.3067

Appendix 2: Countries in the Regional Groups

1. Representative Africa: Ghana, Kenya, Uganda and Tanzania
2. Other Africa: Cameroon, Ethiopia, Ivory Coast, Mozambique, Nigeria, Zimbabwe
3. Central America and the Caribbean: Costa Rica, Dominican Republic, El Salvador, Guatemala, Jamaica
4. Andean Region: Bolivia, Ecuador, Peru
5. Semi-Industrialized Latin America (with Turkey and South Africa as additions): Argentina, Brazil, Chile, Colombia, Mexico, Venezuela, Turkey, South Africa
6. South Asia: Bangladesh, India, Pakistan, Sri Lanka
7. China
8. Southeast Asia: Indonesia, Philippines, Thailand, Vietnam
9. Tigers: Korea, Malaysia, Singapore, Taiwan
10. Middle East: Algeria, Egypt, Morocco, Tunisia, Iran, Iraq, Jordan, Saudi Arabia, Syria, Yemen
11. Former USSR: Russian Federation, Ukraine
12. Eastern Europe: Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia

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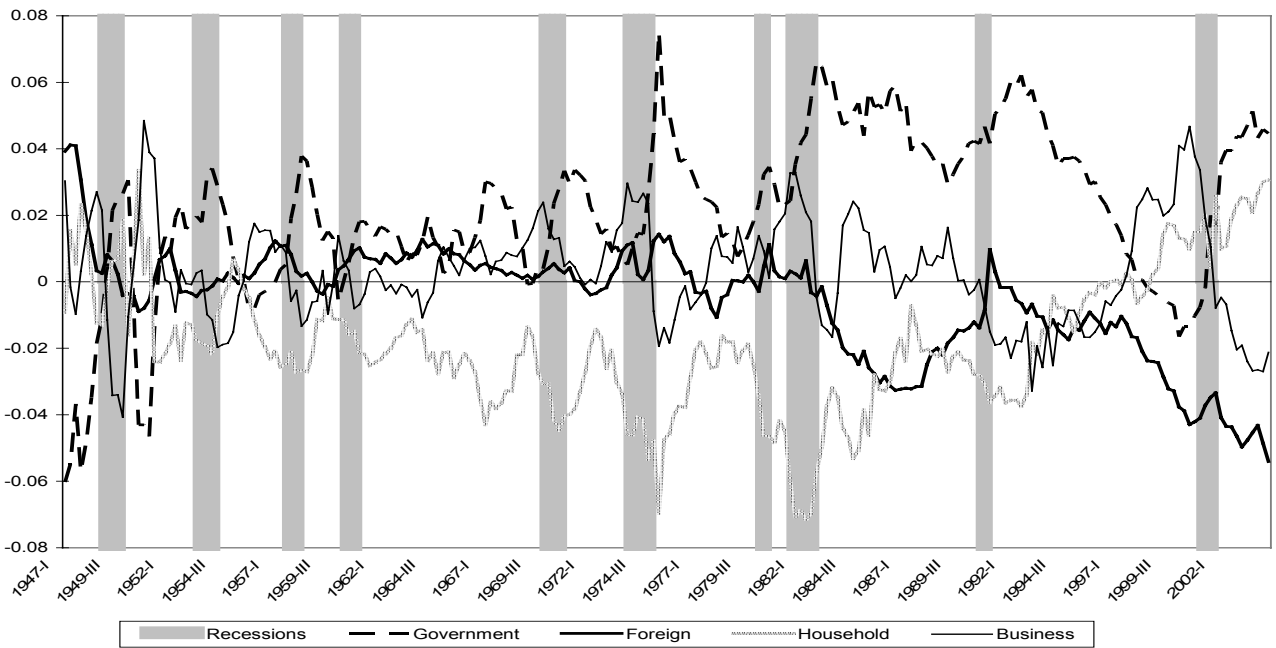


Figure 1: Net borrowing flows normalized by trend GDP and NBER reference cycles

Government and foreign NB as shares of trend GDP and NBER reference cycles

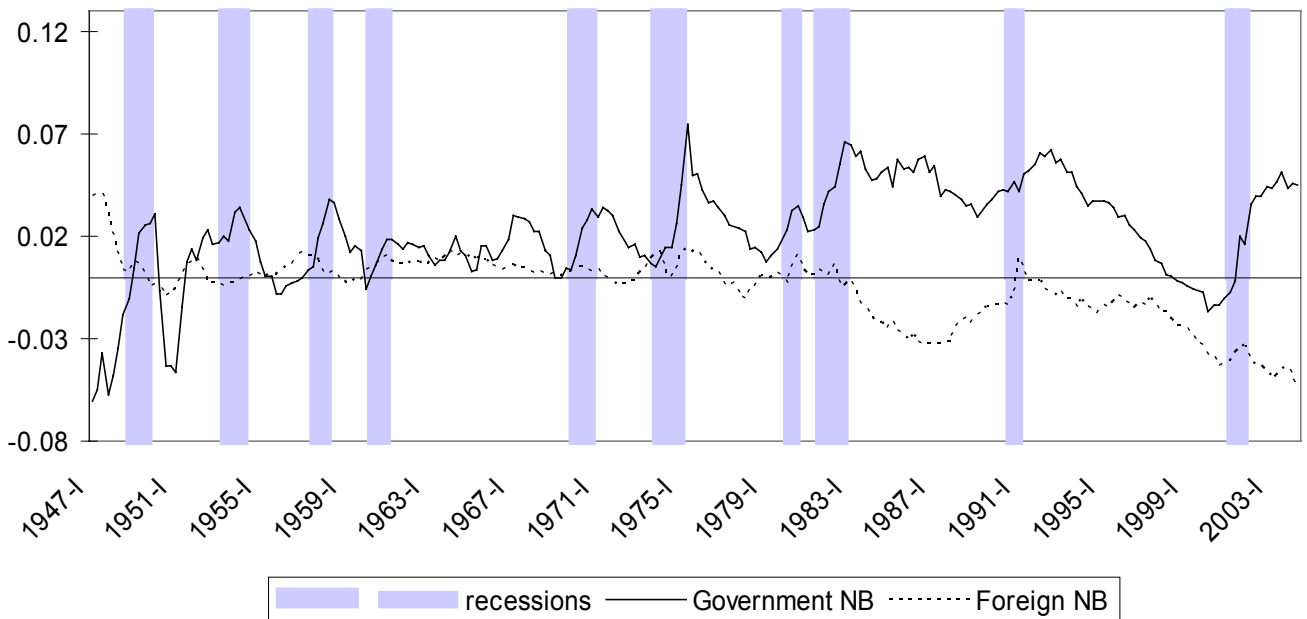


Figure 2: Government and Foreign Net borrowing normalized by trend GDP.

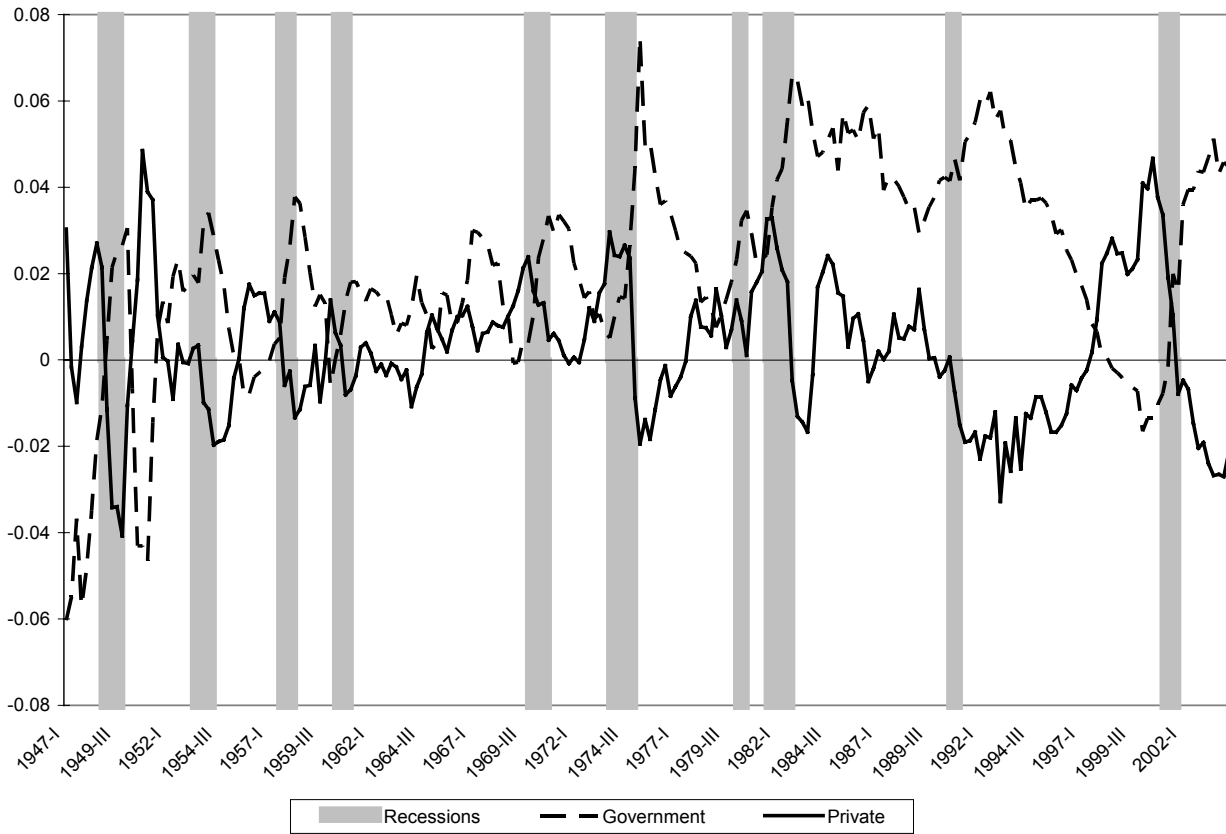


Figure 3: Government and Private Net borrowing normalized by trend GDP.

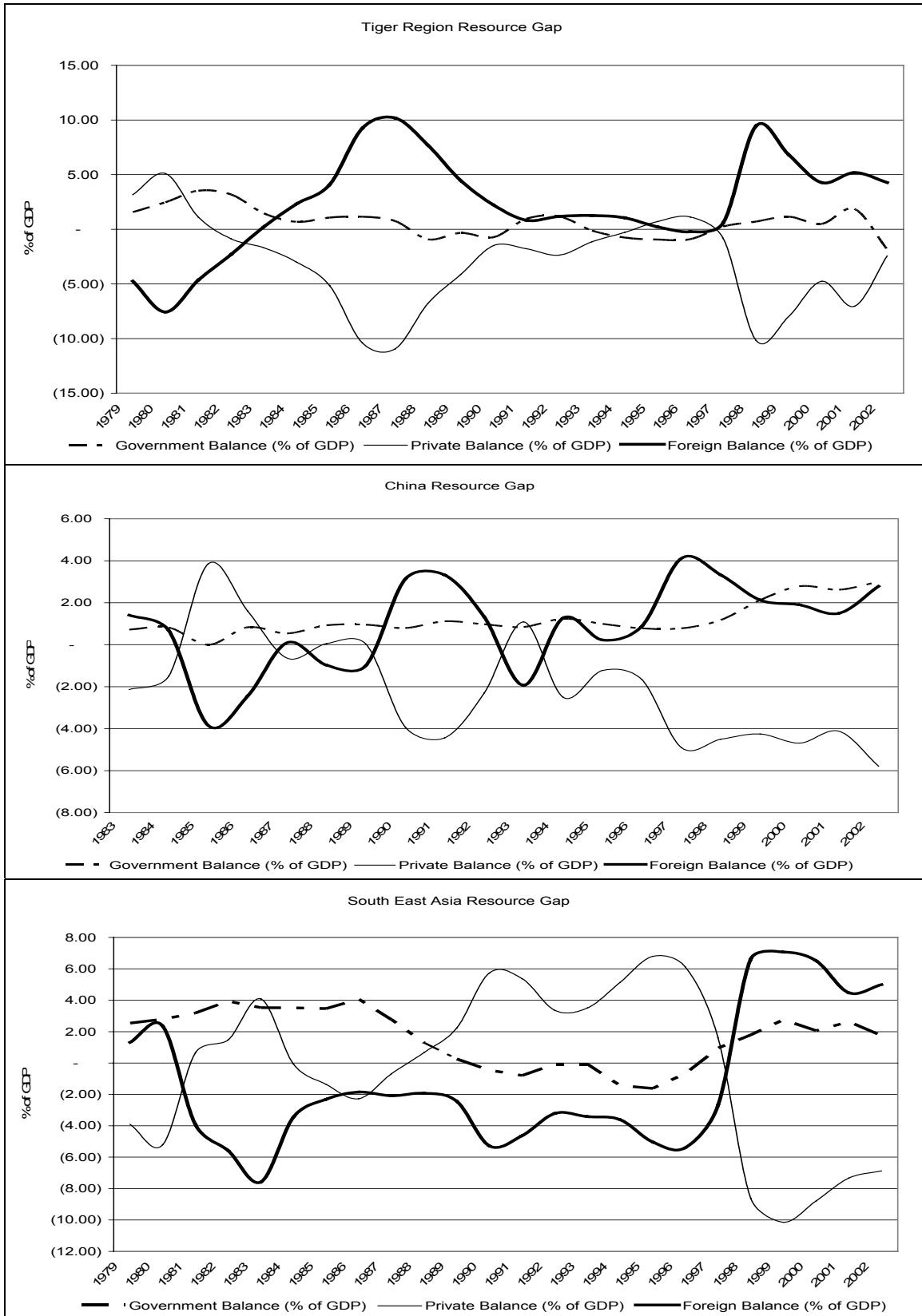


Figure 4: Resource gaps by institutional sectors in the Tigers, China and South East Asia

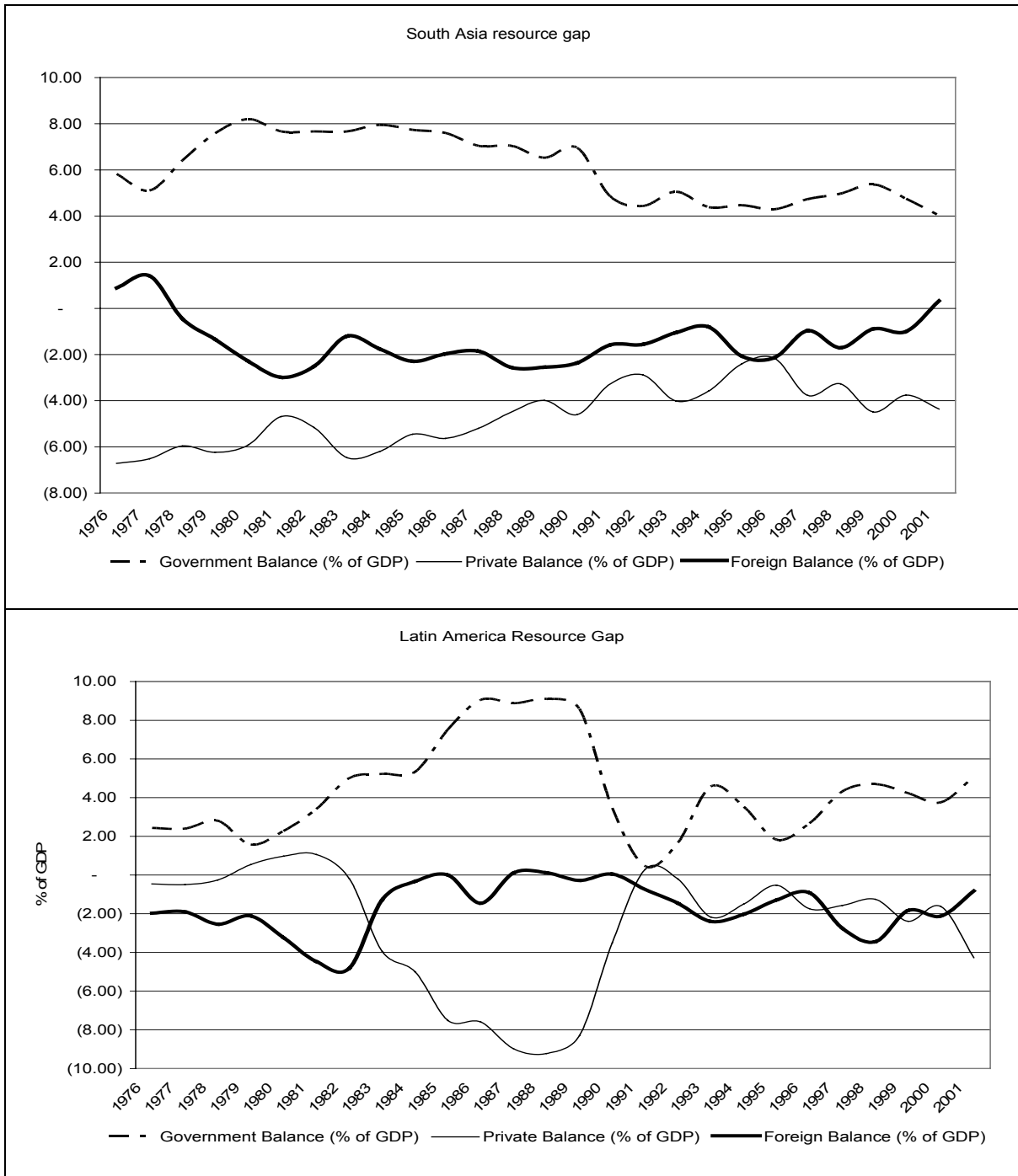


Figure 5: Resource gaps by institutional sectors in South Asia and semi-industrialized Latin America

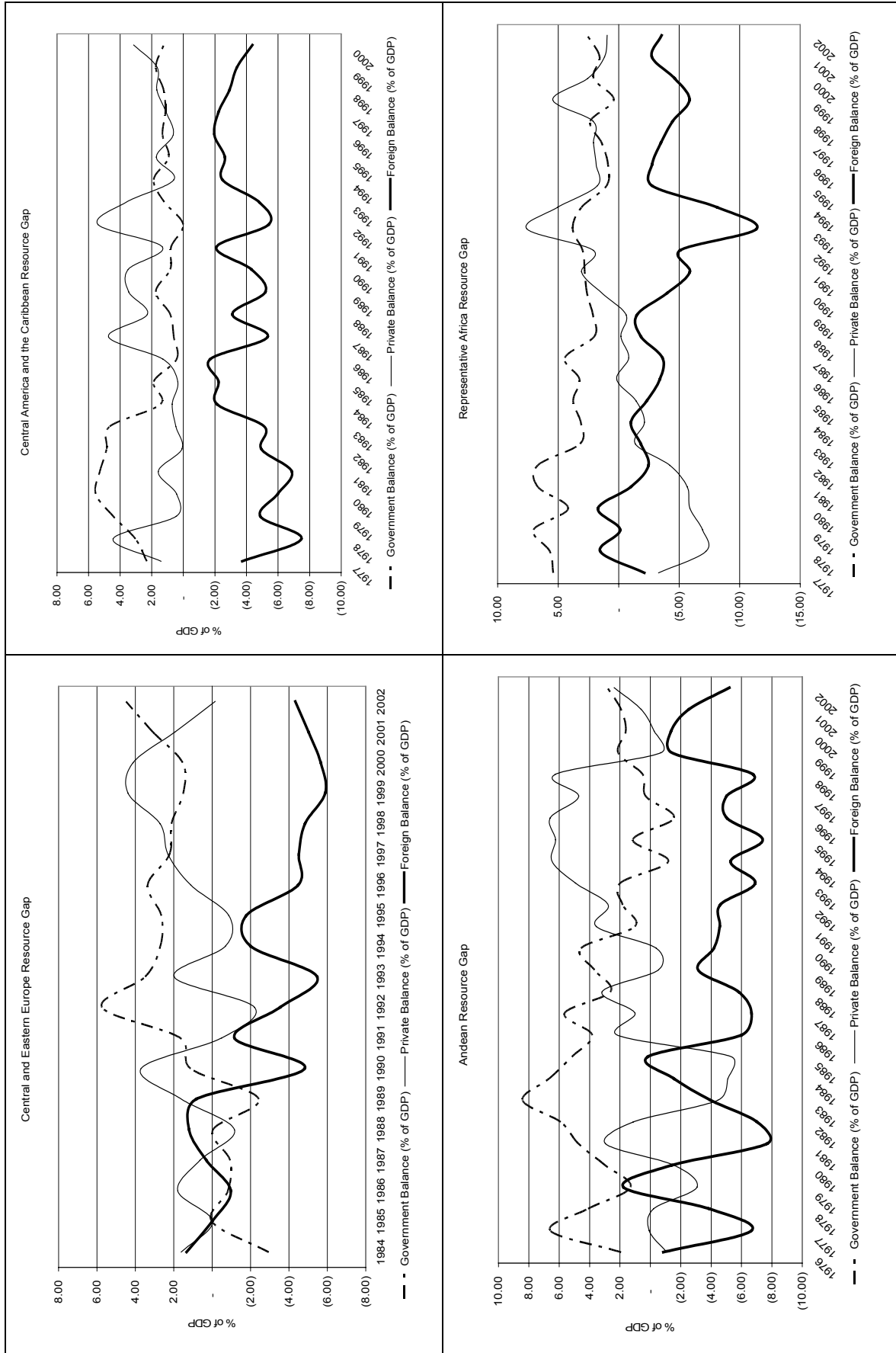


Figure 6: Resource gaps by institutional sectors in Central and Eastern Europe, Central America and the Caribbean, Andean region and Representative Africa

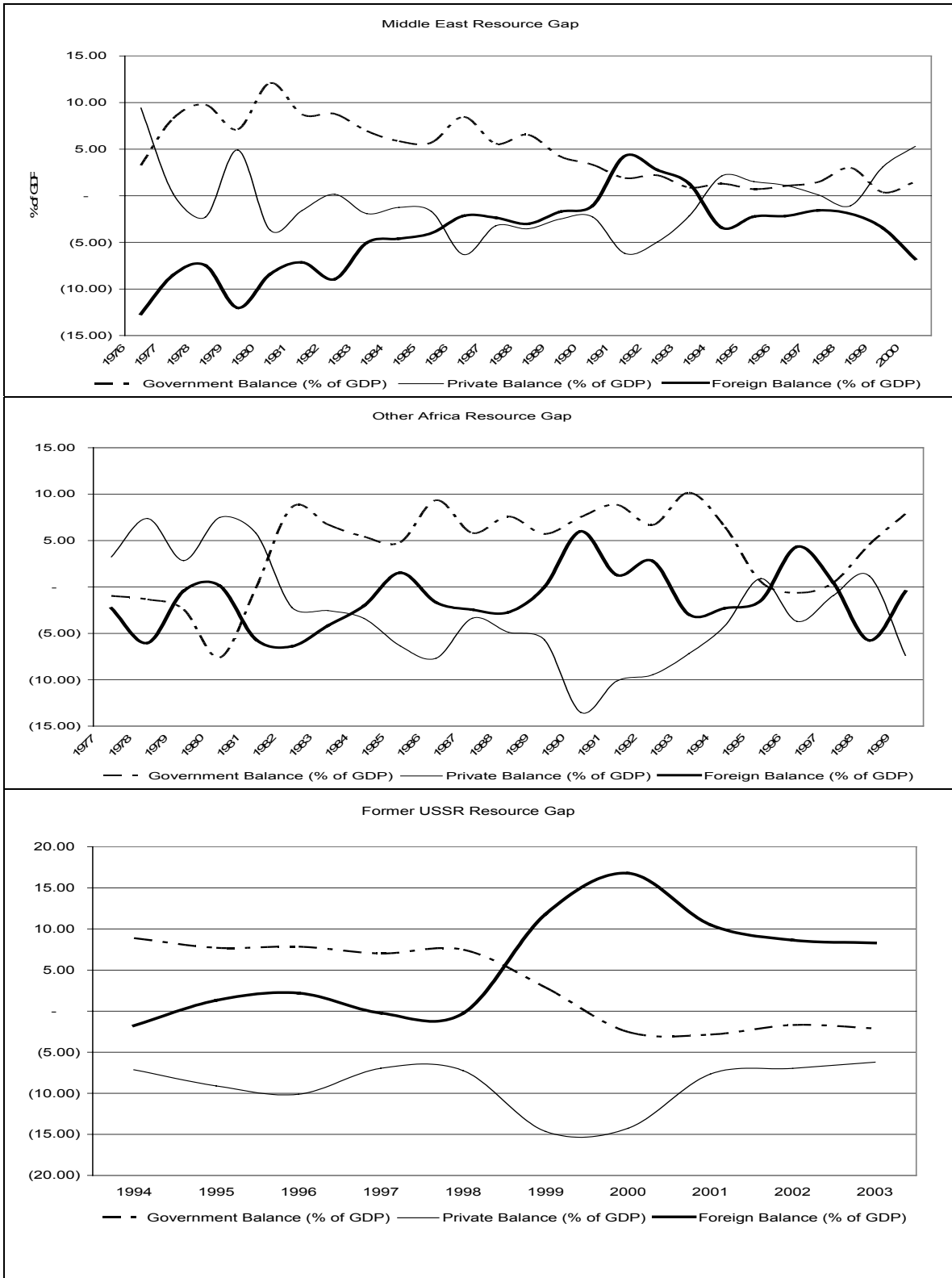


Figure 7: Resource gaps by institutional sectors in the Middle East, Other Africa and Former USSR