



## **ADB Working Paper Series**

### **Exchange Rates and Global Rebalancing**

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Barry Eichengreen and  
Gisela Rua

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Barry Eichengreen is a professor at the University of California, Berkeley. Gisela Rua is a PhD candidate at the University of California, Berkeley. This paper is based on a presentation given at the Brookings-ADBI conference on Trans-Pacific Rebalancing, held on 3–4 March 2010 at ADBI in Tokyo.

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Please contact the author(s) for information about this paper.

Email: [eichengr@econ.berkeley.edu](mailto:eichengr@econ.berkeley.edu); [grua@econ.berkeley.edu](mailto:grua@econ.berkeley.edu)

Asian Development Bank Institute  
Kasumigaseki Building 8F  
3-2-5 Kasumigaseki, Chiyoda-ku  
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500  
Fax: +81-3-3593-5571  
URL: [www.adbi.org](http://www.adbi.org)  
E-mail: [info@adbi.org](mailto:info@adbi.org)

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**Abstract**

This paper considers the general equilibrium relationship between exchange rates and global imbalances. It emphasizes that the exchange rate is not a primitive but an equilibrium price determined by the policy mix. It uses extensions of the two-country Obstfeld-Rogoff model to analyze the response of imbalances and real exchange rates to shocks. Finally, it analyzes the characteristics of episodes in which chronic current account surpluses (as opposed to deficits) come to an end.

**JEL Classification: F0, F3, F4**

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# 1. INTRODUCTION

Everyone agrees that global rebalancing is needed. They just don't agree on what it entails. American commentators talk about the need for increases in consumption spending in Asia without equal emphasis on the need for more saving in the United States (US). Asian commentators emphasize the need to raise savings in the US without acknowledging that it needs to be accompanied by an increase in spending in other regions in order to avoid a shortfall in global demand. Some point to the need for the US to produce additional traded goods without acknowledging that this implies the need for other regions to produce less of the same, absent a significant change in relative prices. Some commentators insist that exchange rate changes are central to the adjustment process, while others insist that they are peripheral. This inability to agree does not enhance the regard with which practitioners of the dismal science are held in the policy community.

Confusion and disagreement frequently stem from the fact that the problem is inadequately specified. In some cases the question posed is: what would be the impact on global imbalances of an exchange rate increase by People's Republic of China (PRC), without at the same time specifying what other variables are to be taken as endogenous if the exchange rate is treated as exogenously set. In other cases the question posed is: how would the exchange rate have to adjust to accommodate a change in the level of spending? In still other cases the formulation distinguishes inadequately between spending on Chinese- and US-produced goods. Some cases distinguish inadequately between changes in spending on traded and nontraded goods. The substitutability of US-produced and foreign-produced traded goods and of traded and nontraded goods produced within the US is not specified. With the question underspecified, the answer is underspecified: it fails to distinguish between equilibrating changes in the real exchange rate (relative overall price levels in the PRC, the US and the rest of the world) and the single factoral terms of trade (the relative price—exchange rate adjusted—of traded goods produced in the two countries).

Then there is disagreement stemming from confusion over which countries and regions are involved in this rebalancing process. Are we talking about the PRC and the US, where the PRC economy is only 30% the size of the US economy—a fact that may have important implications for the changes in relative prices that would have to accompany, say, an exogenously specified increase in US savings rates?<sup>1</sup> Are we talking about a process of rebalancing where the US is on one side and all of Asia is on the other—in which case the size imbalance is considerably less? Or are we talking about rebalancing between the US and the rest of the world, in which case the US is the smaller economy by a considerable margin?

Finally, there is confusion over the circumstances in which different categories of countries can contribute to the process of global rebalancing. The empirical literature has focused on adjustment by deficit countries, asking: under what circumstances have such economies been able to eliminate large and persistent current account deficits? This literature has identified a useful set of stylized facts about the circumstances under which adjustment has occurred. But such emphasis failed to acknowledge that the coin has two sides. It is equally important to ask: under what circumstances have economies with large and persistent current account surpluses been able to eliminate these successfully? With large surpluses heavily concentrated in emerging markets and in petroleum-producing countries, it is important to ask: are the circumstances in which these economies have succeeded in eliminating large current account surpluses different from those of advanced countries and non-oil exporters finding themselves in this position? It may be unwarranted to assume that findings about the characteristics of economies that have succeeded in eliminating large deficits carry over, up to a sign change, to economies that have eliminated large surpluses. It

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<sup>1</sup> The comparison is at market exchange rates, presumably what is relevant for an experiment in which relative price adjustments eliminate initial imbalances in markets for traded goods.

may be similarly reckless to simply assume that findings that apply to advanced countries and non-oil exporters mechanically carry over to emerging markets and oil exporters.

We seek to clarify these questions in this paper. In the first part of the paper we use the simplest model capable of shedding light on the exchange rate and terms-of-trade implications of various rebalancing scenarios: the Obstfeld-Rogoff two-country endowment model (Obstfeld and Rogoff 2007). In this model, each of two countries possesses an endowment (produces a fixed quantity) of traded and nontraded goods that are imperfect substitutes in consumption.<sup>2</sup> Given an assumption about the level of spending in both countries, it is possible to solve for the relative prices (the real exchange rate and terms of trade) that clear markets. This makes it possible, in turn, to solve for the changes in relative prices (the exchange rate and terms of trade changes) needed to clear markets when levels of spending change.

This is the question, in our view, that is most central to global rebalancing and to the role of the exchange rate in that process. Starting from a situation where the US is in current account deficit and the rest of the world is in surplus, what is the effect on the real exchange rate and other relative prices of, *inter alia*, an increase in US savings owing to a financial crisis that wipes out households' retirement accounts? What is the effect of an increase in PRC spending owing to financial reforms that eliminate households' credit constraints, and to the development in the PRC of a social safety net that reduces the need for precautionary saving?

This initial analysis simply replicates the findings of the Obstfeld-Rogoff study. But we then apply the same model to additional questions. How dramatically do relative price effects differ when it is only the PRC, or all of Asia, or the entire rest of the world minus the PRC, on the other side of the US rebalancing process? What difference does it make when the increase in spending in the PRC falls mainly on traded or nontraded goods? How is the relative price and adjustment impact affected when the increase in spending in the PRC takes the form of investment in infrastructure and capacity that can then be used to produce traded or nontraded goods?

In the second part of the paper we turn to the circumstances under which economies have eliminated persistent current account surpluses. We start with a review of the literature on elimination of large deficits. Similar methods are then applied to constructing a sample of cases where large surpluses were eliminated. We compare the results with those in the mirror image (large deficit) cases. The findings for advanced countries are contrasted with those for emerging markets and oil exporters.

We argue that this is an important extension of earlier literature focusing on circumstances under which large deficits were eliminated. When the deficit economy was small, the circumstances under which its external imbalance was eliminated could reasonably be considered in isolation. But when that economy was large, there also had to be significant adjustment on the surplus side. In this case, analyzing the circumstances in which large deficits were eliminated makes little sense without also analyzing the circumstances under which large surpluses were eliminated. The earlier literature having addressed the first question, we add evidence on the second. Putting the pieces together, we are then able to say something about the likelihood that we will now see a sustained reduction in global imbalances.

## 2. OVERVIEW OF GLOBAL IMBALANCES

The debate over global imbalances is of long standing, reflecting the persistence of those imbalances. Figure A2.1, following Blanchard and Milesi-Ferretti (2009), summarizes their

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<sup>2</sup> We add more precision to this statement below.

evolution, expressing the imbalances of different regions as shares of global gross domestic product (GDP). The figure highlights two facts. First, the US accounted for the largest share of global current account deficits; any explanation for imbalances and their evolution will have to account for US behavior. The year 2009 was the first time in years the US did not account for the greater part of the world's deficits. The question now, of course, is whether its share of deficits is likely to expand again as the US and global economies recover.

Second, while the PRC is prominent on the surplus side, it was not alone. In most years the contribution of oil exporters and surplus European countries (such as Germany) was even greater. In some years (early in the period), the PRC contribution was matched by those of Other Emerging Asia (Emerging East Asia excluding the PRC) and Japan. Only in 2009 was the global surplus heavily a PRC surplus. While any explanation for global imbalances clearly will have to reckon with the behavior of the PRC, an analysis limited to the bilateral US-PRC imbalance will not adequately capture the problem.

Some years ago, one of us (Eichengreen 2006) published an article distinguishing several classes of explanations for global imbalances. The first of these was the “new economy” or “relative profitability” interpretation emphasizing the contrast between the rapid productivity growth associated with the rollout of new information and communications technologies in the US and slower growth and lower profitability in crisis-ridden Other East Asia and Japan. This plausibly accounts for some widening of global imbalances in the late 1990s, but less so after the “tech bubble” burst and Other East Asia recovered from its crisis.

The second explanation, the “standard analysis,” focused on declining US savings and corresponding increases in saving in Asia (US Federal Reserve Governor Bernanke’s “global savings glut” [Bernanke 2005]). The initial decline in US savings was ascribed mainly to growing government dissaving following the Bush tax cut of 2001 (Figure A2.2). After 2004 the focus shifted to household dissaving associated with the boom in asset prices, home prices in particular (Figure A2.3). On the surplus side, different explanations applied to different economies. The oil exporters ran large net surpluses in the period of strong global growth and high energy prices in the mid-2000s. High internal and external savings in surplus European countries reflected policies of restraint aimed at restraining wages and consumption.<sup>3</sup> In Other Emerging Asia (i.e., Emerging Asia excluding the PRC), net external savings reflected stagnant investment more than a surge in savings.<sup>4</sup> High savings in the PRC was a function of high growth,<sup>5</sup> strong demand for precautionary saving in the presence of capital market imperfections and the absence of a well developed social safety net, and lack of pressure on profitable state-owned enterprises to pay out dividends.

The third class of explanation focused on the characteristics of international assets and liabilities. The “dark matter” or “exorbitant privilege” view emphasized the tendency for the US to earn a higher return on its external assets than it paid on its liabilities, enabling it to run current account deficits without increasing its net indebtedness to the rest of the world. One interpretation of this differential was that US investors were savvier. A more plausible variant was that they had greater risk tolerance: they were willing to hold relatively risky foreign direct investments, while other investors preferred relatively safe US debt securities. Gourinchas and Rey (2007) documented the existence of this rate-of-return differential and established the link with the composition of external assets and liabilities. Caballero (2010) made an influential statement of the view that the demand in emerging markets for relatively safe debt securities—which the US has a comparative advantage in producing—could

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<sup>3</sup> This can be understood as reflecting the absence of a housing boom in countries like Germany, and that only a small fraction of the population holds a significant share of its savings in the form of stocks. The effects of the asset boom were thus less.

<sup>4</sup> A thorough analysis is in Asian Development Bank (2009).

<sup>5</sup> This is understood in terms of the predictions of the life-cycle model: with younger generations saving out of higher incomes and older generations dissaving out of lower incomes, national savings will be high in fast-growing economies. See Modigliani and Cao (2004).

rationalize the existence of not just rate-of-return differentials, but also growing imbalances as larger and more rapidly growing emerging markets sought to import additional safe assets from the US.

While these three interpretations are different, they are not necessarily incompatible, in general and insofar as they apply to different periods and, particularly, different economies.

Each class of explanation can shed some light on what is likely to happen next. The new economy view does not predict the rapid reemergence of global imbalances insofar as the post-crisis US economy is unlikely to be characterized by high levels of investment.<sup>6</sup> The standard analysis points to the importance of higher US savings rates which, recent research suggests, will continue to run in the mid-single digits.<sup>7</sup> It points, similarly, to the likelihood that household savings in the PRC will begin to decline with better public provision of health care and a more effective social safety net generally.<sup>8</sup> But it also suggests that adjustment in the PRC will remain slow insofar as household savings are inertial and there is still little pressure on PRC enterprises to reduce their retained earnings.<sup>9</sup> Finally, to the extent that the US is no longer viewed as a reliable supplier of safe assets, emerging markets wishing to accumulate them may now turn to other sources. This will mean less foreign financing of US current account deficits.

Note that this analysis has been presented entirely without reference to the exchange rate. Indeed, how exchange rates (shown in Figure A2.4) fit into this story is not entirely clear. It is to this issue that we now turn.

### 3. IMPLICATIONS OF VARIOUS REBALANCING SCENARIOS

#### 3.1 The Obstfeld-Rogoff Model

In this section we describe the Obstfeld-Rogoff model. First described is the structure of preferences, then the equilibrium conditions, and, finally, the parameter values used for simulation. Then shown is the impact on exchange rates (real exchange rates and the terms of trade) of eliminating the imbalance between the US and the rest of the world.

The model used here is Obstfeld-Rogoff's two-country model with exogenous endowments. Prices were assumed to be flexible and the law of one price was assumed to hold for individual tradable goods. Home consumption bias within tradable goods was assumed, which could differ among countries. This is captured by the parameters  $\alpha$  and  $\alpha^*$ . Countries may also assign different preference weights to tradable goods relative to nontradable goods. This is captured by the two parameters  $\gamma$  and  $\gamma^*$ . The values of  $\theta$  and  $\eta$  correspond to (constant) elasticities of substitution between tradable and nontradable goods and domestically-produced and imported tradables, respectively.

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<sup>6</sup> Rapid productivity growth there has of course been in recent quarters, but there is reason to think this was a one-off event, as firms laid off workers and closed plants that were least efficient. The difficulty of structural change, the likelihood of a creditless recovery, and the growing debt overhang are all reasons to worry that US investment rates will lag (Goldman Sachs 2010).

<sup>7</sup> This according to Carroll and Slacalek (2009); Lee, Rabanal, and Sandri (2010); and Mody and Ohnsorge (2010).

<sup>8</sup> Barnett and Brooks (2010) found that one additional yuan of government spending on health care produced a two yuan increase in consumption spending. In contrast, they found little impact on consumption of increases in education spending.

<sup>9</sup> It is on these grounds that the International Monetary Fund projects the reemergence of large surpluses in the PRC by 2012 (Blanchard and Milesi-Ferretti 2009). The decline in household savings rates in the PRC will presumably accelerate after 2015 with the rapid rise in old-age dependency ratios, but this is still far in the future from the perspective of policy analysis.



The Home consumption index is expressed in the nested form

$$C = \left[ \gamma^{\frac{1}{\theta}} C_T^{\frac{\theta-1}{\theta}} + (1-\gamma)^{\frac{1}{\theta}} C_N^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \quad (1)$$

and the Home consumer price index (CPI) corresponding to the preceding Home consumption index  $C$  is

$$P = \left[ \gamma P_T^{1-\theta} + (1-\gamma) P_N^{1-\theta} \right]^{\frac{1}{1-\theta}} \quad (2)$$

with tradables and nontradables consumption given by

$$C_T = \left( \frac{P}{P_T} \right)^{\theta} \gamma C \quad (3)$$

$$C_N = \left( \frac{P}{P_N} \right)^{\theta} (1-\gamma) C \quad (4)$$

Similarly, the tradables consumption index  $C_T$  is expressed as

$$C_T = \left[ \alpha^{\frac{1}{\eta}} C_H^{\frac{\eta-1}{\eta}} + (1-\alpha)^{\frac{1}{\eta}} C_F^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \quad (5)$$

and the price index for tradables given by

$$P_T = \left[ \alpha P_H^{1-\eta} + (1-\alpha) P_F^{1-\eta} \right]^{\frac{1}{1-\eta}} \quad (6)$$

with Home and Foreign tradables consumption

$$C_H = \left( \frac{P_T}{P_H} \right)^{\eta} \alpha C_T \quad (7)$$

$$C_F = \left( \frac{P_T}{P_F} \right)^{\eta} (1-\alpha) C_T \quad (8)$$

In Foreign there are isomorphic indices, but with the parameters  $\alpha^*$  and  $\gamma^*$ .

The terms of trade,  $\tau$ , and the real exchange rate,  $q$ , are<sup>10</sup>

$$\tau = \frac{P_F}{P_H} = \frac{P_F^*}{P_H^*} \quad q = \frac{\varepsilon P^*}{P}$$

Even though the law of one price holds for individual tradable goods, purchasing power parity does not hold for the differing preferred baskets of tradable goods in each country.

This means that  $P_T \neq \varepsilon P_T^*$ , where  $\varepsilon$  is the nominal exchange rate.

Given this structure, market clearing conditions for the Home produced good  $H$ , the Foreign tradable good  $F$ , Home nontradables  $N$ , and Foreign nontradables  $N^*$  are

$$Y_H = C_H + C_H^* \Leftrightarrow Y_H = \alpha \left( \frac{P_H}{P_T} \right)^{-\eta} \gamma \left( \frac{P_T}{P} \right)^{-\theta} C_T + (1 - \alpha^*) \left( \frac{P_H / \varepsilon}{P_T^*} \right)^{-\eta} \gamma^* \left( \frac{P_T^*}{P^*} \right)^{-\theta} C_T^* \quad (9)$$

$$Y_F = C_F + C_F^* \Leftrightarrow Y_F = (1 - \alpha) \gamma \left( \frac{P_F}{P_T} \right)^{-\eta} \left( \frac{P_T}{P} \right)^{-\theta} C_T + \alpha^* \gamma^* \left( \frac{P_F / \varepsilon}{P_T^*} \right)^{-\eta} \left( \frac{P_T^*}{P^*} \right)^{-\theta} C_T^* \quad (10)$$

$$Y_N = C_N \Leftrightarrow Y_N = (1 - \gamma) \left( \frac{P_N}{P} \right)^{-\theta} C_T \quad (11)$$

$$Y_N^* = C_N^* \Leftrightarrow Y_N^* = (1 - \gamma^*) \left( \frac{P_N^*}{P^*} \right)^{-\theta} C_T^* \quad (12)$$

Finally, the current account is

$$\text{Home: } CA = P_H Y_H + iF - P_T C_T \quad (13)$$

$$\text{Foreign: } \varepsilon CA^* = P_F Y_F - iF - P_T^* C_T^* = -CA \quad (14)$$

where  $F$  is Home net foreign assets and  $i$  is the interest rate, in Home currency units, and the real exchange rate is

<sup>10</sup> Discussion here is in terms of the real exchange rate, this being a real rather than a monetary model. Readers preferring to think in terms of the nominal rate can assume that central banks in each country target a stable price level.

$$q = \frac{\left[ \alpha^* \tau^{1-\eta} + (1-\alpha^*) \right]^{\frac{1}{1-\eta}}}{\left[ \alpha + (1-\alpha) \tau^{1-\eta} \right]^{\frac{1}{1-\eta}}} \times \frac{\left[ \gamma^* + (1-\gamma^*) (P_N^* / P_T^*)^{1-\theta} \right]^{\frac{1}{1-\theta}}}{\left[ \gamma + (1-\gamma) (P_N / P_T)^{1-\theta} \right]^{\frac{1}{1-\theta}}} \quad (15)$$

$$\frac{\varepsilon P_T^*}{P_T}$$

In our calibration we initially adopted Obstfeld and Rogoff's (2007) parameter values. We set the dollar value of tradable goods output to GDP at  $\frac{P_H Y_H}{P_H Y_H + P_N Y_N} \approx 0.25$ . Assuming that

US current external deficit was about 5% of GDP, this implied a current account deficit-to-tradables ratio of  $ca = \frac{CA}{P_H Y_H} = -0.05 / 0.25 = -0.2$ . We set net US foreign assets over the

dollar value of traded goods output at  $f = \frac{F}{P_H Y_H} = 0.8$ , and the nominal interest rate at

$i = 0.05$  per year. We also set  $Y_N / Y_H = Y_N^* / Y_F = 1$ ,

$\eta = 2, \theta = 1, \gamma = \gamma^* = 0.25, \alpha = 0.7$  and  $\alpha^* = 0.925$ . Under the assumption that  $\sigma_T = Y_H / Y_F = 0.22$ , the US would account for 21% of the world economy.

We assumed a decline in US spending and an increase abroad sufficient to eliminate the US deficit. Suppose, for example, that a financial crisis depressed the value of US households' retirement accounts and that financial reforms eliminated credit constraints in the PRC. Eliminating the imbalance would cause the dollar to depreciate by 32.3%. On the one hand, there would be a shift in global demand away from the US, which would cause a relative drop in demand for US-produced tradable goods. This is because US citizens were assumed to have a relatively strong preference for US-produced tradables. The US terms of trade would fall by 15.76%. On the other hand, because eliminating the US current account deficit implied a 20% fall in demand for traded goods, a fall in the relative price of nontraded goods in the US would be needed. In parallel with effects in the US, a rise in the price of nontraded goods abroad would also occur. Given the large share of nontradables in the CPI, the overall real exchange rate response would be magnified beyond terms of trade changes.

Changing the two elasticity parameters  $\theta$  and  $\eta$  would have important effects in the adjustment. Higher elasticities of substitution between tradable and nontradable goods and domestically-produced and imported tradables would lead to a smaller impact on the terms of trade and the real exchange rate.

### 3.2 Participation in Global Rebalancing

In this second section, alternative assumptions are explored about which countries participate, along with the US, in the process of global rebalancing. Our benchmark assumption was that all countries participated—the US (which was 21% of the world economy), and the rest of the world. Here we ask how much difference it would make if the PRC (placed at 7% of the world economy) did not participate—i.e., if it prevented its imports and exports from moving. When the PRC is removed from the picture, the rest of the world is smaller relative to the US, and the US becomes approximately 23% of the world economy.

Accordingly, it was assumed that  $\sigma_T = Y_H / Y_F = 0.2579$  instead of 0.22.<sup>11</sup> For different combinations of the two elasticity parameters, Table 1 shows how the impact on exchange rates (the terms of trade and the real exchange rate) of eliminating the imbalance between the US and the rest of the world varied according to participating countries and the relative size of the US economy. Since US citizens were assumed to have a relatively strong preference for Home goods, the fall in the terms of trade increased with the size of the US relative to the world economy. Furthermore, the larger the relative size of the US, the larger the initial current account surplus in the rest of the world. For example, a US current account deficit of 5% of GDP corresponded to a current account surplus in the rest of the world of

$$\frac{CA^*}{GDP^*} = -\frac{CA}{GDP} \times \frac{P_H Y_H}{P_F Y_F} = -(-0.05 * 0.2579 / 0.8843) = 1.46\% \text{ when the US was 23\% of the}$$

world economy, and of  $\frac{CA^*}{GDP^*} = -(-0.05 * 6.71 / 2.2357) = 15\%$  when the US was 75% of the

world economy. Adjustment abroad caused the relative price of foreign nontraded goods to rise in parallel to the fall in the relative price of domestic nontraded goods, which magnified the effect on the real exchange rate. Therefore, if the PRC does not participate in eliminating the imbalances, there will have to be a larger dollar depreciation.

**Table 1: Rebalancing Scenarios with Different Participating Countries**

Countries Involved in the Process of Rebalancing	Size of US <sup>a</sup>	$\theta$	$\eta$	Fall in TOT $\Delta\tau$	Real Depreciation $\Delta q$
US and the rest of the world	0.21	1	2	15.76	32.30
		1	3	9.44	26.37
		2	2	15.76	19.09
		2	3	9.44	14.37
		0.5	2	15.76	64.36
US plus the rest of the world minus PRC	0.23	1	2	16.65	33.58
		1	3	10.09	27.47
		2	2	16.65	20.06
		2	3	10.09	15.14
		0.5	2	16.65	66.41
US and all Asia	0.5	1	2	30.87	57.83
		1	3	20.91	52.26
		2	2	30.87	36.69
		2	3	20.91	30.45
		0.5	2	30.87	108.97
US and PRC	0.75	1	2	51.34	115.66
		1	3	37.57	143.47
		2	2	51.34	69.96
		2	3	37.57	78.27
		0.5	2	51.34	225.18

$\theta$  = elasticity of substitution between tradable and nontradable goods,  $\eta$  = elasticity of substitution between domestically-produced and imported tradables,  $\tau$  = terms of trade,  $q$  = real exchange rate, PRC = People's Republic of China, TOT = terms of trade, US = United States. <sup>a</sup> Percent of world economy as defined in each scenario.

<sup>11</sup> See Appendix A for details.

Alternatively, the cases where the US was on one side of the rebalancing process and either all of Asia or only the PRC was on the other were explored. In the first case, it was assumed that all non-Asian countries prevented any movement in their imports and exports, while in the second case all of Asia except the PRC joined the non-Asian group by excluding itself from the process of rebalancing. Since the US, on its own, was one-and-a-half times the economic size of Asia and three times the economic size of the PRC, its share in collective output was 0.50 and 0.75, respectively.

It followed that the impact on the terms of trade and the real exchange rate would be much bigger. For example, when only the PRC and the US participated in the rebalancing, the dollar depreciation was above 69% for any reasonable combination of the two elasticity parameters.

The conclusion is that it matters greatly how many countries are on the other side of the US current account adjustment. If there is only one (the PRC), the real exchange effects would be extremely large. If all of Asia is on the other side of the US current account adjustment, the real exchange effects would be smaller. If the rest of the world excluding the PRC is on the other side, the effects would be even smaller. The effects would be smaller yet if the entire rest of the world including the PRC is on the other side of the US current account adjustment.

### 3.3 Sectoral Productivity Shocks

In this section we return to our benchmark model where the US accounts for 21% of the world economy and explore the effects of productivity shocks in the rest of the world. First, we look at an increase in foreign production of tradable goods (think of this as infrastructure investment undertaken by the PRC in 2008-09 that increased the supply of exportable goods). We also explore the effect of assuming an increase in foreign capacity to produce nontradable goods. The real exchange rate changes needed to accommodate these different patterns of increased output would be, not surprisingly, very different.

The real exchange rate response is determined by changes in both the terms of trade and the relative prices of domestic and foreign nontradable goods (see equation 15). Given the large share of nontradable goods in the CPI, changes in the relative prices of nontradable goods had a higher weight in the determination of the overall exchange rate response than did changes in the terms of trade.

An increase in foreign production of tradable goods caused the relative prices of both domestic tradable goods and foreign nontradable goods to rise. The former relative price change corresponded to an improvement in the US terms of trade, and the combination of both caused the dollar to depreciate. When the increase in foreign production was concentrated in the nontradable goods sector, there was no change in the terms of trade. Nevertheless, the drop in the relative price of foreign nontradable goods caused the dollar to appreciate. Table 2 reports parameter values and exchange rate changes (the terms of trade and the real exchange rate) for 20% variations in foreign production.

**Table 2: Exchange Rate Responses to Productivity Shocks**

	20% Increase in Foreign Production of Tradables	20% Increase in Foreign Production of Nontradables
$\sigma_T$	0.2	0.22
$\sigma_N$	1	1
$\sigma_N^*$	5/6	1.2
ca	-0.2	-0.2
f	-0.8	-0.8
$\Delta\% \tau$	-3.22	0
$\Delta\% q$	10.97	-13.68

$\sigma_T = \frac{Y_H}{Y_F}$  (ratio between Home and Foreign tradable goods output),  $\sigma_N = \frac{Y_N}{Y_H}$  (ratio between Home nontradable and tradable goods output),  $\sigma_N^* = \frac{Y_{N^*}}{Y_F}$  (ratio between Foreign nontradable and tradable goods output), ca = current account,  $f = \frac{F}{P_H Y_H}$  (net US foreign assets over the dollar value of traded goods output).

It thus matters tremendously whether surplus countries like the PRC, as they continue to grow, concentrate their investment in productive capacity in traded or nontraded goods. In the first case, the US terms of trade would have to increase and the dollar would depreciate in real terms. In the second case, in contrast, there would be no change in the terms of trade and the dollar would appreciate in real terms.

### 3.4 Preference Shocks

In this section, structural reforms (e.g., social safety net or financial market reforms) that changed spending patterns were assumed. First, we assumed an increase in the foreign preference for US exports. This was, in effect, an increase in the foreign preference weight on US tradable goods,  $1-\alpha^*$ , or, equivalently, a reduction in foreign home bias in tradables. As may be seen in the second row of Table 3, raising  $1-\alpha^*$  from 0.075 to 0.200 caused the US terms of trade to rise by about 35% and the dollar exchange rate to appreciate by 31%.<sup>12</sup> This reflects the shift in global demand toward US exports. If foreign home bias were to increase to the level of the US,  $\alpha = \alpha^* = 0.7$ , the rise in the terms of trade would be larger than 50% and the dollar real exchange rate would appreciate by 45%.

<sup>12</sup> We assumed the size of the US to be 21% of the world economy and the elasticity parameters  $\theta$  and  $\eta$  to equal 1 and 2, respectively.

**Table 3: Exchange Rate Responses to Changes in Preference Parameters**

No.	US (Home) Preference Weight on:		Foreign Preference Weight on:		Adjustment	
	US Tradables	Tradables	US Tradables	Tradables	Fall in TOT	Real Depreciation
	$\alpha$	$\gamma$	$1-\alpha^*$	$\gamma^*$	$\Delta\tau$	$\Delta q$
1	0.7	0.25	0.075	0.25		
2	0.7	0.25	0.2	0.25	-34.71%	-30.99%
3	0.7	0.25	0.3	0.25	-51.43%	-44.82%
4	0.4	0.25	0.075	0.25	37.10%	33.19%
5	0.7	0.25	0.075	0.19	0.00%	34.72%
6	0.7	0.25	0.075	0.33	0.00%	-34.52%
7	0.7	0.32	0.075	0.25	0.00%	32.56%

$\alpha$  = US bias towards own tradable goods,  $\gamma$  = Home preference weight for tradable goods (relative to nontradable goods),  $1 - \alpha^*$  = Foreign bias towards US tradable goods,  $\gamma^*$  = Foreign preference weight for tradable goods (relative to nontradable goods),  $\tau$  = terms of trade,  $q$  = real exchange rate, US = United States, TOT = terms of trade.

Next we assumed a reduction in US home bias in tradables from 0.7 to 0.4. In the fourth row of Table 3 we can see this caused the terms of trade to fall by 37% and the dollar to depreciate 33% in real terms. This transpired because lower US home bias caused global demand for US tradable goods to fall.

Finally we looked at changes in foreign preferences for tradables. This corresponds to the foreign preference weight on tradable goods,  $\gamma^*$ . Because this parameter affects only relative consumption of tradable and nontradable goods [see equations (1) to (4)], it had no effect on the terms of trade. However, because it had an impact on the price of foreign nontradable goods (relative to tradable goods), the real exchange rate changed. This may be seen from equation (15) above: the dollar depreciated in real terms when  $\gamma^*$  fell, and appreciated when it increased. Lowering  $\gamma^*$  from 0.25 to 0.19 caused the dollar real exchange rate to depreciate by about 35%. A real appreciation of the same magnitude could be generated by raising  $\gamma^*$  from 0.25 to 0.33, as can be seen in the fifth and sixth rows of Table 3. The effect of raising the US preference for tradables,  $\gamma$ , is similar to lowering the foreign preference for tradables,  $\gamma^*$ . An increase in  $\gamma$  from 0.25 to 0.32 will cause the real exchange rate to depreciate by 33% (seventh row of Table 3).

This shows that changes in spending patterns can result in significant changes in the real exchange rate and terms of trade. Stronger foreign taste for US exports or for tradable goods caused the dollar to appreciate. On the other hand, declines in US home bias in tradables, declines in foreign preference for tradable goods, or increases in US preference for tradable goods caused the dollar to depreciate. As expected, changes in domestic or foreign preferences for tradable goods had no effect on the terms of trade, while changes in home bias in tradables did. A decline in US home bias caused US terms of trade to fall, while a decline in foreign home bias (or, equivalently, an increase in foreign preference for US tradable goods) caused US terms of trade to rise.

## 4. CURRENT ACCOUNT SURPLUS REDUCTIONS

Available literature examining how large current account surpluses end, especially in emerging markets, is limited. In contrast, available literature about the elimination of large current account deficits (“current account reversals”) is considerable, and is summarized in Table A3.1. Most studies identified reversals following the criteria proposed by Milesi-Ferretti and Razin (1998).<sup>13</sup> These criteria identified, inter alia, the initial current account ratio, the

<sup>13</sup> With the exceptions of Algieri and Bracke (2007) and IMF (2007); see below.

size of the adjustment (in percent of GDP and as a fraction of the initial deficit), and its duration. Algieri and Bracke (2007) relaxed earlier criteria using sensitivity analysis in order to maximize the number of episodes. International Monetary Fund (IMF) (2007) shifted the emphasis of previous studies toward both deficit and surplus reversals and proposed a set of criteria applicable to both. Additionally, the duration of the episodes was estimated instead of setting a fixed adjustment period.

Most papers focused on Organisation for Economic Co-operation and Development (OECD) countries, namely Freund (2005); Croke, Kamin, and Leduc (2005); Freund and Warnock (2007); Debelle and Galati (2007); and de Haan, Schokker, and Tcherneva (2008).<sup>14</sup> A few papers considered current account reversals in low- and middle-income economies (Milesi-Ferretti and Razin (1998)), or in both industrial and emerging economies (Adalet and Eichengreen 2007; Algieri and Bracke 2007; and IMF 2007).

While some dispute the main determinants of reversals, there is nonetheless some agreement regarding what variables to consider. Most studies included the current account ratio; macroeconomic variables such as domestic growth, GDP per capita, and the fiscal balance; external sector variables such as the trade balance, trade openness, the real exchange rate, the terms of trade, and the exchange regime; and world variables such as world growth, OECD growth, or US real interest rates. The last column of Table A3.1 reports the effect of the variables used in each study.

Although these papers focused on current account deficit reversals,<sup>15</sup> which may differ beyond a sign change from reductions in current account surpluses, they are nonetheless a logical starting point for this section.

## 4.1 Data and Variable Definitions

Our analysis used data for 46 emerging economies<sup>16</sup> and 26 advanced economies<sup>17</sup> over the period 1980–2008. The main sources of data were the IMF World Economic Outlook Database (October 2009) and the World Bank's World Development Indicators (2009). We started by identifying persistent reductions in current account surpluses. Because the defining criteria have important implications in episode selection and thereby for the results, we considered three different sets of criteria inspired by the above-mentioned literature on deficit reversals.

Our first definition, EP1, is a variant of the measure proposed by Algieri and Bracke (2007). In order for an economy to have an episode that qualified as a persistent reduction in the current account surplus, it must have met the following five criteria:

- i. The current account was in surplus before the reduction.
- ii. Adjustment took place within four years.
- iii. Within 4 years the current account decreased by at least one standard deviation of the economy's current account ratio.

<sup>14</sup> This is evidence of the recent interest in the US situation, as a few papers used analysis of OECD experience to draw inferences for the US.

<sup>15</sup> Except IMF (2007).

<sup>16</sup> Argentina; Bahrain; Bangladesh; Botswana; Brazil; Bulgaria; Chile; PRC; Colombia; Côte d'Ivoire; Croatia; Cyprus; Czech Republic; Egypt; Estonia; Hungary; India; Indonesia; Jordan; Kenya; Lithuania; Macedonia; Malaysia; Mauritius; Mexico; Morocco; Nigeria; Oman; Pakistan; Peru; Philippines; Poland; Qatar; Romania; Russian Federation; Serbia; Slovak Republic; Slovenia; South Africa; Sri Lanka; Taipei, China; Thailand; Tunisia; Turkey; United Arab Emirates; and Viet Nam.

<sup>17</sup> Australia; Austria; Belgium; Canada; Denmark; Finland; France; Germany; Greece; Hong Kong, China; Ireland; Israel; Italy; Japan; Republic of Korea; Luxembourg; Netherlands; New Zealand; Norway; Portugal; Singapore; Spain; Sweden; Switzerland; United Kingdom; and United States.



- iv. The current account reduction was sustained over 5 years—that is, the maximum current account ratio in the 5 years after the adjustment should have remained below the minimum current account ratio in the 3 years before the adjustment.
- v. There was not another reduction in the following 4 years.

Alternatively, EP2 was constructed following (with necessary modifications) Milesi-Ferretti and Razin (1998) and subsequent studies that adopted their criteria:<sup>18</sup>

- i. The current account surplus exceeded 2% of GDP before the reduction.
- ii. The average surplus was reduced by at least 2% of GDP over 3 years (from the maximum to the 3-year average).
- iii. The maximum current account ratio in the 5 years after the reduction was not larger than the minimum current account ratio in the 3 years before the reduction.
- iv. The current account ratio decreased by at least 1/3 of the initial surplus value.
- v. There was not another reduction in the following 3 years.

Finally, we constructed EP3 using the four criteria adopted by the IMF (2007), to which we added a fifth:

- i. At the beginning of the reduction (year 0), the average reduction in the imbalance over the next 3 years must have been at least 1/2 percentage point of GDP.
- ii. At the end of the reduction (year T), the episode finished when a local minimum was reached—that is, when the current account ratio  $ca_t$  remained above  $ca_T$  for 3 consecutive years, and 0.5% or more of the reduction was overturned:  $\left|ca_T - ca_{T-1}\right| / \left|ca_0 - ca_{T-1}\right| \geq 0.005$ .
- iii. Compared with the initial year, the current account ratio in T must have fallen by at least 2.5 percentage points of GDP, and by at least one-half of the initial level.
- iv. In each of the 5 years after the beginning of the episode, the current account ratio must have been smaller than the initial level.
- v. There was not another reduction while one was still ongoing, where the duration of each reduction was determined in criterion ii.

Unlike the first two measures, which looked at adjustments over a fixed period of 3 to 4 years, EP3 allowed for longer-lived reductions in current account surpluses and estimated the duration of each episode. EP3 was less restrictive than EP1 and EP2 as it required only a 0.5% of GDP reduction as opposed to one standard deviation for EP1 and 2% of GDP for EP2. EP1 and EP2 are thus referred to as capturing “substantial surplus reductions,” and EP3 is referred to as identifying both “substantial” and “moderate” surplus reductions. EP3 generated many more episodes (69 in emerging economies and 26 in advanced economies) than EP1 (28 episodes in emerging economies and 13 in advanced economies) and EP2 (34 episodes in emerging economies and 13 in advanced economies).<sup>19</sup>

Table A4.1 lists all episodes identified by each set of criteria. Tables A4.2 and A4.3 report the current account ratio at the beginning of each episode, its change during the adjustment, and the duration of the reduction.

<sup>18</sup> Freund (2005); Croke, Kamin, and Leduc (2005); Freund and Warnock (2007); Adalet and Eichengreen (2007); Debelle and Galati (2007); and de Haan, Schokker, and Tcherneva (2008).

<sup>19</sup> After this paper was drafted, the IMF (2010) studied the consequences (as opposed to the causes, our concern here) of ending sustained current account surpluses. The methodology used was similar to our definition of EP2. Of the 20 episodes listed after 1980, 7 were also included in our measure EP1, 9 in our measure EP2, and 14 in our measure EP3. The IMF publication thus provides something of an independent check on our methodology.

If we compare episodes picked up by EP1 and EP2, we notice some cases where the same episode was captured by both but with a divergence of several years, and others where episodes were captured by only one definition. One way of choosing between these definitions would be to select the one that has the highest proportion of episodes also picked up by the other two—allowing for 3 years of divergence with regard to the starting year. Table A4.4 reports this information. Of the 47 episodes identified by EP1, 28 were also picked up by EP2 and 39 by EP3. On average, 71.3% of episodes identified by EP1 were also identified by the other two definitions. Since the comparable fraction for EP2 was 70.7%, EP1 did the best job in identifying a consistent set of episodes in this sense.

## 4.2 Univariate Patterns

We now turn to the choice of explanatory variables, guided by the literature on current account deficit reversals. These variables and their sources are listed and described in Table A4.5. Table A4.6 shows their means, differences in means, and significance in a two-tailed t-test, with the sample divided into emerging economies and advanced economies to allow for different determinants of reductions in these economies.<sup>20</sup>

For emerging markets, the univariate comparisons suggested that reductions occurred in economies with higher initial current account surpluses and with slower domestic growth. Reductions in surpluses also appeared to be associated with earlier decreases in trade balances, higher real appreciation, and higher public savings. Substantial reductions occurred when oil prices were higher, while substantial and moderate reductions transpired when they were lower. Similarly, in advanced economies, reductions seemed to occur in those with higher current account ratios and higher public savings. They were also associated with faster growth, higher openness to trade, earlier decreases in trade balances, and higher world growth.

Figures A2.5, A2.6, and A2.7 provide a graphical depiction of the behavior of the current account ratio and various correlates during episodes of surplus reductions in emerging economies [(a) panels in each figure] and advanced economies [(b) panels in each figure], where year zero is when the reduction started. The first graph in each eight-graph panel reports the median and average current account ratio over all economies 5 years before and 5 years after reductions. The other seven graphs in each panel compare averages for domestic growth, trade openness, trade balance, the real exchange rate, fiscal balance, world growth, and the real oil price in economies that experienced reductions and those that did not in the five years before and after they occurred.

These variables behaved very differently in emerging economies as compared to advanced economies. In emerging economies, reductions happened after increases in the current account ratio. This contrasts with advanced economies, where this ratio did not show much variation before reductions. Domestic growth in emerging economies accelerated in the years preceding reductions—perhaps reflecting demand-driven growth that translated into increased domestic absorption—while it decelerated slightly in advanced economies.

In both emerging and advanced economies, reductions seemed to occur after a deceleration in the rate of growth of the trade balance. Openness to trade moved in tandem with the trade balance in its improving phase, but did not follow its deceleration in subsequent years. This behavior may have been caused by the rise in imports due to exchange rate appreciation.

The real exchange rate was defined such that an increase represents an appreciation. In line with the theoretical model sketched in the previous section, reductions seemed to be preceded by 2 years of significant real appreciation in emerging economies, and by 1 year of mild appreciation in advanced economies. The fiscal balance was very volatile before

<sup>20</sup> Germany was excluded from the advanced economy subsample because the current account reduction identified after reunification in 1989 had its own historical determinants.

reductions in emerging economies, but more stable in advanced economies. Public savings fell in advanced economies in the year immediately preceding reductions following 2 to 3 years of growth. In both emerging and advanced economies fiscal savings deteriorated markedly in the year of the reduction.

Reductions occurred after 1 to 3 years of decelerating world growth in both emerging and advanced economies. Substantial reductions tended to be preceded by 2 to 3 years of improving oil prices, whose subsequent fall seemed to trigger these reductions. This may reflect the impact of falling oil prices on oil producers' export receipts. Substantial and moderate reductions in advanced economies occurred after smaller increases in oil prices without a subsequent fall, while in emerging economies they seemed to be preceded by 2 years of falling oil prices. The distinct behavior exhibited by several variables before substantial reductions and before substantial and moderate reductions showed that how current account reductions are defined matters greatly.<sup>21</sup>

The one clear conclusion from this univariate analysis was that the behavior of macroeconomic variables around the time of reductions in large current account surpluses was very different in emerging economies compared to advanced economies. Consequently, the two types of economies are disaggregated in the multivariate analysis that follows.

### 4.3 Multivariate Analysis

Logit analysis was used to determine which variables helped predict whether an economy experienced a substantial reduction or a substantial and moderate reduction in its current account surplus. Our dependent variable took a value of 1 if there was a current account reduction, and 0 otherwise. Given the similarities between logit and probit models with binary dependent variables, both models would deliver qualitatively similar conclusions. However, fixed effects probit analysis introduces what Wooldridge (2002) called an "incidental parameters problem." Because the fixed effects logit maximum likelihood estimator does not treat the fixed effects as parameters to be estimated along with the betas, it produces consistent estimators.

To avoid problems of endogeneity, and for consistency with prior studies, 3-year-lagged averages were used for the current account ratio, domestic growth, and the change in the trade balance.<sup>22</sup> Since observations for the same economy in different years were not independent, standard errors were clustered by economy. However, this did not control for unobserved economy-specific characteristics, for which economy fixed effects were used. Year fixed effects were also added to control for unobserved factors that affected all economies in each given year. The inclusion of year fixed effects permitted comparison of the effects of various factors across economies. When economy fixed effects were instead included—effectively dummied out cross-economy differences—we focused on the effects of changes in an explanatory variable within an economy over time on the probability of a surplus reduction.

Results are in Tables A4.7 and A4.8. While we would have liked to have had a consistent set of explanatory variables in the two subsamples, the fiscal balance had to be excluded from the emerging economy subsample, and the dummy for oil exporters had to be excluded from the advanced economy subsample. Fiscal balance data was available for most advanced economies but not for many emerging economies—especially in earlier years, causing a large number of missing observations in the regressions that used the emerging economy

<sup>21</sup> For the case of current account deficit reversals, Algieri and Bracke (2007) showed, similarly, that small modifications of the criteria used in the literature can change considerably the selection of reversals and significantly affect the results.

<sup>22</sup> Other explanatory variables were trade openness, real appreciation, fiscal balance, world growth, the real oil price, and a dummy for oil exporters. World growth and the real oil price were meant to capture the effect of external (and exogenous) factors on the probability of a current account reduction.

subsample. The dummy for oil exporters was dropped from the advanced economy subsample because there was only one economy classified as an oil exporter (Norway).

The first regression in each group considered several domestic determinants of reductions and two external variables.<sup>23</sup> The second regression controlled for unobservable economy-specific characteristics, and the third for year-specific factors. A schematic summary of the signs of the significant coefficient estimates is presented in Table A4.9. In discussing the results, we focus on substantial surplus reductions identified by EP1—which for the reasons presented above dominates EP2, and on substantial and moderate surplus reductions identified by EP3.

Not surprisingly, both groups of reductions were more likely to occur in economies with higher current account surpluses (columns 3, 6, and 9 of Table D7 and Table D8). Substantial and moderate reductions were also more likely after periods of increase in the current account ratio (column 8 of Table D7 and Table D8). Fast-growing emerging economies were less likely to experience both groups of reductions than slow-growing emerging economies, but differences in growth among advanced economies had no significant effect on the likelihood of reductions.

Reductions were less likely in more open emerging economies. More open economies produce more exportables, making policies designed to shift resources toward the production of nontradables more difficult politically. Comparable evidence for advanced economies was weaker, even though there was some evidence that increasing trade openness reduced the probability of current account reductions. In both emerging and advanced economies, substantial reductions were more likely after deceleration in the growth of the trade balance, which may be associated with slower export growth or acceleration in import growth. There was similar evidence for substantial and moderate reductions in advanced economies, but not in emerging economies.

Discussion of Obstfeld and Rogoff's theoretical model in section 3 showed that real appreciations accompanied reductions in the current account surplus. Figures A2.5, A2.6, and A2.7 showed that this was mostly the case in emerging economies. In the multivariate regression analysis we verified this evidence for emerging economies, finding positive coefficient estimates for one-period lagged real appreciations.<sup>24</sup>

Substantial reductions were more likely to occur in advanced economies with smaller fiscal surpluses. Because current account surpluses may be fed by increases in fiscal savings, these reductions were more likely after increases in the fiscal balance. This may be seen as a variant of the “twin deficits hypothesis.” We did not find any effect of the fiscal balance on substantial and moderate reductions.<sup>25</sup>

In summary, we found that large current account surpluses do not last forever: the larger the surplus, the more likely it will eventually diminish. Such adjustment is more likely in less open economies, where political resistance is usually weaker. It also is more likely in emerging market economies when a period of exceptionally high growth has come to an end, and when expansion in the supply of exportables presumably has begun to slow and demand is rebalancing toward domestic goods. Such adjustment in these economies is also associated with real appreciation. In advanced economies, however, it is more likely after reductions in budget surpluses.

The robustness of our results was checked against outliers by removing current account reductions that may have had a significant impact on the results. All regressions were

<sup>23</sup> This corresponds to columns 1, 4, and 7 in tables D7 and D8.

<sup>24</sup> IMF (2010) also found that the ending of sustained current account surpluses tended to be associated with real exchange rate appreciation, although no explicit hypothesis tests were provided.

<sup>25</sup> Additionally, we found no significant effect of the two external variables (world growth and real oil prices), even after controlling for the potentially different effect of oil prices on oil exporters, which does not validate our previous univariate analysis.

reestimated twice: (i) after removing reductions with a very low initial current account ratio (smaller than 0.5% of GDP) from our list of episodes;<sup>26</sup> and (ii) after removing reductions with a very large initial current account ratio (two standard deviations higher than the period average for each economy).<sup>27</sup> All coefficient estimates kept their sign and magnitude. However, some coefficients that were previously significant at 10% became insignificant. This occurred because there were more economies and years in the sample with only zeros (i.e., no reductions), and these observations were therefore dropped from the estimates with fixed effects.

Given the nonlinearity of the empirical model, it is difficult to interpret the coefficient estimates in terms of discrete changes. The marginal effect of each regressor was calculated using all observations in the sample. Their average values are presented in Table A4.10.<sup>28</sup> As seen before, economies with larger surpluses had a higher likelihood of experiencing a reduction. The second, fourth, and sixth columns show that, for each additional percentage point increase in the current account ratio, the likelihood of a reduction increased by between 1.46 and 1.84 percentage points in emerging economies and between 1.10 and 1.20 percentage points in advanced economies. For example, the current account ratio in the PRC in 2007 was 10.9% of GDP. The likelihood of the PRC experiencing a reduction was, on average, 7.00 to 12.00 percentage points higher than that of Chile, Japan, Philippines, or Russian Federation in the same year.<sup>29</sup>

We can see from the fifth row of Table A4.10 the magnitude of the real appreciations that accompanied reductions. Each percentage point increase in the rate of real appreciation raised the likelihood of a reduction by 0.20 to 0.70 percentage points, on average. For example, the rates of appreciation of the Malaysian ringgit, the Philippine peso, and the PRC yuan in 2006 increased between 3.00 and 4.00 percentage points. This corresponded to a 1.00 to 3.00 percentage point higher likelihood of a significant reduction in their current account surpluses.

Because the marginal effect of a specific regressor depends on the values of other regressors, in Figure A2.8 we examine how this response varied with the level of other regressors, focusing on the emerging economy subsample. In the first four graphs it can be seen that faster currency appreciation increased the marginal effect of changes in the current account ratio and accelerations in appreciation itself. For substantial reductions, the marginal effect of changes in the current account was significantly different from zero when real appreciation was strong (between 10% and 28%). For substantial and moderate reductions, the marginal effect of changes in the current account was significantly different from zero even when appreciation was weak. For both groups of reductions, the marginal effect of accelerations in real appreciation was significantly different from zero for levels of currency appreciation below 15%.

The remaining four graphs in Figure A2.8 show that output growth had a different impact on the marginal effect of these variables on the likelihood of substantial reductions and the likelihood of substantial and moderate reductions. For substantial reductions, the response to changes in the current account ratio was significantly different from zero when the growth of economies was between 5% and 10%, and remained stable at around 0.05 in this interval. The response to faster real appreciation increased with the rate of growth and was

<sup>26</sup> This corresponds to 3 episodes picked up by EP1 (1 from the emerging economy subsample and 2 from the advanced economy subsample) and 12 episodes picked up by EP3 (4 from the emerging economy subsample and 8 from the advanced economy subsample).

<sup>27</sup> This corresponds to four episodes picked up by EP1 (all from the emerging economy subsample), seven episodes picked up by EP2 (all from the emerging economy subsample), and seven episodes picked up by EP3 (six from the emerging economy subsample and one from the advanced economy subsample).

<sup>28</sup> Notice that this is different than looking at the marginal effects at the average of all regressors, or at some other point in the space of regressors.

<sup>29</sup> In 2007, the current account ratio in Chile was 4.4%; in the Philippines, 4.9%; in the Russian Federation, 6%; and in Japan, 4.8%.

significantly different from zero when growth was between zero and 5%. In contrast, the response to changes in the current account ratio and to accelerations in real appreciation increased with reductions in domestic growth. It was significantly different than zero when growth was between –5% and 7%.

In summary, higher rates of currency appreciation increased the impact of other determinants—such as the current account ratio and real appreciation itself—on the likelihood of reductions. Slower growth increased the impact of these determinants on the likelihood of substantial and moderate reductions but not on the likelihood of substantial reductions.

## 5. CONCLUSION

Economists disagree about the role of the exchange rate in the process of global rebalancing. Some argue that the imbalances problem is fundamentally an imbalance between saving and investment in the US and a mirror-image imbalance in the PRC. Consequently, since there is no reason to think that a change in the exchange rate should have a significant impact on saving or investment, there is no reason to advocate a yuan revaluation/dollar devaluation as part of the rebalancing process.<sup>30</sup> Others insist that exchange rate adjustments are indispensable to rebalancing. The resulting controversy has been a source of confusion that has not aided the adoption of policies conducive to rebalancing. The danger is that confusion may continue to disrupt efforts to put in place policies needed for a sustainable resolution of imbalances.

In this paper we have attempted to reduce the confusion by making some simple points and exploring their implications. First, the exchange rate is not a primitive. The exchange rate is an endogenously determined relative price that adjusts to clear markets in response to shocks. When considering global rebalancing, it is more productive to think in terms of primitives: what is the shock in response to which rebalancing must occur—an increase in PRC spending? a reduction in US spending? something else? What are the behavioral parameters that shape the impact of the shock on prices and quantities? Given assumptions about these primitives, it is then possible to ask whether and by how much the exchange rate must adjust. The debate over global imbalances has gone awry by focusing on the exchange rate. The exchange rate is better thought of as one of a number of endogenous relative prices that must adjust in response to policy initiatives or other events precipitating the rebalancing process. The simulation exercises undertaken in this paper underscore this point.

The empirical literature tends to forget that not one, but two or more countries will be involved in the rebalancing process. The literature on large current account deficits has asked: are circumstances in the US such that we can now expect a persistent fall in the deficit? For a large economy like the US, however, this question makes sense only if one also asks: are circumstances in other countries now such that we can expect a persistent fall in the surplus? Is this the case in a sufficient number of other countries to match the adjustment in the US? In this paper we have included an analysis of the second set of country participants in an effort to gain a better sense of the overall choreography of the rebalancing process.

We found that large current account surpluses tend to come to an end when they had been allowed to rise to exceptionally high levels. Less open economies (where political resistance to resource reallocation is weaker) were also found more likely to see large current account surpluses come to an end, as were economies where an earlier period of rapid growth had come to an end (presumably moderating the growth of capacity to produce tradables and rebalancing toward domestic goods). For oil exporting emerging markets, large current

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<sup>30</sup> Examples of this point of view include Laurenceson and Qin (2005) and McKinnon and Schnabl (2006).

account surpluses tended to come to an end when the price of oil was unusually low. While limited, available data on government budgets suggested that smaller budget surpluses also helped end large current account surpluses.

Potentially, some of these patterns bode well for future reductions in the PRC's large current account surplus. That surplus has risen to extraordinarily high levels, but cross-country evidence suggests this is unlikely to continue without end. Both domestic and foreign pressures make some reduction of these extraordinarily large surpluses probable. The ongoing demographic transition and the likely deceleration of economic growth in the face of more spending on social programs should boost the likelihood of some reduction in the PRC current account surplus. The increases in government spending in general support this view. On the other hand, the fact that the PRC economy is so open, making output and employment growth dependent on exports, is likely to create political resistance to adjustment.

These arguments underscore the fact that the requisite adjustments are not guaranteed and are not likely to occur automatically. Appropriate policy action would greatly increase the likelihood that countries on the surplus side of global imbalances contribute constructively to global rebalancing.

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## APPENDIX 1: DERIVATION OF $\sigma_T$ FOR DIFFERENT RELATIVE SIZES OF THE UNITED STATES ECONOMY

Assuming that the share of tradable goods output to gross domestic product (GDP) is approximately 0.25 in the United States (US) and in the rest of the world, the share of tradables to nontradables is approximately 1/3:

$$\frac{P_H Y_H}{P_H Y_H + P_N Y_N} \approx 0.25 \Rightarrow \frac{P_H Y_H}{P_N Y_N} \approx \frac{1}{3}$$

$$\frac{P_F^* Y_F}{P_F^* Y_F + P_N^* Y_N^*} \approx 0.25 \Rightarrow \frac{P_F^* Y_F}{P_N^* Y_N^*} = \frac{P_F Y_F}{\varepsilon P_N^* Y_N^*} \approx \frac{1}{3}$$

With the relative size of the US is given by

$$\frac{\text{US GDP}}{\text{World GDP}} = \frac{P_H Y_H + P_N Y_N}{P_H Y_H + P_N Y_N + P_F Y_F + \varepsilon P_N^* Y_N^*} \approx \frac{4P_H Y_H}{4P_H Y_H + 4P_F Y_F} = \frac{P_H Y_H}{P_H Y_H + P_F Y_F}$$

the value of  $\sigma_T = \frac{Y_H}{Y_F}$  such that the US is  $\omega\%$  of the world solves the following nonlinear equation:

$$\frac{\sigma_T / \tau(\sigma_T)}{1 + \sigma_T / \tau(\sigma_T)} = \omega$$

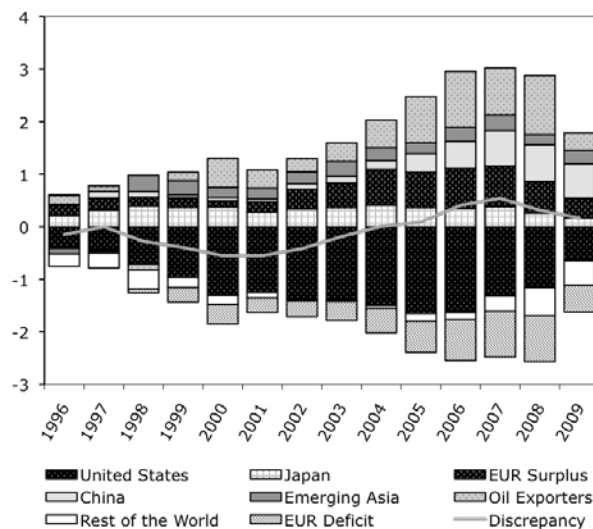
where  $\tau(\sigma_T)$  is given by the equilibrium condition

$$1 = \alpha \frac{1}{[\alpha + (1 - \alpha)\tau^{1-\eta}]} (1 + if - ca) + (1 - \alpha^*) \frac{1}{[\alpha^* \tau^{1-\eta} + (1 - \alpha^*)]} \left( \frac{\tau}{\sigma_T} - if + ca \right).$$

In the benchmark model, the US is approximately 21% of the world economy and  $\sigma_T$  equals 0.22. The initial value of the terms of trade is 0.8439. When the PRC does not participate in the rebalancing, the relative size of the US in the world economy less the PRC is approximately 23%. In this case,  $\sigma_T = 0.2579$  and the initial value of  $\tau$  is 0.8843. Where the US and Asia do the rebalancing, the relative size of the US in this grouping of economies is 50%, and both  $\sigma_T$  and  $\tau$  are equal to 1.5361. If only the US and the PRC participate, the relative size of the US is 75%, and  $\sigma_T = 6.7068$  and  $\tau = 2.2357$ .

## APPENDIX 2: FIGURES

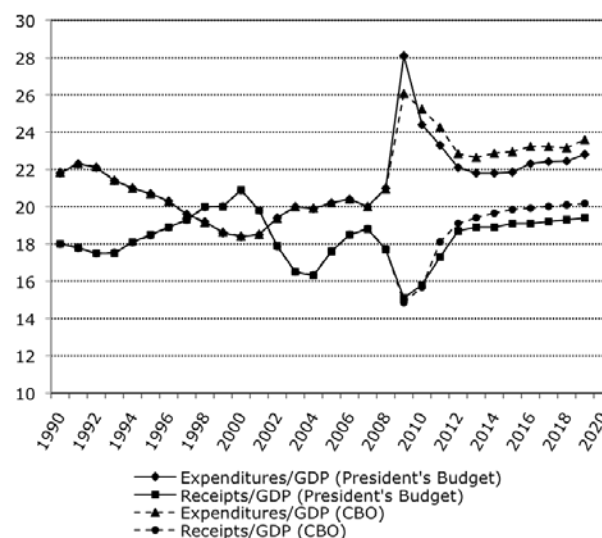
**Figure A2.1: Global Imbalances as a Percent of Global Gross Domestic Product**



Source: International Monetary Fund World Economic Outlook Database October 2009.  
<http://www.imf.org/external/pubs/ft/weo/2009/02/weodata/index.aspx> (accessed on November 18, 2009).

Emerging Asia includes Hong Kong, China; Indonesia; Republic of Korea; Malaysia; Philippines; Singapore Taipei, China; and Thailand. EUR deficit includes Greece, Ireland, Italy, Portugal, Spain, UK, Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Turkey, and Ukraine. EUR surplus includes Austria, Belgium, Denmark, Finland, Germany, Luxembourg, Netherlands, Sweden, and Switzerland. Oil exporters are Algeria, Angola, Azerbaijan, Bahrain, Republic of Congo, Ecuador, Equatorial Guinea, Gabon, Iran, Kazakhstan, Kuwait, Libya, Nigeria, Norway, Oman, Qatar, Russia, Saudi Arabia, Sudan, Syria, Trinidad and Tobago, United Arab Emirates, Venezuela, and Yemen. Rest of the world: remaining countries.

**Figure A2.2: United States Federal Expenditures and Revenues as a Percent of Gross Domestic Product**

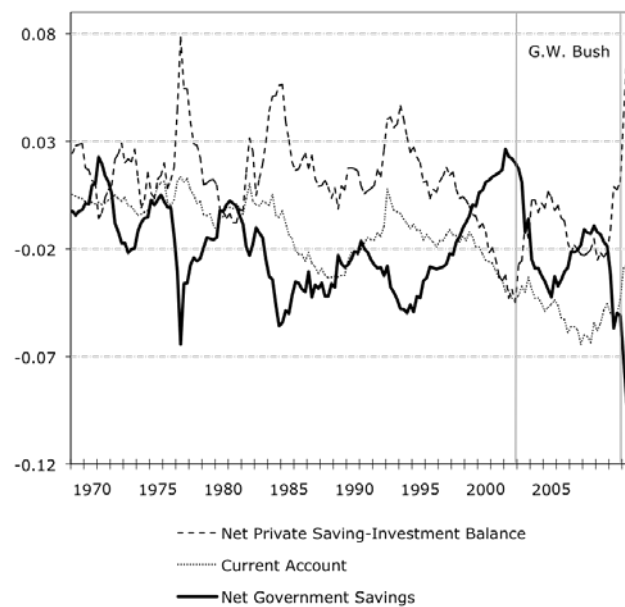


Sources: Office of Management and Budget (White House) and Congressional Budget Office

<http://www.whitehouse.gov/omb/> (accessed on November 17, 2010)

<http://www.cbo.gov/> (accessed on November 17, 2010)

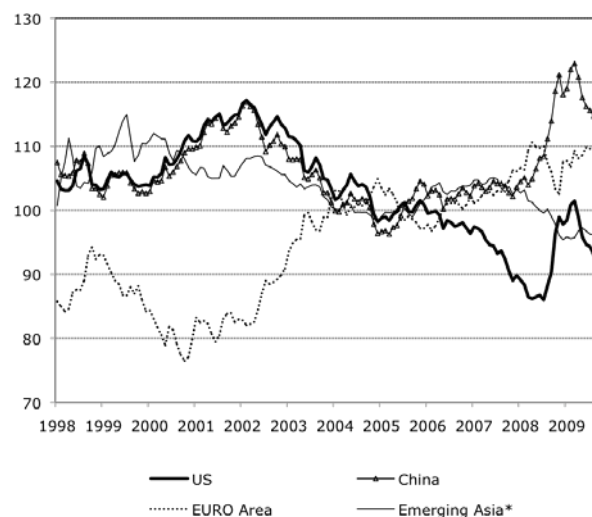
**Figure A2.3: United States Savings and Investment—Normalized by Nominal Gross Domestic Product**



Source: Bureau of Economic Analysis, National Income and Product Accounts Tables

<http://www.bea.gov/national/nipaweb/SelectTable.asp?Selected=N> (accessed on November 28, 2010)

**Figure A2.4: Effective Exchange Rate, 2005=100  
(Broad index, monthly averages)**

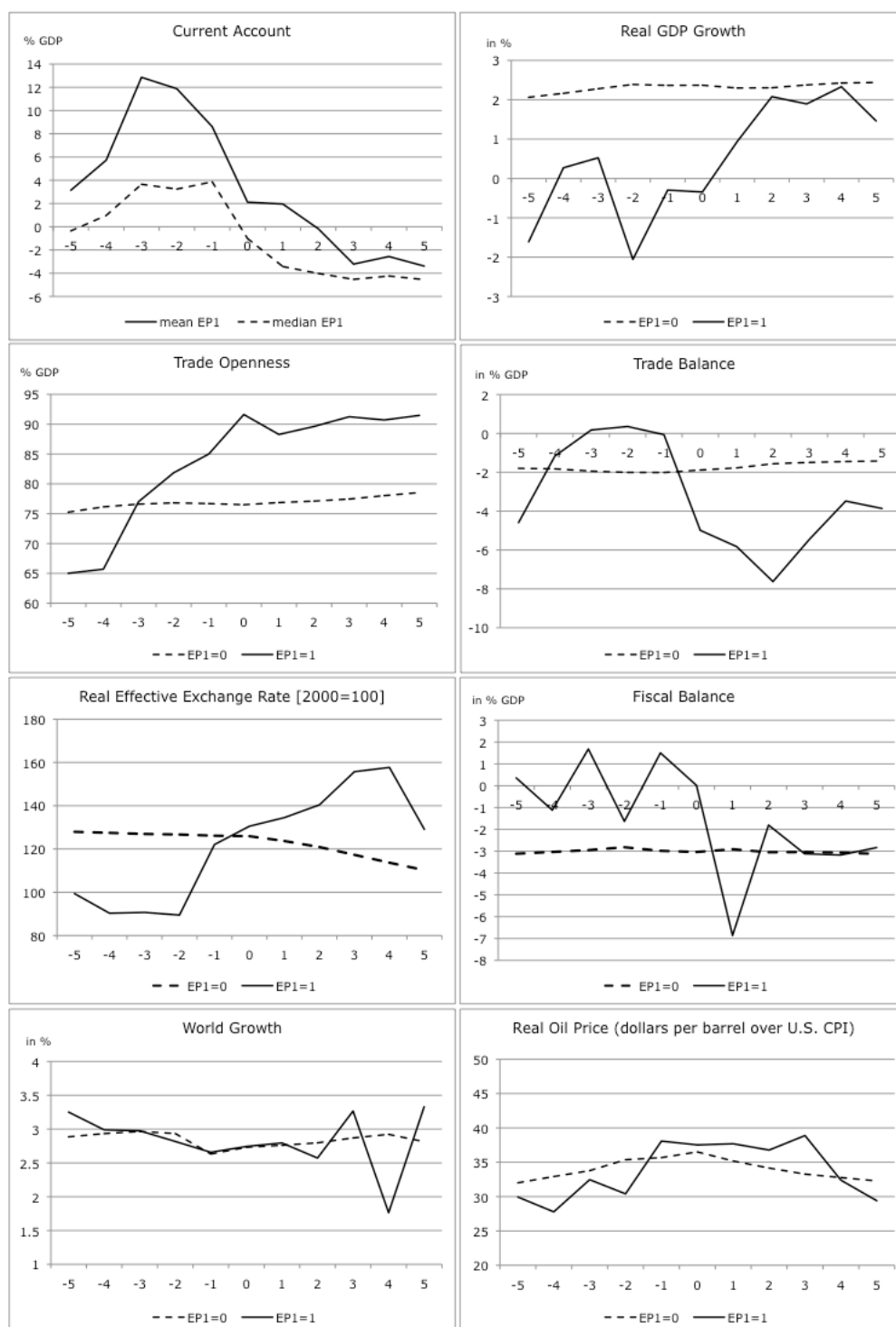


Source: Bank of International Settlements

<http://www.bis.org/statistics/eer/index.htm> (accessed on November 18, 2010)

\* Hong Kong, China; Indonesia,; Republic of Korea; Malaysia; Philippines; Singapore; Taipei, China; and Thailand.

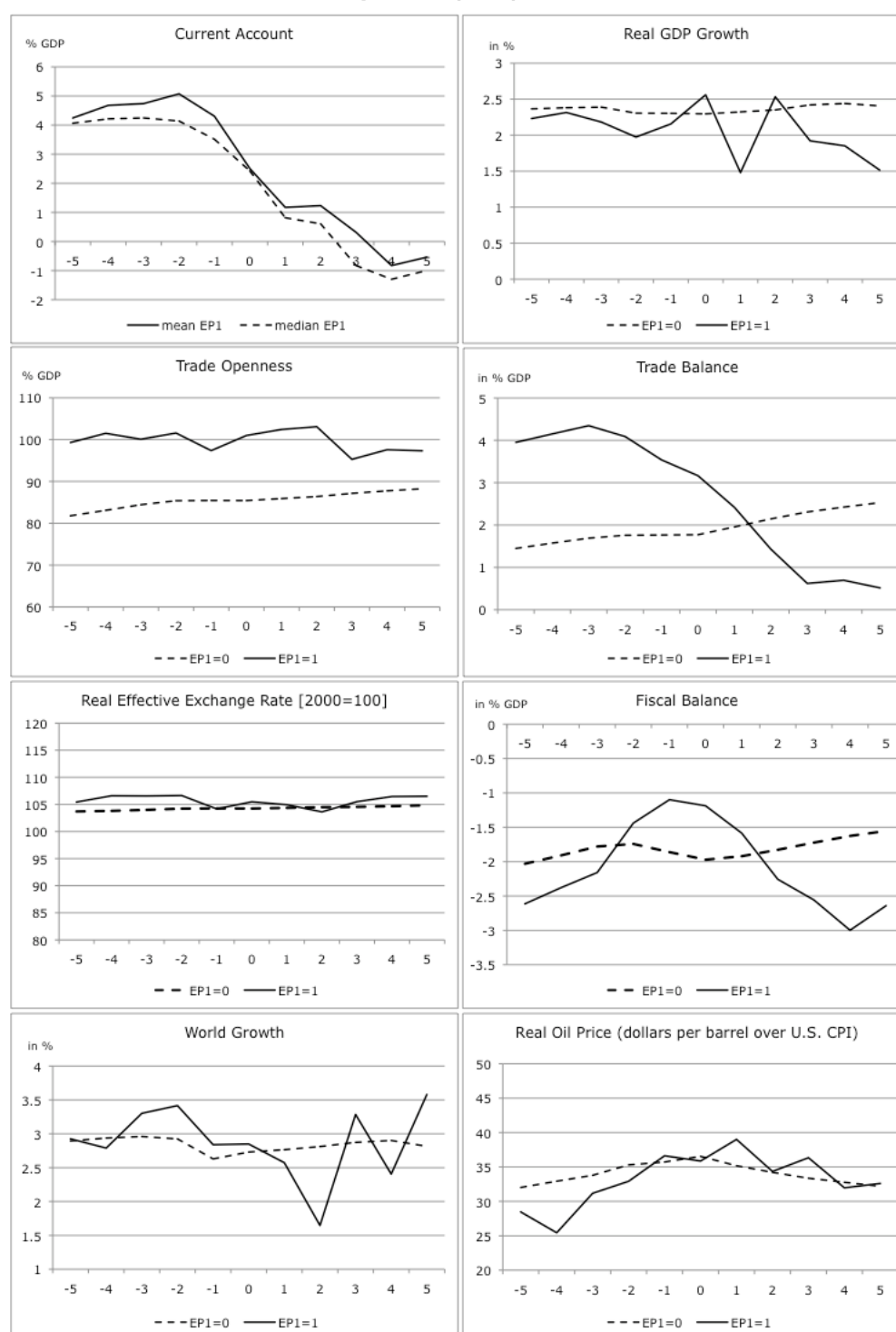
**Figure A2.5(a): Dynamics of Key Variables Before and After Substantial Reductions in Current Account Surpluses (EP1)–Emerging Economies**



Source: Author's calculations.

CPI = consumer price index, GDP = gross domestic product, US = United States.

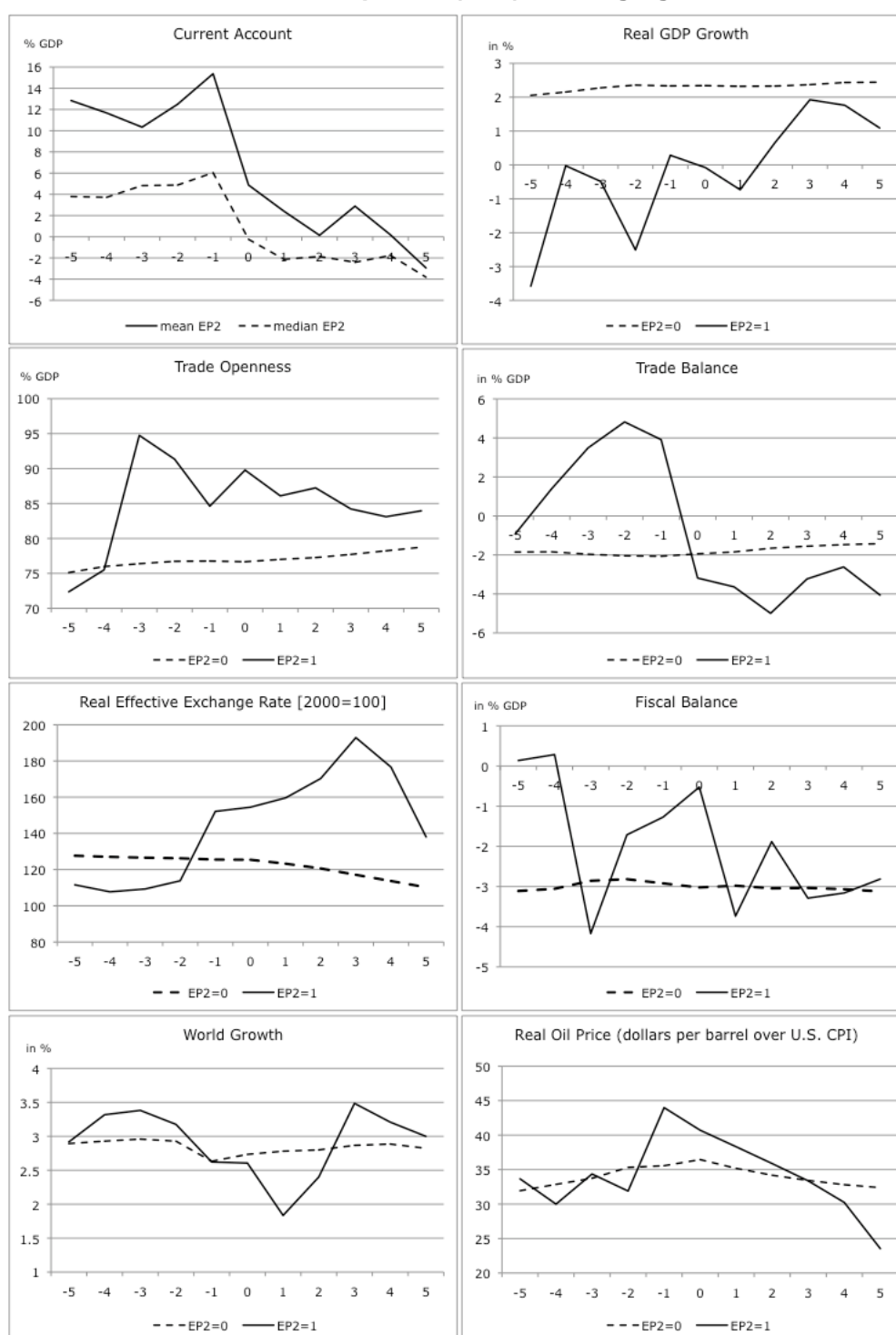
**Figure A2.5(b): Dynamics of Key Variables Before and After Substantial Reductions in Current Account Surpluses (EP1)—Advanced Economies**



Source: Author's calculations.

CPI = consumer price index, GDP = gross domestic product, US = United States.

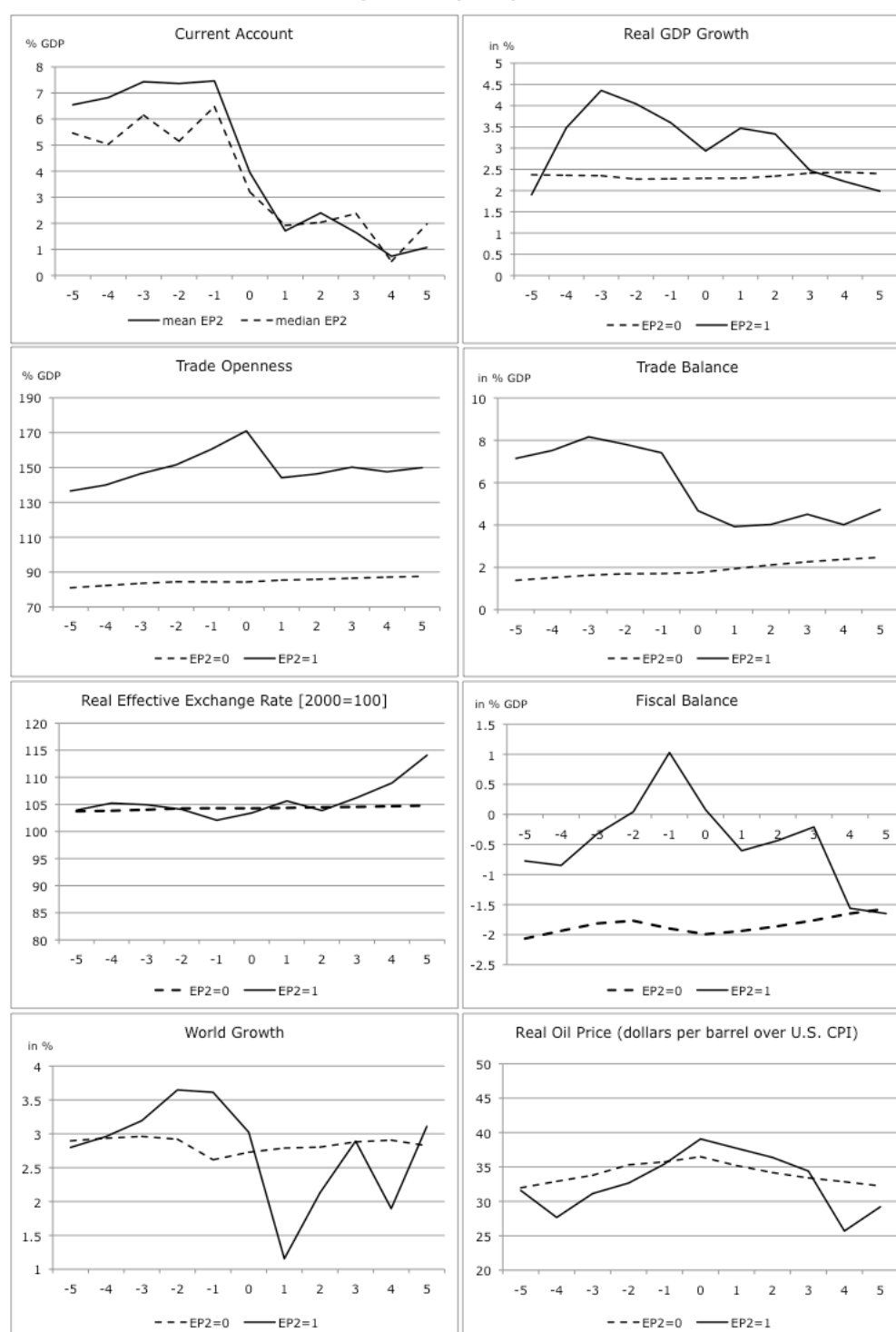
**Figure A2.6(a): Dynamics of Key Variables Before and After Substantial Reductions in Current Account Surpluses (EP2)—Emerging Economies**



Source: Author's calculations.

CPI = consumer price index, GDP = gross domestic product, US = United States.

**Figure A2.6(b): Dynamics of Key Variables Before and After Substantial Reductions in Current Account Surpluses (EP2)—Advanced Economies**

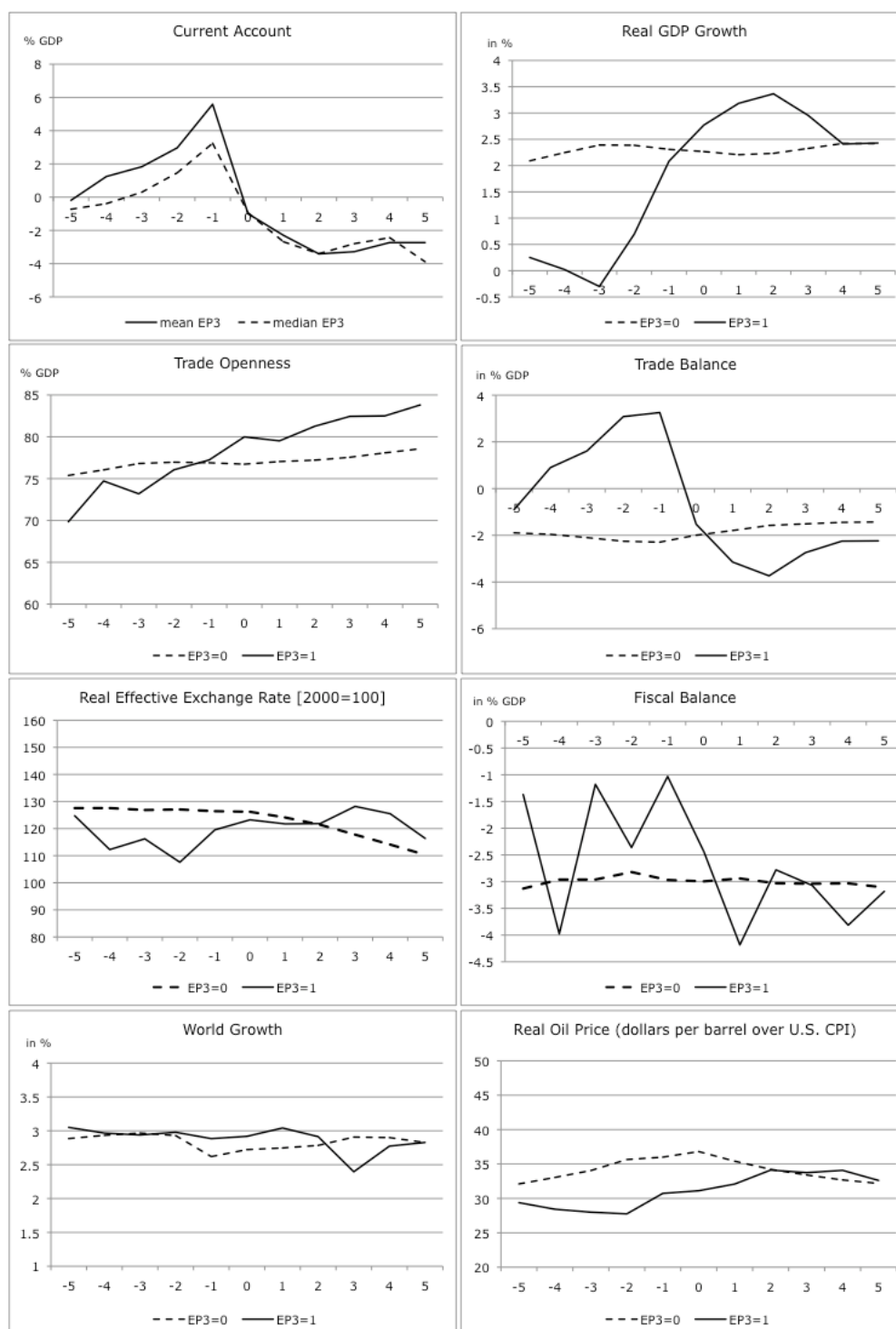


Source: Author's calculations.

CPI = consumer price index, GDP = gross domestic product, US = United States.



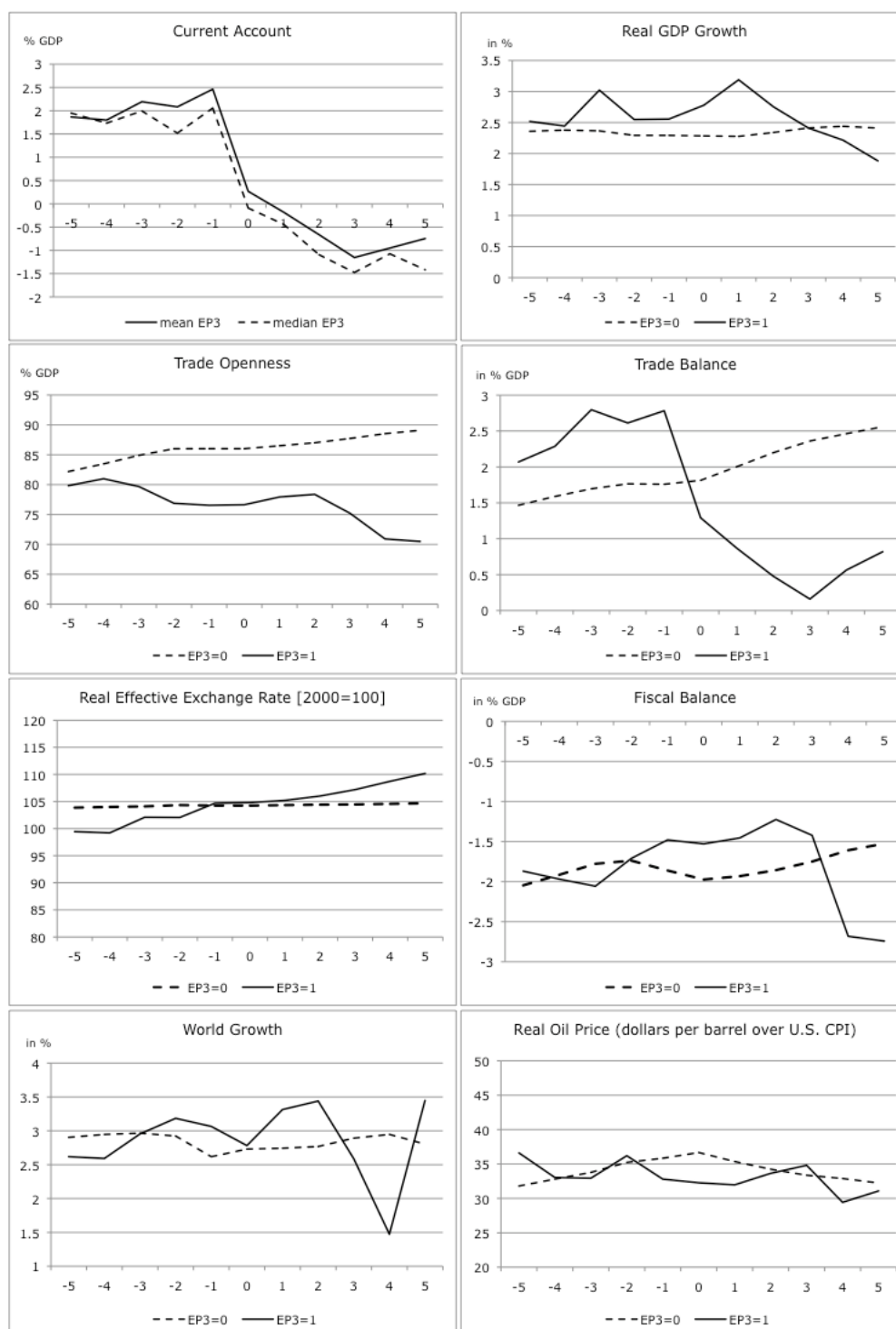
**Figure A2.7(a): Dynamics of Key Variables Before and After Substantial and Moderate Reductions in Current Account Surpluses (EP3)—Emerging Economies**



Source: Author's calculations.

CPI = consumer price index, GDP = gross domestic product, US = United States.

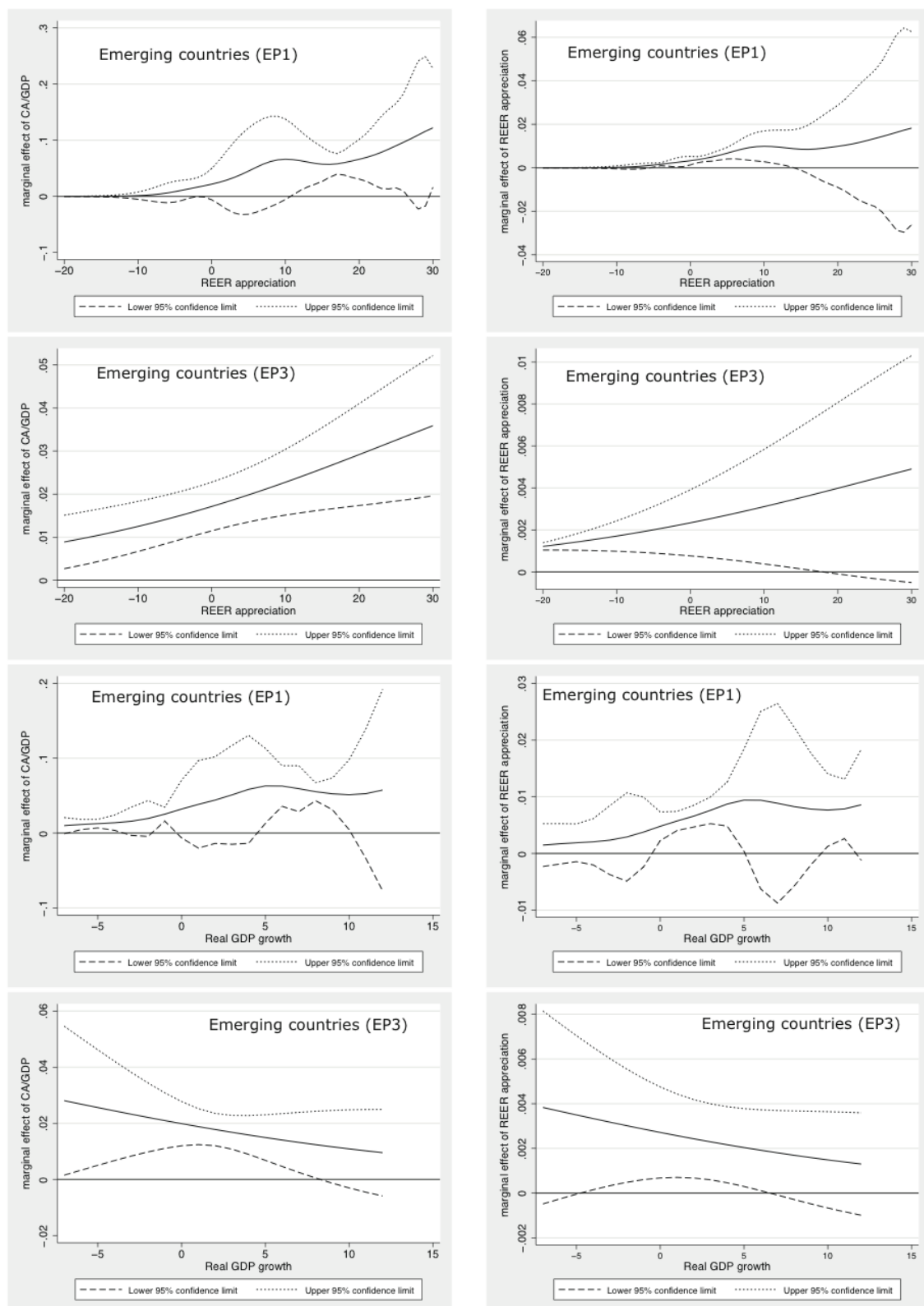
**Figure A2.7(b): Dynamics of Key Variables Before and After Substantial and Moderate Reductions in Current Account Surpluses (EP3)—Advanced Economies**



Source: Author's calculations.

CPI = consumer price index, GDP = gross domestic product, US = United States.

**Figure A2.8: Evaluating Marginal Effects over the Response Surface**



Source: Author's calculations.

CA/GDP = current account as a percentage of GDP, REER = real effective exchange rate, GDP = Gross Domestic Product.

## APPENDIX 3: LITERATURE REVIEW

**Table A3.1: Literature Review**

Article	Period	Countries	Definiton of Current Account Reversals					No. Episodes	Main Determinants of Reversals	Sign
			Initial CA to GDP	Size of Adjustment GDP	Share of Initial Deficit	Years of Adjustment	Sustainability of Adjustment			
Milesi-Ferretti and Razin (1998)	1974–1990	86 low and middle income		3% or 5%	1/3	3		72 or 48 CA/GDP		–
									Trade openness	–
									Reserves/Imports	–
									GDP per capita	+
									Fiscal balance	+
									Terms of trade	–
									Ch. ToT	+
									US real interest rates	+
Freund (2005)	1980–1997	25 industrial	(2%)	2%	1/3	3	5	25	CA/GDP	–
									Reserve growth	–
									Real GDP growth	–
									REER appreciation	
Croke et al. (2005)	1980–1999	21 industrial	(2%)	2%	1/3	3	5	23	Government balance	
									Real interest rates	
Freund and Warnock (2007) <sup>a</sup>	1980–2003	25 OECD	(2%)	2%	1/3	3	5	26	(...)	
									(...)	
Algieri and Bracke (2007) <sup>b</sup>	1973–2006	45 industrial and emerging	<0%	1 std. dev.		4	5	71	CA/GDP	
									Import expansion variable	
									Exch. rate overvaluation	
									Output gap	
									Credit expansion	
									Real oil price <sup>c</sup>	

Article	Period	Countries	Definiton of Current Account Reversals						No. Episodes	Main Determinants of Reversals	Sign
		Initial CA to GDP	Size of Adjustment		Years of Adjustment	Sustainability of Adjustment					
			GDP	Share of Initial Deficit							
IMF (2007)	1960–2006	47 advanced, emerging and oil exporters		2.5	1/2	estimated	5	119	(...)		
		56 all	<0%	2% or 3%	1/3	3	3	194	CA deficit Trade balance/GDP Government balance US interest rates GDP per capita US real GDP growth Openness	+ – – – + +	
Adalet and Eichengreen (2007)	1880–1998										
Debelle and Galati (2007)	1974–2003	21 industrial	(2%)	2%	1/3	3	5	28	Global growth US interest rate CA REER Real GDP growth Terms of trade	– + – – – –	
		29 OECD	(2%) plus larger than at t-1	2%	1/3	3	5	41	CA Output gap REER appreciation Government Balance Exch. regime Financial Openness	– + – – – –	
de Haan et al (2008)	1960–2004										

Source: Author's calculations.

CA = Current Account, GDP = Gross Domestic Product, ToT = Terms of Trade, REER = Real Effective Exchange Rate, OECD = Organisation for Economic Co-operation and Development.

<sup>a</sup>They also define persistent deficits, which satisfy: (i) CA/GDP below 2% for 5 consecutive years, (ii) no reversal, and (iii) CA/GDP below 2/3 of its initial level in each of the 5 years.

<sup>b</sup>They classify episodes into three groups based on the characteristics of the adjustment and find different determinants depending on the type of adjustment. The first is characterized by a slowdown of real GDP and little exchange rate movements, the second by large depreciations without significant changes in the GDP growth, and the third by slower growth and exchange rate depreciation.

<sup>c</sup>Multiplied by 1 for net oil importers and zero for net oil exporters.

# APPENDIX 4: TABLES

**Table A4.1: Episodes of Current Account Surplus Reductions (Number of Cases)**

EP1		EP2		EP3			
Bahrain	1981	Bahrain	1983	Argentina	1991	Macedonia	1992
Brazil	2007	Bulgaria	1981	Argentina	2004	Malaysia	1990
Bulgaria	1998	Bulgaria	1998	Bahrain	1984	Mauritius	1988
Colombia	1993	Chile	2008	Bahrain	1989	Mauritius	2005
Cote d'Ivoire	1987	Cote d'Ivoire	1987	Botswana	1988	Mexico	1988
Croatia	1993	Croatia	1995	Botswana	2000	Morocco	1989
Czech Republic	1994	Indonesia	1981	Brazil	1993	Morocco	2003
Egypt	2007	Indonesia	2003	Brazil	2006	Nigeria	1981
Estonia	1994	Jordan	1981	Bulgaria	1985	Nigeria	1991
Hungary	1993	Jordan	1990	Bulgaria	1998	Nigeria	2001
India	2005	Lithuania	1993	PRC	1983	Oman	1982
Indonesia	1981	Macedonia	1992	PRC	1992	Oman	1991
Jordan	1981	Mexico	1988	PRC	1998	Oman	2006
Jordan	1990	Morocco	2007	Colombia	1993	Pakistan	2005
Jordan	2005	Nigeria	1981	Colombia	2001	Peru	1986
Lithuania	1993	Oman	1981	Cote d'Ivoire	1987	Philippines	1989
Macedonia	1992	Qatar	1981	Cote d'Ivoire	1996	Philippines	1999
Mauritius	2005	Qatar	1986	Cote d'Ivoire	2003	Poland	1996
Mexico	1988	Qatar	1990	Croatia	1995	Qatar	1990
Morocco	2005	Romania	1990	Cyprus	1999	Qatar	2006
Nigeria	1981	Russian Federation	2007	Czech Republic	1994	Romania	1990
Oman	1981	Slovenia	1993	Egypt	1996	Russian Federation	2006
Pakistan	2005	South Africa	1981	Egypt	2006	Slovakia	1996
Poland	1996	South Africa	1994	Estonia	1994	Slovenia	1995
Qatar	1983	Taipei,China	1988	Hungary	1993	Slovenia	2003
Qatar	1987	Taipei,China	1992	India	2004	South Africa	1981
Romania	1990	UAE	1981	Indonesia	1981	South Africa	1994
Slovenia	1993	UAE	1991	Indonesia	2003	South Africa	2003
South Africa	1981			Jordan	1981	Taipei,China	1993
South Africa	2003			Jordan	1990	Thailand	1987
Taipei,China	1988			Jordan	2005	Thailand	2002
Thailand	2002			Kenya	1994	Tunisia	1989
UAE	1983			Kenya	2005	Turkey	2002
UAE	1991			Lithuania	1993	UAE	1991
						Viet Nam	2002

<b>34</b>		<b>28</b>		<b>69</b>			
Austria	1992	Belgium	2000	Austria	1992	Italy	1999
Belgium	2000	Belgium	2007	Belgium	2005	Japan	1987
Belgium	2005	Finland	2005	Canada	1983	Rep. of Korea	1990
Canada	2007	Germany	1990	Canada	2001	Rep. of Korea	2005
France	2002	Hong Kong, China	1990	Denmark	2006	Netherlands	1986
Germany	1990	Hong Kong, China	1994	Finland	1985	Netherlands	1998
Hong Kong, China	1991	Ireland	1998	Finland	2005	Norway	1986
Italy	1999	Japan	2008	France	2005	Portugal	1994
Netherlands	1986	Rep. of Korea	1990	Germany	1991	Spain	1987
Netherlands	1998	Netherlands	1986	Hong Kong, China	1994	Sweden	1987
Switzerland	2007	Netherlands	1998	Ireland	1998	UK	1982
UK	1983	Singapore	2008	Israel	1991	US	1982
US	1981	Switzerland	2007	Italy	1987	US	1992
<b>13</b>		<b>13</b>		<b>26</b>			

**Table A4.2: Description of Episodes in Emerging Economies**

Identified by	Economy	Year	Initial CA Ratio	ΔCA Ratio			No. Years		
				EP1	EP2	EP3	EP1	EP2	EP3
EP3	Argentina	1991	3.30			(7.57)			4
EP3	Argentina	2004	6.32			(4.96)			5
EP1	Bahrain	1981	16.78	(14.36)			4		
EP2	Bahrain	1983	21.53		(23.77)			3	
EP3	Bahrain	1984	10.07			(16.55)			4
EP3	Bahrain	1989	5.00			(22.40)			4
EP3	Botswana	1988	25.64			(20.87)			5
EP3	Botswana	2000	10.54			(7.06)			5
EP3	Brazil	1993	1.44			(5.76)			7
EP3	Brazil	2006	1.59			(3.52)			5
EP1	Brazil	2007	1.25	(3.18)			4		
EP2	Bulgaria	1981	3.66		(3.54)			3	
EP3	Bulgaria	1985	1.67			(26.36)			9
EP1 EP2									
EP3	Bulgaria	1998	4.12	(9.75)	(9.70)	(29.58)	4	3	11
EP2	Chile	2008	4.39		(4.83)			3	
EP3	PRC	1983	1.99			(4.42)			4
EP3	PRC	1992	3.24			(3.02)			4
EP3	PRC	1998	3.88			(2.57)			4
EP1 EP3	Colombia	1993	1.36	(5.61)		(6.16)	4		5
EP3	Colombia	2001	0.81			(3.94)			10
EP1 EP2									
EP3	Cote d'Ivoire	1987	8.93	(25.56)	(26.27)	(25.56)	4	3	4
EP3	Cote d'Ivoire	1996	0.20			(3.00)			5
EP3	Cote d'Ivoire	2003	6.69			(7.37)			5
EP1	Croatia	1993	2.62	(6.84)			4		
EP2 EP3	Croatia	1995	4.07		(14.77)	(11.34)		3	8
EP3	Cyprus	1999	2.70			(21.02)			10
	Czech								
EP1 EP3	Republic	1994	1.24	(7.58)		(7.58)	4		4
EP3	Egypt	1996	0.64			(2.56)			4
EP3	Egypt	2006	3.24			(6.08)			5
EP1	Egypt	2007	1.63	(4.47)			4		
EP1 EP3	Estonia	1994	1.22	(12.36)		(12.36)	4		4
EP1 EP3	Hungary	1993	0.95	(4.85)		(9.32)	4		8
EP3	India	2004	1.53			(4.04)			7
EP1	India	2005	0.12	(2.32)			4		
EP1 EP2									
EP3	Indonesia	1981	3.04	(5.31)	(9.80)	(7.68)	4	3	6
EP2 EP3	Indonesia	2003	4.00		(3.90)	(3.95)		3	6
EP1 EP2									
EP3	Jordan	1981	9.58	(15.03)	(17.49)	(15.03)	4	3	4
EP1 EP2									
EP3	Jordan	1990	3.65	(15.29)	(18.06)	(15.29)	4	3	4
EP1 EP3	Jordan	2005	0.78	(12.06)		(12.06)	4		4
EP3	Kenya	1994	2.10			(6.09)			5
EP3	Kenya	2005	0.15			(8.25)			5
EP1 EP2									
EP3	Lithuania	1993	5.33	(10.25)	(15.91)	(16.95)	4	3	6
EP1 EP2									
EP3	Macedonia	1992	6.29	(12.62)	(15.3)	(14.96)	4	3	7
EP3	Malaysia	1990	0.66			(10.25)			6



Identified by	Economy	Year	Initial CA Ratio	ΔCA Ratio			No. Years		
				EP1	EP2	EP3	EP1	EP2	EP3
EP3	Mauritius	1988	7.09			(12.13)			8
EP1 EP3	Mauritius	2005	0.83	(9.54)		(11.41)	4		6
EP1 EP2									
EP3	Mexico	1988	2.86	(7.51)	(5.69)	(9.58)	4	3	5
EP3	Morocco	1989	0.42			(3.64)			7
EP3	Morocco	2003	3.65			(8.39)			8
EP1	Morocco	2005	1.69	(7.12)			4		
EP2	Morocco	2007	2.15		(7.62)			3	
EP1 EP2									
EP3	Nigeria	1981	8.85	(13.25)	(22.91)	(27.59)	4	3	6
EP3	Nigeria	1991	7.62			(15.74)			4
EP3	Nigeria	2001	12.57			(6.73)			4
EP1 EP2	Oman	1981	17.60	(14.19)	(11.64)		4	3	
EP3	Oman	1982	17.84			(30.32)			5
EP3	Oman	1991	9.41			(31.94)			8
EP3	Oman	2006	16.75			(17.21)			4
EP1 EP3	Pakistan	2005	1.85	(10.19)		(10.19)	4		4
EP3	Peru	1986	0.29			(8.01)			10
EP3	Philippines	1989	0.84			(6.36)			5
EP3	Philippines	1999	2.27			(2.63)			4
EP1 EP3	Poland	1996	0.61	(8.06)		(8.06)	4		4
EP2	Qatar	1981	106.84		(49.57)			3	
EP1	Qatar	1983	74.12	(40.62)			4		
EP2	Qatar	1986	62.31		(29.49)			3	
EP1	Qatar	1987	33.50	(42.43)			4		
EP2 EP3	Qatar	1990	44.68		(58.73)	(75.71)		3	6
EP3	Qatar	2006	33.21			(22.41)			4
EP1 EP2									
EP3	Romania	1990	4.68	(9.38)	(12.44)	(11.78)	4	3	9
	Russian Federation								
EP3	Russian Federation	2006	11.05			(7.43)			4
EP2	Federation	2007	9.54		(5.92)			3	
EP3	Slovakia	1996	1.95			(10.24)			6
EP1 EP2	Slovenia	1993	5.79	(5.51)	(7.27)		4	3	
EP3	Slovenia	1995	4.26			(8.21)			5
EP3	Slovenia	2003	1.07			(6.60)			6
EP1 EP2									
EP3	South Africa	1981	4.08	(6.58)	(4.56)	(6.58)	4	3	4
EP2 EP3	South Africa	1994	2.13		(3.28)	(3.89)		3	5
EP1 EP3	South Africa	2003	0.83	(7.14)		(8.24)	4		6
EP1 EP2	Taipei,China	1988	17.38	(10.61)	(10.75)		4	3	
EP2	Taipei,China	1992	6.77		(4.19)			3	
EP3	Taipei,China	1993	3.91			(2.67)			6
EP3	Thailand	1987	0.57			(8.91)			4
EP1 EP3	Thailand	2002	4.43	(8.76)		(8.76)	4		4
EP3	Tunisia	1989	0.96			(9.74)			5
EP3	Turkey	2002	1.92			(7.95)			5
EP2	UAE	1981	34.06		(15.35)			3	
EP1	UAE	1983	22.82	(11.85)			4		
EP1 EP2									
EP3	UAE	1991	22.07	(22.00)	(13.78)	(22.00)	4	3	4
EP3	Viet Nam	2002	2.10			(14.02)			7

Source: Author's calculations.

CA = Current Account.

**Table A4.3: Description of Episodes in Advanced Economies**

Identified by	Economy	Year	Initial CA Ratio	ΔCA Ratio			No. Years		
				EP1	EP2	EP3	EP1	EP2	EP3
EP1 EP3	Austria	1992	0.04	(2.89)		(2.89)	4		4
EP1 EP2	Belgium	2000	7.90	(3.77)	(3.26)		4	3	
EP1 EP3	Belgium	2005	3.51	(6.06)		(6.06)	4		4
EP2	Belgium	2007	2.65		(3.61)			3	
EP3	Canada	1983	0.61			(4.53)			7
EP3	Canada	2001	2.72			(5.32)			9
EP1	Canada	2007	1.40	(3.24)			4		
EP3	Denmark	2006	4.35			(3.25)			4
EP3	Finland	1985	0.07			(5.40)			7
EP2 EP3	Finland	2005	6.55		(2.4)	(6.01)		3	5
EP1	France	2002	1.83	(2.26)			4		
EP3	France	2005	0.61			(2.87)			4
EP1 EP2	Germany	1990	4.56	(5.51)	(5.66)		4	3	
EP3	Germany	1991	2.93			(4.35)			4
EP2	Hong Kong, China	1990	9.16		(6.15)			3	
EP1	Hong Kong, China	1991	6.20	(7.02)			4		
EP2 EP3	Hong Kong, China	1994	4.76		(7.28)	(9.15)		3	4
EP2 EP3	Ireland	1998	2.90		(3.26)	(8.23)		3	10
EP3	Israel	1991	0.31			(5.30)			5
EP3	Italy	1987	0.45			(3.13)			6
EP1 EP3	Italy	1999	1.62	(2.40)		(5.03)	4		10
EP3	Japan	1987	4.26			(2.82)			4
EP2	Japan	2008	4.82		(2.78)			3	
EP2 EP3	Rep. of Korea	1990	2.22		(3.42)	(6.20)		3	7
EP3	Rep. of Korea	2005	3.90			(4.59)			4
EP1 EP2 EP3	Netherlands	1986	7.15	(3.21)	(4.23)	(5.09)	4	3	7
EP1 EP2 EP3	Netherlands	1998	6.48	(4.04)	(4.60)	(4.04)	4	3	4
EP3	Norway	1986	4.73			(4.82)			4
EP3	Portugal	1994	0.26			(10.50)			7
EP2	Singapore	2008	23.49		(10.95)			3	
EP3	Spain	1987	1.50			(5.08)			5
EP3	Sweden	1987	0.03			(2.79)			6
EP1 EP2	Switzerland	2007	14.40	(7.28)	(8.25)		4	3	
EP3	UK	1982	1.89			(6.75)			8
EP1	UK	1983	0.80	(1.72)			4		
EP1	US	1981	0.08	(2.48)			4		
EP3	US	1982	0.16			(3.55)			6
EP3	US	1992	0.05			(6.05)			15

Source: Author's calculations.

CA = Current Account.

**Table A4.4: Cross-Checking of Episodes (Number of Cases)**

	EP1	EP2	EP3	Fraction
EP1	47	28	39	71.3%
EP2	28	41	30	70.7%
EP3	39	30	95	36.3%

Source: Author's calculations.

**Table A4.5: Data Description and Sources**

Variables	Description of variables	Sources
CA/GDP	Current account in percent of GDP	World Economic Outlook Database (WEO), Oct. 2009
Real growth	Growth in real GDP per capita	World Bank's World Development Indicators (WDI)
Openness	Trade openness = (Imports + Exports)/GDP	WDI
Trade balance	Trade balance to GDP	WDI
REER appreciation	Growth in the real effective exchange rate index [2000=100] -- an increase means appreciation	WDI and IMF's International Financial Statistics (IFS)
Government deficit	Government deficit to GDP	WEO
World growth	World GDP growth	WDI
Oil exporter	Dummy variable that equals 1 if the share of oil exports on total exports is higher than 20 percent	WDI
Real oil price	Nominal oil price adjusted by US CPI	WEO
Emerging/Advanced	FTSE Global Equity Index Series Country Classification	FTSE

Source: Author.

CA = Current Account, GDP = Gross Domestic Product, REER = Real Effective Exchange Rate, CPI = Consumer Price Index; FTSE = is the name of the company, a joint venture between the Financial Times and the London Stock Exchange.

**Table A4.6: Summary Statistics: Means and Difference in Means**

Emerging Economies	Obs.	0	EP1 1	Diff.	0	EP2 1	Diff.	0	EP3 1	Diff.
$CA/GDP_{t-1,t-3}$	1183	(1.20)	11.31	12.51***	(1.15)	12.03	13.17***	(1.19)	3.32	4.51***
$Real\ growth_{t-1,t-3}$	1160	2.40	0.63	(1.77)**	2.39	0.90	(1.49)	2.43	1.17	(1.26)***
$Openness_{t-1}$	1174	76.25	84.99	8.74	76.32	84.62	8.3	76.43	77.23	0.8
$\Delta TradeBal_{t-1,t-3}$	999	0.12	(1.81)	(1.92)***	0.10	(1.30)	(1.4)**	0.13	(0.81)	(0.95)***
$REER\ appreciation_{t-1,t}$	550	0.11	7.96	7.85**	0.29	1.63	1.34	0.15	2.96	2.81
$Fiscal\ Balance_t$	138	(2.98)	1.50	4.48**	(2.92)	(1.27)	1.65	(2.97)	(1.03)	1.94
$World\ growth_t$	1380	2.63	2.66	0.02	2.63	2.62	(0.01)	2.62	2.88	0.27
$Real\ oil\ price_t$	1380	35.68	38.08	2.4	35.57	43.98	8.42**	36.00	30.73	(5.27)**
$Oil\ exporter$	977	0.17	0.19	0.02	0.16	0.33	0.17*	0.16	0.22	0.05

<b>Advanced Economies</b>										
CA/GDP <sub><i>t-1, t-3</i></sub>	710	0.69	4.82	4.13***	0.64	7.42	6.78***	0.71	2.33	1.63
Real growth <sub><i>t-1, t-3</i></sub>	780	2.41	2.17	(0.25)	2.38	4.00	1.62***	2.40	2.69	0.29
Openness <sub><i>t-1</i></sub>	731	84.90	97.37	12.47	83.87	160.42	76.56***	85.44	76.55	(8.89)
$\Delta TradeBal_{t-1, t-3}$	710	0.24	(0.24)	(0.47)	0.24	(0.49)	(0.73)**	0.25	(0.42)	(0.67)***
REER appreciation <sub><i>t-1, t</i></sub>	695	0.34	1.23	0.89	0.34	1.62	1.29	0.35	0.36	0
Fiscal Balance <sub><i>t</i></sub>	777	(1.86)	(1.10)	0.76	(1.90)	1.03	2.93**	(1.86)	(1.48)	0.38
World growth <sub><i>t</i></sub>	780	2.63	2.84	0.21	2.62	3.61	1*	2.62	3.06	0.45
Real oil price <sub><i>t</i></sub>	780	35.72	36.63	0.91	35.74	35.44	(0.3)	35.84	32.80	(3.04)
Oil exporter	707	0.04	0.00	(0.04)	0.04	0.00	(0.04)	0.04	0.00	(0.04)

Source: Author's calculations.

CA = Current Account, GDP = Gross Domestic Product, REER = Real Effective Exchange Rate, *TradeBal* = Trade Balance.

Note: Two-tailed t-test p-value: \* $<0.1$ , \*\* $<0.05$ , \*\*\* $<0.01$ .

**Table A4.7: Determinants of Current Account Reductions in Emerging Economies**

Item	Substantial Reductions				Substantial and Moderate Reductions				
	EP1	EP2	EP3						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CA/GDP <sub>t-1,t-3</sub>	<b>0.485</b>	3.013	<b>0.431</b>	<b>0.304</b>	<b>0.898</b>	<b>0.304</b>	<b>0.204</b>	<b>0.314</b>	<b>0.248</b>
	[0.16]***	[2.07]	[0.24]*	[0.06]***	[0.45]**	[0.16]*	[0.06]***	[0.06]***	[0.06]***
Real growth <sub>t-1,t-3</sub>	(0.127)	0.753	<b>(0.280)</b>	<b>(0.174)</b>	<b>(0.654)</b>	<b>(0.457)</b>	<b>(0.109)</b>	(0.0791)	<b>(0.127)</b>
	[0.10]	[0.82]	[0.13]**	[0.05]***	[0.23]***	[0.22]**	[0.04]***	[0.10]	[0.05]**
Openness <sub>t-1</sub>	<b>(0.0402)</b>	0.166	<b>(0.0644)</b>	<b>(0.0228)</b>	(0.0593)	<b>(0.0217)</b>	<b>(0.00625)</b>	(0.0209)	<b>(0.00798)</b>
	[0.01]***	[0.11]	[0.03]**	[0.01]**	[0.14]	[0.01]**	[0.00]*	[0.02]	[0.00]*
$\Delta TradeBal_{t-1,t-3}$	<b>(0.516)</b>	<b>(0.998)</b>	<b>(0.505)</b>	<b>(0.464)</b>	<b>(1.258)</b>	(0.341)	(0.0647)	0.0171	0.0383
	[0.16]***	[0.48]**	[0.28]*	[0.18]***	[0.56]**	[0.30]	[0.12]	[0.15]	[0.16]
REER appreciation <sub>t-1,t</sub>	<b>0.116</b>	<b>0.450</b>	<b>0.133</b>	<b>0.0644</b>	0.0690	0.0337	<b>0.0316</b>	<b>0.0429</b>	<b>0.0359</b>
	[0.04]***	[0.19]**	[0.06]**	[0.03]**	[0.09]	[0.03]	[0.01]***	[0.02]***	[0.01]***
World growth <sub>t-1</sub>	0.289	0.918		0.535	0.191		0.359	0.317	
	[0.52]	[2.65]		[0.68]	[0.83]		[0.26]	[0.29]	
Real oil price <sub>t-1</sub>	-0.0584	(0.110)		0.0654	<b>0.163</b>		<b>(0.0886)</b>	<b>(0.103)</b>	
	[0.05]	[0.10]		[0.04]	[0.07]**		[0.03]***	[0.04]**	
$ROP_{t-1}$ *Oil exporter	(0.153)			(0.0437)			0.0154		
	[0.14]			[0.03]			[0.01]		
Constant	(1.410)	(27.10)	(0.893)	(6.841)	(13.10)	0.933	(0.964)	2.265	(3.078)
	[1.95]	[11.15]**	[1.49]	[3.24]**	[13.69]	[1.94]	[1.21]	[3.11]	[1.35]**
Observations	448	182	113	448	130	84	448	369	262
Fixed effects	No	Country	Year	No	Country	Year	No	Country	Year
Log-likelihood	(22.68)	(9.473)	(14.96)	(21.67)	(11.57)	(13.46)	(81.81)	(74.79)	(66.87)
McFadden pseudo-R <sup>2</sup>	0.435	0.711	0.482	0.319	0.524	0.377	0.176	0.205	0.211
No. Clusters	22	8	22	22	6	22	22	17	22

Source: Author's calculations.

CA = current account, GDP = gross domestic product, REER = real effective exchange rate,  $TradeBal$  = trade balance,  $ROP$  = real oil price.

Notes:

1. Robust standard errors in brackets, clustered by country. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

2. The current account ratio, domestic growth, and the change in trade balance are defined as averages over the 3 years preceding the event. REER appreciation is the lagged annual percentage change in the real effective exchange rate index.

**Table A4.8: Determinants of Current Account Reductions in Advanced Economies**

Item	Substantial Reductions				Substantial and Moderate Reductions				
		EP1			EP2		EP3		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CA/GDP <sub><i>t-1,t-3</i></sub>	<b>0.263</b> [0.07]***	<b>1.490</b> [0.33]***	<b>0.334</b> [0.09]***	<b>0.336</b> [0.16]**	<b>1.576</b> [0.53]***	<b>0.442</b> [0.26]*	<b>0.148</b> [0.05]***	<b>0.208</b> [0.10]**	<b>0.181</b> [0.06]***
Real growth <sub><i>t-1,t-3</i></sub>	(0.0499) [0.26]	0.626 [1.01]	(0.337) [0.22]	0.440 [0.51]	<b>2.316</b> [0.73]***	0.707 [0.63]	0.119 [0.21]	0.0346 [0.27]	0.120 [0.27]
Openness <sub><i>t-1</i></sub>	(0.00141) [0.01]	<b>(0.133)</b> [0.05]**	(0.00107) [0.01]	(0.00638) [0.01]	<b>(0.153)</b> [0.08]**	(0.00680) [0.02]	(0.00425) [0.00]	(0.0203) [0.02]	(0.00453) [0.00]
$\Delta TradeBal_{t-1,t-3}$	<b>(0.974)</b> [0.26]***	<b>(2.488)</b> [1.36]*	<b>(1.532)</b> [0.35]***	(0.612) [0.53]	<b>(3.819)</b> [1.63]**	<b>(1.298)</b> [0.62]**	<b>(0.750)</b> [0.32]**	<b>(0.806)</b> [0.42]*	<b>(0.778)</b> [0.34]**
REER appreciation <sub><i>t-1,t</i></sub>	(0.0129) [0.06]	0.0346 [0.10]	0.0332 [0.06]	(0.0661) [0.09]	0.0372 [0.24]	0.0329 [0.09]	0.0151 [0.03]	0.00570 [0.04]	0.0311 [0.03]
Fiscal Balance <sub><i>t-1</i></sub>	<b>(0.127)</b> [0.07]*	<b>0.659</b> [0.30]**	<b>(0.189)</b> [0.10]*	(0.140) [0.10]	<b>0.748</b> [0.43]*	<b>(0.371)</b> [0.17]**	(0.0664) [0.05]	0.0169 [0.06]	(0.0474) [0.05]
World growth <sub><i>t-1</i></sub>	(0.413) [0.39]	(1.214) [0.91]		<b>0.899</b> [0.27]***	<b>2.757</b> [1.37]**		(0.0281) [0.26]	(0.0479) [0.30]	
Real oil price <sub><i>t-1</i></sub>	0.0269 [0.03]	0.0763 [0.07]		0.00686 [0.02]	0.0701 [0.10]		0.00602 [0.02]	0.00591 [0.02]	
Constant	(4.316) [1.33]***	2.530 [2.92]	(3.005) [1.25]**	(9.542) [1.81]***	(25.88) [9.99]***	(6.153) [1.70]***	(3.683) [0.99]***	(2.542) [1.07]**	(2.907) [1.17]**
Observations	549	201	196	549	126	110	549	408	256
Fixed effects	No	Country	Country	No	Country	Year	No	Country	Year
Log-likelihood	(42.06)	(20.81)	(30.64)	(27.65)	(11.78)	(18.66)	(79.19)	(72.09)	(60.25)
McFadden pseudo-R <sup>2</sup>	0.158	0.476	0.224	0.262	0.564	0.284	0.0779	0.0968	0.142
No. Clusters	23	8	23	23	5	23	23	16	23

Source: Author's calculations.

CA = Current Account, GDP = Gross Domestic Product, REER = Real Effective Exchange Rate,  $TradeBal$  = Trade Balance.

Notes:

1. Robust standard errors in brackets, clustered by country. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ 

2. The current account ratio, domestic growth, and the change in trade balance are defined as averages over the 3 years preceding the event. REER appreciation is the lagged annual percentage change in the real effective exchange rate index.

**Table A4.9: Sign of Significant Coefficient Estimates**

Item	Substantial Reductions				Substantial and Moderate Reductions				
	EP1		EP2		EP3				
Emerging Economies	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$CA/GDP_{t-1,t-3}$	+		+	+	+	+	+	+	+
Real growth <sub>t-1,t-3</sub>			--	--	--	--	--		--
Openness <sub>t-1</sub>	--		--	--		--	--		--
$\Delta TradeBal_{t-1,t-3}$	--	--	--	--	--				
REER appreciation <sub>t-1,t</sub>	+	+	+	+			+	+	+
World growth <sub>t-1</sub>			N/A			N/A			N/A
Real oil price <sub>t-1</sub>			N/A		+	N/A	--	--	N/A
$ROP_{t-1}$ * Oil exporter		N/A	N/A		N/A	N/A		N/A	N/A
Advanced Economies	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$CA/GDP_{t-1,t-3}$	+	+	+	+	+	+	+	+	+
Real growth <sub>t-1,t-3</sub>					+				
Openness <sub>t-1</sub>		--			--				
$\Delta TradeBal_{t-1,t-3}$	--	--	--		--	--	--	--	--
REER appreciation <sub>t-1,t</sub>									
Fiscal Balance <sub>t-1</sub>	--	+	--		+	--			
World growth <sub>t-1</sub>			N/A	+	+	N/A			N/A
Real oil price <sub>t-1</sub>			N/A			N/A			N/A

Source: Author's calculations.

CA = Current Account, GDP = Gross Domestic Product, REER = Real Effective Exchange Rate,  $TradeBal$  = Trade Balance,  $ROP$  = Real oil price.

**Table A4.10: Average Marginal Effects**

	EP1		EP2		EP3	
	reg.(2)	reg.(3)	reg.(5)	reg.(6)	reg.(8)	reg.(9)
<b>Emerging Economies</b>						
CA/GDP <sub><i>t-1,t-3</i></sub>	0.0486	0.0172	0.0244	0.0146	0.0178	0.0184
Real growth <sub><i>t-1,t-3</i></sub>	0.0121	(0.0109)	(0.0178)	(0.0219)	(0.0047)	(0.0095)
Openness <sub><i>t-1</i></sub>	0.0027	(0.0026)	(0.0016)	(0.0010)	(0.0012)	(0.0006)
$\Delta TradeBal_{t-1,t-3}$	(0.0162)	(0.0206)	(0.0342)	(0.0163)	0.0008	0.0028
REER appreciation <sub><i>t-1,t</i></sub>	0.0072	0.0053	0.0019	0.0016	0.0024	0.0026
World growth <sub><i>t-1</i></sub>	0.0147		0.0052		0.0181	
Real oil price <sub><i>t-1</i></sub>	(0.0018)		0.0044		(0.0058)	
<b>Advanced Economies</b>						
CA/GDP <sub><i>t-1,t-3</i></sub>	0.0532	0.0109	0.0472	0.0122	0.0098	0.0109
Real growth <sub><i>t-1,t-3</i></sub>	0.0086	(0.0205)	0.0618	0.0078	0.0036	0.0051
Openness <sub><i>t-1</i></sub>	(0.0047)	0.0000	(0.0052)	(0.0002)	(0.0011)	(0.0003)
$\Delta TradeBal_{t-1,t-3}$	(0.0712)	(0.0504)	(0.1132)	(0.0294)	(0.0397)	(0.0476)
REER appreciation <sub><i>t-1,t</i></sub>	0.0048	0.0015	0.0057	0.0001	(0.0014)	(0.0008)
Fiscal Balance <sub><i>t-1</i></sub>	0.0261		0.0273		0.0012	
World growth <sub><i>t-1</i></sub>	(0.0306)		0.0891		(0.0042)	
Real oil price <sub><i>t-1</i></sub>	0.0017		0.0017		0.0004	

Source: Author's calculations.

CA = Current Account, GDP = Gross Domestic Product, REER = Real Effective Exchange Rate,  $TradeBal$  = Trade Balance.