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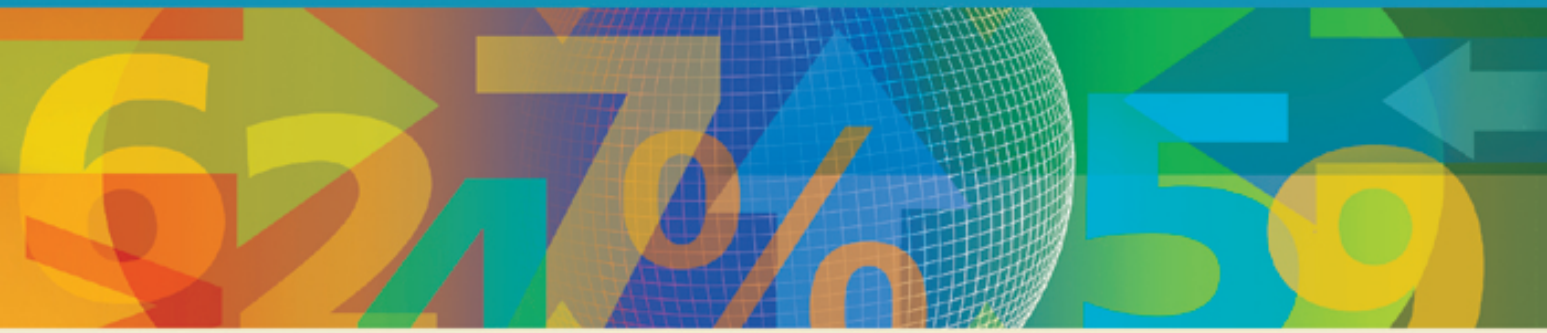
External Performance in Low-Income Countries



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Preface

Assessments of exchange rate misalignments and external imbalances have become more prominent in the daily work of the International Monetary Fund, with frequent application to virtually every country. However, undertaking an external assessment for low-income countries (LICs) remains challenging because they have received limited attention in the literature—in part because of lack of data—and methodologies developed for advanced economies and emerging markets cannot be automatically applied to LICs. LICs are likely to be characterized by different policies, heavier distortions in the financial sector, lower access to official external financing, higher sensitivity to exogenous shocks, and different composition of external trade. While an earlier IMF Occasional Paper (Lee and others, 2008) summarizes methodologies available for an external assessment in advanced economies and emerging markets, this paper extends the analysis to LICs.

More precisely, this paper offers estimates of the relationship between the real effective exchange rate, the current account, and the net external assets position and a set of fundamentals in the medium to long term, with particular emphasis on LICs. The lack of attention paid to these countries has often been justified by data limitations, which led us to build a large database, unique in the set of indicators and number of countries it covers. Despite extensive data-collection efforts, this study still lacks wide coverage for many indicators, thus highlighting the need for further efforts to improve data production and quality control.

We find that the same broad set of economic fundamentals coherently explains the three external indicators in LICs. We also find that medium-term determinants of LICs' external balances are somewhat different from standard determinants found in the literature. In addition to standard determinants, aid flows (grants and concessional loans), domestic financial liberalization, the removal of capital account controls, shocks (terms of trade, natural disasters), demographic measures, and the quality of institutions have a significant impact on the indicators of external balances of LICs. The results are generally consistent across methodologies and—for standard economic indicators—are mainly in line with the existing literature. The paper also derives a new measure of trade elasticities, which is important in gauging the coherence of exchange rate assessments based on the three external indicators.

The main results for LICs are innovative and interesting. Domestic financial liberalization tends to be associated with higher current account balances and net foreign assets positions, suggesting a positive effect on domestic saving. Capital account liberalization tends to be associated with lower current account and net foreign assets positions, and more appreciated real exchange rates, as predicted by standard theories. Negative exogenous shocks tend to raise (respectively, reduce) the current account in countries with closed (respectively, open) capital accounts pointing at the importance of capital account frictions in shaping intertemporal consumption-smoothing decisions. Finally, foreign aid is progressively absorbed over time through net imports, and tends to be associated with a more depreciated real exchange rate in the long run, a result that may reflect larger productivity gains in the nontradable relative to the tradable sector (however, given that government consumption is controlled for in the regression and has a positive coefficient, the overall effect of aid on the real exchange rate, including the channel via government consumption, would be smaller in absolute value or may even be positive).

This paper is the result of an IMF Research Department project on external performance in low-income countries. Peter Pedroni has been an impressive consultant for the project, and the authors are grateful for the invaluable help he offered through extensive support, discussions, and advice. The authors are also grateful to Oya Celaysun for her views on issues related to the net foreign assets in LICs. We benefited from discussions with and comments from Andy Berg, Olivier Blanchard, Nicolas Courdacier, Atish Ghosh, Michael Klein, Nelson Mark, Peter Montiel, Jonathan D. Ostry, Antonio Spilimbergo, Kenneth West, other colleagues at the

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The opinions expressed in this paper are those of the authors and do not necessarily reflect the views of the national authorities, the IMF, or IMF Executive Directors.

In memory of our friend and colleague Alessandro Prati, who passed away on June 21, 2009. His intellectual depth was and will remain a vast source of inspiration to all of us. His careful analysis, sharp intuition, and relentless curiosity guided the search for most of the new results offered in this paper, and for many more insights that remain on the research agenda.

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1 Overview

This paper empirically investigates the external balance of low-income countries (LICs) by offering a coherent analysis of determinants of medium- to long-term real exchange rates, current accounts, and net foreign assets, and by emphasizing factors that are more likely to be specific to LICs.[1] The rise and persistence of large external imbalances in recent years have renewed interest in this area from both empirical and theoretical perspectives, and have also highlighted the need for a multi-pronged approach to the analysis of external balances based on multiple indicators. In this paper, the simultaneous analysis of the three indicators of external balance allows the consistency of the results across indicators to be checked, an effort generally absent in the literature. The focus on LICs aims at filling another gap. Although the literature on the determinants of the real exchange rate and of the current account is vast, few contributions focus specifically on LICs, or account for features that are specific to—or more important for—this set of countries. This analysis emphasizes factors such as structural policy and institutional distortions, access to special external financing, and a larger macroeconomic sensitivity to exogenous shocks. The empirical analysis required extensive efforts to create a wide database, covering a unique set of indicators and economies.

A large literature has based the analysis of medium-term determinants of current accounts on the standard intertemporal approach emphasizing saving and investment decisions (Chinn and Prasad, 2003; Lee and others, 2008).[2] A more recent empirical literature has aimed at explaining the patterns of global imbalances that have widened over the past decade as a function of financial crises, financial distortions, and institutional settings (Gruber and Kamin, 2007; Chinn and Ito, 2007; and, from a theoretical perspective, Gourinchas and Jeanne, 2007; Mendoza, Quadrini, and Rios-Rull, 2008; and Caballero, Farhi, and Gourinchas, 2008). Others have illustrated the role of labor market policies and exchange rate regimes in influencing the persistence and dynamics of the current account (Ju and Wei, 2007; Chinn and Wei, 2008) and the relationship between the labor market, financial frictions, and fiscal policies in shaping the optimal current account responses to shocks (Blanchard, 2007).

The literature on real exchange rates is vast and justice to all contributions cannot be done here. Broad surveys are offered by Froot and Rogoff (1995); Rogoff (1996); and for developing countries, by Edwards (1989); Hinkle and Montiel (1999); and Edwards and Savastano (2000).[3] The traditional findings of Meese and Rogoff (1983) on the unpredictability of exchange rates at short horizons are still undisputed, and the literature has converged toward explaining the behavior of real exchange rates at medium- to long-term horizons as a function of fundamentals (Engel and West, 2005; Engel, Mark, and West, 2008). Empirical analyses of long-run real exchange rates are typically guided by steady-state relationships in models involving the intertemporal and intratemporal allocation of resources between tradable and nontradable sectors (Obstfeld and Rogoff, 1999; Montiel, 1999; Ricci, Milesi-Ferretti, and Lee, 2008; and Vegh, forthcoming).

A growing literature has uncovered the medium-term determinants of gross and net foreign assets, after the creation of the Lane and Milesi-Ferretti database of external positions.[4] Lane and Milesi-

[1]Real exchange rates can be defined in many different ways, depending on the price concept adopted for comparison across countries. Unless otherwise noted, this paper refers to consumer price index–based (CPI-based) real effective exchange rates, in line with most other empirical analysis. In theoretical discussions related to small open economies that take the price of tradables as given, consumer price index-based real effective exchange rates would be closely related to the ratio of the price of nontradables to tradables.

[2]For earlier contributions on the determinants of saving in advanced economies and emerging markets, see Schmidt-Hebbel, Webb, and Corsetti (1992); Edwards (1995); Masson, Bayoumi, and Samiei (1998); and Bosworth and Collins (1999).

[3]For a recent application to Central and Eastern European countries, see Maeso-Fernandez, Osbat, and Schnatz (2004).

[4]For the latest version, see Lane and Milesi-Ferretti (2007).

Ferretti (2002b) offer a theoretical and empirical discussion of long-term determinants of the net foreign assets position. Faria and others (2007) show that more-open economies with better institutions have a greater equity share in external liabilities.

Few studies have focused on LICs with the notable exceptions of Edwards (1989) and Hinkle and Montiel (1999).[5] This paper argues that LICs differ from other countries mainly along three broad dimensions, which simultaneously affect the current account, the real exchange rate, and the net foreign assets position. These three dimensions are (1) structural policies or distortions, particularly those related to the capital account and the domestic financial system; (2) exogenous shocks, particularly natural disasters (the effects of which may depend on the degree of capital account openness) and terms of trade shocks; and (3) official external financing (grants and concessional loans).

These factors are particularly important for the sample of countries considered in this paper. First, LICs face greater distortions—some of which are policy-induced—than do other countries. For example, capital account controls, which were prevalent in a large number of countries in the sample, may reduce the ability of LICs to borrow to bring consumption and investment forward, as required by a lower level of development or the occurrence of negative shocks. Capital controls may therefore affect domestic demand, the current account, net foreign assets, and the real exchange rate.[6] Domestic financial liberalization such as occurred during the 1980s and the 1990s in many developing countries may reduce borrowing constraints and boost investment, which would tend to lower the current account and the net foreign assets position, and cause the real exchange rate to appreciate. But financial liberalization may also raise private saving, which, everything else equal, would improve the current account and the net foreign assets position, and cause the real exchange rate to depreciate.

Second, LICs are in general more exposed to shocks than are other countries, and may—as a result of the lack of diversification of their production structure—experience larger macroeconomic consequences associated with these shocks.[7] For example, LICs are exposed to frequent terms of trade fluctuations associated with both their exports (e.g., main crop or natural resources) and their imports (e.g., oil). Such terms-of-trade fluctuations affect the real exchange rate and the current account through income effects as well as through intra- and intertemporal substitution effects. Moreover, LICs frequently experience natural shocks, such as droughts, floods, windstorms, and earthquakes, that have larger macroeconomic consequences than they do in high- and middle-income countries—including on the external position. Finally, wars and violent political transitions between regimes have often occurred in the historical sample. Such events, by disrupting investment, consumption, and capital flows, can have a bearing on the current account and the real exchange rate at a relatively short horizon.

Finally, capital flows are typically of a different nature in LICs than they are in other countries. A large part of LICs' foreign borrowing is in the form of official development assistance (grants or concessional loans). Such capital flows do not respond to market incentives, and often do not need to be repaid, thus contributing to the financing of larger trade deficits over the medium term. Aid flows also have often been associated with the risk of Dutch disease, and are expected to lead to more appreciated real exchange rates in the short run by increasing aggregate demand (Van Wijnbergen, 1984). In the long run, however, the effect on

[5]For recent contributions, see Chudik and Mongardini (2007); Di Bella, Lewis, and Martin (2007); Elbadawi (2007); Roudet, Saxegaard, and Tsangarides (2007); Delechat (2008); and Kireyev (2008). The impact of fiscal and monetary policies on the real exchange rate and the current account in the presence of large distortions has been explored by Edwards (1988) and Prati and Tressel (2006). Prati and Tressel (2006) and Berg and others (2007) show in particular that countries' absorption of foreign aid inflows is affected by policy responses, often resulting in the accumulation of foreign exchange reserves.

[6]Gourinchas and Jeanne (2007) argue that the patterns of capital flows to developing countries do not coincide with the predictions of standard neoclassical theory, and suggest a theory based on frictions affecting saving and investment decisions. Many LICs initiated capital account liberalization during the analysis period, providing the possibility of testing these and other theoretical predictions.

[7]See, for instance, Loayza and others (2007).

the real exchange rate is uncertain, depending on the relative impact on the productivity of tradables versus nontradables (Torvik, 2001).

This paper estimates the relationship between the real effective exchange rate, the current account, and the net external assets position and a broad set of fundamentals in the medium to long term, with particular emphasis on LICs. Interestingly, the same broad set of economic fundamentals coherently explains the three external indicators in LICs. However, medium-term determinants of LICs' external balances are somewhat different from standard determinants found in the literature.

Several innovative and interesting results arise. First, regarding policy distortions, domestic financial reforms are associated with an improvement of the current account and of the net foreign assets position, suggesting a larger positive effect on saving than on investment. Capital account liberalization allows countries to borrow against disasters (lower current account) and allows LICs in general to borrow from higher-income countries. Consistent with this result, capital account liberalization is associated with a more appreciated real exchange rate in the long run, possibly resulting from the effect of capital inflows on absorption. Moreover, the quality of institutions is generally positively associated with larger external wealth in the long run.

Second, regarding shocks, a positive terms of trade shock tends to improve the current account and cause the real exchange rate to appreciate, but mainly if the shock arises from a change in the export price (which is consistent with the fact that import prices are associated with an additional substitution effect working in the opposite direction from the income effect common to both the export and import prices). Natural disasters tend to be associated with an improvement (respectively, deterioration) of the current account, in countries with closed (respectively, open) capital accounts, highlighting the importance of capital account frictions in shaping intertemporal consumption-smoothing decisions. Furthermore, preliminary evidence suggests the effect of income shocks on the current account may depend on the initial net foreign assets position.

Third, regarding external financing, an increase in aid arising from concessional loans or grants progressively results in higher imports, but the evidence suggests that some portion of aid flows is saved in the short run. In the long run, an increase in aid is associated with a depreciation of the real effective exchange rate. The latter result may be surprising in light of the standard Dutch disease argument, but is consistent with more general theories of Dutch disease with learning by doing in both tradable and nontradable sectors (Torvik, 2001). While aid may cause appreciation in the real exchange rate in the short run (as expenditure on nontradables increases relative to supply), it may also be associated with long-run depreciation if it is channeled to improving the productivity of nontradables relative to the productivity of tradables.

Another particularly important contribution of this work is its reliance on a large original database encompassing many countries across the spectrum of development, and the simultaneous and consistent employment of determinants for the three indicators of external performance. The analysis required an extensive data-gathering and cleanup exercise. The data set contains various indicators for 134 countries over the period 1980–2006. Countries used in the main analysis were classified on the basis of their income group. The LIC sample (see Appendix Table A1) comprises low-income and lower-middle-income economies according to the World Bank classification, and excludes emerging markets (China, Colombia, India, Indonesia, Pakistan, and Thailand) to make the sample as homogeneous as possible. High-income and higher-middle-income economies (in the World Bank classification), including the six emerging-market countries, were mainly used as a comparator group. The Appendix provides a description of all variables. Summary statistics for the main data are provided in Appendix Table A2. The number of LICs entering the regressions varies across specifications based on data availability for the specific indicators, but the largest LIC set (used in regressions with standard fundamentals as well as in the trading partner calculations) includes 59 low- and lower-middle-income countries.

The three methods offered in this paper can be used to assess external imbalances as the deviation of external indicators from the levels consistent

with fundamentals. In this respect it is important to note that consistency with fundamentals does not necessarily imply equilibrium. Consistency is equivalent to equilibrium only if fundamentals are also in equilibrium. For example, countries with unsustainable levels of fiscal deficit and public debt could experience both current account deficits and net foreign liability positions—which are consistent with those unsustainable fiscal fundamentals, but would not result in equilibrium.

With this caveat in mind, it may be interesting to compare imbalances resulting from the three different methods over the medium term, that is, when temporary fluctuations and possibly unsustainable situations have been eliminated. One interesting way to achieve this comparison requires first constructing measures for the imbalances and then converting them into a single metric. For each external indicator, imbalances can be constructed in three steps. The first is to project the fundamentals at sustainable levels over the medium term.[8] The second step is to calculate medium-term benchmark values (the "norms") for the respective external indicators by multiplying the vector of medium-term fundamentals by the coefficients estimated in the methodology described above for the respective external indicator. The third step is to derive the imbalance for each of the three external indicators as the difference between the medium-term projection for the external indicator and its benchmark value. A crude way of converting these imbalances into one metric—for example, exchange rate gaps—relies on trade elasticities.[9,10] Although a comprehensive external assessment is beyond the scope of this analysis, this paper discusses methodological issues related to the elasticities.

Chapters 6 and 7 of this paper offer a new methodology for calculating import demand and export supplies as well as for deriving resulting trade balance elasticities. The method does not rely on econometrics, but rather on standard results borrowed from production theory and a well-known model of international trade. Specifically, using an economy's GDP function, the derivative with respect to export prices gives the export supply function (assuming all production is exported) and the derivative with respect to the price of imported intermediates gives the import demand function. This approach isolates the determinants of both the export supply and the import demand functions using observable data, that is, cost and distributive shares. Using data for these determinants, this approach then permits the estimation of export supply and import demand elasticities. Econometric estimates of trade elasticities for LICs are particularly scarce, so one contribution of this paper is that it presents a set of elasticity values for these countries.

[8]Nonstationary variables can normally be expected to remain at their current values unless changes are expected, for example, because of planned policies. Regarding projections of net foreign assets and their components and determinants, deriving a medium-term assessment requires the consideration of additional issues in LICs. First, it is necessary to forecast the degree of concessionality of future debt and the extent of debt relief to obtain a proper measure of net foreign assets and of public and external debt. In doing so, an assessment of the sustainable level of debt must be made, because this level is likely to be an upper bound of the target level of debt of the donor community. Second, returns on assets and liabilities are likely to differ in general, and LICs are no exception; these countries may actually face a pattern opposite of that faced by advanced economies, that is, higher returns on their liabilities than on their assets (for a deeper discussion, see Lane and Milesi-Ferretti, 2003)

[9]The current account imbalance could be converted into an exchange rate gap using an elasticity of the trade balance with respect to the exchange rate, that is, it could be measured as the change in the exchange rate that would deliver the change in trade balance that equals the medium-term current account gap versus fundamentals. The net foreign assets position imbalance could be measured in terms of exchange rate gaps in three steps: First, derive the net foreign assets norm as the level that is consistent with fundamentals over the medium term. Second, derive the current account norm as the level that is consistent in steady state with the net foreign assets norm in steady state. Under certain assumptions—such as equal returns on assets and liabilities—the factor of proportionality between the current account ratio to GDP and the net foreign assets ratio to GDP is the growth rate of nominal GDP (see Lane and Milesi-Ferretti, 2007, for a more general treatment). Finally, convert the resulting current account gap into an exchange rate gap using trade elasticities, as described in the main text.

[10]Even though the elimination of current account or net foreign assets imbalances may arise not just from movements in the exchange rates but also in other variables affecting the saving-investment decision, it is useful for comparison purposes to measure the change in the exchange rate that would deliver such an adjustment.

Chapter 7 shows how the calculated elasticities could be used in gauging the trade balance elasticity with respect to the exchange rate. It also identifies the relevant condition that must hold for a real devaluation to improve the trade balance for a "small" country, and relates this condition to the one used in exchange rate assessments for large countries. A real devaluation always improves the trade balance for a small country as measured by foreign currency, but may not for a large country—one that is able to influence the international prices of its exports or imports.

While the authors hope to have provided a coherent and comprehensive analysis of the current account, the real exchange rate, and the net foreign assets position in LICs, there is certainly scope for further research. First, the extent of external imbalances and the relationships between the three measures should be studied in an empirically based dynamic model encompassing the various external indicators as well as their determinants (resulting in a framework with a nontrivial net foreign assets position in the long run) to properly assess the dynamic path of the variables of interest. Second, a crucial priority is to improve the quality and the extent of data coverage for LICs. Several key indicators (black market premiums, price distortions, trade restrictions, capital account restrictions, productivity in tradables and nontradables, and other structural and financing indicators) are generally missing for numerous countries, an issue that would impair a proper economic assessment of their external balances. Third, a deeper understanding of the nonlinearities underlying the relationship under investigation is critical. For example, the analysis of the interaction between capital account liberalization and income, and between each of these two factors and other determinants, lags behind the numerous theoretical hypotheses that have been put forward.

2 Literature on the Main Determinants of External Balance

This chapter reviews the determinants of the real effective exchange rate and of the current account, with particular emphasis on factors that play an important role for lower-income countries. Toward the end of the chapter, the more limited literature on the determinants of net foreign assets (which generally follows similar intuitions as for the current account) is discussed. The main emphasis of this review is on the theoretical arguments that guide the empirical analysis, but it also highlights the empirical contributions related to each conceptual argument to ease comparison with the results of this analysis. Potential determinants are classified into four main groups: (1) main determinants identified in the literature; (2) structural policies, distortions, and institutions; (3) shocks; and (4) external financing.

In principle, the same factors should affect the real exchange rate and the current account simultaneously (Blanchard, 2007; Edwards, 1989; Obstfeld and Rogoff, 1999; Hinkle and Montiel, 1999; and Vegh, forthcoming). However, foundations for the empirical analysis of the real exchange rate have usually been derived from long-run steady-state analyses of models with tradable and nontradable goods in the presence of balanced trade. At the same time, empirical analysis of the current account has been underpinned by the intertemporal approach to the current account, often in single-good models, that is, without a meaningful exchange rate. Of course, a comprehensive model for external assessment would need to encompass both approaches. But to convey the intuition behind the main effect of each factor on the current account or the real exchange rate, it would be convenient to refer to the respective approach traditionally used.

Macroeconomic Policies, Predetermined Characteristics, and Economic Development

Fiscal Policy

In the absence of Ricardian equivalence, fiscal policy affects aggregate demand and national saving, and therefore, the current account balance and the real exchange rate.[1] Empirically, Chinn and Prasad (2003) and Lee and others (2008) find that the fiscal balance is significantly and positively associated with the current account in pooled ordinary least squares (OLS) regressions.[2] Fiscal policy also affects the real exchange rate through a composition effect in a multi-good economy even in the presence of Ricardian equivalence (Obstfeld and Rogoff, 1999). If government spending falls relatively more on nontraded goods than private consumption does (which is often the case for government consumption), the real exchange rate will appreciate because the relative price of nontraded goods must increase to maintain internal and external balance (Ostry, 1994; Hinkle and Montiel, 1999; and Vegh, forthcoming). Consistent with this prediction, the empirical literature tends to find a positive coefficient (see De Gregorio, Giovannini, and Wolf, 1994; and Ricci, Milesi-Ferretti, and Lee, 2008).

Net Foreign Assets

Countries with initially higher net foreign assets can afford higher spending (above income flow)—and therefore a lower current account—and remain solvent even while reducing their net foreign assets positions (Obstfeld and Rogoff, 1999). However, in steady state, growing economies with a constant positive net-foreign-assets-to-GDP ratio would experience a positive current account.[3] Moreover, in

[1]Blanchard (1985) and Weil (1989) present models breaking Ricardian equivalence in infinitely lived agent models by respectively introducing a positive probability of death and successive cohorts of infinitely lived agents. In such models, a fiscal deficit raises the current generation's consumption and reduces the current account balance by shifting taxes to future generations.

[2]However, with country fixed effects, the fiscal balance tends to become insignificant in a sample of advanced countries (Chinn and Prasad, 2003; Chinn and Ito, 2007; and Gruber and Kamin, 2007).

[3]See Lane and Milesi-Ferretti (2002a); Chinn and Prasad (2003); and Lee and others (2008) for consistent empirical evidence in pooled OLS regressions. Blanchard (1985) and Weil (1989) present models with uncertain horizons or distinct

steady state, higher net foreign assets allow higher consumption of both tradable and nontradable goods while remaining solvent, implying a more appreciated real exchange rate (Lane and Milesi-Ferretti, 2002a, 2004; and Ricci, Milesi-Ferretti, and Lee, 2008). This relationship may not hold in LICs experiencing debt relief: if an increase in debt is expected to be associated with debt relief in the future, the decline in net foreign assets resulting from the increase in debt may not be associated either with lower consumption needed to service external liabilities through trade surplus, or with changes in the real exchange rate. The effect of such expectations cannot be disentangled in the data and could thus affect the coefficient of net foreign assets in current account and real exchange rate regressions.

Demographics

Under the life-cycle hypothesis, a higher share of inactive dependent population reduces national savings and the current account balance, thus resulting in a more appreciated real exchange rate. Population growth and fertility have a negative effect on the current account and a positive effect on the real exchange rate if they are correlated with the share of young inactive people in the population. These predictions are confirmed empirically in analyses of the current account (Lee and others, 2008), of the real exchange rate (Rose, Saktiandi, and Braude, 2009), and of net foreign assets (Lane and Milesi-Ferretti, 2002b).

Stage of Development and Economic Growth

Neoclassical theory predicts that countries at an early stage of development should import capital and borrow against their future incomes to finance their investment needs and smooth out consumption, given high marginal utility of consumption (Obstfeld and Rogoff, 1999).[4] Similarly, fast-growing countries with higher expected productivity gains should invest more, implying a deterioration of the current account.[5] Finally, high productivity growth in the tradable sector relative to the nontradable sector should be associated with a more appreciated real exchange rate (Balassa-Samuelson effect): an increase in productivity in the tradable relative to the nontradable sector, with respect to trading partners, will lead to higher wages in the tradable sector (whose price is given in world markets if the country is small) and subsequently put upward pressure on wages and prices in the nontraded sector.[6] Ricci, Milesi-Ferretti, and Lee (2008) and Choudhri and Khan (2005) find that a 10 percent increase in the productivity of tradables relative to nontradables tends to appreciate the real exchange rate by about 1 to 2 percent on average. Moreover, higher income will result in upward pressure on prices of nontraded goods relative to traded goods because traded goods are priced on the international market, leading to a real exchange rate appreciation. However, a good measure of relative productivity is not readily available for LICs. Therefore, this paper uses real GDP per capita as a proxy variable, as in most of the literature. Given that this variable may not accurately capture the relative productivity effects—on the contrary, it averages out productivity in tradables and nontradables—the expected sign on this proxy is not clear.

infinitely lived dynasties, in which the current account does not need to be zero in steady state even with infinitely lived agents: countries with positive (negative) steady-state net foreign assets will enjoy a current account surplus (deficit) in steady state. There could also be systematic differences between debtor and creditor countries in the relationship between the current account and net foreign assets (Kraay and Ventura, 2000).

[4]For a discussion of how the relationship between country saving and interest rates depends on the level of development, see Ogaki, Ostry, and Reinhart (1996).

[5]The effect of trend output growth on the current account can be ambiguous. In an overlapping generation model, an increase in trend output growth also raises aggregate saving by raising the wealth accumulated by the young relative to the wealth used up by the old (who had lower incomes when young). Hence, such a model predicts a positive effect of trend output growth on the current account (Modigliani, 1986).

[6]The effect is more complex in the presence of nonhomogeneous goods (MacDonald and Ricci, 2007; and Lee and Tang, 2007).

Policy Distortions and Institutions

Domestic Financial Reforms

A more developed financial system facilitates investment and helps attract foreign capital, thereby lowering the current account balance and causing the real effective exchange rate to appreciate.[7] A more developed financial system may also improve the current account balance and cause the real exchange rate to depreciate if it stimulates domestic saving (McKinnon, 1973; and Edwards, 1995).[8] Gourinchas and Jeanne (2007) model an open economy in which both investment and saving decisions are distorted by "wedges" affecting the return to capital. Their model predicts that financial liberalization can have ambiguous effects on the external position of a developing country: a reduction of the saving distortion tends to *reduce* capital inflows by increasing domestic saving, but a reduction of the investment distortion tends to *increase* capital inflows by raising capital scarcity.[9] Empirical analyses have usually relied on measures of financial development as a proxy for the degree of financial liberalization, and have found at best weak effects on the current account (Gruber and Kamin, 2007; and Chinn and Ito, 2007).

Capital Account Openness

Neoclassical theory predicts that, over the development process, capital account liberalization should be associated with deterioration of the current account (capital inflows) and real exchange rate appreciation in developing countries, and with an improvement of the current account (capital outflows) and real exchange rate depreciation in advanced economies (Lucas, 1988; and Edwards, 1989).[10] Moreover, a more open capital account allows countries to borrow against future income and, therefore, to run a lower current account balance when hit by a temporary negative income shock (Vegh, forthcoming). However, Kraay and Ventura (2000) suggest that, if the marginal unit of wealth is invested in the same way as the average unit of wealth, transitory positive income shocks will lead to a current account deficit (surplus) in countries with negative (positive) net foreign assets.

Institutions

Broad institutional characteristics such as the quality of property rights and contract enforcement can have first-order effects on the current account balance and capital flows. Countries with better institutions may be more able to attract a steady flow of foreign capital as a result of lower expropriation risks, and therefore can sustain lower current account balances and net foreign assets positions (Alfaro, Kalemli-Ozcan, and Volosovych, 2007; Gruber and Kamin, 2007). However, in countries with better institutions, the political process may be less likely to favor overvalued real exchange rates, and therefore result in higher current account and net foreign assets positions. The same outcome may arise if better institutions generate an environment more conducive to saving.

Trade Reforms

The effect of trade liberalization on the current account and the real exchange rate is theoretically ambiguous (Edwards, 1989). A common form of trade liberalization—a reduction in import tariffs—would generate income and substitution effects that could have offsetting effects on the real

[7]Greenwood and Jovanovic (1990) show that domestic financial reforms may increase investment by relaxing borrowing constraints. More broadly, a large literature has identified theoretically and empirically the channels through which financial development affects investment and economic growth (for example, Levine, 1997; and Fry, 1995).

[8]Empirical contributions found a weak link between domestic financial liberalization—measured by the real interest rate—and private saving rates in developing countries (Loayza, Schmidt-Hebbel, and Servén, 2000).

[9]An alternative model of the effect of financial globalization on the external position is that of Martin and Rey (2006), who show that financial liberalization can result in a crash and a reversal of the current account. To account for such effects, the empirical estimations in this analysis will include dummy variables for financial crisis.

[10]Empirical evidence has not confirmed the direction of capital flows predicted by basic neoclassical theory. See, for instance, Prasad, Rajan, and Subramanian (2007), and Gourinchas and Jeanne (2007).

exchange rate (Edwards and van Wijnbergen, 1987; Khan and Ostry, 1992). A reduction in import tariffs would lower the prices of imported goods and encourage consumers to substitute imports for domestic (i.e., nontraded) goods, which would reduce the prices of nontraded goods. There would also be an income effect: a reduction in tariffs would raise real income and tend to push up the prices on nontraded goods, provided they were normal goods.[11] Two studies—Edwards (1989) and Ricci, Milesi-Ferretti, and Lee (2008)—find empirical evidence to support the claim that a reduction in import tariffs leads to a real exchange rate depreciation.[12]

A reduction in import tariffs will affect the real exchange rate and the current account through intertemporal channels as well. A temporary reduction in import tariffs would induce consumers to shift consumption of imports from future periods to the present, worsening the current account in the present, but improving it in the period ahead. There would also be an income effect: the higher real income that results from a reduction in tariffs would tend to improve the current account to the extent that the tariff reduction encourages households to raise savings (Ostry 1990; Edwards and Ostry, 1990).[13]

[11]Liberalization would also increase permanent income if trade restrictions reduce productivity. For example, firms may be able to produce output more efficiently if they have access to imported intermediate inputs. Barriers that restrict access to imported goods would therefore reduce productivity.

[12]Goldfajn and Valdes (1999) include a measure of a country's openness, defined as the ratio of exports plus imports to GDP, as a "fundamental" in their equilibrium real exchange rate regressions. Although they did not include tariffs on imports explicitly, the authors claim that the openness variable is a proxy for trade liberalization. They find that for a large majority of the 93 countries studied, greater openness is associated with a more depreciated real exchange rate.

[13]Permanent liberalization may also affect the current account if perceived as temporary: if the reforms lack credibility and agents anticipate a policy reversal, agents will consume more today and the current account would deteriorate because of intertemporal substitution effects (Calvo, 1987).

Price Controls and Black Market Premiums

Administered prices keep prices below the market level and are, therefore, associated with a more depreciated real exchange rate (Ricci, Milesi-Ferretti, and Lee, 2008). However, price controls may also take the form of a marketing board pushing domestic prices up, which would therefore be associated with a more appreciated real exchange rate. Finally, a black market rate that is more depreciated than the official exchange rate (i.e., a positive black market premium indicating expectations of a devaluation of the official rate) is associated with a more appreciated official real exchange rate (i.e., based on the official rate, which is the prevalent basis for measuring real exchange rates) for given fundamentals.

Shocks

Terms of Trade

The impact of a change in a country's terms of trade on its real exchange rate is uncertain, as it depends on the magnitude of income and substitution effects (Edwards and van Wijnbergen, 1987; Mendoza, 1995). In the case of a rise in the price of a country's exports, both the income and substitution effects work in the direction of pushing up the prices of domestically produced (nontraded) goods, but it is uncertain whether the magnitude of the increase in the prices of those goods exceeds the rise in export prices. In the case of a terms-of-trade improvement that arises from a decline in the price of imports, the impact on the price of nontraded goods is ambiguous, as the positive income effect would tend to push up the prices of those goods (Ostry, 1988; Edwards and Ostry, 1992), but the substitution effect would tend to reduce prices of those goods. This same sort of reasoning would apply if one adopted a definition of the real exchange rate based on relative consumer price indices. Depending on how the real exchange rate responds to the terms-of-trade change, the trade balance and current account will adjust in a manner that depends on the sensitivity of trade flows to changes in the real exchange rate. Although empirical work seems to support the view that a terms-

of-trade improvement leads to a real exchange rate appreciation (Ostry and Reinhart, 1992; Chen and Rogoff, 2003; Cashin, Céspedes, and Sahay, 2004; and Ricci, Milesi-Ferretti, and Lee, 2008), recent work by Christiansen and others (2011) calls this conclusion into question.[14]

There are also intertemporal considerations at work. An improvement in the terms of trade—whether through a rise in the price of exports or a decline in the price of imports—raises income, which could have implications for the current account through changes in household saving behavior. For example, if consumers respond to a terms-of-trade improvement by increasing savings so as to smooth consumption over time, the current account would improve. Also, if consumers perceive a decline in import prices to be temporary, they could shift consumption of imports from the future to the present (Obstfeld and Rogoff, 1999; Vegh, forthcoming), which would worsen the current account in the present period, but improve it in the period ahead.

Natural Disasters

A negative income shock positively affects the current account balance if national saving increases, or if investment falls relative to saving, as a consequence of the shock. However, the current account could worsen if the country can smooth consumption by borrowing on international financial markets (Obstfeld and Rogoff, 1999). Thus, it is expected that the effect of natural disasters depends on the degree of capital account openness.[15] When considering the long-run relationship between the real exchange rate and its fundamentals, shocks may not play any role because it is likely that they have only temporary effects.

External Financing through Official Aid

In the short run, a surge in aid could push up domestic prices and induce the real exchange rate to appreciate because supply has limited ability to respond to an increase in aggregate demand financed by aid. In the long run, however, the effect of aid on the real exchange rate is theoretically ambiguous—aid flows may cause an increase (decrease) in the productivity of the nontraded goods sector *relative to* the productivity of the traded sector, thereby causing the real exchange rate to depreciate (appreciate).[16]

To empirically estimate the impact of aid on the current account, aid must be broken down into its two main components (grants and concessional loans), given that the two components are accounted for in different parts of the balance of payments (the former enters the current account and the latter the financial account). Also, to the extent that aid flows are usually redistributed to private agents through government expenditures and are not intermediated by the domestic financial system, their effect on the external position is independent of the impact of domestic financial liberalization. Conceptually, and as a first-order approximation, aid flows can be modeled as exogenous transfers.

Grants

Countries receiving steady flows of grants are able to sustain a lower trade balance in the medium term. Given that grants are accounted for in the current account section of the balance of payments, the current account should remain unchanged if a grant fully finances a deterioration of the trade balance. If, on the contrary, part of the grant is saved

[14]Christiansen and others (2011) also provide an analysis of the separate effects of import and export prices.

[15]It may also depend on the initial net foreign assets position (Kraay and Ventura, 2000; Guo and Jin, 2009).

[16]Torvik (2001) shows how such ambiguity results from a model with traded and nontraded sectors, learning by doing, and spillover effects. If aid tends to expand the size of the nontraded sector, productivity will grow faster in the nontraded sector than in the traded sector as a result of stronger learning by doing in the nontraded sector. Hence, the real exchange rate would depreciate in the long run as a result of a permanent aid inflow.

in the form of international reserves, the current account will improve.[17]

Concessional Loans

Concessional loans allow the financing of a lower current account in the medium term. Moreover, debt issued at concessional terms poses a measurement issue because it is associated with a gap between the nominal and the present market value of net foreign assets.[18] This paper examines the effect of net foreign assets when accounting for the present value of public and publicly guaranteed debt. [19] Of course, this valuable correction has limitations—the additional effect from expected future debt relief cannot be accounted for as a result of lack of data.

The literature on net foreign assets is more limited, in part because until recently empirical analysis has been impaired by the lack of good data. Lane and Milesi-Ferretti (2002b) offer a theoretical and empirical discussion of the main determinants of net foreign assets for advanced economies and developing countries.[20] First, public debt tends to reduce net foreign assets, similar to the effect of budget deficits on the current account. Second, a higher share of dependent population implies the need to run down savings (and thus reduce net foreign assets) to consume more. Third, the relationship between income and net foreign assets is more uncertain. A positive relationship is suggested by the standard development model in which poor countries borrow and rich countries lend, but can also be derived in models with habit formation, or nonlinearities in the utility function. However, a negative relationship with income may arise from a higher desire for precautionary saving in developing countries. Finally, richer countries tend to invest more in equity (Faria and others, 2007), which is more likely to offer a higher long-term return and result in a higher level of net foreign assets.

[17]See Prati and Tressel (2006) and Berg and others (2007) for evidence on the relationship between aid flows, policies, and current account balances in aid-receiving countries, and Mongardini and Rayner (2009) for evidence on the relationship between aid flows, policies, and the real exchange rate.

[18]Extensive borrowing on concessional terms implies that net present value calculations are crucial for deriving realistic indicators of the net external position of LICs. New measures of net foreign assets encompassing the net present value of external debt have been constructed, which for some countries can be substantially different from the standard net foreign assets measure.

[19]The authors are grateful to Ibrahim Levent and his team at the World Bank for sharing with us the net present value calculations.

[20]See Lane and Milesi-Ferretti (2007) for a second edition of their data set.

3 Empirical Analysis of the Current Account[1]

This chapter analyzes the medium-term relationship between the current account and a set of fundamentals. Following the existing literature, the estimations consist of ordinary least squares or fixed-effect regressions for an unbalanced panel of nonoverlapping, four-year averages over the period 1981–2005 with six observations for most countries.[2] The variables in the regressions are generally stationary. Also, the current account needs to be stationary for the intertemporal budget constraint to hold (Ghosh and Ostry, 1997).

Benchmark Current Account Regressions for Low-Income Countries

The preferred current account regressions for this sample of low-income countries are reported in Table 3.1.[3] In addition to country fixed effects, the regressions include traditional variables (Chinn and Prasad, 2003; Chinn and Ito, 2007; and Lee and others, 2008) such as the fiscal balance; demographic variables (old-age dependency ratio, population growth); initial net foreign assets position; the oil trade balance; and variables related to the stage of development (GDP per capita relative to the United States, and real per capita GDP growth). Most notably, in this sample of LICs, the ratio of the fiscal balance to GDP (relative to that of trading partners) and population growth remain strongly significant with the expected sign.

The set of control variables also includes a measure of the terms of trade that has traditionally not been included in current account regressions. The findings are consistent with the interpretation that income effects resulting from terms-of-trade fluctuations have a strong impact on the current account: a temporary improvement in the terms of trade tends to improve the current account because part of the increase in income is saved to smooth consumption over time.

Columns (1) through (7) of Table 3.1 report regressions in which are introduced—one by one or in groups—the new medium-term determinants, specific to LICs, of the current account, in addition to the previous set of its medium-term determinants. Columns (8) and (9) summarize the preferred results, either when maintaining standard determinants, or when using a parsimonious specification with only significant variables.

Regarding official financing, an aggregate measure of foreign aid is significantly and negatively correlated with the current account.[4] The estimated coefficient implies that, for any dollar of aid, the current account deteriorates by about 10 cents during the same period. To better understand this effect, it is useful to note that the two components of foreign aid (grants and concessional loans) are accounted for in separate parts of the balance of payments (the current account and the financial account, respectively), and hence should be expected to have effects of opposite signs on the current account. The analysis presents regressions with the two separate components in columns (2), (6), (8), and (9). The estimated coefficients imply that, on average, about 80 percent of grants are fully absorbed through an increase in net imports over a four-year period, while only 30 to 50 percent of concessional loans received are absorbed through net imports over the same horizon.[5] Consistent

[1]An earlier version of this chapter was published in the *International Seminar on Macroeconomics,* Vol. 6, No. 1, published by the University of Chicago Press.

[2]See Chapters 1 and 2 for a discussion of the literature and of the data set. The data set is presented in detail in the Appendix. The variables in the regressions are generally stationary. Also, the current account needs to be stationary for the intertemporal budget constraint to hold (Ghosh and Ostry, 1997).

[3]Most variables in the analysis are computed in relation to trading partners, and the main results are not affected if the period sample mean is also removed from other variables.

[4]The analysis uses the aggregate measure of foreign aid adjusted for debt relief, in percentage of GDP, as constructed by Roodman (2006).

[5]The estimated effects of aid flows on the current account are generally robust to small changes in the regression sample. However,

Table 3.1. Medium-Term Determinants of the Current Account: Main Results

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Controls									
Fiscal balance to GDP	0.2432**	0.2466**	0.3392**	0.3472**	0.3966***	0.3497**	0.2528**	0.3224***	0.3680***
	(0.0466)	(0.0465)	(0.0280)	(0.0150)	(0.0040)	(0.0187)	(0.0225)	(0.0095)	(0.0005)
Old-age dependency	–0.2673	–0.2415	–0.0140	–0.2326	–0.0324	0.0194	–0.4630	0.1425	
	(0.3881)	(0.4375)	(0.9617)	(0.4602)	(0.9174)	(0.9495)	(0.1263)	(0.6296)	
Population growth	–1.6275**	–1.4663**	–2.6210***	–2.4801***	–2.4438***	–2.1768***	–1.1773*	–1.8436***	–1.7452***
	(0.0209)	(0.0410)	(0.0009)	(0.0045)	(0.0011)	(0.0024)	(0.0715)	(0.0052)	(0.0082)
Initial net foreign assets	–0.0103	–0.0099	–0.0045	–0.0016	0.0186	0.0129	–0.0043	–0.0079	
	(0.4115)	(0.4371)	(0.7014)	(0.9022)	(0.2035)	(0.4030)	(0.7245)	(0.4899)	
Oil trade balance to GDP	0.1820	0.1892	–0.0122	0.0098	0.0451	0.0215	0.1868	–0.0004	
	(0.1467)	(0.1420)	(0.9234)	(0.9352)	(0.7103)	(0.8649)	(0.1399)	(0.9971)	
Income per capita (relative to United States)	0.1017	0.0372	0.2680	0.1912	0.2358	0.1632	0.1110	0.1747	
	(0.6813)	(0.8908)	(0.2320)	(0.4052)	(0.2671)	(0.5044)	(0.6566)	(0.4729)	
Per capita real GDP growth	0.1446	0.1263	–0.0034	0.0698	–0.0252	–0.0057	0.1376	0.0916	
	(0.3078)	(0.3849)	(0.9798)	(0.5963)	(0.8490)	(0.9668)	(0.3218)	(0.4897)	
New medium-term determinants									
Terms of trade, goods and services	0.0228*	0.0236*	0.0345**	0.0315**	0.0336**	0.0332**	0.0260**	0.0269**	0.0319***
	(0.0955)	(0.0905)	(0.0191)	(0.0267)	(0.0165)	(0.0263)	(0.0499)	(0.0340)	(0.0074)
Aid flows to GDP	–0.1130*								
	(0.0636)								
Concessional loans to GDP		–0.3122*				–0.4754**		–0.5565***	–0.4882**
		(0.0695)				(0.0247)		(0.0081)	(0.0127)
Net grants to GDP		–0.0282				0.2108*		0.2168*	0.1981*
		(0.7365)				(0.0616)		(0.0543)	(0.0571)
Domestic financial liberalization (initial)			0.0343**		0.0276*	0.0326**		0.0241	0.0244*
			(0.0139)		(0.0992)	(0.0433)		(0.1379)	(0.0797)
Capital account liberalization (initial)				0.0492**	0.0376*	0.0332		0.0434**	0.0435**
				(0.0156)	(0.0862)	(0.1190)		(0.0371)	(0.0289)
Natural disaster				0.0349**	0.0101	0.0032		0.0359***	0.0361***
				(0.0105)	(0.5855)	(0.8572)		(0.0064)	(0.0041)
Natural disaster × initial capital account				–0.0605**	–0.0566**	–0.0495*		–0.0627**	–0.0654***
				(0.0236)	(0.0385)	(0.0699)		(0.0145)	(0.0071)
Natural disaster × initial net foreign assets					–0.0357**	–0.0309*			
					(0.0252)	(0.0826)			
Violent political transition							0.0287***	0.0280***	0.0262***
							(0.0000)	(0.0006)	(0.0014)
Observations	223	219	143	143	143	139	223	139	139
R-squared	0.73	0.73	0.82	0.82	0.83	0.84	0.75	0.85	0.84

Note: *** $p<0.01$; ** $p<0.05$; * $p<0.1$. Robust *p*-values in parentheses. Robust panel regressions of the current-account-to-GDP ratio on country fixed effects, a set of control variables (the fiscal-balance-to-GDP ratio, demographic variables, the initial-net-foreign-assets-to-GDP ratio, the oil-trade-balance-to-GDP ratio, income per capita relative to the United States, and per capita real GDP growth), and a set of medium-term determinants of the current account, including (1) aid flows to GDP, (2) financial and capital account liberalization, and (3) shocks (natural disasters, terms-of-trade fluctuations). The dependent variable and explanatory variables are averaged over four-year periods (except when stated otherwise) and cover 1981–2005.

with theoretical predictions of normative models (Matsen and Torvik, 2004), on average, a large share of aid is not immediately spent on net imports, and is indirectly saved as foreign exchange reserves. Berg and others (2007) and Prati and Tressel (2006) provide consistent evidence that macroeconomic responses to aid surges may limit the short-run absorption of aid in LICs. Overall, the negative coefficient for total aid reported in column

the estimated coefficient of grants reported in the specification of column (2) becomes closer to those of columns (6), (8), and (9) when run on the same sample. See Berg, Mirzoev, and others (2010); Berg, Gottschalk, and others (2010); and Prati and Tressel (2006) for macroeconomic and policy responses to aid flows.

(1) reflects similar effects for the two aid components on spending patterns but opposite accounting standards in the current and financial accounts.

Domestic financial reforms are associated with higher current accounts, suggesting that these reforms boost domestic private saving more than they boost investment. This interpretation is consistent with the McKinnon hypothesis,[6] according to which liberalization of domestic banking systems in developing countries results in higher saving rates by raising the return on financial saving.[7] The estimated effect implies that shifting from complete financial repression to the sample average level of liberalization would improve the current account by 1.5 percent of GDP. Evidence consistent with this interpretation is shown in Table 3.2, which suggests that real deposit rates increase when countries liberalize their domestic financial systems.[8]

The opposite effects on the current account of domestic financial liberalization and of concessional loans may be explained by the fact that aid flows are typically *not* intermediated by the domestic financial system, as discussed in Chapter 2 (aid flows typically finance government current expenditures and public investment). In addition, part of aid flows, by being redistributed through transfers, temporarily increases private agents' disposable income, thus raising private consumption and saving.[9]

Exogenous negative income shocks (as proxied by natural disasters) have a negative impact on the current account, as predicted by standard theory,

Table 3.2. Real Deposit Interest Rates in Selected Asian Developing Countries and the United States

Economy	1968–74	1975–81	1982–88
Bangladesh	–7.88	–3.19	2.33
India	–2.46	0.07	1.13
Indonesia	–1.21	–5.80	7.57
Korea, Rep. of	1.58	–2.58	5.13
Malaysia	2.01	1.79	5.37
Nepal	–0.62	4.04	3.36
Pakistan	–2.33	–1.55	2.96
Philippines	–4.22	–0.16	–0.32
Sri Lanka	–4.52	0.27	4.08
Taiwan Province of China	0.34	2.88	5.48
Thailand	1.24	1.52	7.67
United States	1.31	0.24	4.86

Sources: Fry (1995) and authors' calculations for the United States (annual average continuously compounded rates). Data for the United States are from IMF, *International Financial Statistics* (lines 60lc and 64).

but only in countries with fully open capital accounts (as indicated by the sum of the linear and the interaction terms).[10] This result is consistent with standard smoothing of aggregate consumption through international borrowing in open economies.[11] Because the analysis is already controlling for official capital flows, the estimates are likely to capture the effect of private capital flows.

Conversely, natural disasters are associated with current account improvements in countries with closed capital accounts. A possible explanation is that these negative shocks trigger a procyclical increase in saving (relative to investment) when there is no access to international capital markets. Kraay and Ventura (2000) suggest that negative income shocks should lead to current account surpluses (deficits) in debtor (creditor) countries because domestic investment falls more (less) than saving following such

[6]Initially formulated by McKinnon (1973), and also conceptualized by Fry (1995).

[7]The findings in this paper are also consistent with the model of Gourinchas and Jeanne (2007), who suggest that saving wedges may be more important than investment wedges in developing countries. However, the findings are less consistent with Caballero, Farhi, and Gourinchas (2008) and with Mendoza, Quadrini, and Rios-Rull (2008), who show how the lack of financial development may result in precautionary saving, and therefore higher current account balances.

[8]Real deposit rates increased between the early 1970s and the end of the 1980s in a sample of Asian countries that moved from financial repression to financial liberalization over this period (Fry, 1995).

[9]Whether private agents partly save these windfall earnings is a subject for future research. The aggregate estimates in this analysis suggest that part of aid is saved over a four-year horizon, which may be caused by macroeconomic policy responses, or by private agents' consumption-saving decisions.

[10]The measure is defined as the frequency of negative income shocks over a four-year period, where natural disasters include floods, droughts, earthquakes, and windstorms. Such natural events are typical, frequent, and likely to have macroeconomic implications in LICs. In this sample, the frequency of these shocks is high, about 0.6 per four-year period.

[11]In a country with a fully liberalized capital account, a natural disaster occurring at an average frequency of 0.6 during a four-year period would be associated with a deterioration in the current account equivalent to –0.7 percent of GDP.

shocks.[12] When interacting the natural disaster variable with the initial net foreign assets position, the analysis yields a negative and significant coefficient on the interaction term (which tends to support the prediction of the Kraay and Ventura model) and an insignificant coefficient on the shock variable itself (Table 3.1, column 5). Controlling for aid, however, weakens this estimated effect of the portfolio composition (Table 3.1, column 6).

The impact of capital account liberalization on the current account needs to be analyzed jointly with the role of shocks: as just discussed, when countries face negative income shocks, more-open capital accounts allow them to borrow on international capital markets, which is consistent with consumption smoothing. However, in good times, capital account liberalization seems to be associated with capital outflows in LICs, which is consistent with the presence of financial repression during the sample. Table 3.2 shows that 6 out of 11 developing countries covered exhibited real deposit rates below U.S. deposit rates in the 1980s.[13] Turning to institutional factors, violent political events tend to improve the current account, suggesting that political unrest may trigger significant capital flight.

Robustness

The main baseline results are generally robust to the inclusion of various additional explanatory variables as shown in Table 3.3. Column (1) allows for a dynamic effect of the current account by controlling for the lagged current account: limited persistence of the current account beyond a four-year horizon is found in this sample of LICs.[14] Column (2) shows that trade reforms (as measured by an index of average tariffs) have no additional explanatory power. Column (3) splits the terms-of-trade index into two components, and shows that export prices are strongly positively correlated with the current account, while import prices are weakly and negatively correlated with it. A weaker correlation for the latter is consistent with income effects and substitution effects of import price movements having opposite effects on the current account. Next, as shown in column (4), the results are robust to the inclusion of the six emerging markets that have been excluded from the LIC sample (China, Colombia, India, Indonesia, Pakistan, and Thailand). Furthermore, the results are robust to the use of a broader measure of capital account liberalization (updated version of Quinn, 1997; see the Appendix), as reported in column (5).

Columns (6), (7), and (8) of Table 3.3 consider alternative interaction terms with the index of capital account openness. Column (6) controls for an interaction between the fiscal balance and the capital account index, to test whether the effect of fiscal policy may depend on the capacity of private agents to offset fiscal policies by borrowing or lending in international markets. The analysis finds that, in this sample of LICs, the effect of fiscal policy on aggregate demand and on the current account is not significantly affected by the degree of capital account openness. However, the negative sign of the interaction term is consistent with standard theories, implying a lower effect of the fiscal balance on the current account in countries with more-open capital accounts. Column (7) considers an interaction with population growth, but again does not yield any significant effect. Still, the negative sign on the interaction term is consistent with neoclassical theories, according to which countries with younger nonactive populations are more able to borrow against future income when the capital account is open. The last column considers an interaction term with real per capita GDP growth; the positive sign of the interaction term, although not significant, would suggest that countries with more open capital accounts tend to run higher current account balances when growth is temporarily above its trend.[15]

[12]Guo and Jin (2009) show that a portfolio-composition effect might dominate the income effect in past data.

[13]There was, however, a large dispersion of real deposit rates in developing countries over the period 1970–90 (Gelb, 1989).

[14]Controlling for lags of grant and concessional loans also does not affect the main results (regression available upon request).

[15]This result is consistent with Gourinchas and Jeanne (2007), who find evidence that countries with faster productivity growth tend to attract less foreign capital. However, if the country fixed effects are omitted to test for long-run cross-country differences, the opposite sign tends to be found on this interaction term: countries with faster economic growth tend to run lower current account balances when they liberalize their capital accounts.

Table 3.3. Medium-Term Determinants of the Current Account: Robustness

Variables	(1)	(2)	(3)	(4)[1]	(5)	(6)	(7)	(8)
Fiscal balance to GDP	0.3166**	0.3083***	0.3486***	0.2568**	0.3230***	0.5104***	0.3886***	0.3597***
	(0.0141)	(0.0030)	(0.0025)	(0.0188)	(0.0047)	(0.0016)	(0.0004)	(0.0007)
Population growth	–1.4924*	–2.7107***	–1.6308**	–1.7432***	–1.8557***	–1.7513***	–1.4558**	–1.7485***
	(0.0550)	(0.0000)	(0.0173)	(0.0030)	(0.0068)	(0.0045)	(0.0228)	(0.0050)
Terms of trade, goods (log)	0.0289**	0.0352***		0.0249**	0.0327***	0.0304**	0.0278**	0.0323***
	(0.0268)	(0.0037)		(0.0460)	(0.0070)	(0.0118)	(0.0242)	(0.0058)
Concessional loans to GDP	–0.4185*	–0.4808**	–0.4343**	–0.5318***	–0.4468**	–0.4681**	–0.4340**	–0.5076**
	(0.0712)	(0.0128)	(0.0220)	(0.0074)	(0.0219)	(0.0158)	(0.0232)	(0.0116)
Net grants to GDP	0.1710	0.1154	0.1953*	0.2328**	0.1532	0.1787*	0.1754*	0.1881*
	(0.1446)	(0.2816)	(0.0552)	(0.0332)	(0.1860)	(0.0737)	(0.0933)	(0.0675)
Violent political transition	0.0265**	0.0234***	0.0272***	0.0255***	0.0269***	0.0271***	0.0244***	0.0277***
	(0.0119)	(0.0068)	(0.0009)	(0.0033)	(0.0026)	(0.0019)	(0.0036)	(0.0002)
Domestic financial liberalization (initial)	0.0317**	0.0168	0.0251*	0.0415***	0.0248*	0.0244*	0.0260*	0.0235
	(0.0355)	(0.3297)	(0.080)	(0.0073)	(0.0977)	(0.0781)	(0.0644)	(0.1512)
Capital account liberalization (initial)	0.0247	0.0390*	0.0432**	0.0331		0.0415**	0.0488**	0.0432**
	(0.2917)	(0.0621)	(0.0297)	(0.1038)		(0.0384)	(0.0198)	(0.0291)
Natural disaster	0.0350**	0.0321**	0.0355***	0.0303***	0.0329**	0.0376***	0.0380***	0.0356***
	(0.0124)	(0.0330)	(0.0036)	(0.0071)	(0.0269)	(0.0032)	(0.0027)	(0.0038)
Natural disaster × initial capital account	–0.0499*	–0.0594**	–0.0664***	–0.0691***		–0.0666***	–0.0646***	–0.0643***
	(0.0788)	(0.0235)	(0.0056)	(0.0041)		(0.0067)	(0.0079)	(0.0071)
Lag of current account to GDP	0.0145							
	(0.8704)							
Trade restrictions (initial)		0.0002						
		(0.9898)						
Export price			0.0431***					
			(0.0041)					
Import price index			–0.0252*					
			(0.0679)					
Capital account liberalization (Quinn, 1997)					0.0345*			
					(0.0857)			
Natural disaster × capital account (Quinn, 1997)					–0.0487*			
					(0.0613)			
Fiscal balance to GDP × capital account						–0.3019		
						(0.3002)		
Population growth × capital account							–1.2912	
							(0.1067)	
Economic growth × capital account								0.4167
								(0.1545)
Per capita real GDP growth								–0.0867
								(0.6280)
Observations	121	134	139	172	137	139	139	139
R-squared	0.86	0.84	0.85	0.80	0.84	0.85	0.85	0.85

Note: *** $p<0.01$; ** $p<0.05$; * $p<0.1$. Robust p-values in parentheses. Robust panel regressions of the current-account-to-GDP ratio on country fixed effects, a set of control variables (the fiscal-balance-to-GDP ratio, demographic variables), and a set of medium-term determinants of the current account identified in Table 3.1. The dependent variable and explanatory variables are averaged over four-year periods (except when stated otherwise) and cover 1981–2005. Additional control variables are added one at a time: a four-year lag of the medium-term current account, an index of average import tariff, price indexes for exports and imports, an alternative broader measure of capital account liberalization (based on an extension of Quinn, 1997), and interaction terms between the capital account liberalization index and (1) the fiscal balance, (2) population growth, and (3) per capita real GDP growth.

[1]Column (4) considers a broader country sample that includes emerging markets classified as lower-middle-income countries (China, Colombia, India, Indonesia, Pakistan, and Thailand).

Table 3.4. Current Account Regressions with Different Slopes for Low- and High-Income Countries

	(1)		(2)		(3)	
Variables	LICs	HICs	LICs	HICs	LICs	HICs
Fiscal balance to GDP	0.3224***	−0.0811	0.3176**	−0.1198	0.3173**	−0.2111
	(0.0099)	(0.6449)	(0.0147)	(0.4662)	(0.0144)	(0.2773)
Old-age dependency	0.1425	−1.7237**	0.0642	−1.8566***	0.0595	−2.3592***
	(0.6342)	(0.0204)	(0.8302)	(0.0094)	(0.8416)	(0.0064)
Population growth	−1.8436***	0.0618	−1.8460***	−0.4686	−1.8461***	−1.6787*
	(0.0055)	(0.9532)	(0.0075)	(0.6304)	(0.0073)	(0.0965)
Net foreign assets to GDP	−0.0079	−0.0646**	−0.0119	−0.0734***	−0.0121	−0.0811***
	(0.4956)	(0.0171)	(0.3098)	(0.0048)	(0.2972)	(0.0062)
Oil trade balance to GDP	−0.0004	0.0369	−0.0266	0.1145	−0.0282	0.2615
	(0.9971)	(0.8395)	(0.7997)	(0.5277)	(0.7861)	(0.1923)
Income per capita (relative to United States)	0.1747	0.2427*	0.1163	0.1309	0.1127	0.1151
	(0.4787)	(0.0783)	(0.6525)	(0.2933)	(0.6612)	(0.3977)
Per capita real GDP growth	0.0916	−0.2543	0.1262	−0.1471	0.1283	−0.1891
	(0.4954)	(0.2536)	(0.3689)	(0.5020)	(0.3590)	(0.3929)
Violent political transition	0.0280***	0.0687***	0.0273***	0.0651***	0.0272***	0.0589***
	(0.0006)	(0.0001)	(0.0017)	(0.0001)	(0.0016)	(0.0006)
Terms of trade, goods (log)	0.0269**	0.0654*	0.0240*	0.0486	0.0238*	0.0499
	(0.0356)	(0.0698)	(0.0639)	(0.1670)	(0.0641)	(0.1348)
Concessional loans to GDP	−0.5565***	…	−0.6426***	…	−0.6479***	…
	(0.0085)	…	(0.0027)	…	(0.0023)	…
Net grants to GDP	0.2168*	…	0.2138*	…	0.2136*	…
	(0.0567)	…	(0.0649)	…	(0.0639)	…
Domestic financial liberalization (initial)	0.0241	0.0288	0.0170	0.0200	0.0166	0.0031
	(0.1424)	(0.3535)	(0.3194)	(0.5018)	(0.3294)	(0.9292)
Capital account liberalization (initial)	0.0434**	−0.1145**	0.1917***	…	0.0916***	…
	(0.0388)	(0.0197)	(0.0002)	…	(0.0016)	…
Natural disaster	0.0359***	−0.0021	0.0353**	−0.0284	0.0352**	…
	(0.0067)	(0.9465)	(0.0106)	(0.3717)	(0.0104)	…
Natural disaster × capital account	−0.0627**	0.0853*	−0.0544**	0.1100**	−0.0539**	…
	(0.0153)	(0.0824)	(0.0460)	(0.0170)	(0.0467)	…
Capital account liberalization (all countries, initial)	…		−0.1765***		−0.0781***	
	…		(0.0009)		(0.0021)	
Capital account liberalization × GDP per capita	…		0.2288**		0.2427**	
	…		(0.0199)		(0.0129)	
Observations	234		234		234	
R-squared	0.83		0.83		0.82	

Note: HICs = high-income countries; LICs = low-income countries. *** $p<0.01$; ** $p<0.05$; * $p<0.1$. Robust *p*-values in parentheses. Robust panel regression of the current-account-to-GDP ratio on a set of medium-term determinants of Table 3.1, column (8). Independent variables are interacted with dummy variables for this sample of LICs and HICs. Sample and period averages are as in Tables 3.1 and 3.2.

Are Low-Income Countries Different?

Low-income countries are expected to differ from high-income countries because of their higher exposure to shocks, greater distortions, and different sources of external financing. Tables 3.4 and 3.5 explore the extent to which various medium-term determinants of the current account have significantly different effects on the current accounts of low-income countries and of high-income coun-

tries, by allowing for different slopes within the same regression (Table 3.4) and testing the significance of their difference (Table 3.5).

Among standard determinants of the current account, the analysis finds that (1) the fiscal balance, (2) the old-age dependency ratio, and (3) initial net foreign assets have significantly different impacts on the current account in LICs relative to other countries. In particular, no significant association is found between the current account and the fiscal balance in high-income countries, a finding consistent with Chinn and Prasad (2003) and Isard and Faruqee (1998). This result is consistent with the hypothesis that Ricardian equivalence is more likely to be a reasonable first-order approximation of consumption and saving decisions in high-income countries than in other countries. The negative sign of the coefficient for the initial net foreign assets position in high-income countries is consistent with the standard intertemporal approach to the current account, which predicts that initially richer countries can sustain lower current account balances in the medium term (hence, more of a dynamic effect than a steady-state relationship).

The analysis seems to find a surprising negative association between the current account and capital account openness for higher-income countries when they do not experience natural disasters (column 1)—a finding seemingly inconsistent with the standard prediction of neoclassical theory because richer countries should experience capital outflows when opening up their capital accounts. Moreover, for this group of countries, the analysis yields a positive coefficient on the interaction term between the capital account openness variable and the natural disaster variable. It is likely that this result stems from the specification in column (1) being ideal for LICs, but not for high-income countries: natural disasters (such as floods, droughts, earthquakes, and windstorms) may not really affect the current account of higher-income economies. Hence, column (2) introduces an interaction term between the capital account openness variable and GDP per capita for the whole sample as a way to test more directly the prediction of neoclassical theory that capital should flow from more-developed to less-developed countries. A positive coefficient is found for the interaction term, which is consistent with the prediction of this theory, and the total effect of capital account liberalization on the current account is positive for the richer countries.[16] It is also possible that natural disasters are not relevant from a macroeconomic perspective for high-income countries (see the insignificant coefficient on this variable for the higher-income group). The regression in column (3) drops the natural disaster variable and the interaction term, and shows that the interaction of the capital account liberalization index with GDP per capita is still consistent with the prediction of standard development theory.

Table 3.5. *F*-Tests of Equality (*p*-values) of Coefficients across Income Groups for Regressions Reported in Table 3.4

Variables	(1)	(2)	(3)
Fiscal balance to GDP	0.06	0.04	0.02
Old-age dependency	0.02	0.01	0.01
Population growth	0.13	0.24	0.89
Net foreign assets to GDP	0.05	0.03	0.03
Oil trade balance to GDP	0.86	0.50	0.20
Income per capita (relative to United States)	0.81	0.96	0.99
Per capita real GDP growth	0.18	0.29	0.23
Violent political transition	0.03	0.04	0.09
Terms of trade, goods (log)	0.31	0.51	0.46
Domestic financial liberalization (initial)	0.89	0.93	0.73
Capital account liberalization (initial)	0.00	…	…
Natural disaster	0.27	0.06	…
Natural disaster × capital account	0.01	0.00	…

Note: Null hypothesis: coefficient HIC = coefficient LIC (*p*-value of *F*-test is reported). Regressions are those reported in Table 3.4.

[16]The total effect of capital account openness on the current account turns positive at a GDP per capita of about two-thirds of the U.S. GDP per capita for countries that do not experience natural disasters, and at one-third that of the U.S. GDP for countries that experience natural disasters.

Empirical Analysis of the Real Exchange Rate[1]

4

This chapter investigates the long-run relationship between the real effective exchange rate and a set of fundamentals. The estimation relies on an unbalanced panel of annual data covering 1980–2006. Panel unit root tests show the unit root nature of the variables involved in the estimation, apart from the natural shocks (Table 4.1). Panel cointegration tests have been performed for the benchmark regressions of interest (columns 3 in Tables 4.2 and 4.3) and reject the null of no cointegration.[2] Under the assumption of I(1) cointegrated variables, dynamic ordinary least squares (DOLS) with fixed effects regression provides—from the coefficients of the variables in levels—an estimate of the long-run cointegrating relationship between the real exchange rate and the set of fundamentals. As part of the DOLS specification, in addition to the variables in levels, the analysis introduces changes in right-hand-side variables and—given the short length of the sample—one lead and one lag of these changes.[3]

Benchmark Real Effective Exchange Rate Regressions for Low-Income Countries

Tables 4.2 and 4.3 report the preferred specifications for low-income countries with two different measures of the real effective exchange rate.[4] The first is consumer price index–based, as offered by the IMF's Information Notice System (INS). The second is constructed from the average domestic price level relative to the United States as reported in the Penn World Table, then turned into a real effective exchange rate by applying the same trading partner weights employed in the calculation of the IMF-INS real effective exchange rate. Results are virtually identical, with a few exceptions discussed below. The regression specifications include traditional variables such as net foreign assets, productivity, government consumption, terms of trade, and trade restrictions, but also LIC-specific variables such as aid flows and capital account liberalization. Moreover, demographics and price controls, which have also been shown to matter in other samples (Rose, Saktiandi, and Braude, 2009; and Ricci, Milesi-Ferretti, and Lee, 2008), are likely to be relevant for LICs. The first column of Tables 4.2 and 4.3 includes a dummy for natural disaster as defined in Chapter 3, given that LICs are widely affected by such natural occurrences. The results hint at a negative effect of these shocks on the real exchange rate. However, given that the econometric nature of these (0,1) indicators is uncertain (the panel unit root test rejects the unit root hypothesis; see Table 4.1), column (2) (and subsequent regressions) excludes this indicator. These temporary shocks should be expected to have only temporary effects and no long-run impact on the real exchange rate.

Column (3) drops insignificant variables and derives a benchmark regression. Consistent with the previous literature, government consumption is associated with an appreciation in the real exchange rate, which is usually the case under the presumption that government spending goes toward nontradables (as opposed to tradables) in a higher proportion than does private spending. An improvement in the terms of trade causes the real exchange rate to appreciate with effects similar to

[1]An earlier version of this chapter was published in the *International Seminar on Macroeconomics,* Vol. 6, No. 1, published by the University of Chicago Press.

[2]Panel unit root tests are based on Pesaran (2007) to control for cross-sectional dependence. The authors are grateful to Peter Pedroni for running the panel unit root tests using his programs developed in the Regression Analysis of Time Series. Panel cointegration tests are based on group mean augmented Dickey-Fuller panel cointegration tests (Pedroni, 1999, 2004).

[3]See Chapters 1 and 2 for a discussion of the literature and of the data set. The data set is presented in detail in the Appendix.

[4]The benchmark regressions are virtually unchanged if time dummies are included to account for possible common movements in the real effective exchange rate of LICs associated with, for example, an exchange rate adjustment in advanced economies.

Table 4.1. Panel Unit Root Test Statistic

Variables	Statistic[1]	
	Sample A[2]	Sample B[2]
Log of REER (INS)	–1.59	–1.57
Log of REER (PWT)	–1.82	–1.97
Net foreign assets to GDP	–2.02	–2.06
Net foreign assets to trade	–1.58	–1.39
Net foreign assets (w/NPV debt) to GDP	–2.06	–2.03
Net foreign assets (w/NPV debt) to trade	–1.83	–1.53
Relative productivity (log)[3]	–1.53	–1.22
Terms of trade, goods (log)	–1.45	–1.36
Government consumption to GDP[3]	–1.99	–2.12[4]
Trade restrictions[3]	–2.04	–1.75
Administered agricultural prices[3]	–0.79	–1.12
Maximum agricultural price intervention[3]	–1.26	–0.96
Aid flows to GDP[3]	–2.19[4]	–2.07
Fertility[3]	–0.54	–0.57
Capital account liberalization[3]	–1.95	–1.85
Domestic financial liberalization[3]	–1.50	–1.50
Natural disaster	–3.66[4]	–3.52[4]
Constraint on executive	–0.85	–0.80
Public debt to GDP	–1.52	–1.53
Public debt to trade	–1.82	–1.87
NPV of external debt to trade	…	–1.63

Note: REER = real effective exchange rate; NPV = net present value; PWT = Penn World Table; INS = IMF's Information Notice System.

[1]Test based on Pesaran (2007).

[2]Samples A and B refer to restricting the sample to having at least 14 or 20 observations per country, respectively.

[3]The variable is constructed relative to the weighted average of the trading partners.

[4]Reject null hypothesis of unit root at 5 percent one-sided.

those found in other samples of countries (Ricci, Milesi-Ferretti, and Lee, 2008). Fertility is associated with an appreciation of the real exchange rate, as in Rose, Saktiandi, and Braude (2009). The net foreign assets position is not significant because possible expectations of debt relief may blur the intertemporal role of this variable in this sample of LICs. Overall productivity is not significant with respect to the IMF-INS real exchange rate and is negative with respect to the Penn World Table.[5]

[5]Note that for data set consistency, the productivity indicator is based on GDP per worker from the Penn World Table data set.

One possible explanation is that, in LICs, measures of overall productivity reflect tradable and nontradable sectors' productivities equally, and occasionally may even reflect productivity in nontradables more closely than in tradables.[6]

Turning to variables specific to LICs, aid inflows are associated in the long run with a more depreciated exchange rate, potentially indicating a positive effect on productivity in the nontradable sector relative to the tradable sector. Aid is generally thought to increase domestic prices (especially of nontradables), thus leading to appreciation of the real exchange rate (Dutch disease) in the short run, that is, when the supply side of the economy has not had a chance to adjust. In the long run, however, an increase in aid would be consistent with depreciation of the real exchange rate if aid raises productivity of nontradables relative to the productivity of tradables (Torvik, 2001).[7] Given that the regressions control for government consumption, the estimated effect of aid should operate through government investment or private expenditure financed by aid; this also implies that the overall effect of aid, including through the government consumption channel, would be smaller in absolute value or may even be positive.

Capital account liberalization is associated with an appreciation of the real exchange rate, sug-

[6]The opposite assumption stands behind the standard presumption for using aggregate productivity as a proxy for the Balassa-Samuelson effect. Unfortunately, it was not possible to construct a better proxy for the Balassa-Samuelson effect despite extensive efforts. For this reason, in Table 4.3, the proxy was dropped in column (3) even though significant.

[7]An alternative explanation for the negative coefficient is the presence of endogeneity. In particular, countries that are simultaneously experiencing depreciating exchange rates and economic difficulties may also be aid receivers. However, such an interpretation would not be consistent with the long-run nature of the estimated cointegration relationship (unless changes in the real exchange rate can have long-term effects on donor countries' aid policies). Moreover, when replacing the aid measure with the ratio of aggregate aid to aggregate GDP in LICs (which is positively related to countries' aid ratios, but is not related to country-specific exchange rate fluctuations) the coefficient remains negative and significant. The analysis also considered the short-run effect of aid, via the coefficients of change in the aid measure in an error correction specification (which will be discussed below), but these are insignificant when either one, two, three, or four lags of the changes are entered.

gesting that, in the long run, such liberalization promotes persistent net capital inflows. Price distortions are also somewhat significant. In particular, the presence of marketing boards (as captured by the indicator "maximum agricultural price intervention") is likely to keep prices high and thus lead the real exchange rate to appreciate.

The last column of Tables 4.2 and 4.3 includes the black market premium, which, unfortunately, halves the sample size. Because real exchange rates are normally measured at official rates, the positive and significant coefficient is consistent with the standard interpretation that the presence of a black market premium usually signals an overvalued official exchange rate. Generally, in these circumstances, most public transactions occur at the official rate, while private transactions tend to occur at the black market rate, so the actual average exchange rate is likely to lie between the official and the black market rates. This would correspond to a coefficient between zero and one, which is what the analysis finds. However, the sample size decreases substantially, which limits the usefulness of the regressions. Measuring the exchange rate correctly is an important issue, deserving wide attention in real exchange rate analysis—especially when focusing on LICs that have traditionally been more prone to dual exchange rate systems and problems of measurements of price levels—and requiring additional efforts in data collection.

Table 4.2. Real Effective Exchange Rate (IMF Information Notice System Definition) Regressions

(Panel dynamic ordinary least squares with fixed effects; only long-run coefficients reported)

Variables	(1)	(2)	(3)	(4)
Net foreign assets (w/NPV debt) to trade	–0.0168	–0.0175		
	(0.2661)	(0.2511)		
Relative productivity (log)[1]	–0.1019	–0.0770		
	(0.3613)	(0.4869)		
Terms of trade, goods (log)	0.3458***	0.3455***	0.3931***	0.4353***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Government consumption to GDP[1]	1.2667*	1.1259*	2.0271***	1.9688***
	(0.0622)	(0.0910)	(0.0002)	(0.0074)
Aid flows to GDP[1]	–2.2405***	–2.1679***	–1.6187***	–1.3812***
	(0.0000)	(0.0000)	(0.0000)	(0.0016)
Capital account liberalization[1]	0.3152***	0.2916***	0.2978***	0.4910***
	(0.0025)	(0.0056)	(0.0011)	(0.0000)
Trade restrictions[1]	0.0975	0.1003		
	(0.2836)	(0.2630)		
Administered agricultural prices[1]	–0.0004	–0.0223		
	(0.9954)	(0.7174)		
Maximum agricultural price intervention[1]	0.0596	0.0691	0.0596	0.0129
	(0.2059)	(0.1368)	(0.1660)	(0.8473)
Fertility[1]	0.1239***	0.1221***	0.0979***	0.1512***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Natural disaster	–0.0951*			
	(0.0559)			
Black market premium (percent)				0.2547***
				(0.0015)
Observations	522	522	609	338
R-squared	0.71	0.70	0.65	0.78

Note: NPV = net present value. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust *p*-values in parentheses. Robust dynamic ordinary least squares panel regressions with fixed effects of the real effective exchange rate (IMF, Information Notice System source) on net foreign assets (with NPV of external debt) to trade ratio, log of relative productivity, terms of trade for goods, government consumption to GDP, aid to GDP (or its components: concessional loans and grants), capital account liberalization, trade restrictions, agricultural price reforms, fertility, natural disaster, and black market premium. Unbalanced panel with annual data 1980–2006.

[1]The variable is constructed relative to the weighted average of the trading partners.

Are Low-Income Countries Different?

Low-income countries differ from high-income countries (HICs) mainly because of the specific factors controlled for in the regressions (distortions, financing, and shocks). Traditional factors do not show great difference when these specific factors are controlled for. However, neglecting the presence of the specific factors would lead to misspecifications, and even coefficients on traditional factors would appear different. Columns (1) and (2) of Table 4.4 present a specification typically used for HICs (Ricci, Milesi-Ferretti, and Lee, 2008), but estimated with separate coefficients for LICs and HICs. All coefficients appear to be significantly different (see Table 4.5, column 1). Column (3) in Table 4.4 shows a regression equivalent to the one in column (2) of Table 4.2—the benchmark before dropping variables that have been found relevant for a broader sample of advanced economies—but again with different slopes for LICs and HICs.

Table 4.3. Real Effective Exchange Rate (Penn World Table) Regressions

(Panel dynamic ordinary least squares with fixed effects; only long-run coefficients reported)

Variables	(1)	(2)	(3)	(4)
Net foreign assets (w/NPV debt) to trade	0.0094 (0.4610)	0.0087 (0.5053)		
GDP per worker PWT (log)	–0.4418*** (0.0006)	–0.4266*** (0.0010)		
Terms of trade, goods (log)	0.1634** (0.0281)	0.1600** (0.0326)	0.1970*** (0.0077)	0.2040** (0.0318)
Government consumption to GDP[1]	2.0186** (0.0350)	1.8770* (0.0507)	3.3371*** (0.0000)	5.3549*** (0.0000)
Aid flows to GDP[1]	–3.2405*** (0.0000)	–3.1855*** (0.0000)	–2.0504*** (0.0000)	–1.3181*** (0.0049)
Capital account liberalization[1]	0.1746** (0.0418)	0.1520* (0.0850)	0.1984** (0.0233)	0.3048** (0.0265)
Trade restrictions[1]	–0.0434 (0.6543)	–0.0258 (0.7934)		
Administered agricultural prices[1]	–0.0299 (0.6735)	–0.0650 (0.3607)		
Maximum agricultural price intervention[1]	0.0343 (0.4661)	0.0530 (0.2462)	0.1842*** (0.0002)	0.0574 (0.4864)
Fertility[1]	0.1464*** (0.0001)	0.1484*** (0.0001)	0.1247*** (0.0001)	0.1072*** (0.0060)
Natural disaster	–0.1549*** (0.0057)			
Black market premium (percent)				0.4344*** (0.0000)
Observations	522	522	622	364
R-squared	0.75	0.74	0.69	0.81

Note: NPV = net present value; PWT = Penn World Table. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust *p*-values in parentheses. Robust dynamic ordinary least squares panel regressions with fixed effects of the real effective exchange rate (PWT source) on net foreign assets (with NPV of external debt) to trade ratio, log of relative productivity, terms of trade for goods, government consumption to GDP, aid to GDP (or its components: concessional loans and grants), capital account liberalization, trade restrictions, agricultural price reforms, fertility, natural disaster, and black market premium. Unbalanced panel with annual data 1980–2006.

[1]The variable is constructed relative to the weighted average of the trading partners.

Because this regression encompasses indicators that are relevant for both sets of countries, it may be the best for assessing the different roles of these indicators across samples of countries. The difference in the coefficients of the traditional variables is now insignificant in most indicators (Table 4.5, column 2). Net foreign assets appear to play a different role in the two sets of countries, which is not surprising given that an expectation of possible debt relief may reduce the relevance of this variable in LICs. However, the key LIC factors (apart from fertility) seem to play different roles in the two samples, which is again not surprising given that these indicators are likely to be less relevant in HICs. Column (3) of Table 4.4 shows the income split for a regression equivalent to the baseline in Table 4.2, column (3) (i.e., dropping variables not relevant for LICs), and Table 4.5, column (3), presents the corresponding test of equality of coefficients; results are now somewhat different, but it may be because the regression is tailored to LICs and is misspecified for the other group.

Robustness

The benchmark model for LICs is generally robust to alternative specifications. Tables 4.6 and 4.7 repeat in column (1) the benchmark derived in column (3) of Tables 4.2 and 4.3 and then explore the robustness of alternative indicators. In particular, columns (2) and (3) allow for the terms of trade (respectively, in goods only or goods and services) to be split into the two components (price of exports and price of imports), and show that the effect is mainly due to the price of exports. This is expected, and is consistent with the robustness results for the current account regressions (Table 3.3): an improvement in the terms of trade from a decline in import prices may generate not only a positive income effect (increasing demand for domestic goods), but also an additional substitution effect away from domestic goods, thus with offsetting effects on the real exchange rate.[8] Results for the other variables are consistent with the previous regressions.

[8]See Christiansen, Kolovich and Tokarick (2008) for a broad theoretical and empirical analysis of the effect of the components of the terms of trade.

Table 4.4. Real Effective Exchange Rate (IMF Information Notice System Definition) Regressions with Different Slopes for Low-Income and High-Income/Emerging Market Countries

(Panel dynamic ordinary least squares with fixed effects; only long-run coefficients reported)

	(1)		(2)		(3)	
Variables	HIC/EM	LIC	HIC/EM	LIC	HIC/EM	LIC
Net foreign assets (w/NPV debt) to trade	0.0276***	0.0074	0.0847***	–0.0165		
	(0.0020)	(0.6476)	(0.0000)	(0.2699)		
Relative productivity (log)[1]	–0.1346**	0.2087***	–0.1235	–0.1157		
	(0.0350)	(0.0028)	(0.1336)	(0.2598)		
Terms of trade, goods (log)	0.1023	0.3811***	0.1745**	0.3325***	0.1564**	0.3938***
	(0.1466)	(0.0000)	(0.0262)	(0.0000)	(0.0331)	(0.0000)
Government consumption to GDP[1]	1.3367***	0.1634	1.5695***	1.2225**	1.7819***	2.0246***
	(0.0015)	(0.7362)	(0.0017)	(0.0489)	(0.0004)	(0.0002)
Trade restrictions[1]	0.3179***	0.0474	0.2767***	0.0833		
	(0.0004)	(0.5393)	(0.0048)	(0.2646)		
Administered prices	–0.1070***					
	(0.0000)					
Administered agricultural prices[1]			–0.2448***	0.0283		
			(0.0011)	(0.5365)		
Maximum agricultural price intervention[1]			–0.1081	0.0789*	–0.0417	0.0591
			(0.1006)	(0.0558)	(0.5501)	(0.1187)
Aid to GDP[1]			3.3650**	–2.4081***	0.7691	–1.6192***
			(0.0373)	(0.0000)	(0.5668)	(0.0000)
Fertility[1]			0.1054**	0.1213***	0.1939***	0.0970***
			(0.0392)	(0.0000)	(0.0000)	(0.0000)
Capital account liberalization[1]			0.0283	0.2823***	0.3209***	0.2999***
			(0.7224)	(0.0046)	(0.0001)	(0.0008)
Observations	1,916		1,361		1,471	
R-squared	0.53		0.72		0.66	

Note: NPV = net present value. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust *p*-values in parentheses. Robust dynamic ordinary least squares panel regressions with fixed effects of the real effective exchange rate (IMF Information Notice System source) on same determinants as Tables 4.2 and 4.3. Independent variables are interacted with dummy variables for low-income countries (LICs) and high-income countries (HICs) and emerging markets (EM). First two columns present standard determinants only. Second two columns encompass determinants in column (2) of Tables 4.2 and 4.3. Last two columns present determinants in column (3) of Tables 4.2 and 4.3. Unbalanced panel with annual data, 1980–2006.

[1]The variable is constructed relative to the weighted average of the trading partners.

Speed of Adjustment

To assess the speed at which the real exchange rate adjusts toward its long-run cointegrating relationship, the analysis imposes the estimated cointegrating relationship in an error-correction specification. The error-correction term is constructed by using the difference of the real exchange rate from the sum of the products of the fundamentals entering the baseline regression in Table 4.2, column (3), multiplied by the corresponding level coefficients. The analysis then runs changes of the real exchange rate on the lag of the error-correction term as well as on lagged

Table 4.5. *F*-Tests of Equality (*p*-values) of Coefficients of Regressions in Table 4.4

Variables	(1)	(2)	(3)
Net foreign assets (w/NPV debt) to trade	0.2710	0.0000	
Relative productivity (log)[1]	0.0003	0.9525	
Terms of trade, goods (log)	0.0020	0.1165	0.0175
Government consumption to GDP[1]	0.0678	0.6628	0.7432
Trade restrictions[1]	0.0221	0.1168	
Administered agricultural prices[1]		0.0019	
Maximum agricultural price intervention[1]		0.0161	0.2043
Aid to GDP[1]		0.0006	0.0818
Fertility[1]		0.7801	0.0308
Capital account liberalization[1]		0.0465	0.8620

Note: *p*-values for the null hypotheses: coefficient HIC = coefficient LIC. NPV = net present value.

[1]The variable is constructed relative to the weighted average of the trading partners.

Table 4.6. Real Effective Exchange Rate (IMF Information Notice System Definition) Regressions, Robustness

(Panel dynamic ordinary least squares with fixed effects; only long-run coefficients reported)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Terms of trade, goods (log)	0.3931***			0.2578***	0.4281***	0.3766***	0.3930***	0.3871***
	(0.0000)			(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Government consumption to GDP[1]	2.0271***	1.8930***	1.6995**	1.2982*	2.6090***	1.7860***	2.3317***	2.0402***
	(0.0002)	(0.0003)	(0.0167)	(0.0871)	(0.0000)	(0.0009)	(0.0000)	(0.0004)
Aid flows to GDP[1]	−1.6187***	−1.4091***	−1.5832***	−4.6194***	−1.8067***	−1.4648***	−1.9358***	−1.6471***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Capital account liberalization[1]	0.2978***	0.2890***	0.2594**		0.3374***	0.2611***	0.2511***	0.2816***
	(0.0011)	(0.0011)	(0.0103)		(0.0001)	(0.0022)	(0.0057)	(0.0025)
Maximum agricultural price intervention[1]	0.0596	0.0657	0.1616***	0.0886**	0.0501	−0.0295	0.0058	0.0528
	(0.1660)	(0.1223)	(0.0002)	(0.0238)	(0.2247)	(0.4794)	(0.8933)	(0.2153)
Fertility[1]	0.0979***	0.0821***	0.1100***	0.1490***			0.1156***	0.1013***
	(0.0000)	(0.0005)	(0.0003)	(0.0000)			(0.0000)	(0.0000)
Price of exports, goods		0.3698***						
		(0.0000)						
Price of imports, goods		−0.3754***						
		(0.0000)						
Price of exports, goods and services			0.1554*					
			(0.0921)					
Price of imports, goods and services			−0.0751					
			(0.3470)					
Capital account liberalization (other)[1]				0.0668				
				(0.3459)				
Infant mortality rate (UN)[1]					0.0052***			
					(0.0001)			
Old-age dependency[1]						5.2828***		
						(0.0000)		
GDP per worker, PWT (log)							−0.2360**	
							(0.0255)	
Relative productivity (log)[1]								−0.0363
								(0.6816)
Observations	609	609	609	561	609	609	555	609
R-squared	0.65	0.66	0.61	0.64	0.64	0.68	0.68	0.66

Note: PWT = Penn World Table. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust p-values in parentheses. Robust dynamic ordinary least squares panel regressions with fixed effects of the real effective exchange rate (IMF Information Notice System source) on same determinants as in the benchmark derived in column (3) of Table 4.2. Additional controls encompass splitting terms of trade in price of exports and of imports (either of goods only or of goods and services), and alternative measures of capital account liberalization, of demographics, and of productivity. Unbalanced panel with annual data, 1980–2006.

[1]The variable is constructed relative to the weighted average of the trading partners.

changes of the real exchange rate and of the other right-hand-side variables entering the baseline. In the four specifications derived by progressively entering from one up to four lags, the robust OLS coefficient of the lagged error-correction term hovered around 0.2, suggesting that a shock to the gap would have a half-life of about three years. The analysis replicated the exercise with the alternative measure of the real exchange rate (using Table 4.3, column 3) and obtained a somewhat higher speed of adjustment, on the order of 0.3, indicative of a half-life of about two years. These results are consistent with the previous literature (Rogoff, 1996).

Table 4.7. Real Effective Exchange Rate (Penn World Table) Regressions, Robustness

(Panel dynamic ordinary least squares with fixed effects; only long-run coefficients reported)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Terms of trade, goods (log)	0.1970***			0.1098	0.3453***	0.2593***	0.1892***	0.2023***
	(0.0077)			(0.1327)	(0.0000)	(0.0000)	(0.0092)	(0.0045)
Government consumption to GDP[1]	3.3371***	3.0899***	2.8125***	2.1511**	4.0085***	2.8295***	3.4689***	4.0020***
	(0.0000)	(0.0000)	(0.0002)	(0.0230)	(0.0000)	(0.0001)	(0.0000)	(0.0000)
Aid flows to GDP[1]	−2.0504***	−1.5720***	−1.5319***	−3.9983***	−2.4248***	−1.6520***	−2.1860***	−2.6034***
	(0.0000)	(0.0002)	(0.0006)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)
Capital account liberalization[1]	0.1984**	0.1995**	0.2124**		0.3337***	0.1672**	0.1747*	0.1140
	(0.0233)	(0.0166)	(0.0167)		(0.0002)	(0.0314)	(0.0575)	(0.1836)
Maximum agricultural price intervention[1]	0.1842***	0.2037***	0.1958***	0.2401***	0.1764***	0.0412	0.1770***	0.1095**
	(0.0002)	(0.0000)	(0.0000)	(0.0000)	(0.0009)	(0.3679)	(0.0003)	(0.0290)
Fertility[1]	0.1247***	0.1311***	0.1553***	0.1485***			0.1364***	0.1354***
	(0.0001)	(0.0000)	(0.0000)	(0.0000)			(0.0002)	(0.0001)
Price of exports, goods		0.2490***						
		(0.0012)						
Price of imports, goods		−0.0875						
		(0.3106)						
Price of exports, goods and services			0.2331***					
			(0.0060)					
Price of imports, goods and services			−0.0715					
			(0.3759)					
Capital account liberalization (other)				0.1540*				
				(0.0883)				
Infant mortality rate (UN)[1]					0.0046***			
					(0.0077)			
Old-age dependency[1]						6.3982***		
						(0.0000)		
Relative productivity (log)[1]							−0.0889	
							(0.4985)	
GDP per worker, PWT (log)								−0.3678***
								(0.0029)
Observations	622	622	622	571	622	622	622	587
R-squared	0.69	0.70	0.70	0.74	0.63	0.70	0.69	0.70

Note: PWT = Penn World Table. *** $p<0.01$; ** $p<0.05$; * $p<0.1$. Robust p-values in parentheses. Robust dynamic ordinary least squares panel regressions with fixed effects of the real effective exchange rate (Penn World Table source) on same determinants as in the benchmark derived in column (3) of Table 4.3. Additional controls encompass splitting terms of trade in price of exports and of imports (either of goods only or of goods and services), and alternative measures of capital account liberalization, of demographics, and of productivity. Unbalanced panel with annual data 1980–2006.

[1]The variable is constructed relative to the weighted average of the trading partners.

5 Empirical Analysis of the Net Foreign Assets Position[1]

This chapter empirically investigates the net foreign assets position of low-income countries. The estimation relies on an unbalanced panel of annual data covering 1980–2006. As with the real exchange rate, panel unit root tests confirm the unit root nature of the variables involved in the estimation (see Table 4.1 in Chapter 4); and panel cointegration tests performed for the benchmark regressions (Table 5.1, column 1) reject the null hypothesis of no cointegration (see discussion of these tests in Chapter 4). Similar to the real exchange rate regressions, the panel cointegration estimation is based on dynamic ordinary least squares with fixed effects. In addition to determinants identified in the literature (public debt, demographics, and income per capita), the analysis considers the role of policy distortions (capital account and domestic financial liberalization) and of the quality of institutions.[2]

Benchmark Net Foreign Asset Regressions for Low-Income Countries

Table 5.1 reports the preferred regression of the net-foreign-assets-to-trade ratio in column (1).[3] Results are broadly consistent with those obtained in the analysis of the current account. Starting with the less-common indicators, note first that domestic financial liberalization is associated with higher net foreign assets, again an indication (as discussed in Chapters 3 and 4) that domestic financial reforms have a significantly larger positive effect on aggregate saving than on aggregate investment. Second, the relationship with capital account liberalization is negative in LICs (Table 5.1) and positive in high-income countries (Table 5.2), a result that is consistent with the current account regressions and with standard neoclassical theory, according to which developing countries should experience capital inflows when opening up to foreign capital. Third, countries with better institutional characteristics also have higher net foreign assets, which may be explained by the argument that better institutions may facilitate the saving process, resulting in higher net foreign assets.[4]

Regarding the standard variables, the analysis confirms a strong link between net foreign assets and public debt, demographic factors, and income. In the long run, half of the increase in public debt is reflected in a reduction of net foreign assets. The effect is close to the one estimated by Lane and Milesi-Ferretti (2002b) for developing countries ranging in the 0.5–0.8 interval. The effect of public debt on net foreign assets is somewhat larger than the effect of fiscal balance on the current account presented in Chapter 3.[5] A higher share of dependent population is associated with lower saving and net foreign assets, a result that is also consistent

[1]An earlier version of this chapter was published in the *International Seminar on Macroeconomics,* Vol. 6, No. 1, published by the University of Chicago Press. © 2009 by the National Bureau of Economic Research. All rights reserved.

[2]See Chapters 1 and 2 for a discussion of the literature and of the data set. The data set is presented in detail in the Appendix.

[3]The ratio of net foreign assets to trade is preferred to the ratio to GDP because GDP is more sensitive to fluctuations in the exchange rate, which is known to be correlated with the right-hand-side variables from the analysis presented in the previous section. The public debt data are from Jaimovich and Panizza (2006); because the availability of public debt data for LICs is limited, the variable is spliced with external debt (mostly public in LICs) for a few countries. Time dummies might be appropriate to absorb common movements in the net foreign assets position of LICs arising from, for example, exchange rate fluctuations that may cause valuation effects; results are virtually identical if these dummies are excluded. The net foreign assets regressions drop Nicaragua from the sample because of extreme values of both debt and net foreign assets, which would increase the coefficient of debt substantially (doubling it to almost 1).

[4]An alternative explanation is related to the high correlation of these indicators with the level of development, which may affect saving as discussed above and may be only imperfectly captured by income per capita.

[5]This result could be due to deficits being partly monetized in LICs over the sample: deficits financed by money creation would be less likely to result in external debt, while deficits financed by public debt would be more likely to result in external debt. Hence, the lower effect of the fiscal balance on the current account may simply reflect the average of two effects, while the effect of debt on net foreign assets would capture only one of them.

Table 5.1. Net Foreign Assets Regressions

(Panel dynamic ordinary least squares with fixed effects; only long-run coefficients reported)

Variables	(1) NFA to Trade	(2) NFA to GDP	(3) NFA (w/NPV) to Trade	(4) NFA to Trade	(5) NFA to Trade	(6) NFA to Trade	(7) NFA to Trade	(8) NFA to Trade	(9) NFA to Trade	(10) NFA to Trade
Public debt to trade	−0.4566***			−0.4240***	−0.4369***	−0.4084***	−0.4764***	−0.4840***	−0.4686***	−0.4610***
	(0.0000)			(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Fertility[1]	−0.3135***	−0.0531**	−0.0761		−0.2997***	−0.5563***	−0.1375	−0.3612***	−0.4913***	−0.2896**
	(0.0028)	(0.0260)	(0.1597)		(0.0035)	(0.0000)	(0.1316)	(0.0026)	(0.0001)	(0.0119)
Relative productivity (log)[1]	1.5867***	0.2829***	0.5295***	1.6864***	1.8451***			1.1766**	1.7841***	1.3836***
	(0.0016)	(0.0019)	(0.0050)	(0.0026)	(0.0003)			(0.0316)	(0.0008)	(0.0039)
Constraint on executive	0.2280***	0.0293**	0.0086	0.2520***	0.2221***	0.1847***	0.1944***	0.2324***	0.2504***	0.2505***
	(0.0000)	(0.0109)	(0.7005)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Domestic financial liberalization[1]	2.0003***	0.2081**	0.2147	2.0634***	1.6171***	1.3346***	1.6155***	1.2107**	1.8758***	2.2360***
	(0.0001)	(0.0458)	(0.4030)	(0.0000)	(0.0001)	(0.0009)	(0.0009)	(0.0223)	(0.0006)	(0.0001)
Capital account liberalization[1]	−1.4137***	−0.1060	−0.4333**	−1.3293***		−0.7920**	−1.6001***	−1.5802***	−1.4892***	−1.1084**
	(0.0011)	(0.1886)	(0.0436)	(0.0030)		(0.0498)	(0.0003)	(0.0004)	(0.0042)	(0.0191)
Public debt to GDP		−0.5423***								
		(0.0000)								
NPV of external debt to trade			−0.8922***							
			(0.0000)							
Old-age dependency[1]				−16.3720**						
				(0.0192)						
Capital account liberalization (other)[1]					−0.4263*					
					(0.0948)					
Income per capita (relative to United States)						28.0763***				
						(0.0000)				
GDP per worker, PWT (log)							0.8484**			
							(0.0498)			
Terms of trade, goods and services (log)								0.3861		
								(0.1988)		
Trade restrictions[1]									0.5061	
									(0.1425)	
Administered agricultural prices[1]										0.4681
										(0.1833)
Maximum agricultural price intervention[1]										0.4551**
										(0.0127)
Observations	610	590	612	610	653	599	610	539	554	566
R-squared	0.81	0.84	0.96	0.82	0.83	0.82	0.81	0.82	0.82	0.81

Note: NFA = net foreign assets; NPV = net present value; PWT = Penn World Table. *** $p<0.01$; ** $p<0.05$; * $p<0.1$. Robust p-values in parentheses. Robust dynamic ordinary least squares panel regressions with fixed effects of the net foreign assets to trade ratio (or NFA to GDP in column (2), or NFA adjusted for the NPV of external debt in column (3)) on public-debt-to-trade ratio, fertility, log of relative productivity, quality of institutions (constraint on executive), financial liberalization, and capital account liberalization. Additional controls encompass alternative measures of debt, demographics, capital account liberalization, relative income or productivity, terms of trade, trade restrictions, and agricultural price reforms. Unbalanced panel with annual data, 1980–2006.

[1]The variable is constructed relative to the weighted average of the trading partners.

with theoretical intuition and past evidence. The positive association of income per capita with net foreign assets in LICs is in line with the standard development model in which poor countries borrow (note, however, that Lane and Milesi-Ferretti, 2002b, find the opposite result).

Robustness

Robustness exercises are presented in columns (4)–(10) of Table 5.1. The results are robust to using alternative measures of net foreign assets with matching alternative debt indicators (net foreign assets and public debt to GDP in column 2, or net foreign assets and external debt, both adjusted for the net present value of external debt in column 3), as well as alternative measures of demographics, capital account liberalization, and relative income or productivity (columns 4–7). Terms-of-trade shocks or other policy distortions, such as trade restrictions and price controls in the agricultural sector, do not seem to matter after controlling for other determinants (columns 8–10).

Are Low-Income Countries Different?

Table 5.2 presents the benchmark net foreign assets regression (Table 5.1, column 1) for high- and low-income countries in columns (1) and (2), as well as the test of equality of coefficients in column (3). The high-income group appears quite different for about half of the indicators and not too different for the other half. As mentioned, the most interesting result is the opposite coefficient for capital account liberalization, consistent with the fact that rich countries lend and poor borrow. Debt appears insignificant for the high-income sample, which is in line with the range of zero to 0.2 found by Lane and Milesi-Ferretti (2002b) for this group of countries. A possible interpretation is that public debt is less likely to be foreign financed in higher-income countries than in LICs, possibly resulting from much deeper financial markets in more developed countries (which may allow these countries to get closer to Ricardian equivalence). The role of demographics, domestic financial liberalization, and institutions seems to follow the same economic pattern for both sets of countries, although the size of the effect may be somewhat different.

Table 5.2. Net Foreign Assets Regressions: Comparing Low-Income with High-Income/Emerging Market Countries

(Panel dynamic ordinary least squares with fixed effects; only long-run coefficients reported)

	(1)	(2)	(3)
	Net Foreign Assets to Trade		Test of Equality of Coefficients
Variables	LICs	HICs/EMs	(*p*-values)
Public debt to trade	−0.4566***	−0.0059	0.000
	(0.0000)	(0.9141)	
Fertility[1]	−0.3135***	−0.2623**	0.731
	(0.0026)	(0.0136)	
Relative productivity (log)[1]	1.5867***	0.3129	0.030
	(0.0015)	(0.3092)	
Constraint on executive	0.2280***	0.1221***	0.074
	(0.0000)	(0.0007)	
Domestic financial liberalization[1]	2.0003***	0.8670***	0.059
	(0.0001)	(0.0088)	
Capital account liberalization[1]	−1.4137***	1.2703***	0.000
	(0.0010)	(0.0000)	
Observations	1,414		
R-squared	0.87		

Note: *** $p<0.01$; ** $p<0.05$; * $p<0.1$. Robust *p*-values in parentheses. Robust dynamic ordinary least squares panel regressions with fixed effects of the net-foreign-assets-to-trade ratio on same fundamentals as in the benchmark (column (1)) of Table 5.1, interacted with dummy variables for the sample of low-income countries (LICs) and a dummy variable for richer countries, including high-income countries and emerging markets (HICs and EMs). Unbalanced panel with annual data, 1980–2006.

[1]The variable is constructed relative to the weighted average of the trading partners.

Speed of Adjustment

As in the real exchange rate analysis, an error-correction specification is implemented to gauge the speed of adjustment of the net foreign assets position. An error-correction term was derived using the difference of the net foreign assets from the sum of the products of the fundamentals entering the baseline regression in Table 5.1, column (1), multiplied by the corresponding-level coefficients. Error-correction regressions equivalent to the specification discussed above deliver robust ordinary least squares coefficients of the lagged error-correction term of about 0.25, suggesting that shocks to the gap between the net foreign assets position and its long-run relationship have a half-life of about two and a half years.

6 Import and Export Elasticities

This chapter sets out the details of a methodology that can be used to calculate export supply and import demand elasticities without using econometrics. There is a long tradition in estimating trade elasticities (see Stern, Francis, and Schumacher, 1976; and Khan and Goldstein, 1985, for surveys) and the magnitude of the estimates varies widely (in some instances the signs of the estimates are contrary to theory). Most estimates in the literature are based on empirical work done on advanced economies. Many fewer studies focus on developing countries given the generally poor quality of data on trade volumes and prices in these countries, as well as the sometimes volatile behavior of economic variables.

The methodology presented below uses a well-accepted model of international trade, together with a comprehensive data set. The advantages of this methodology are (1) elasticities can be calculated with readily available data (i.e., input-output data); (2) elasticities can be calculated without using econometrics; and (3) it is possible to calculate elasticity values for developing countries—including countries for which there were no prior estimates available.

Export supply and import demand elasticities can be calculated by using results from production theory. For example, it is well known that the derivative of an economy's GDP function with respect to an output price gives the general equilibrium supply function, using Hotelling's lemma (see Kohli, 1991, for an explanation). The demand function for inputs can be obtained in a similar fashion and this approach has been used by Kee, Nicita, and Olarreaga (2008), among others, to estimate import demand elasticities. More generally, there is a large literature in international trade that uses the GDP function approach to estimate elasticities (Kohli, 1991). In this approach, the demand for imports arises from the demand for imported intermediate inputs. Even if one assumes that there is a demand for imports for consumption, this approach is still valid if one assumes that imports for consumption arise in the production sector, considering that they have to be combined with wholesaling and retail services before they are consumed. In this sense, even imports for consumption can be thought of as an intermediate input.

The Model

Assumptions

The methodology uses a standard general equilibrium model from international trade theory, as described in Jones (1965), Dixit and Norman (1980), and Woodland (1982). The model assumes that an economy produces three goods: (1) a good that is exported, denoted by (E); (2) a good that competes with imports, denoted by (M); and (3) a nontraded good (N). It is assumed that there is no local demand for the exportable good. Each of these three goods is produced using labor (L) that is mobile across sectors, a factor (K) specific to each sector, and imported intermediate inputs (I). Because labor is assumed to be mobile across sectors, it must earn the same wage regardless of where it is employed. The return to the specific factor in each sector will, of course, differ. The price of imported intermediates is assumed to be exogenous. The output prices of all three goods are treated as parameters.

It is assumed that the output of each good is produced under constant returns to scale and zero profits. Therefore, the following conditions must hold:

$$wa_{LE} + r_E a_{KE} + p_I a_{IE} = p_E \quad (6.1)$$

$$wa_{LM} + r_M a_{KM} + p_I a_{IM} = p_M \quad (6.2)$$

$$wa_{LN} + r_N a_{KN} + p_I a_{IN} = p_N, \quad (6.3)$$

where p_E is the domestic price of exports, p_M is the domestic price of imports (inclusive of any tariff), p_N is the price of the nontraded good, a_{ij} is the amount of factor i (i = labor, capital, and imported inputs) used per unit of good j, w is the wage rate, r_j is the

return to capital in sector j, and p_I is the exogenously given price of imported intermediate inputs.

The primary factors of production—labor and capital—are assumed to be fully employed:

$$a_{KE}X_E = K_E \tag{6.4}$$

$$a_{KM}X_M = K_M \tag{6.5}$$

$$a_{KN}X_N = K_N \tag{6.6}$$

$$a_{LE}X_E + a_{LM}X_M + a_{LN}X_N = L, \tag{6.7}$$

where K_j is the amount of capital used in sector j, L is the endowment of labor in the economy, and X_j is the output of good j.

Equations 6.1–6.3 reflect the assumption that the price of each good must equal per-unit cost. That is, per-unit labor costs, plus per-unit capital costs, plus the per-unit cost of imported inputs must equal the output price of each good. This zero-profit condition implicitly assumes perfect competition (see Tokarick, 2010, for a discussion of how imperfect competition could be introduced). Equations 6.4–6.6 represent the assumption that capital is sector specific, reflecting a short- to medium-run focus. Equation 6.7 requires that the labor market clear: the amount of labor used in each sector, summed across all sectors, must equal the economy-wide endowment.

Model Solution

Totally differentiating equations 6.1 through 6.7 and putting them in proportional change form gives

$$\hat{w}\theta_{LE} + \hat{r}_E\theta_{KE} + \hat{p}_I\theta_{IE} = \hat{p}_E \tag{6.8}$$

$$\hat{w}\theta_{LM} + \hat{r}_M\theta_{KM} + \hat{p}_I\theta_{IM} = \hat{p}_M \tag{6.9}$$

$$\hat{w}\theta_{LN} + \hat{r}_N\theta_{KN} + \hat{p}_I\theta_{IN} = \hat{p}_N \tag{6.10}$$

$$\lambda_{KE}\hat{X}_E = \hat{K}_E - \lambda_{KE}\hat{a}_{KE} \tag{6.11}$$

$$\lambda_{KM}\hat{X}_M = \hat{K}_M - \lambda_{KM}\hat{a}_{KM} \tag{6.12}$$

$$\lambda_{KN}\hat{X}_N = \hat{K}_N - \lambda_{KN}\hat{a}_{KN} \tag{6.13}$$

$$\lambda_{LE}\hat{X}_E + \lambda_{LM}\hat{X}_M + \lambda_{LN}\hat{X}_N = \hat{L} - \hat{a}_{LE}\lambda_{LE} - \hat{a}_{LM}\lambda_{LM} - \hat{a}_{LN}\lambda_{LN}. \tag{6.14}$$

In the above equations, θ_{ij} is the share of good j's cost accounted for by factor i, λ_{ij} is the proportion of the supply of factor i used in sector j, and a "^" denotes proportional change, for example, $\hat{p} = \frac{dp}{p}$. As a result of the assumed structure, the following relationships must hold:

1. $\sum_i \theta_{ij} = 1$, for each sector j (6.15)

2. $\sum_j \lambda_{ij} = 1$, for each factor i. (6.16)

Each a_{ij}, the factor demands per unit of output, depends on the input prices:

$a_{ij} = a_{ij}(w, r_j, p_I)$.

Each $\hat{a}_{ij}$ can also be related to the elasticity of substitution between labor, capital, and imported inputs in each sector j. Assuming that the elasticity of substitution among all three factors is the same, the following relationships hold for each sector j, using the definition of the elasticity of substitution, σ_j:

$$\sigma_j = \frac{\hat{a}_{Kj} - \hat{a}_{Lj}}{\hat{w} - \hat{r}_j}, \text{ or } \sigma_j(\hat{w} - \hat{r}_j) = \hat{a}_{Kj} - \hat{a}_{Lj} \tag{6.17}$$

$$\sigma_j = \frac{\hat{a}_{Kj} - \hat{a}_{Ij}}{\hat{p}_I - \hat{r}_{Kj}}, \text{ or } \sigma_j(\hat{p}_I - \hat{r}_{Kj}) = \hat{a}_{Kj} - \hat{a}_{Ij} \tag{6.18}$$

$$\sigma_j = \frac{\hat{a}_{Lj} - \hat{a}_{Ij}}{\hat{p}_I - \hat{w}}, \text{ or } \sigma_j(\hat{p}_I - \hat{w}) = \hat{a}_{Lj} - \hat{a}_{Ij}. \tag{6.19}$$

Cost minimization requires that:

$$\theta_{LE}\hat{a}_{LE} + \theta_{KE}\hat{a}_{KE} + \theta_{IE}\hat{a}_{IE} = 0 \tag{6.20}$$

$$\theta_{LM}\hat{a}_{LM} + \theta_{KM}\hat{a}_{KM} + \theta_{IM}\hat{a}_{IM} = 0 \tag{6.21}$$

$$\theta_{LN}\hat{a}_{LN} + \theta_{KN}\hat{a}_{KN} + \theta_{IN}\hat{a}_{IN} = 0. \tag{6.22}$$

Equations 6.17–6.22 can be used to solve for each $\hat{a}_{ij}$, as a function of the factor prices; the elasticity of substitution between labor, capital, and imported inputs in each sector; and the relevant cost shares (Jones, 1965). Using the above relationships, the solutions for each $\hat{a}_{ij}$ are

$$\hat{a}_{LE} = -\sigma_E(\hat{w} - \hat{r}_E)\theta_{KE} - \theta_{IE}\sigma_E(\hat{w} - \hat{p}_I) \tag{6.23}$$

$$\hat{a}_{KE} = \sigma_E(\hat{w} - \hat{r}_E)\theta_{LE} + \theta_{IE}\sigma_E(\hat{p}_I - \hat{r}_E) \tag{6.24}$$

$$\hat{a}_{IE} = \sigma_E(\hat{w} - \hat{p}_I)\theta_{LE} + \theta_{KE}\sigma_E(\hat{r}_E - \hat{p}_I) \tag{6.25}$$

$$\hat{a}_{LM} = -\sigma_M(\hat{w} - \hat{r}_M)\theta_{KM} - \theta_{IM}\sigma_M(\hat{w} - \hat{p}_I) \tag{6.26}$$

$$\hat{a}_{KM} = \sigma_M(\hat{w} - \hat{r}_M)\theta_{LM} + \theta_{IM}\sigma_M(\hat{p}_I - \hat{r}_M) \tag{6.27}$$

$$\hat{a}_{IM} = \sigma_M(\hat{w} - \hat{p}_I)\theta_{LM} + \theta_{KM}\sigma_M(\hat{r}_M - \hat{p}_I) \tag{6.28}$$

$$\hat{a}_{LN} = -\sigma_N(\hat{w} - \hat{r}_N)\theta_{KN} - \theta_{IN}\,\sigma_N(\hat{w} - \hat{p}_I) \qquad (6.29)$$

$$\hat{a}_{KN} = \sigma_N(\hat{w} - \hat{r}_N)\theta_{LN} + \theta_{IN}\,\sigma_N(\hat{p}_I - \hat{r}_N) \qquad (6.30)$$

$$\hat{a}_{IN} = \sigma_N(\hat{w} - \hat{p}_I)\theta_{LN} + \theta_{KN}\,\sigma_N(\hat{r}_N - \hat{p}_I). \qquad (6.31)$$

Equations 6.23–6.31 show how each factor demand (per unit of output) responds to changes in input prices.

Substituting equations 6.23–6.31 into equations 6.8–6.14, it is possible to solve for all the endogenous variables ($\hat{w}$, $\hat{r}_E$, $\hat{r}_M$, $\hat{r}_N$, $\hat{X}_E$, $\hat{X}_M$, $\hat{X}_N$) as a function of the exogenous variables ($\hat{L}$, $\hat{K}_E$, $\hat{K}_M$, $\hat{K}_N$, $\hat{p}_E$, $\hat{p}_M$, $\hat{p}_N$ $\hat{p}_I$).

Because the objective is to determine values for the export supply elasticity and the import demand elasticity, two relationships are of interest:

1. Export supply elasticity = $\dfrac{\hat{X}_E}{\hat{P}_E}$, which can be obtained from the equation for the output of the exportable good: $\hat{X}_E = F(\hat{L}, \hat{K}_E, \hat{K}_M, \hat{K}_N, \hat{p}_E, \hat{p}_M, \hat{p}_I)$. The coefficient of the term $\hat{p}_E$ gives the export supply elasticity:

$$\frac{\hat{X}_E}{\hat{p}_E} = \frac{\lambda_{LE}\sigma_E\theta_{KM}\theta_{KN}\theta_{IE}\sigma_E}{\lambda_{LE}\sigma_E\theta_{KM}\theta_{KN}(1-\theta_{IE})} + \frac{\lambda_{LM}\sigma_M\theta_{KN}(1-\theta_{IM})\sigma_E(1-\theta_{KE})}{+\lambda_{LM}\sigma_M\theta_{KE}\theta_{KN}(1-\theta_{IM})} + \frac{\lambda_{LN}\sigma_N\theta_{KM}(1-\theta_{IN})\sigma_E(1-\theta_{KE})}{+\lambda_{LN}\sigma_N\theta_{KE}\theta_{KM}(1-\theta_{IN})}. \qquad (6.32)$$

2. Import demand arises from the demand for imported intermediate inputs. Total demand for imported inputs in the economy (M_I) is

$M_I = \sum_{Ij}$, where $M_{Ij} = a_{Ij}X_j$.

Therefore,

$\hat{M}_I = \lambda_{IE}\hat{M}_{IE} + \lambda_{IM}\hat{M}_{IM} + \lambda_{IN}\hat{M}_{IN}$, and $\hat{M}_{Ij} = \hat{a}_{Ij} + \hat{X}_j$.

Using the solutions for $\hat{a}_{Ij}$ and $\hat{X}_j$, it is possible to solve for $\hat{M}_I$ as a function of $\hat{p}_I$. Therefore, the import demand elasticity = $\dfrac{\hat{M}_I}{\hat{p}_I}$, which equals

$$\frac{\hat{M}_I}{\hat{p}_I} = \frac{1}{\lambda_{LE}\sigma_E\theta_{KM}\theta_{KN}(1-\theta_{IE}) + \lambda_{LM}\sigma_M\theta_{KE}\theta_{KN}(1-\theta_{IM}) + \lambda_{LN}\sigma_N\theta_{KE}\theta_{KM}(1-\theta_{IN})} \qquad (6.33)$$

$$\begin{bmatrix} -\lambda_{IE}[\sigma_E\lambda_{LE}\sigma_E\theta_{KM}\theta_{KN} + \sigma_E\lambda_{LM}\sigma_M\theta_{KN}(1-\theta_{IM}-\theta_{LE}) + \sigma_E\lambda_{LN}\sigma_N\theta_{KM}(1-\theta_{IN}-\theta_{LE})] \\ -\lambda_{IM}[\sigma_M\lambda_{LE}\sigma_E\theta_{KN}(1-\theta_{IE}-\theta_{LM}) + \sigma_M\lambda_{LM}\sigma_M\theta_{KE}\theta_{KN} + \sigma_M\lambda_{LN}\sigma_N\theta_{KE}(1-\theta_{IN}-\theta_{LM})] \\ -\lambda_{IN}[\sigma_N\lambda_{LE}\sigma_E\theta_{KM}(1-\theta_{IE}-\theta_{LN}) + \sigma_N\lambda_{LM}\sigma_M\theta_{KE}(1-\theta_{IM}-\theta_{LN}) + \sigma_N\lambda_{LN}\sigma_N\theta_{KE}\theta_{KM}] \end{bmatrix}$$

Effects of Changes in Parameters on Elasticity Values

This discussion reviews how the calculated elasticities are affected by the underlying parameters: (1) the elasticity of substitution between factors (σ_j), (2) the cost share of factor i in the production of good j (θ_{ij}), and (3) the proportion of the total supply of factor i used in the production of good j (λ_{ij}).

- Changes in the elasticities of substitution between factors (σ_j): Increases in σ_j will increase the magnitude of both the export supply and import demand elasticities, regardless of the sector. The reason is that a higher value for σ_j makes it easier to alter factor proportions, that is, factor usage, in each sector. Therefore, regarding export supply, a higher σ_j will make it easier to increase output and will thus increase the export supply elasticity. Regarding the demand for imported intermediate inputs, a higher value for σ_j will make it easier for firms to substitute between labor and imported intermediates. Firms can alter factor usage more easily; therefore, the import demand elasticity will be larger.

- Changes in the factor cost shares, (θ_{ij}): Under model assumptions, capital is assumed to be fixed by sector, while labor can move freely across sectors. Similarly, firms can freely alter the amounts of imported intermediate inputs they use. Therefore, larger values for (θ_{Lj}) and (θ_{Ij}), and thus smaller values for (θ_{Kj}), will increase the magnitude of the export supply elasticity. The larger (θ_{Kj}) is, the more difficult it will be for firms to increase output in response to a price change because capital stocks are fixed by sector.
- Changes in the distributive shares, (λ_{ij}): The effect of changes in the distributive shares can either raise or lower the magnitudes of the elasticities.

Calculation of Elasticities

Equations 6.32 and 6.33 give the elasticities of interest and can be calculated for values of σ_j, θ_{ij}, and λ_{ij}. This discussion explains how values for these parameters can be obtained.

Data on θ_{ij}, and λ_{ij} for 87 countries and regions are available from the Global Trade Analysis Project (GTAP) database for 1997 and 2001. Data are available for 2004 for 113 countries and regions. The GTAP database contains information on value added by sector, as well as its components (primary inputs), given that it is based on country input-output tables. The GTAP database is described in Dimaranan (2006). The countries and regions in the database include a mix of developed and developing economies—24 and 63, respectively—in both the 1997 and 2001 vintages:

Developed economies: Australia, New Zealand, China, Hong Kong SAR, Japan, Republic of Korea, Canada, United States, United Kingdom, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and Switzerland.

Developing economies: Rest of countries in Oceania, Taiwan Province of China, rest of East Asia, Indonesia, Malaysia, the Philippines, Singapore, Thailand, Vietnam, rest of Southeast Asia, Bangladesh, India, Sri Lanka, rest of South Asia, Mexico, rest of North America, Columbia, Peru, Venezuela, Andean Pact countries, Argentina, Brazil, Chile, Uruguay, rest of South America, Central America, countries of the Caribbean, countries of the Free Trade Area of the Americas, rest of European Free Trade Association, rest of Europe, Albania, Bulgaria, Croatia, Cyprus, Czech Republic, Hungary, Malta, Poland, Romania, Slovak Republic, Slovenia, Estonia, Latvia, Lithuania, the Russian Federation, rest of former Soviet Union, Turkey, rest of the Middle East, Morocco, Tunisia, rest of North Africa, Botswana, South Africa, rest of Southern African Customs Union, Malawi, Mozambique, Tanzania, Zambia, Zimbabwe, Madagascar, Uganda, rest of Southern African Development Community, and the rest of sub-Saharan Africa.

To apply the methodology described above, the following strategy was adopted:

- The GTAP database contains data on labor, capital, and imported inputs for 57 sectors. Starting from the full database, the 57 sectors in each economy were aggregated into three sectors per economy (exportable, importable, and nontradable) using sectoral data on trade flows. If exports or imports from a sector were 10 percent of value added or less, the sector was classified as nontradable. A sector was considered exportable if exports exceeded imports and exports exceeded 10 percent of value added. A sector was importable otherwise.
- The GTAP database contains a value for the elasticity of substitution among factors used in the 57 sectors for each economy. The values are taken from various econometric studies. The GTAP assumes that these elasticities are the same for all 87 economies. The elasticities are aggregated from the 57 sectors into the 3, using data on value-added shares in each sector. Both short- and long-run elasticities of substitution are available.
- Once the sectors were classified into three categories, λ_{ij} (distributive shares) and θ_{ij} (factor shares) were calculated for each economy. Then, using the elasticities of substitution, equations 6.32 and 6.33 were used to calculate the elasticities.

Import demand and export supply elasticities were calculated using the procedure described above. There are several types of elasticities:

- Both a short- and a long-run import demand and export supply elasticity were calculated. The short-run elasticities correspond to a set of short-run elasticities of substitution among inputs (σ_{j_SR}), while the long-run elasticities correspond to a set of long-run elasticities of substitution (σ_{j_LR}). In general, the long-run σ_{j_LR} are higher in magnitude, compared with the short-run σ_{j_SR}.
- Import demand and export supply elasticities are calculated for two sets of assumptions: (1) elasticities are computed with respect to their own price (the standard definition of elasticities, holding everything else constant); and (2) elasticities are computed including general equilibrium effects, where they take into account

changes in both the own price and the price of other traded goods. For example, the own export supply elasticity measures how export supply changes as the price of exports changes, holding all other prices constant. A devaluation, for instance, increases the prices of imported intermediate inputs, which will reduce the export supply response to the extent that exports use imported inputs. The mathematical formulas for the general equilibrium elasticities are presented in Tokarick (2010).

Elasticity values are reported in Tables 6.1 and 6.2. Table 6.1 reports estimated import demand elasticities from various studies, as well as from the method described above. Kee, Nicita, and Olarreaga (2008) estimated import demand elasticities using a GDP function approach similar to the one used in this chapter. Senhadji (1997) estimated import demand elasticities using what might be termed the traditional approach: regressing imports on relative prices and real income. GTAP 2001 refers to the data from version 6 of the GTAP database (data for 2001), while GTAP 2004 refers to data from version 7 of the GTAP database (data for 2004). For each of these two data sets, a set of short-run (SR) and long-run (LR) elasticities are reported. The short run is defined to be about six months to a year at the most, while long run refers to three years or more. In addition, a set of both short-run and long-run elasticities are reported that take into account general equilibrium effects. The columns on the far right of the table show the average elasticities calculated for 2001 and 2004.

Table 6.2 reports export supply elasticities estimated in the literature, as well as export supply elasticities estimated using the method described in this chapter. The format of this table follows the format of Table 6.1.

Regarding the general equilibrium elasticities, it is possible that the import demand elasticity could be positive, while the export supply elasticity could be negative. Consider the import demand elasticities. If only the price of imported inputs changes, the quantity demanded must fall, leading to a negative elasticity. When the price of exports is also allowed to change, the net quantity demanded of imported inputs could actually increase. This could occur because a devaluation raises the domestic price of exports and leads to an increase in export volume. Because the export sector uses imported inputs, this will lead to an increase in demand for imported inputs. The net impact on import volume depends on the impact of the rise in the price of imports (holding export volume constant) plus the impact through the expansion in exports. It turns out that the import demand elasticity is positive for one country, Sweden, as shown in Table 6.1.

Similarly, the general equilibrium export supply elasticity could be negative. An increase in the price of exports alone will increase export volume; thus the partial equilibrium export supply elasticity is positive. When the price of imported inputs also changes, export volume will be reduced because exports require imported inputs. Depending on the intensity with which exports use imported inputs, export volume could rise or fall on net. As shown in Table 6.2, all export supply elasticities are positive.

Table 6.1. Import Demand Elasticities

	Kee, Nicita, and Olarreaga (2008)	Senhadji (1997)	GTAP 2001				GTAP 2004				Averages for 2001 and 2004			
					Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects	
			SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
Low-Income[1]														
Bangladesh	–1.61		–1.23	–1.69	–0.25	–0.33	–1.24	–1.71	–0.24	–0.33	–1.23	–1.70	–0.24	–0.33
Benin	–1.08	–0.54	–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
Burkina Faso	–1.06		–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
Burundi	–1.10	–0.27	–0.99	–1.33	–0.95	–1.29	–0.99	–1.33	–0.87	–1.18	–0.99	–1.33	–0.91	–1.23
Cambodia			–0.97	–1.33	–0.83	–1.15	–1.82	–2.54	–1.05	–1.51	–1.39	–1.93	–0.94	–1.33
Central African Rep.	–1.04		–0.99	–1.33	–0.95	–1.29	–1.02	–1.40	–1.03	–1.41	–1.01	–1.37	–0.99	–1.35
Chad	–1.02		–0.99	–1.33	–0.95	–1.29	–1.02	–1.40	–1.03	–1.41	–1.01	–1.37	–0.99	–1.35
Comoros	–1.08		–0.99	–1.33	–0.95	–1.29	–0.99	–1.33	–0.87	–1.18	–0.99	–1.33	–0.91	–1.23
Congo, Dem. Rep.			–0.93	–1.25	–0.60	–0.83	–1.07	–1.45	–1.00	–1.37	–1.00	–1.35	–0.80	–1.10
Côte d'Ivoire	–1.12	–0.46	–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
Eritrea			–0.99	–1.33	–0.95	–1.29	–0.99	–1.33	–0.87	–1.18	–0.99	–1.33	–0.91	–1.23
Ethiopia	–1.15		–0.99	–1.33	–0.95	–1.29	–1.25	–1.71	–0.63	–0.89	–1.12	–1.52	–0.79	–1.09
Gambia, The	–1.07	–0.18	–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
Ghana	–1.09		–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
Guinea	–1.10		–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
Guinea-Bissau			–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
Haiti		–0.56	–1.29	–1.75	–1.06	–1.44	–1.33	–1.85	–1.23	–1.72	–1.31	–1.80	–1.14	–1.58
India	–1.74	–0.14	–1.04	–1.41	–0.83	–1.13	–1.28	–1.76	–0.21	–0.28	–1.16	–1.59	–0.52	–0.71
Kenya	–1.14	–0.77	–0.99	–1.33	–0.95	–1.29	–0.99	–1.33	–0.87	–1.18	–0.99	–1.33	–0.91	–1.23
Kyrgyz Rep.	–1.03		–1.24	–1.68	–0.90	–1.22	–1.43	–1.98	–0.64	–0.86	–1.34	–1.83	–0.77	–1.04
Lao People's Dem. Rep.			–0.97	–1.33	–0.83	–1.15	–1.04	–1.41	–0.55	–0.75	–1.00	–1.37	–0.69	–0.95
Madagascar	–1.17	–0.26	–1.22	–1.66	–1.22	–1.68	–1.08	–1.45	–0.63	–0.87	–1.15	–1.56	–0.93	–1.27
Malawi	–1.07	–0.94	–1.03	–1.37	–0.52	–0.74	–1.07	–1.42	–0.80	–1.12	–1.05	–1.40	–0.66	–0.93
Mali	–1.08		–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
Mauritania		–0.45	–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
Mozambique			–1.13	–1.53	–0.70	–0.95	–1.12	–1.58	–0.41	–0.60	–1.13	–1.55	–0.56	–0.78
Myanmar		–0.04	–0.97	–1.33	–0.83	–1.15	–0.67	–0.87	–0.49	–0.66	–0.82	–1.10	–0.66	–0.90
Nepal	–1.13		–1.01	–1.38	–0.47	–0.62	–1.15	–1.58	–0.83	–1.15	–1.08	–1.48	–0.65	–0.88
Niger	–1.09		–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
Nigeria	–1.32	–0.34	–0.99	–1.33	–0.95	–1.29	–0.91	–1.23	–0.83	–1.15	–0.95	–1.28	–0.89	–1.22
Pakistan		–0.52	–1.01	–1.38	–0.47	–0.62	–1.04	–1.40	–0.80	–1.07	–1.03	–1.39	–0.63	–0.84
Papua New Guinea	–1.15	–0.27	–1.39	–1.89	–0.56	–0.75	–1.30	–1.79	–0.68	–0.93	–1.35	–1.84	–0.62	–0.84
Rwanda	–1.07	–0.12	–0.99	–1.33	–0.95	–1.29	–0.99	–1.33	–0.87	–1.18	–0.99	–1.33	–0.91	–1.23
Senegal	–1.09		–0.99	–1.33	–0.95	–1.29	–1.28	–1.72	–1.00	–1.32	–1.13	–1.53	–0.97	–1.30
Sierra Leone			–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
Tajikistan			–1.24	–1.68	–0.90	–1.22	–1.06	–1.42	–0.87	–1.18	–1.15	–1.55	–0.88	–1.20
Tanzania	–1.31		–0.94	–1.26	–0.72	–0.98	–0.94	–1.30	–0.60	–0.87	–0.94	–1.28	–0.66	–0.92

Table 6.1 ***(continued)***

	Kee, Nicita, and Olarreaga (2008)	Senhadji (1997)	GTAP 2001				GTAP 2004				Averages for 2001 and 2004			
					Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects	
			SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
Togo	–1.09		–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
Uganda	–1.26		–0.85	–1.13	–0.62	–0.83	–0.78	–1.05	–0.49	–0.68	–0.82	–1.09	–0.56	–0.76
Uzbekistan			–1.24	–1.68	–0.90	–1.22	–1.06	–1.42	–0.87	–1.18	–1.15	–1.55	–0.88	–1.20
Vietnam			–1.64	–2.22	–1.31	–1.80	–1.62	–2.21	–1.39	–1.90	–1.63	–2.22	–1.35	–1.85
Zambia	–1.11	–0.51	–1.08	–1.47	–0.77	–1.04	–1.11	–1.53	–0.87	–1.22	–1.10	–1.50	–0.82	–1.13
Zimbabwe	–1.11		–0.96	–1.31	–0.41	–0.56	–1.15	–1.57	–0.37	–0.51	–1.06	–1.44	–0.39	–0.54
Mean	**–1.15**	**–0.40**	**–1.05**	**–1.42**	**–0.85**	**–1.16**	**–1.18**	**–1.60**	**–0.87**	**–1.19**	**–1.11**	**–1.51**	**–0.86**	**–1.17**
Median	**–1.10**	**–0.40**	**–0.99**	**–1.33**	**–0.95**	**–1.29**	**–1.15**	**–1.58**	**–0.87**	**–1.18**	**–1.15**	**–1.55**	**–0.91**	**–1.23**
Standard deviation	**0.16**	**0.24**	**0.14**	**0.20**	**0.21**	**0.29**	**0.21**	**0.30**	**0.28**	**0.38**	**0.15**	**0.21**	**0.22**	**0.30**
Lower-Middle-Income[1]														
Albania	–1.14		–1.22	–1.66	–0.57	–0.77	–1.16	–1.60	–0.71	–1.01	–1.19	–1.63	–0.64	–0.89
Algeria	–1.24	–0.06	–0.94	–1.27	–0.86	–1.16	–1.12	–1.50	–1.08	–1.46	–1.03	–1.39	–0.97	–1.31
Armenia	–1.07		–1.24	–1.68	–0.90	–1.22	–1.17	–1.65	–0.76	–1.08	–1.20	–1.67	–0.83	–1.15
Azerbaijan	–1.12		–1.24	–1.68	–0.90	–1.22	–1.57	–2.28	–1.56	–2.27	–1.41	–1.98	–1.23	–1.74
Belarus	–1.1		–1.24	–1.68	–0.90	–1.22	–1.74	–2.42	0.00	0.00	–1.49	–2.05	–0.45	–0.61
Bolivia	–1.15		–1.11	–1.51	–0.99	–1.36	–0.90	–1.22	–0.53	–0.73	–1.01	–1.36	–0.76	–1.04
Bulgaria	–1.12		–1.56	–2.12	–0.95	–1.31	–1.66	–2.27	–1.11	–1.54	–1.61	–2.20	–1.03	–1.42
Cameroon	–1.25	–0.76	–0.99	–1.33	–0.95	–1.29	–1.02	–1.40	–1.03	–1.41	–1.01	–1.37	–0.99	–1.35
Cape Verde	–1.02		–0.99	–1.33	–0.95	–1.29	–1.32	–1.77	–1.12	–1.53	–1.15	–1.55	–1.04	–1.41
China	–1.44	–0.19	–1.19	–1.65	–0.31	–0.43	–1.36	–1.88	–0.57	–0.78	–1.27	–1.77	–0.44	–0.61
Colombia	–1.45	–0.63	–1.01	–1.38	–0.81	–1.11	–1.00	–1.36	–0.73	–1.00	–1.01	–1.37	–0.77	–1.05
Congo, Republic of	–1.05	–0.42	–0.99	–1.33	–0.95	–1.29	–1.02	–1.40	–1.03	–1.41	–1.01	–1.37	–0.99	–1.35
Dominican Republic		–0.32	–1.29	–1.75	–1.06	–1.44	–1.33	–1.85	–1.23	–1.72	–1.31	–1.80	–1.14	–1.58
Ecuador			–1.11	–1.51	–0.99	–1.36	–1.20	–1.65	–1.13	–1.56	–1.16	–1.58	–1.06	–1.46
Egypt	–1.31		–0.94	–1.27	–0.86	–1.16	–1.18	–1.62	–0.61	–0.84	–1.06	–1.45	–0.74	–1.00
El Salvador	–1.20		–1.34	–1.83	–1.04	–1.43	–1.36	–1.86	–0.62	–0.84	–1.35	–1.85	–0.83	–1.13
Georgia	–1.14		–1.24	–1.68	–0.90	–1.22	–1.19	–1.63	–0.63	–0.86	–1.22	–1.66	–0.76	–1.04
Guatemala	–1.22		–1.34	–1.83	–1.04	–1.43	–1.06	–1.46	–0.66	–0.92	–1.20	–1.65	–0.85	–1.17
Guyana	–1.05		–1.19	–1.61	–0.77	–1.04	–1.33	–1.85	–1.00	–1.37	–1.26	–1.73	–0.89	–1.21
Honduras	–1.07	–0.14	–1.34	–1.83	–1.04	–1.43	–1.36	–1.86	–0.62	–0.84	–1.35	–1.85	–0.83	–1.13
Indonesia	–1.38	–0.62	–1.08	–1.47	–0.84	–1.15	–0.97	–1.32	–0.62	–0.86	–1.02	–1.40	–0.73	–1.00
Iran, Islamic Rep. of	–1.32		–0.99	–1.34	–0.81	–1.10	–1.21	–1.64	–1.18	–1.60	–1.10	–1.49	–0.99	–1.35
Jordan	–1.08		–0.99	–1.34	–0.81	–1.10	–0.93	–1.27	–0.75	–1.05	–0.96	–1.30	–0.78	–1.07
Kiribati	–1.01		–1.39	–1.89	–0.56	–0.75	–1.30	–1.79	–0.68	–0.93	–1.35	–1.84	–0.62	–0.84
Lesotho	–1.02		–1.38	–1.90	–0.49	–0.66	–1.32	–1.79	–0.52	–0.70	–1.35	–1.84	–0.50	–0.68
Macedonia, FYR	–1.12		–1.42	–1.92	–0.63	–0.86	–1.29	–1.75	–0.96	–1.31	–1.36	–1.83	–0.79	–1.09
Maldives	–1.03		–1.01	–1.38	–0.47	–0.62	–1.15	–1.58	–0.83	–1.15	–1.08	–1.48	–0.65	–0.88

Table 6.1 ***(continued)***

	Kee, Nicita, and Olarreaga (2008)	Senhadji (1997)	GTAP 2001				GTAP 2004				Averages for 2001 and 2004			
					Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects	
			SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
Moldova	–1.07		–1.24	–1.68	–0.90	–1.22	–1.96	–2.65	–1.70	–2.31	–1.60	–2.17	–1.30	–1.77
Mongolia	–1.03		–1.19	–1.64	–1.02	–1.41	–1.23	–1.69	–0.60	–0.83	–1.21	–1.66	–0.81	–1.12
Morocco	–1.21	–0.21	–1.16	–1.59	–0.81	–1.11	–1.29	–1.77	–1.12	–1.52	–1.22	–1.68	–0.97	–1.32
Namibia	–1.06		–1.38	–1.90	–0.49	–0.66	–1.32	–1.79	–0.52	–0.70	–1.35	–1.84	–0.50	–0.68
Nicaragua	–1.06	–0.15	–1.34	–1.83	–1.04	–1.43	–1.18	–1.60	–0.91	–1.23	–1.26	–1.72	–0.97	–1.33
Paraguay	–1.15	–0.16	–1.19	–1.61	–0.77	–1.04	–1.23	–1.68	–0.82	–1.15	–1.21	–1.65	–0.80	–1.09
Peru	–1.50	–0.32	–0.98	–1.33	–0.77	–1.05	–0.90	–1.24	–0.63	–0.87	–0.94	–1.29	–0.70	–0.96
Philippines	–1.15	–0.36	–1.77	–2.40	–0.52	–0.73	–1.63	–2.24	–0.53	–0.72	–1.70	–2.32	–0.53	–0.72
Syrian Arab Republic			–0.99	–1.34	–0.81	–1.10	–0.93	–1.27	–0.75	–1.05	–0.96	–1.30	–0.78	–1.07
Sri Lanka	–1.14		–1.30	–1.77	–0.70	–0.95	–1.29	–1.72	–0.69	–0.90	–1.30	–1.75	–0.69	–0.92
Sudan	–1.39		–0.99	–1.33	–0.95	–1.29	–0.99	–1.33	–0.87	–1.18	–0.99	–1.33	–0.91	–1.23
Swaziland	–1.05		–1.38	–1.90	–0.49	–0.66	–1.32	–1.79	–0.52	–0.70	–1.35	–1.84	–0.50	–0.68
Thailand	–1.18	–0.51	–1.62	–2.24	–0.36	–0.49	–1.79	–2.47	–0.21	–0.28	–1.71	–2.35	–0.28	–0.39
Tunisia	–1.11		–1.50	–2.06	–1.09	–1.50	–1.68	–2.38	–1.29	–1.86	–1.59	–2.22	–1.19	–1.68
Turkmenistan	–1.04		–1.24	–1.68	–0.90	–1.22	–1.06	–1.42	–0.87	–1.18	–1.15	–1.55	–0.88	–1.20
Ukraine	–1.19		–1.24	–1.68	–0.90	–1.22	–1.79	–2.44	–0.39	–0.54	–1.52	–2.06	–0.64	–0.88
Mean	**–1.16**	**–0.35**	**–1.22**	**–1.66**	**–0.81**	**–1.10**	**–1.27**	**–1.75**	**–0.81**	**–1.11**	**–1.25**	**–1.70**	**–0.81**	**–1.11**
Median	**–1.13**	**–0.32**	**–1.24**	**–1.68**	**–0.86**	**–1.16**	**–1.23**	**–1.69**	**–0.75**	**–1.05**	**–1.22**	**–1.67**	**–0.80**	**–1.09**
Standard deviation	**0.13**	**0.22**	**0.20**	**0.27**	**0.20**	**0.28**	**0.26**	**0.37**	**0.33**	**0.46**	**0.21**	**0.29**	**0.22**	**0.31**
Upper-Middle-Income[1]														
Argentina	–1.86	–0.64	–1.20	–1.67	–1.00	–1.41	–1.24	–1.68	–1.05	–1.43	–1.22	–1.67	–1.03	–1.42
Belize	–1.07		–1.34	–1.83	–1.04	–1.43	–1.36	–1.86	–0.62	–0.84	–1.35	–1.85	–0.83	–1.13
Botswana	–1.04		–1.18	–1.62	–0.59	–0.80	–1.13	–1.56	–1.09	–1.50	–1.16	–1.59	–0.84	–1.15
Brazil	–2.17	–0.30	–1.20	–1.66	–0.87	–1.20	–1.04	–1.41	–0.65	–0.86	–1.12	–1.53	–0.76	–1.03
Chile	–1.27	–0.09	–1.26	–1.74	–0.98	–1.37	–1.29	–1.73	–1.08	–1.43	–1.28	–1.74	–1.03	–1.40
Costa Rica	–1.10	–0.55	–1.34	–1.83	–1.04	–1.43	–1.36	–1.84	–0.43	–0.61	–1.35	–1.84	–0.73	–1.02
Croatia	–1.19		–1.86	–2.53	–0.66	–0.87	–2.06	–2.89	–0.87	–1.21	–1.96	–2.71	–0.76	–1.04
Dominica	–1.06		–1.29	–1.75	–1.06	–1.44	–1.33	–1.85	–1.23	–1.72	–1.31	–1.80	–1.14	–1.58
Gabon	–1.16	–0.27	–0.99	–1.33	–0.95	–1.29	–1.02	–1.40	–1.03	–1.41	–1.01	–1.37	–0.99	–1.35
Grenada	–1.03		–1.29	–1.75	–1.06	–1.44	–1.33	–1.85	–1.23	–1.72	–1.31	–1.80	–1.14	–1.58
Jamaica	–1.14		–1.29	–1.75	–1.06	–1.44	–1.33	–1.85	–1.23	–1.72	–1.31	–1.80	–1.14	–1.58
Kazakhstan	–1.12		–1.24	–1.68	–0.90	–1.22	–1.20	–1.65	–0.84	–1.18	–1.22	–1.66	–0.87	–1.20
Latvia	–1.11		–1.49	–2.03	–1.08	–1.48	–1.43	–1.96	–1.10	–1.51	–1.46	–2.00	–1.09	–1.49
Lebanon	–1.13		–0.99	–1.34	–0.81	–1.10	–0.93	–1.27	–0.75	–1.05	–0.96	–1.30	–0.78	–1.07
Libya			–0.94	–1.27	–0.86	–1.16	–1.12	–1.50	–1.08	–1.46	–1.03	–1.39	–0.97	–1.31
Lithuania	–1.17		–1.62	–2.24	–0.79	–1.11	–1.74	–2.40	–0.76	–1.03	–1.68	–2.32	–0.77	–1.07
Malaysia	–1.08		–1.60	–2.19	–0.52	–0.73	–1.49	–2.06	–0.51	–0.71	–1.54	–2.12	–0.51	–0.72

Table 6.1 *(continued)*

	Kee, Nicita, and Olarreaga (2008)	Senhadji (1997)	GTAP 2001				GTAP 2004				Averages for 2001 and 2004			
					Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects	
			SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
Mauritius	–1.08	–0.26	–0.93	–1.25	–0.60	–0.83	–1.36	–1.84	–0.29	–0.40	–1.15	–1.54	–0.45	–0.61
Mexico	–1.34	–0.37	–1.13	–1.56	–0.57	–0.80	–1.47	–2.05	–0.19	–0.28	–1.30	–1.81	–0.38	–0.54
Panama	–1.19	–0.01	–1.34	–1.83	–1.04	–1.43	–1.15	–1.59	–0.70	–0.99	–1.25	–1.71	–0.87	–1.21
Poland	–1.32		–1.26	–1.71	–1.02	–1.37	–1.34	–1.82	–0.90	–1.21	–1.30	–1.77	–0.96	–1.29
Romania	–1.19		–1.18	–1.60	–0.83	–1.12	–1.27	–1.73	–0.51	–0.70	–1.22	–1.67	–0.67	–0.91
Russian Federation	–1.57		–0.96	–1.30	–0.84	–1.14	–0.97	–1.32	–0.84	–1.15	–0.96	–1.31	–0.84	–1.15
Seychelles	–1.06		–0.93	–1.25	–0.60	–0.83	–0.99	–1.33	–0.87	–1.18	–0.96	–1.29	–0.73	–1.00
South Africa	–1.43	–0.53	–1.17	–1.62	–0.64	–0.87	–1.32	–1.83	–0.71	–0.99	–1.25	–1.72	–0.68	–0.93
St. Kitts and Nevis	–1.02		–1.29	–1.75	–1.06	–1.44	–1.33	–1.85	–1.23	–1.72	–1.31	–1.80	–1.14	–1.58
St. Lucia	–1.07		–1.29	–1.75	–1.06	–1.44	–1.33	–1.85	–1.23	–1.72	–1.31	–1.80	–1.14	–1.58
St. Vincent and the Grenadines	–1.02		–1.29	–1.75	–1.06	–1.44	–1.33	–1.85	–1.23	–1.72	–1.31	–1.80	–1.14	–1.58
Suriname	–1.04		–1.19	–1.61	–0.77	–1.04	–1.33	–1.85	–1.00	–1.37	–1.26	–1.73	–0.89	–1.21
Turkey	–1.32	0.03	–1.25	–1.70	–0.70	–0.95	–1.30	–1.80	–0.91	–1.26	–1.28	–1.75	–0.80	–1.11
Uruguay	–1.44	–0.20	–1.23	–1.69	–0.89	–1.24	–1.54	–2.08	–0.69	–0.94	–1.38	–1.89	–0.79	–1.09
Venezuela	–1.48		–1.34	–1.87	–1.29	–1.81	–0.99	–1.31	–0.88	–1.19	–1.16	–1.59	–1.09	–1.50
Mean	**–1.23**	**–0.29**	**–1.25**	**–1.70**	**–0.88**	**–1.21**	**–1.29**	**–1.78**	**–0.87**	**–1.19**	**–1.27**	**–1.74**	**–0.87**	**–1.20**
Median	**–1.14**	**–0.27**	**–1.25**	**–1.71**	**–0.89**	**–1.23**	**–1.33**	**–1.83**	**–0.87**	**–1.20**	**–1.28**	**–1.74**	**–0.85**	**–1.18**
Standard deviation	**0.26**	**0.22**	**0.20**	**0.28**	**0.19**	**0.27**	**0.23**	**0.33**	**0.28**	**0.40**	**0.20**	**0.29**	**0.21**	**0.29**
High-Income: Non-OECD[1]														
Antigua and Barbuda	–1.08		–1.29	–1.75	–1.06	–1.44	–1.33	–1.85	–1.23	–1.72	–1.31	–1.80	–1.14	–1.58
Bahamas, The	–1.09		–1.29	–1.75	–1.06	–1.44	–1.33	–1.85	–1.23	–1.72	–1.31	–1.80	–1.14	–1.58
Bahrain	–1.09		–0.99	–1.34	–0.81	–1.10	–0.93	–1.27	–0.75	–1.05	–0.96	–1.30	–0.78	–1.07
Barbados	–1.12		–1.29	–1.75	–1.06	–1.44	–1.33	–1.85	–1.23	–1.72	–1.31	–1.80	–1.14	–1.58
Bermuda	–1.06		–1.99	–2.66	–1.60	–2.12	–1.92	–2.59	–1.71	–2.31	–1.95	–2.62	–1.66	–2.21
Brunei Darussalam	–1.08		–0.97	–1.33	–0.83	–1.15	–0.94	–1.24	–0.73	–0.98	–0.95	–1.28	–0.78	–1.07
Cyprus	–1.13		–2.63	–3.68	–2.60	–3.65	–1.49	–2.02	–1.04	–1.37	–2.06	–2.85	–1.82	–2.51
Estonia	–1.05		–1.61	–2.20	–0.49	–0.67	–2.40	–3.34	–1.77	–2.51	–2.00	–2.77	–1.13	–1.59
French Polynesia	–1.06		–1.39	–1.89	–0.56	–0.75	–1.30	–1.79	–0.68	–0.93	–1.35	–1.84	–0.62	–0.84
Greenland	–1.04		–1.99	–2.66	–1.60	–2.12	–1.92	–2.59	–1.71	–2.31	–1.95	–2.62	–1.66	–2.21
Hong Kong SAR	–1.05		–1.48	–2.03	–0.91	–1.24	–1.47	–2.04	–0.66	–0.92	–1.48	–2.03	–0.79	–1.08
Israel	–1.20	–0.10	–0.99	–1.34	–0.81	–1.10	–0.93	–1.27	–0.75	–1.05	–0.96	–1.30	–0.78	–1.07
Macao SAR	–1.11		–1.19	–1.64	–1.02	–1.41	–1.23	–1.69	–0.60	–0.83	–1.21	–1.66	–0.81	–1.12
Malta	–1.11		–1.77	–2.41	–0.90	–1.25	–1.58	–2.19	–0.72	–1.03	–1.67	–2.30	–0.81	–1.14
New Caledonia	–1.07		–1.39	–1.89	–0.56	–0.75	–1.30	–1.79	–0.68	–0.93	–1.35	–1.84	–0.62	–0.84
Oman	–1.11		–0.99	–1.34	–0.81	–1.10	–0.93	–1.27	–0.75	–1.05	–0.96	–1.30	–0.78	–1.07
Saudi Arabia	–1.30		–0.99	–1.34	–0.81	–1.10	–0.93	–1.27	–0.75	–1.05	–0.96	–1.30	–0.78	–1.07

Table 6.1 *(continued)*

	Kee, Nicita, and Olarreaga (2008)	Senhadji (1997)	GTAP 2001				GTAP 2004				Averages for 2001 and 2004			
					Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects	
			SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
Singapore	–1.05		–2.91	–3.99	–0.64	–0.90	–2.55	–3.53	–0.39	–0.54	–2.73	–3.76	–0.51	–0.72
Slovenia	–1.10		–1.60	–2.19	–0.63	–0.82	–1.55	–2.14	–0.70	–0.92	–1.57	–2.16	–0.66	–0.87
Taiwan Province of China	–1.17		–2.15	–3.00	–0.25	–0.31	–2.62	–3.64	0.26	0.38	–2.39	–3.32	0.01	0.03
Trinidad and Tobago	–1.15	–0.49	–1.29	–1.75	–1.06	–1.44	–1.33	–1.85	–1.23	–1.72	–1.31	–1.80	–1.14	–1.58
Mean	**–1.11**	**–0.30**	**–1.53**	**–2.09**	**–0.95**	**–1.30**	**–1.49**	**–2.05**	**–0.91**	**–1.25**	**–1.51**	**–2.07**	**–0.93**	**–1.28**
Median	**–1.09**	**–0.30**	**–1.39**	**–1.89**	**–0.83**	**–1.15**	**–1.33**	**–1.85**	**–0.75**	**–1.05**	**–1.35**	**–1.84**	**–0.79**	**–1.08**
Standard deviation	**0.06**	**0.28**	**0.54**	**0.75**	**0.50**	**0.69**	**0.52**	**0.73**	**0.48**	**0.66**	**0.50**	**0.70**	**0.42**	**0.58**
High-Income: OECD[1]														
Australia	–1.46	–0.34	–1.26	–1.76	–1.15	–1.61	–1.24	–1.73	–1.15	–1.61	–1.25	–1.74	–1.15	–1.61
Austria	–1.25	–0.33	–1.46	–1.97	–0.68	–0.89	–1.52	–2.08	–0.65	–0.86	–1.49	–2.02	–0.67	–0.88
Belgium	–1.14	–0.17	–2.88	–3.88	0.12	0.14	–2.36	–3.29	–0.95	–1.26	–2.62	–3.58	–0.41	–0.56
Canada	–1.28	–0.57	–1.42	–1.93	–0.70	–0.94	–1.27	–1.72	–0.51	–0.72	–1.34	–1.82	–0.61	–0.83
Czech Republic	–1.15		–1.64	–2.25	–0.95	–1.29	–1.82	–2.48	–0.84	–1.12	–1.73	–2.37	–0.90	–1.20
Denmark	–1.38	–0.14	–1.55	–2.13	–0.40	–0.54	–1.36	–1.89	–0.70	–1.02	–1.46	–2.01	–0.55	–0.78
Finland	–1.37		–1.57	–2.21	–0.08	–0.07	–1.50	–2.10	0.04	0.05	–1.54	–2.16	–0.02	–0.01
France	–1.47	–0.22	–1.23	–1.68	–0.73	–1.04	–1.44	–1.97	–0.73	–1.02	–1.34	–1.83	–0.73	–1.03
Germany	–1.43	–0.06	–1.43	–1.97	–0.05	–0.02	–1.48	–2.05	–0.16	–0.17	–1.46	–2.01	–0.10	–0.10
Greece	–1.37	–0.40	–1.24	–1.67	–0.35	–0.48	–1.31	–1.83	–1.24	–1.75	–1.27	–1.75	–0.80	–1.11
Hungary	–1.11		–1.58	–2.16	–0.67	–0.90	–1.74	–2.37	–0.57	–0.76	–1.66	–2.27	–0.62	–0.83
Iceland	–1.20	–0.44	–1.44	–1.96	–1.21	–1.66	–1.42	–1.94	–0.93	–1.26	–1.43	–1.95	–1.07	–1.46
Ireland	–1.20		–1.67	–2.26	–0.04	–0.06	–1.66	–2.25	–0.43	–0.61	–1.67	–2.26	–0.24	–0.34
Italy	–1.35	–0.21	–1.48	–2.04	–0.85	–1.17	–1.43	–1.97	–0.56	–0.76	–1.46	–2.01	–0.70	–0.97
Japan	–1.83	–0.14	–1.20	–1.67	–0.54	–0.74	–1.27	–1.78	–0.56	–0.77	–1.24	–1.72	–0.55	–0.75
Korea, Rep. of	–1.24	–0.17	–2.00	–2.80	–0.19	–0.22	–2.01	–2.81	–0.16	–0.20	–2.00	–2.80	–0.17	–0.21
Luxembourg	–1.05		–1.97	–2.67	–0.74	–1.03	–3.28	–4.54	–3.06	–4.24	–2.62	–3.61	–1.90	–2.63
Netherlands	–1.15		–1.68	–2.29	–0.52	–0.69	–1.59	–2.15	–0.56	–0.76	–1.64	–2.22	–0.54	–0.73
New Zealand	–1.27	–0.38	–1.17	–1.58	–0.75	–1.00	–1.20	–1.63	–0.66	–0.88	–1.19	–1.60	–0.70	–0.94
Norway	–1.41	–0.41	–1.44	–1.96	–1.21	–1.66	–1.24	–1.69	–1.12	–1.55	–1.34	–1.83	–1.17	–1.61
Portugal	–1.25	–0.38	–1.65	–2.26	–1.11	–1.52	–1.54	–2.10	–1.03	–1.41	–1.59	–2.18	–1.07	–1.46
Slovak Republic	–1.09		–1.75	–2.43	–0.64	–0.87	–1.69	–2.34	–0.57	–0.78	–1.72	–2.39	–0.61	–0.83
Spain	–1.33	–0.35	–1.37	–1.89	–1.04	–1.43	–1.24	–1.69	–0.90	–1.22	–1.31	–1.79	–0.97	–1.33
Sweden	–1.37	–0.06	–1.70	–2.36	0.11	0.19	–1.60	–2.23	–0.09	–0.10	–1.65	–2.29	0.01	0.04
Switzerland	–1.32	–0.22	–1.40	–1.92	–0.83	–1.17	–1.46	–1.99	–0.28	–0.38	–1.43	–1.96	–0.56	–0.78
United Kingdom	–1.42	–0.01	–1.41	–1.95	–1.23	–1.72	–1.32	–1.82	–1.17	–1.63	–1.37	–1.89	–1.20	–1.68
United States	–2.09	–0.25	–1.14	–1.59	–1.07	–1.50	–1.29	–1.79	–1.11	–1.55	–1.21	–1.69	–1.09	–1.52

Table 6.1 ***(concluded)***

	Kee, Nicita, and Olarreaga (2008)	Senhadji (1997)	GTAP 2001				GTAP 2004				Averages for 2001 and 2004			
					Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects	
			SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
Mean	**–1.33**	**–0.26**	**–1.55**	**–2.12**	**–0.65**	**–0.89**	**–1.57**	**–2.16**	**–0.77**	**–1.05**	**–1.56**	**–2.14**	**–0.71**	**–0.97**
Median	**–1.32**	**–0.24**	**–1.46**	**–1.97**	**–0.70**	**–0.94**	**–1.46**	**–1.99**	**–0.66**	**–0.88**	**–1.46**	**–2.01**	**–0.67**	**–0.88**
Standard deviation	**0.22**	**0.15**	**0.35**	**0.47**	**0.42**	**0.59**	**0.43**	**0.60**	**0.58**	**0.81**	**0.36**	**0.50**	**0.42**	**0.59**
Overall														
Mean	**–1.20**	**–0.32**	**–1.27**	**–1.73**	**–0.83**	**–1.13**	**–1.33**	**–1.82**	**–0.84**	**–1.16**	**–1.30**	**–1.78**	**–0.83**	**–1.14**
Median	**–1.13**	**–0.30**	**–1.24**	**–1.68**	**–0.89**	**–1.22**	**–1.31**	**–1.77**	**–0.84**	**–1.15**	**–1.25**	**–1.72**	**–0.82**	**–1.13**
Standard deviation	**0.19**	**0.21**	**0.33**	**0.46**	**0.31**	**0.43**	**0.35**	**0.49**	**0.38**	**0.53**	**0.32**	**0.45**	**0.30**	**0.41**

Note: Blank cells indicate no data available. GTAP = Global Trade Analysis Project. SR = short-run; LR = long-run.

[1]Economies are grouped according to 2007 gross national income per capita, calculated using the World Bank Atlas method. The groups are as follows: low-income, $935 or less; lower-middle-income, $936–$3,705; upper-middle-income, $3,706–$11,455; and high-income, $11,456 or more.

Table 6.2. Export Supply Elasticities

	Broda, Limão, and Weinstein (2006)	GTAP 2001				GTAP 2004				Averages for 2001 and 2004			
				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects	
		SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
Low-Income[1]													
Bangladesh		2.20	3.04	1.40	1.92	2.09	2.91	1.31	1.83	2.15	2.97	1.35	1.87
Benin		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
Burkina Faso		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
Burundi		0.30	0.36	0.28	0.33	0.66	0.88	0.60	0.80	0.48	0.62	0.44	0.57
Cambodia		0.33	0.44	0.27	0.36	1.11	1.51	0.49	0.69	0.72	0.98	0.38	0.52
Central African Rep.		0.30	0.36	0.28	0.33	0.15	0.17	0.15	0.17	0.23	0.26	0.21	0.25
Chad		0.30	0.36	0.28	0.33	0.15	0.17	0.15	0.17	0.23	0.26	0.21	0.25
Comoros		0.30	0.36	0.28	0.33	0.66	0.88	0.60	0.80	0.48	0.62	0.44	0.57
Congo, Dem. Rep. of		0.42	0.54	0.25	0.32	0.08	0.09	0.04	0.04	0.25	0.31	0.14	0.18
Côte d'Ivoire		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
Eritrea		0.30	0.36	0.28	0.33	0.66	0.88	0.60	0.80	0.48	0.62	0.44	0.57
Ethiopia		0.30	0.36	0.28	0.33	0.79	1.04	0.50	0.67	0.55	0.70	0.39	0.50
Gambia, The		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
Ghana		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
Guinea		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
Guinea-Bissau		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
Haiti		0.98	1.31	0.80	1.07	0.62	0.87	0.55	0.77	0.80	1.09	0.68	0.92
India		0.81	1.11	0.65	0.88	1.61	2.22	0.81	1.12	1.21	1.66	0.73	1.00
Kenya		0.30	0.36	0.28	0.33	0.66	0.88	0.60	0.80	0.48	0.62	0.44	0.57
Kyrgyz Rep.		1.27	1.71	0.88	1.19	0.46	0.64	0.16	0.21	0.87	1.17	0.52	0.70
Lao People's Dem. Rep.		0.33	0.44	0.27	0.36	0.84	1.12	0.50	0.67	0.59	0.78	0.39	0.52
Madagascar		0.74	0.91	0.75	0.93	0.86	1.14	0.59	0.79	0.80	1.03	0.67	0.86
Malawi		0.97	1.21	0.67	0.84	0.55	0.64	0.29	0.34	0.76	0.93	0.48	0.59
Mali		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
Mauritania		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
Mozambique		1.23	1.67	0.93	1.25	1.12	1.55	0.72	1.01	1.17	1.61	0.83	1.13
Myanmar		0.33	0.44	0.27	0.36	0.29	0.35	0.18	0.22	0.31	0.39	0.23	0.29
Nepal		1.31	1.82	0.92	1.28	1.00	1.37	0.79	1.08	1.16	1.59	0.86	1.18
Niger		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
Nigeria		0.30	0.36	0.28	0.33	0.02	0.02	0.00	0.00	0.16	0.19	0.14	0.17
Pakistan		1.31	1.82	0.92	1.28	0.69	0.95	0.35	0.48	1.00	1.38	0.64	0.88
Papua New Guinea		1.45	1.99	0.82	1.12	0.84	1.15	0.51	0.71	1.15	1.57	0.67	0.91
Rwanda		0.30	0.36	0.28	0.33	0.66	0.88	0.60	0.80	0.48	0.62	0.44	0.57
Senegal		0.30	0.36	0.28	0.33	0.80	1.14	0.44	0.62	0.55	0.75	0.36	0.47
Sierra Leone		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
Tajikistan		1.27	1.71	0.88	1.19	0.32	0.41	0.24	0.31	0.79	1.06	0.56	0.75
Tanzania		0.62	0.81	0.53	0.69	0.63	0.83	0.49	0.65	0.63	0.82	0.51	0.67

Table 6.2 *(continued)*

	Broda, Limão, and Weinstein (2006)	GTAP 2001				GTAP 2004				Averages for 2001 and 2004			
				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects	
		SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
Togo		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
Uganda		0.89	1.15	0.60	0.78	0.54	0.68	0.32	0.41	0.71	0.91	0.46	0.60
Uzbekistan		1.27	1.71	0.88	1.19	0.32	0.41	0.24	0.31	0.79	1.06	0.56	0.75
Vietnam		1.06	1.37	0.53	0.69	0.98	1.33	0.71	0.96	1.02	1.35	0.62	0.83
Zambia		0.57	0.78	0.35	0.48	0.60	0.75	0.40	0.51	0.59	0.77	0.38	0.49
Zimbabwe		0.97	1.30	0.67	0.90	1.10	1.49	0.50	0.68	1.04	1.40	0.58	0.79
Mean		**0.63**	**0.82**	**0.47**	**0.61**	**0.64**	**0.85**	**0.42**	**0.56**	**0.63**	**0.83**	**0.45**	**0.59**
Median		**0.30**	**0.36**	**0.28**	**0.33**	**0.55**	**0.68**	**0.32**	**0.41**	**0.48**	**0.62**	**0.39**	**0.52**
Standard deviation		**0.46**	**0.65**	**0.29**	**0.41**	**0.38**	**0.53**	**0.24**	**0.34**	**0.37**	**0.52**	**0.23**	**0.32**
Lower-Middle-Income[1]													
Albania		0.80	1.09	0.46	0.63	0.92	1.22	0.58	0.77	0.86	1.16	0.52	0.70
Algeria	12.66	0.27	0.36	0.22	0.30	0.04	0.05	0.02	0.03	0.16	0.20	0.12	0.16
Armenia		1.27	1.71	0.88	1.19	1.34	1.87	0.88	1.22	1.31	1.79	0.88	1.21
Azerbaijan		1.27	1.71	0.88	1.19	0.10	0.11	0.09	0.10	0.68	0.91	0.49	0.65
Belarus	14.39	1.27	1.71	0.88	1.19	3.23	4.49	1.55	2.16	2.25	3.10	1.22	1.68
Bolivia	8.06	0.50	0.64	0.44	0.56	0.54	0.72	0.39	0.52	0.52	0.68	0.41	0.54
Bulgaria		1.10	1.47	0.65	0.88	0.87	1.18	0.43	0.59	0.98	1.32	0.54	0.74
Cameroon		0.30	0.36	0.28	0.33	0.15	0.17	0.15	0.17	0.23	0.26	0.21	0.25
Cape Verde		0.30	0.36	0.28	0.33	0.47	0.60	0.31	0.40	0.39	0.48	0.29	0.36
China	3.68	1.23	1.71	0.74	1.03	1.58	2.20	0.84	1.16	1.40	1.96	0.79	1.10
Colombia		0.76	1.00	0.66	0.88	0.61	0.80	0.48	0.64	0.68	0.90	0.57	0.76
Congo, Republic of		0.30	0.36	0.28	0.33	0.15	0.17	0.15	0.17	0.23	0.26	0.21	0.25
Dominican Republic		0.98	1.31	0.80	1.07	0.62	0.87	0.55	0.77	0.80	1.09	0.68	0.92
Ecuador	14.50	0.50	0.64	0.44	0.56	0.20	0.25	0.17	0.21	0.35	0.45	0.30	0.39
Egypt		0.27	0.36	0.22	0.30	0.73	1.01	0.47	0.64	0.50	0.68	0.35	0.47
El Salvador		1.03	1.37	0.76	1.02	1.33	1.82	0.82	1.13	1.18	1.60	0.79	1.08
Georgia		1.27	1.71	0.88	1.19	0.98	1.34	0.67	0.92	1.12	1.52	0.78	1.06
Guatemala		1.03	1.37	0.76	1.02	0.88	1.19	0.68	0.93	0.95	1.28	0.72	0.98
Guyana		0.84	1.15	0.66	0.91	0.81	1.17	0.51	0.73	0.83	1.16	0.59	0.82
Honduras		1.03	1.37	0.76	1.02	1.33	1.82	0.82	1.13	1.18	1.60	0.79	1.08
Indonesia		0.30	0.41	0.19	0.25	0.46	0.61	0.28	0.38	0.38	0.51	0.24	0.32
Iran, Islamic Rep. of		0.33	0.44	0.20	0.26	0.03	0.04	0.02	0.02	0.18	0.24	0.11	0.14
Jordan		0.33	0.44	0.20	0.26	0.16	0.20	0.07	0.09	0.25	0.32	0.13	0.17
Kiribati		1.45	1.99	0.82	1.12	0.84	1.15	0.51	0.71	1.15	1.57	0.67	0.91
Lesotho		1.47	2.03	0.93	1.28	1.23	1.68	0.63	0.86	1.35	1.85	0.78	1.07
Macedonia, FYR		1.60	2.12	0.66	0.88	1.23	1.62	0.69	0.91	1.41	1.87	0.67	0.89

Table 6.2 *(continued)*

		GTAP 2001				GTAP 2004				Averages for 2001 and 2004			
				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects	
	Broda, Limão, and Weinstein (2006)	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
Maldives		1.31	1.82	0.92	1.28	1.00	1.37	0.79	1.08	1.16	1.59	0.86	1.18
Moldova		1.27	1.71	0.88	1.19	1.43	1.83	0.87	1.11	1.35	1.77	0.88	1.15
Mongolia		1.57	2.09	1.24	1.65	0.58	0.79	0.34	0.46	1.08	1.44	0.79	1.06
Morocco		0.94	1.29	0.76	1.04	0.91	1.26	0.82	1.13	0.92	1.27	0.79	1.08
Namibia		1.47	2.03	0.93	1.28	1.23	1.68	0.63	0.86	1.35	1.85	0.78	1.07
Nicaragua		1.03	1.37	0.76	1.02	1.08	1.47	0.88	1.20	1.06	1.42	0.82	1.11
Paraguay	8.95	0.84	1.15	0.66	0.91	0.67	0.89	0.48	0.64	0.75	1.02	0.57	0.77
Peru		0.39	0.54	0.30	0.41	0.84	1.17	0.77	1.06	0.62	0.85	0.53	0.73
Philippines		1.58	2.12	0.32	0.43	1.41	1.95	0.39	0.54	1.50	2.04	0.36	0.49
Syrian Arab Republic		0.33	0.44	0.20	0.26	0.16	0.20	0.07	0.09	0.25	0.32	0.13	0.17
Sri Lanka		1.18	1.60	0.71	0.97	0.72	0.98	0.32	0.43	0.95	1.29	0.52	0.70
Sudan		0.30	0.36	0.28	0.33	0.66	0.88	0.60	0.80	0.48	0.62	0.44	0.57
Swaziland		1.47	2.03	0.93	1.28	1.23	1.68	0.63	0.86	1.35	1.85	0.78	1.07
Thailand		1.25	1.73	0.31	0.43	1.44	1.98	0.28	0.38	1.34	1.86	0.29	0.40
Tunisia		1.01	1.39	0.71	0.98	0.88	1.19	0.44	0.59	0.95	1.29	0.57	0.78
Turkmenistan		1.27	1.71	0.88	1.19	0.32	0.41	0.24	0.31	0.79	1.06	0.56	0.75
Ukraine	10.86	1.27	1.71	0.88	1.19	2.51	3.40	0.92	1.24	1.89	2.55	0.90	1.22
Mean	**10.44**	**0.94**	**1.26**	**0.62**	**0.83**	**0.88**	**1.20**	**0.52**	**0.70**	**0.91**	**1.23**	**0.57**	**0.77**
Median	**10.86**	**1.03**	**1.37**	**0.71**	**0.97**	**0.84**	**1.17**	**0.51**	**0.71**	**0.95**	**1.28**	**0.57**	**0.77**
Standard deviation	**4.25**	**0.45**	**0.62**	**0.28**	**0.39**	**0.58**	**0.81**	**0.31**	**0.43**	**0.46**	**0.64**	**0.26**	**0.36**
Upper-Middle-Income[1]													
Argentina		0.69	0.92	0.58	0.77	0.53	0.68	0.40	0.52	0.61	0.80	0.49	0.64
Belize		1.03	1.37	0.76	1.02	1.33	1.82	0.82	1.13	1.18	1.60	0.79	1.08
Botswana		1.43	1.98	1.05	1.45	0.20	0.25	0.18	0.23	0.82	1.12	0.62	0.84
Brazil		0.93	1.29	0.68	0.95	0.71	0.99	0.49	0.68	0.82	1.14	0.58	0.81
Chile		0.51	0.68	0.36	0.48	0.47	0.66	0.32	0.44	0.49	0.67	0.34	0.46
Costa Rica		1.03	1.37	0.76	1.02	0.81	1.08	0.32	0.43	0.92	1.23	0.54	0.72
Croatia		2.17	2.98	1.51	2.07	1.76	2.48	1.05	1.47	1.97	2.73	1.28	1.77
Dominica		0.98	1.31	0.80	1.07	0.62	0.87	0.55	0.77	0.80	1.09	0.68	0.92
Gabon		0.30	0.36	0.28	0.33	0.15	0.17	0.15	0.17	0.23	0.26	0.21	0.25
Grenada		0.98	1.31	0.80	1.07	0.62	0.87	0.55	0.77	0.80	1.09	0.68	0.92
Jamaica		0.98	1.31	0.80	1.07	0.62	0.87	0.55	0.77	0.80	1.09	0.68	0.92
Kazakhstan		1.27	1.71	0.88	1.19	0.72	0.96	0.46	0.61	0.99	1.33	0.67	0.90
Latvia	15.06	2.59	3.52	1.66	2.25	1.45	1.99	0.98	1.35	2.02	2.75	1.32	1.80
Lebanon	23.62	0.33	0.44	0.20	0.26	0.16	0.20	0.07	0.09	0.25	0.32	0.13	0.17
Libya		0.27	0.36	0.22	0.30	0.04	0.05	0.02	0.03	0.16	0.20	0.12	0.16

Table 6.2 *(continued)*

		GTAP 2001				GTAP 2004				Averages for 2001 and 2004			
				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects	
	Broda, Limão, and Weinstein (2006)	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
Lithuania	16.68	1.62	2.20	0.84	1.15	2.05	2.84	0.68	0.95	1.83	2.52	0.76	1.05
Malaysia		1.09	1.49	0.49	0.68	1.17	1.61	0.55	0.76	1.13	1.55	0.52	0.72
Mauritius		0.42	0.54	0.25	0.32	1.33	1.80	0.55	0.74	0.87	1.17	0.40	0.53
Mexico		0.63	0.87	0.25	0.35	1.10	1.53	0.26	0.37	0.87	1.20	0.26	0.36
Panama		1.03	1.37	0.76	1.02	0.94	1.27	0.74	1.00	0.99	1.32	0.75	1.01
Poland		1.66	2.31	1.34	1.86	1.04	1.43	0.57	0.79	1.35	1.87	0.96	1.32
Romania		1.12	1.55	0.58	0.79	2.13	2.90	1.21	1.64	1.63	2.22	0.89	1.22
Russian Federation	9.17	0.30	0.39	0.24	0.32	0.22	0.28	0.16	0.20	0.26	0.34	0.20	0.26
Seychelles		0.42	0.54	0.25	0.32	0.66	0.88	0.60	0.80	0.54	0.71	0.43	0.56
South Africa		0.96	1.35	0.67	0.93	0.95	1.30	0.60	0.83	0.95	1.32	0.63	0.88
St. Kitts and Nevis		0.98	1.31	0.80	1.07	0.62	0.87	0.55	0.77	0.80	1.09	0.68	0.92
St. Lucia		0.98	1.31	0.80	1.07	0.62	0.87	0.55	0.77	0.80	1.09	0.68	0.92
St. Vincent and the Grenadines		0.98	1.31	0.80	1.07	0.62	0.87	0.55	0.77	0.80	1.09	0.68	0.92
Suriname		0.84	1.15	0.66	0.91	0.81	1.17	0.51	0.73	0.83	1.16	0.59	0.82
Turkey		0.77	1.05	0.54	0.73	0.59	0.81	0.35	0.48	0.68	0.93	0.44	0.61
Uruguay		0.72	0.99	0.54	0.74	1.23	1.66	0.62	0.83	0.98	1.33	0.58	0.78
Venezuela		0.12	0.14	0.08	0.10	0.10	0.12	0.06	0.07	0.11	0.13	0.07	0.08
Mean	**16.13**	**0.94**	**1.27**	**0.66**	**0.90**	**0.83**	**1.13**	**0.50**	**0.69**	**0.88**	**1.20**	**0.58**	**0.79**
Median	**15.87**	**0.98**	**1.31**	**0.67**	**0.94**	**0.69**	**0.92**	**0.55**	**0.77**	**0.82**	**1.13**	**0.60**	**0.83**
Standard deviation	**5.94**	**0.54**	**0.74**	**0.37**	**0.51**	**0.53**	**0.74**	**0.28**	**0.39**	**0.48**	**0.67**	**0.29**	**0.41**
High-Income: Non-OECD[1]													
Antigua and Barbuda		0.98	1.31	0.80	1.07	0.62	0.87	0.55	0.77	0.80	1.09	0.68	0.92
Bahamas, The		0.98	1.31	0.80	1.07	0.62	0.87	0.55	0.77	0.80	1.09	0.68	0.92
Bahrain		0.33	0.44	0.20	0.26	0.16	0.20	0.07	0.09	0.25	0.32	0.13	0.17
Barbados		0.98	1.31	0.80	1.07	0.62	0.87	0.55	0.77	0.80	1.09	0.68	0.92
Bermuda		2.50	3.48	1.46	2.02	2.84	3.72	2.15	2.81	2.67	3.60	1.80	2.41
Brunei Darussalam		0.33	0.44	0.27	0.36	0.19	0.24	0.10	0.12	0.26	0.34	0.18	0.24
Cyprus		0.24	0.33	0.23	0.32	0.28	0.39	0.15	0.19	0.26	0.36	0.19	0.26
Estonia		1.94	2.65	1.11	1.52	0.97	1.32	0.45	0.63	1.45	1.98	0.78	1.08
French Polynesia		1.45	1.99	0.82	1.12	0.84	1.15	0.51	0.71	1.15	1.57	0.67	0.91
Greenland		2.50	3.48	1.46	2.02	2.84	3.72	2.15	2.81	2.67	3.60	1.80	2.41
Hong Kong SAR		0.78	1.07	0.54	0.75	0.74	1.02	0.39	0.54	0.76	1.04	0.47	0.64
Israel		0.33	0.44	0.20	0.26	0.16	0.20	0.07	0.09	0.25	0.32	0.13	0.17
Macao SAR		1.57	2.09	1.24	1.65	0.58	0.79	0.34	0.46	1.08	1.44	0.79	1.06
Malta		0.97	1.32	0.43	0.59	0.78	1.07	0.29	0.41	0.87	1.20	0.36	0.50

Table 6.2 *(continued)*

		GTAP 2001				GTAP 2004				Averages for 2001 and 2004			
				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects	
	Broda, Limão, and Weinstein (2006)	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
New Caledonia		1.45	1.99	0.82	1.12	0.84	1.15	0.51	0.71	1.15	1.57	0.67	0.91
Oman	9.50	0.33	0.44	0.20	0.26	0.16	0.20	0.07	0.09	0.25	0.32	0.13	0.17
Saudi Arabia	5.62	0.33	0.44	0.20	0.26	0.16	0.20	0.07	0.09	0.25	0.32	0.13	0.17
Singapore		2.79	3.80	0.78	1.08	2.80	3.87	0.89	1.23	2.79	3.84	0.84	1.15
Slovenia		2.51	3.52	1.67	2.32	2.42	3.42	1.57	2.21	2.46	3.47	1.62	2.27
Taiwan Province of China	13.96	3.02	4.26	1.14	1.60	3.35	4.67	1.10	1.52	3.19	4.46	1.12	1.56
Trinidad and Tobago		0.98	1.31	0.80	1.07	0.62	0.87	0.55	0.77	0.80	1.09	0.68	0.92
Mean	**9.69**	**1.30**	**1.78**	**0.76**	**1.04**	**1.08**	**1.47**	**0.62**	**0.85**	**1.19**	**1.63**	**0.69**	**0.94**
Median	**9.50**	**0.98**	**1.31**	**0.80**	**1.07**	**0.62**	**0.87**	**0.51**	**0.71**	**0.80**	**1.09**	**0.68**	**0.92**
Standard deviation	**4.17**	**0.93**	**1.31**	**0.47**	**0.66**	**1.08**	**1.47**	**0.64**	**0.86**	**0.99**	**1.37**	**0.54**	**0.73**
High-Income: OECD[1]													
Australia		0.56	0.72	0.48	0.63	0.64	0.87	0.57	0.77	0.60	0.80	0.53	0.70
Austria		1.46	2.00	0.92	1.24	1.53	2.15	0.82	1.15	1.50	2.08	0.87	1.20
Belgium		4.81	6.46	1.67	2.25	3.14	4.47	1.39	1.95	3.98	5.46	1.53	2.10
Canada		1.59	2.17	1.21	1.65	1.22	1.61	0.75	0.99	1.40	1.89	0.98	1.32
Czech Republic	10.03	1.52	2.10	0.79	1.09	1.48	2.07	0.40	0.56	1.50	2.09	0.60	0.82
Denmark		2.02	2.78	1.21	1.66	1.00	1.32	0.66	0.87	1.51	2.05	0.93	1.27
Finland		2.10	3.00	0.96	1.37	1.54	2.14	0.78	1.09	1.82	2.57	0.87	1.23
France		0.97	1.30	0.76	1.02	1.71	2.28	0.95	1.27	1.34	1.79	0.85	1.14
Germany		3.42	4.77	2.26	3.14	2.41	3.42	1.32	1.87	2.91	4.09	1.79	2.51
Greece		1.77	2.38	1.11	1.50	0.59	0.79	0.56	0.76	1.18	1.59	0.84	1.13
Hungary		1.27	1.74	0.61	0.82	1.81	2.50	0.68	0.93	1.54	2.12	0.64	0.88
Iceland		0.53	0.71	0.34	0.46	1.97	2.69	1.00	1.37	1.25	1.70	0.67	0.91
Ireland		1.86	2.50	0.84	1.13	1.28	1.72	0.41	0.56	1.57	2.11	0.62	0.84
Italy		1.27	1.75	0.84	1.16	1.20	1.66	0.59	0.82	1.24	1.70	0.72	0.99
Japan		1.54	2.18	1.25	1.76	1.60	2.26	1.20	1.69	1.57	2.22	1.22	1.72
Korea, Rep. of		2.45	3.48	0.79	1.11	2.22	3.13	0.67	0.94	2.34	3.31	0.73	1.02
Luxembourg		3.83	5.14	2.15	2.88	2.01	2.77	1.75	2.42	2.92	3.95	1.95	2.65
Netherlands		2.23	3.06	1.02	1.40	1.78	2.41	0.51	0.69	2.01	2.73	0.77	1.04
New Zealand		1.07	1.45	0.76	1.03	0.95	1.31	0.73	1.00	1.01	1.38	0.74	1.01
Norway		0.53	0.71	0.34	0.46	0.22	0.27	0.17	0.21	0.37	0.49	0.26	0.33
Portugal		1.72	2.37	1.25	1.73	1.57	2.16	1.14	1.57	1.64	2.26	1.20	1.65
Slovak Republic		1.93	2.71	0.68	0.94	1.66	2.32	0.53	0.73	1.80	2.51	0.60	0.84
Spain		0.95	1.32	0.74	1.03	1.22	1.63	0.85	1.13	1.08	1.47	0.80	1.08

Table 6.2 *(concluded)*

		GTAP 2001				GTAP 2004				Averages for 2001 and 2004			
				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects				Adjusted to include general equilibrium effects	
	Broda, Limão, and Weinstein (2006)	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
Sweden		2.66	3.72	1.61	2.24	2.08	2.94	1.02	1.44	2.37	3.33	1.32	1.84
Switzerland		1.36	1.82	1.06	1.42	1.33	1.84	0.80	1.11	1.35	1.83	0.93	1.27
United Kingdom		1.47	1.91	1.37	1.79	0.83	1.06	0.74	0.95	1.15	1.48	1.06	1.37
United States		1.63	2.22	1.41	1.93	1.49	2.05	1.16	1.60	1.56	2.14	1.29	1.77
Mean	**10.03**	**1.81**	**2.48**	**1.04**	**1.43**	**1.53**	**2.11**	**0.82**	**1.13**	**1.67**	**2.29**	**0.93**	**1.28**
Median	**10.03**	**1.61**	**2.20**	**0.94**	**1.30**	**1.54**	**2.15**	**0.76**	**1.04**	**1.53**	**2.10**	**0.84**	**1.14**
Standard deviation		**1.00**	**1.37**	**0.48**	**0.66**	**0.61**	**0.87**	**0.35**	**0.50**	**0.75**	**1.05**	**0.39**	**0.55**
Overall													
Mean	**11.85**	**1.04**	**1.41**	**0.68**	**0.91**	**0.93**	**1.27**	**0.55**	**0.75**	**0.99**	**1.34**	**0.62**	**0.83**
Median	**11.35**	**0.98**	**1.31**	**0.68**	**0.94**	**0.76**	**1.03**	**0.51**	**0.73**	**0.83**	**1.16**	**0.59**	**0.82**
Standard deviation	**5.08**	**0.75**	**1.04**	**0.41**	**0.57**	**0.68**	**0.95**	**0.37**	**0.51**	**0.67**	**0.94**	**0.36**	**0.50**

Note: Blank cells indicate no data available. GTAP = Global Trade Analysis Project. SR = short-run; LR = long-run.

[1]Economies are grouped according to 2007 GNI per capita, calculated using the World Bank Atlas method. The groups are low-income, $935 or less; lower-middle-income, $936–$3,705; upper-middle-income, $3,706–$11,455; and high-income, $11,456 or more.

7 Trade Elasticities and the Exchange Rate

Chapters 1 and 2 of this paper discussed the macrobalance approach, which is one method a researcher can use to determine the extent to which a country's current account balance deviates from its long-run, sustainable value. Once the magnitude of any change in the current account is estimated, one would then like to know how changes in a country's exchange rate would close any gap between the level of the actual current account and its long-run sustainable value. Changes in exchange rates alter prices and trade flows, and Chapter 6 described this relationship—elasticities of demand and supply for exports and imports. This chapter describes how those trade elasticities can be used to estimate how a change in a country's exchange rate affects its *trade* balance—a key component of its current account. The chapter also explains the conditions that must be satisfied in order for various types of exchange rate changes to have desired impacts on the trade balance. In particular, under what circumstances will a depreciation improve the trade balance and the current account? In general, it will depend on the values of the trade elasticities. This chapter also presents estimates of how changes in exchange rates affect the trade balances of about 150 countries, using the elasticity values discussed in Chapter 6.

The General Formula for Trade Balance Elasticities

First, an analytical expression is derived for how a change in a country's real exchange rate would affect its trade balance. The analysis also shows how the elasticities estimated in Chapter 6 can be used in this exercise.

A country's trade balance, as measured by foreign currency, can be written

$$TB^* = P_E^* E - P_M^* M, \qquad (7.1)$$

where P_E^* is the price of exports in foreign currency, P_M^* is the price of imports in foreign currency, E is the volume of exports, M is the volume of imports, and TB^* is the trade balance. Note that E and M are functions of both the domestic and foreign prices of each good. Totally differentiating equation 7.1 gives

$$dTB^* = P_E^*(\hat{P}_E^* + \hat{E}) - P_M^* M(\hat{P}_M^* + \hat{M}), \qquad (7.2)$$

where $\hat{}$ denotes proportional change, that is, $\hat{M} = \frac{dM}{M}$. The domestic prices of imports (P_M) and exports (P_E) are related to foreign prices and the nominal exchange rate (r) as follows:

$$p_M r = p^*_M, \text{ or } \hat{p}_M = \hat{p}^*_M - \hat{r}$$
$$p_E r = p^*_E, \text{ or } \hat{p}_E = \hat{p}^*_E - \hat{r}.$$

To allow for the possibility that changes in foreign prices or the exchange rate are not fully passed through into domestic prices, the above equations can be modified to include pass-through coefficients. For example,

$$\hat{p}_M = \phi_M(\hat{p}^*_M - \hat{r}) \qquad (7.3)$$
$$\hat{p}_E = \phi_E(\hat{p}^*_E - \hat{r}), \qquad (7.4)$$

where ϕ_M and ϕ_E are the pass-though coefficients for import and export prices, respectively, and lie between zero and one. If $\phi_M = \phi_E = 1$, then pass-through is complete and changes in foreign prices are fully reflected in domestic prices. There is no consensus in the literature on values for these parameters. Frankel, Parsley, and Wei (2005) estimate that for developing countries and emerging markets, the pass-through coefficient is in the range of 0.66 to 0.77.

In equation 7.2, expressions for changes in foreign prices and quantities are needed. Define the following:

$\hat{E}^D = \eta_E \hat{p}^*_E$ (export demand equation, with export demand elasticity $\eta_E < 0$)

$\hat{E}^S = \varepsilon_E \hat{p}_E$ (export supply equation, with export supply elasticity $\varepsilon_E > 0$)

$\hat{M}^D = \eta_M \hat{p}_M$ (import demand equation, with import demand elasticity $\eta_M < 0$)

$\hat{M}^S = \varepsilon_M \hat{p}^*_M$ (import supply equation, with import supply elasticity $\varepsilon_M > 0$).

In these equations, export demand and import supply depend on foreign prices, while import demand and export supply depend on domestic prices. In the export market, export demand must equal export supply ($\hat{E}^D = \hat{E}^S$): $\eta_E \hat{p}_E^* = \varepsilon_E \hat{p}_E$. Using equation 7.4, the solution for $\hat{p}_E^*$ is

$$\hat{p}_E^* = \frac{-\varepsilon_E \phi_E}{(\eta_E - \phi_E \varepsilon_E)} \hat{r}. \tag{7.5}$$

Following a similar procedure to solve for $\hat{p}_M^*$ yields

$$\hat{p}_M^* = \frac{\eta_M \phi_M}{(\phi_M \eta_M - \varepsilon_M)} \hat{r}. \tag{7.6}$$

Note that choices of elasticity values determine the response of $\hat{p}_E^*$ to a change in r. For example, if the country under consideration is "small," then $\eta_E = \infty$ and $\hat{p}_E^* = 0$ from equation 7.5. Also, small implies that the import supply elasticity is infinite. From equation 7.6, $\varepsilon_M = \infty$ implies that $\hat{p}_M^* = 0$. So, a small country is unable to influence the foreign currency prices of exports and imports.

Substituting equations 7.5 and 7.6 into equation 7.2, along with the solutions for $\hat{E}$ and $\hat{M}$, gives

$$\frac{dTB^*}{\mathrm{dr/r}} = P_E^* E\left[\frac{-\varepsilon_E \phi_E(\eta_E + 1)}{\eta_E - \varepsilon_E \phi_E}\right] - P_M^* M\left[\frac{\eta_M \phi_M(1 + \varepsilon_M)}{\eta_M \phi_M - \varepsilon_M}\right]. \tag{7.7}$$

Dividing both sides of equation 7.7 by GDP (denominated in the foreign currency) gives

$$\frac{dTB^*/GDP^*}{\mathrm{dr/r}} = S_X\left[\frac{-\varepsilon_E \phi_E(\eta_E + 1)}{\eta_E - \varepsilon_E \phi_E}\right] - S_M\left[\frac{\eta_M \phi_M(1 + \varepsilon_M)}{\eta_M \phi_M - \varepsilon_M}\right], \tag{7.8}$$

where S_E and S_M are the shares of exports and imports in GDP, respectively. To compute how the trade balance would change, *denominated in domestic currency*, use the relationship

$$TBr = TB^*, \tag{7.9}$$

where TB is the trade balance measured in domestic currency.

Differentiating equation 7.9 with respect to r gives

$$\frac{dTB}{dr} r = \frac{dTB^*}{dr} - TB \tag{7.10}$$

or,

$$\frac{dTB}{dr} r = \frac{1}{r} \frac{dTB^*}{dr/r} - TB. \tag{7.11}$$

Substituting equation 7.7 into equation 7.11 and manipulating, gives

$$\frac{dTB/GDP}{\mathrm{dr/r}} = S_E\left[\frac{-\eta_E(1 + \varepsilon_E \phi_E)}{\eta_E - \varepsilon_E \phi_E}\right] - S_M\left[\frac{\varepsilon_M(1 + \eta_M \phi_M)}{\eta_M \phi_M - \varepsilon_M}\right]. \tag{7.12}$$

It needs to be emphasized that a devaluation could cause the trade balance to improve when measured in foreign currency terms, but deteriorate when measured in domestic currency terms. Consider the small-country case, where prices are fixed in foreign currency terms. Suppose a devaluation raises the domestic prices of imports and exports by the full amount of the exchange rate change—the case of full pass-through. Then export volume will rise and import volume will fall. Measured at *foreign* prices, the trade balance must improve because foreign prices are fixed and export volume increased, while import volume decreased. So the change in the trade balance must be positive. Measured at *domestic* prices, however, the change in the trade balance could be positive or negative. On the export side, the domestic price of exports rises and so does volume, so export revenue must increase. On the import side, however, expenditure on imports could rise or fall because the domestic price of imports rises with the devaluation, but the volume falls. So what happens to import expenditure depends on the elasticity of demand for imports, as shown in equation 7.12—it will depend on whether η_M is greater or less than one. Using equation 7.10 it is easy to see that the only situation in which the trade balance *must* change in the same direction in both foreign and domestic currency is if the trade balance is initially zero.

Special Cases

Equations 7.8 and 7.12 are general formulas that show how a change in a country's real exchange rate affects its trade balance. A few special cases are of particular interest: a small country, with

assumptions of being a price taker in both export and import markets, which is most appropriate for LICs; and the standard Keynesian assumption underlying the usual Marshall-Lerner condition.

Case 1: Small-Country Assumption ($\eta_E = \infty$, $\varepsilon_M = \infty$)

Many LICs are "small" in world markets for their imports and exports, that is, they are unable to affect prices denominated in foreign currency by how much they buy or sell. Under these assumptions, both the export demand elasticity that they face and their import supply elasticity would be infinite. In this case, letting $\eta_E = \varepsilon_M = \infty$, equation (7.8) reduces to a simple form:

$$\frac{\partial TB^*/GDP^*}{dr/r} = -S_E\varepsilon_E\phi_E + S_M\eta_M\phi_M < 0, \qquad (7.13)$$

where ε_E is a country's export supply elasticity (defined as a positive number) and η_M is the import demand elasticity (defined as a negative number). Given that the shares of exports and imports in GDP are positive, equation 7.13 must be negative. That is, under the small-country assumption, an appreciation of the real exchange rate must worsen the trade balance (or alternatively, a depreciation of the real exchange rate will improve the trade balance). A depreciation raises the domestic currency price of exports (while the foreign price remains unchanged), causing producers to increase the quantity of exports supplied. It also raises the domestic currency price of imports (while the foreign price remains unchanged), causing consumers to reduce the quantity of imports demanded. Both of these effects work to improve the trade balance. Tables 6.1 and 6.2 presented estimated values for export supply ε_E and import demand elasticities η_M. Using these elasticity values together with equation 7.13, it is possible to calculate how a given change in a country's exchange rate would affect its trade balance.

Case 2: Keynesian Assumption ($\varepsilon_E = \infty$, $\varepsilon_M = \infty$)

One case that has received attention is the so-called "Keynesian case"—a situation in which a country can influence the price of exports but not the price of imports (Kindleberger and Lindert, 1978, p. 539). If the supplies of both exports and imports are assumed to be perfectly elastic, equation 7.12 reduces to

$$\frac{\partial TB^*/GDP^*}{dr/r} = S_E\eta_E + S_M(1 + \eta_M\phi_M) < 0. \qquad (7.14)$$

Equation 7.14 is frequently referred to as the Marshall-Lerner condition, which is the condition for a depreciation to improve the trade balance in the special case in which supply elasticities are assumed to be infinite and $\phi_E = \phi_M = 1$ (full pass-through). Under these assumptions, a depreciation will improve the trade balance when trade is balanced initially ($S_E = S_M$) if the sum of the export and import demand elasticities is greater than one.[1]

In summary, the Keynesian case assumes that both export and import supply elasticities are infinite, while the small-country assumption assumes that the export demand and import supply elasticities are infinite. This difference reflects alternative assumptions about pricing behavior in countries, namely, whether producers set prices in domestic or foreign currency. If countries are unable to affect the foreign prices of the goods they import and export, it would be appropriate to use the small-country assumptions with regard to elasticities. If the countries under study have some market power, that is, are able to influence *foreign* prices by how much they sell, it would be appropriate to use an export demand elasticity that is less than infinity. A consequence of using the small-country assumptions is that a real devaluation will *always* improve the trade balance because a devaluation cannot reduce the foreign-currency prices of imports and exports, so the devaluation only affects trade volumes—export volume rises and import volume declines. In the Keynesian case, a devaluation will in general have ambiguous effects on the trade balance in domestic currency terms. Table 7.1 summarizes the cases described above and presents the conditions for a devaluation to improve the trade balance.

[1]This is the case assumed in Lee and others (2008), who work with a sample of advanced economies and emerging markets and assume that countries possess at least some market power, since the export demand elasticity is assumed to be less than infinite.

Table 7.1. Summary of How Changes in the Exchange Rate Affect the Trade Balance

	Small Country Case	Keynesian Case	General Case
Elasticity values	$\eta_E = -\infty$ $\varepsilon_E > 0$ $\eta_M < 0$ $\varepsilon_M = \infty$	$\eta_E < 0$ $\varepsilon_E = \infty$ $\eta_M < 0$ $\varepsilon_M = \infty$	$\eta_E < 0$ $\varepsilon_E > 0$ $\eta_M < 0$ $\varepsilon_M > 0$
Condition for devaluation to improve trade balance in foreign currency	$-S_E\varepsilon_E\Phi_E + S_M\eta_M\Phi_M < 0$	$S_E(\eta_E + 1) + S_M\eta_M\Phi_M < 0$	$S_E\left[\frac{-\varepsilon_E\Phi_E(\eta_E+1)}{\eta_E - \varepsilon_E\Phi_E}\right]$ $-S_M\left[\frac{\eta_M\Phi_M(1+\varepsilon_M)}{\eta_M\Phi_M - \varepsilon_M}\right] < 0$
Condition for devaluation to improve trade balance in domestic currency	$-S_E(1+\varepsilon_E\Phi_E) + S_M(1+\eta_M\Phi_M) < 0$	$S_E\eta_E + S_M(1+\eta_M\Phi_M) < 0$	$S_E\left[\frac{-\eta_E(1+\varepsilon_E\Phi_E)}{\eta_E - \varepsilon_E\Phi_E}\right]$ $-S_M\left[\frac{\varepsilon_M(1+\eta_M\Phi_M)}{\eta_M\Phi_M - \varepsilon_M}\right] < 0$

Note: η_E is the export demand elasticity; ε_E is the export supply elasticity; η_m is the import demand elasticity; ε_m is the import supply elasticity; Φ_E measures the extent of pass-through into export prices; Φ_M measures the extent of pass-through into import prices; and S_E and S_M are the shares of exports and imports in GDP.

For a discussion on the relationship between the calculations presented in this section and trade balance elasticities with respect to the real exchange rate, or for extensions to imperfect competition and less-than-perfect labor mobility, see Tokarick (2010).

For illustrative purposes, Table 7.2 reports the trade balance elasticities that result from using various formulae. The column labeled "Keynesian" assumes that export and import supply elasticities are infinite, while export and import demand elasticities are set—for most countries—at the value adopted in Lee and others (2008), that is, –0.71 and –0.92, respectively.[2] The column labeled "Small country" lists the trade balance elasticities that result from assuming that import supply and export demand elasticities are infinite, and setting the import demand and export supply elasticities at their respective country-specific, long-run general equilibrium values calculated in Chapter 6 and reported in Tables 6.1 and 6.2 (last column on the right, labeled "Adjusted to include general equilibrium effects, LR").

The column labeled "General" in Table 7.2 refers to the trade balance elasticities that result from applying the assumptions listed in the last column of Table 7.1. For illustrative purposes, this case assumes that the import supply elasticity is infinite, import demand elasticities are taken from Table 6.1, export supply elasticities are taken from Table 6.2, and export demand elasticities are set equal to the value adopted for the illustration of the Keynesian case above (–0.71). This general formula would be appropriate to use for cases in which both the home country and foreign countries can influence the price of the country exports, but the home country is still a price taker in the imports market.

For all the trade balance elasticities reported in Table 7.2, it was assumed that $\phi_E = \phi_M = 1$, that is, the full pass-through case. Country-specific values could be used if known.

In Table 7.2, for most countries, the absolute value of the trade balance elasticity for the "general case" lies between the elasticities for the Keynesian case and the small-country case. An exception is Bangladesh, where the trade balance elasticity for the general case exceeds the Keynesian trade balance elasticity. Using the formula for changes in the trade

[2]For a few countries, Lee and others (2008) adopt a different value. Import demand elasticities (η_M) are set at –1.0 for the euro area, United States, Malaysia, and Colombia; –0.67 for China; and –1.10 for Brazil. Export demand elasticities (η_E) are set at – 0.85 for the United States and Brazil, –0.95 for China, and –0.94 for Malaysia. Lee and others also adjust overall export elasticities depending on the country share of commodity exports (whose elasticity is assumed to be –1.0).

balance in domestic currency terms, this will occur when

$$S_E\left[\frac{-\eta_E(\varepsilon_E+1)}{\eta_E-\varepsilon_E}\right]+S_M(\eta_M+1)>S_E\eta_E^{CGER}+S_M(1-\eta_M^{CGER}).$$

Substituting in the relevant values, this condition can be expressed as

$$\eta_M>\frac{S_E}{S_M}\left[\frac{-0.2059}{-0.71-\varepsilon_E}\right]-0.92.$$

Because the import demand elasticity for Bangladesh is relatively high (–0.33), the above condition is satisfied. However, for most other countries, the import demand elasticity is more negative. Also, a low value for $\left(\frac{S_E}{S_M}\right)$ will increase the likelihood that the above condition is satisfied. In the case of Bangladesh, this ratio is 0.62. Because the bracketed term in the above condition is positive, a low value for $\left(\frac{S_E}{S_M}\right)$ means that a low weight will be attached to this term.

Table 7.2. Trade Balance Elasticities

	Domestic Currency			Foreign Currency		
	Keynesian	General	Small country	Keynesian	General	Small country
Low-Income[1]						
Bangladesh	–0.14	0.06	–0.42	–0.28	–0.07	–0.56
Benin	–0.06	–0.18	–0.23	–0.16	–0.28	–0.33
Burkina Faso	–0.07	–0.23	–0.29	–0.21	–0.36	–0.42
Burundi	–0.08	–0.25	–0.36	–0.38	–0.55	–0.67
Cambodia	–0.38	–0.79	–1.19	–0.51	–0.92	–1.32
Central African Rep.	–0.10	–0.24	–0.30	–0.18	–0.33	–0.38
Chad	–0.31	–0.65	–0.81	–0.36	–0.70	–0.86
Congo, Dem. Rep.	–0.43	–0.71	–0.87	–0.45	–0.74	–0.90
Côte d'Ivoire	–0.29	–0.60	–0.81	–0.28	–0.58	–0.79
Eritrea	–0.05	–0.12	–0.18	–0.13	–0.20	–0.26
Ethiopia	–0.12	–0.23	–0.37	–0.36	–0.47	–0.60
Gambia, The	–0.30	–0.76	–1.00	–0.55	–1.02	–1.25
Ghana	–0.20	–0.52	–0.68	–0.39	–0.71	–0.87
Guinea	–0.17	–0.44	–0.57	–0.32	–0.59	–0.73
Guinea-Bissau	–0.18	–0.45	–0.59	–0.33	–0.61	–0.74
India	–0.14	–0.11	–0.38	–0.19	–0.16	–0.43
Kenya	–0.15	–0.29	–0.46	–0.24	–0.39	–0.56
Kyrgyz Rep.	–0.42	–0.64	–1.23	–0.70	–0.92	–1.51
Lao People's Dem. Rep.	–0.19	–0.25	–0.45	–0.22	–0.28	–0.48
Madagascar	–0.22	–0.41	–0.77	–0.25	–0.43	–0.80
Malawi	–0.15	–0.19	–0.38	–0.37	–0.42	–0.61
Mali	–0.13	–0.31	–0.40	–0.20	–0.37	–0.47
Mauritania	–0.27	–0.59	–0.79	–0.32	–0.64	–0.84
Mozambique	–0.17	–0.14	–0.51	–0.28	–0.26	–0.62
Nepal	–0.07	–0.08	–0.27	–0.27	–0.27	–0.46

Table 7.2 *(continued)*

	Domestic Currency			Foreign Currency		
	Keynesian	General	Small country	Keynesian	General	Small country
Niger	–0.12	–0.35	–0.44	–0.30	–0.54	–0.63
Nigeria	–0.36	–0.60	–0.72	–0.19	–0.43	–0.55
Pakistan	–0.08	–0.08	–0.22	–0.16	–0.16	–0.30
Papua New Guinea	–0.40	–0.42	–1.10	–0.44	–0.46	–1.14
Rwanda	–0.06	–0.17	–0.25	–0.25	–0.36	–0.44
Senegal	–0.15	–0.36	–0.51	–0.34	–0.56	–0.71
Sierra Leone	–0.16	–0.37	–0.49	–0.24	–0.46	–0.58
Tajikistan	–0.08	–0.28	–0.44	–0.49	–0.68	–0.85
Tanzania	–0.18	–0.22	–0.47	–0.35	–0.40	–0.64
Togo	–0.32	–0.81	–1.06	–0.56	–1.05	–1.30
Uganda	–0.12	–0.09	–0.25	–0.28	–0.25	–0.41
Uzbekistan	–0.27	–0.43	–0.81	–0.21	–0.37	–0.75
Vietnam	–0.57	–1.69	–2.60	–0.71	–1.83	–2.75
Zambia	–0.17	–0.28	–0.45	–0.21	–0.33	–0.49
Mean	**–0.20**	**–0.39**	**–0.62**	**–0.32**	**–0.52**	**–0.74**
Median	**–0.17**	**–0.31**	**–0.47**	**–0.28**	**–0.43**	**–0.63**
Standard deviation	**0.12**	**0.31**	**0.43**	**0.14**	**0.32**	**0.44**
Lower-Middle-Income[1]						
Albania	–0.17	–0.19	–0.44	–0.39	–0.42	–0.66
Algeria	–0.33	–0.60	–0.71	–0.20	–0.46	–0.57
Armenia	–0.11	–0.24	–0.53	–0.34	–0.46	–0.76
Azerbaijan	–0.40	–0.85	–1.33	–0.23	–0.69	–1.17
Belarus	–0.42	–0.26	–1.54	–0.46	–0.30	–1.58
Bolivia	–0.23	–0.34	–0.58	–0.20	–0.30	–0.54
Bulgaria	–0.47	–1.01	–1.68	–0.58	–1.12	–1.79
Cameroon	–0.14	–0.31	–0.38	–0.18	–0.34	–0.42
China	–0.33	–0.31	–0.85	–0.23	–0.22	–0.75
Colombia	–0.15	–0.19	–0.38	–0.18	–0.22	–0.41
Congo, Republic of	–0.59	–1.10	–1.40	–0.41	–0.93	–1.22
Dominican Republic	–0.19	–0.48	–0.82	–0.26	–0.55	–0.89
Ecuador	–0.23	–0.52	–0.70	–0.25	–0.54	–0.72
Egypt	–0.21	–0.30	–0.50	–0.30	–0.39	–0.59
El Salvador	–0.16	–0.29	–0.64	–0.35	–0.49	–0.84
Georgia	–0.26	–0.38	–0.92	–0.46	–0.58	–1.12
Guatemala	–0.15	–0.28	–0.57	–0.28	–0.41	–0.70
Honduras	–0.37	–0.64	–1.42	–0.69	–0.97	–1.75
Indonesia	–0.19	–0.27	–0.40	–0.18	–0.26	–0.38
Jordan	–0.37	–0.66	–0.81	–0.72	–1.01	–1.16
Lesotho	–0.38	–0.21	–1.03	–0.76	–0.59	–1.41

Table 7.2 *(continued)*

	Domestic Currency			Foreign Currency		
	Keynesian	General	Small country	Keynesian	General	Small country
Macedonia, FYR	–0.44	–0.69	–1.45	–0.67	–0.92	–1.68
Moldova	–0.49	–1.87	–3.01	–1.15	–2.53	–3.67
Mongolia	–0.52	–0.78	–1.79	–0.54	–0.80	–1.81
Morocco	–0.25	–0.49	–0.99	–0.34	–0.58	–1.08
Namibia	–0.30	–0.22	–0.83	–0.37	–0.30	–0.90
Nicaragua	–0.31	–0.72	–1.41	–0.64	–1.05	–1.74
Paraguay	–0.48	–0.72	–1.43	–0.52	–0.77	–1.47
Peru	–0.15	–0.20	–0.41	–0.17	–0.22	–0.43
Philippines	–0.26	–0.23	–0.49	–0.36	–0.33	–0.59
Syrian Arab Republic	–0.26	–0.43	–0.53	–0.35	–0.52	–0.62
Sri Lanka	–0.15	–0.19	–0.41	–0.25	–0.29	–0.51
Sudan	–0.11	–0.19	–0.32	–0.11	–0.19	–0.31
Swaziland	–0.49	–0.34	–1.33	–0.70	–0.55	–1.55
Thailand	–0.58	–0.26	–0.73	–0.57	–0.26	–0.72
Tunisia	–0.40	–0.99	–1.58	–0.42	–1.01	–1.60
Turkmenistan	–0.30	–0.42	–0.83	–0.08	–0.20	–0.61
Ukraine	–0.32	–0.35	–1.08	–0.45	–0.48	–1.21
Mean	**–0.31**	**–0.49**	**–0.95**	**–0.40**	**–0.59**	**–1.05**
Median	**–0.30**	**–0.34**	**–0.82**	**–0.36**	**–0.48**	**–0.86**
Standard deviation	**0.14**	**0.34**	**0.55**	**0.22**	**0.42**	**0.64**
Upper-Middle-Income[1]						
Argentina	–0.14	–0.28	–0.45	–0.13	–0.27	–0.44
Botswana	–0.35	–0.52	–1.05	–0.24	–0.41	–0.94
Brazil	–0.10	–0.14	–0.30	–0.09	–0.13	–0.29
Chile	–0.23	–0.51	–0.73	–0.30	–0.57	–0.79
Costa Rica	–0.45	–0.63	–1.27	–0.53	–0.71	–1.35
Croatia	–0.36	–0.48	–1.62	–0.42	–0.54	–1.68
Gabon	–0.49	–0.83	–1.07	–0.18	–0.53	–0.77
Jamaica	–0.33	–0.86	–1.44	–0.49	–1.03	–1.61
Kazakhstan	–0.28	–0.43	–0.90	–0.19	–0.34	–0.81
Latvia	–0.24	–0.53	–1.31	–0.31	–0.60	–1.38
Libya	–0.63	–1.09	–1.30	–0.29	–0.76	–0.97
Lithuania	–0.45	–0.66	–1.55	–0.53	–0.74	–1.63
Malaysia	–1.21	–0.95	–1.91	–1.01	–0.75	–1.71
Mauritius	–0.45	–0.32	–0.79	–0.54	–0.41	–0.88
Mexico	–0.23	–0.15	–0.31	–0.25	–0.17	–0.34
Panama	–0.24	–0.40	–0.85	–0.26	–0.42	–0.87
Poland	–0.37	–0.68	–1.59	–0.43	–0.74	–1.65
Romania	–0.19	–0.22	–0.66	–0.29	–0.31	–0.76

Table 7.2 *(continued)*

	Domestic Currency			Foreign Currency		
	Keynesian	General	Small country	Keynesian	General	Small country
Russian Federation	–0.13	–0.23	–0.30	–0.14	–0.23	–0.30
South Africa	–0.22	–0.27	–0.64	–0.26	–0.31	–0.68
Turkey	–0.24	–0.39	–0.69	–0.32	–0.47	–0.76
Uruguay	–0.23	–0.33	–0.67	–0.20	–0.31	–0.64
Venezuela	–0.23	–0.53	–0.58	–0.23	–0.53	–0.57
Mean	**–0.34**	**–0.50**	**–0.96**	**–0.33**	**–0.49**	**–0.95**
Median	**–0.24**	**–0.48**	**–0.85**	**–0.29**	**–0.47**	**–0.81**
Standard deviation	**0.23**	**0.26**	**0.47**	**0.20**	**0.22**	**0.47**
High-Income: Non-OECD[1]						
Estonia	–0.44	–1.04	–1.92	–0.50	–1.10	–1.99
Hong Kong SAR	–1.34	–2.00	–3.65	–1.28	–1.94	–3.60
Israel	–0.30	–0.49	–0.60	–0.32	–0.50	–0.61
Oman	–0.40	–0.62	–0.76	–0.24	–0.46	–0.60
Saudi Arabia	–0.45	–0.70	–0.86	–0.31	–0.56	–0.72
Singapore	–1.69	–1.50	–5.03	–1.43	–1.25	–4.77
Slovenia	–0.71	–0.72	–3.52	–0.73	–0.75	–3.55
Trinidad and Tobago	–0.32	–0.67	–1.22	–0.26	–0.61	–1.15
Mean	**–0.71**	**–0.97**	**–2.20**	**–0.63**	**–0.90**	**–2.12**
Median	**–0.45**	**–0.71**	**–1.57**	**–0.41**	**–0.68**	**–1.57**
Standard deviation	**0.52**	**0.52**	**1.66**	**0.48**	**0.51**	**1.64**
High-Income: OECD[1]						
Australia	–0.14	–0.35	–0.54	–0.16	–0.36	–0.56
Austria	–0.44	–0.48	–1.43	–0.39	–0.44	–1.38
Belgium	–0.70	–0.39	–2.97	–0.68	–0.37	–2.94
Canada	–0.21	–0.21	–0.71	–0.19	–0.20	–0.69
Czech Republic	–0.80	–1.31	–2.55	–0.76	–1.28	–2.51
Denmark	–0.35	–0.33	–1.12	–0.32	–0.31	–1.10
Finland	–0.34	0.05	–0.70	–0.30	0.09	–0.66
France	–0.20	–0.28	–0.71	–0.23	–0.30	–0.74
Germany	–0.37	0.03	–1.54	–0.32	0.08	–1.50
Greece	–0.13	–0.21	–0.50	–0.22	–0.30	–0.59
Hungary	–0.64	–0.68	–1.72	–0.61	–0.65	–1.69
Ireland	–0.55	–0.24	–1.10	–0.41	–0.11	–0.96
Italy	–0.23	–0.29	–0.70	–0.23	–0.29	–0.71
Japan	–0.12	–0.10	–0.47	–0.11	–0.10	–0.46
Korea, Rep. of	–0.37	–0.01	–0.71	–0.38	–0.02	–0.72
Luxembourg	–1.21	–3.69	–9.04	–0.73	–3.20	–8.56

Table 7.2 *(concluded)*

	Domestic Currency			Foreign Currency		
	Keynesian	General	Small country	Keynesian	General	Small country
Netherlands	–0.57	–0.52	–1.62	–0.51	–0.45	–1.55
New Zealand	–0.18	–0.21	–0.54	–0.16	–0.20	–0.52
Norway	–0.38	–0.73	–0.97	–0.16	–0.51	–0.76
Portugal	–0.23	–0.49	–1.19	–0.28	–0.54	–1.23
Slovak Rep.	–0.69	–0.73	–1.83	–0.70	–0.74	–1.84
Spain	–0.18	–0.36	–0.74	–0.24	–0.42	–0.80
Sweden	–0.37	0.09	–1.10	–0.31	0.14	–1.05
Switzerland	–0.47	–0.45	–1.52	–0.39	–0.38	–1.44
United Kingdom	–0.17	–0.42	–0.84	–0.20	–0.45	–0.87
United States	–0.09	–0.21	–0.50	–0.12	–0.24	–0.53
Mean	**–0.39**	**–0.48**	**–1.44**	**–0.35**	**–0.44**	**–1.40**
Median	**–0.36**	**–0.34**	**–1.04**	**–0.31**	**–0.34**	**–0.92**
Standard deviation	**0.26**	**0.72**	**1.67**	**0.20**	**0.63**	**1.59**
Overall						
Mean	**–0.32**	**–0.49**	**–1.02**	**–0.37**	**–0.54**	**–1.08**
Median	**–0.26**	**–0.39**	**–0.77**	**–0.31**	**–0.46**	**–0.76**
Standard deviation	**0.24**	**0.45**	**1.01**	**0.22**	**0.43**	**0.97**

[1]Economies are grouped according to 2007 gross national income per capita, calculated using the World Bank Atlas method. The groups are as follows: low-income, $935 or less; lower-middle-income, $936–$3,705; upper-middle-income, $3,706–$11,455; and high-income, $11,456 or more.

Appendix: The Database

The database includes data since 1980 for all countries with a population larger than 1 million. A few countries were dropped because of a substantial lack of data or very poor data quality. The database includes 134 countries, of which 31 are high-income countries; 26 are upper-middle-income countries; 36 are lower-middle-income countries; and 41 are low-income countries (based on World Bank Development Indicators, 2008). The low-income country (LIC) sample comprises the last two groups and excludes emerging markets to make the sample as homogeneous as possible (Table A1).[1] The high-income country (HIC) sample—mainly used as a comparator group—includes the first two groups and the six countries excluded from the LIC group. The regression sample is often smaller because of the unbalanced nature of the data set. To construct variables relative to trading partners, the analysis uses the weights used by the IMF Information Notice System (IMF-INS) to calculate real effective exchange rates.

The variables used in the regressions are explained below, with a summary of statistics in Table A2.

Exchange Rates

Real Effective Exchange Rate

- The natural logarithm of the consumer price index–based real effective exchange rate was taken from the IMF-INS.
- The database also includes a measure of the real exchange rate computed on the basis of the Penn World Table variable *P*, which captures price levels relative to the United States. The natural logarithm of this variable was taken, and then computed in deviations from trading partners, using the same weights as used in the IMF-INS measure.

[1]China, Colombia, India, Indonesia, Pakistan, and Thailand are excluded.

Table A1. Low-Income Country Sample

Country	Regression Inclusion	Country	Regression Inclusion
Albania	1, 3	Macedonia, FYR	
Algeria	3	Madagascar	1, 2, 3
Azerbaijan	1, 2, 3	Malawi	
Bangladesh	1, 2, 3	Mali	
Belarus	2, 3	Morocco	1, 2, 3
Benin		Mozambique	1, 2, 3
Bolivia	1, 2, 3	Namibia	
Burkina Faso	1, 2, 3	Nepal	3
Cambodia		Nicaragua	1, 2
Cameroon	1, 2, 3	Niger	
Chad		Nigeria	1, 2, 3
Congo, Dem. Rep. of		Papua New Guinea	
Congo, Republic of		Paraguay	1, 3
Côte d'Ivoire	1, 2, 3	Peru	1, 2, 3
Dominican Republic	1, 2, 3	Philippines	1, 2, 3
Ecuador	1, 2, 3	Rwanda	
Egypt	3	Senegal	1, 3
El Salvador	1, 2, 3	Sierra Leone	2
Ethiopia	1, 2, 3	Sri Lanka	1, 2, 3
Gambia, The	2	Swaziland	
Georgia	3	Syrian Arab Republic	
Ghana	2, 3	Tanzania	1, 2, 3
Guatemala	1, 2, 3	Togo	
Guinea		Tunisia	1, 2, 3
Honduras	2	Uganda	1, 2, 3
Jamaica	1, 2, 3	Ukraine	2, 3
Jordan	1, 2, 3	Uzbekistan	1
Kenya	1, 2, 3	Vietnam	3
Kyrgyz Rep.	2, 3	Zambia	2
Lao People's Dem. Rep.			

1. Countries included in current account baseline (Table 3.1, column 9).
2. Countries included in the real exchange rate baseline (Table 4.2, column 3).
3. Countries included in the net foreign assets baseline (Table 5.1, column 1).

Black Market Premium

The black market premium was computed as the log difference between the black market nominal

Table A2. Regression Variable Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Current account to GDP	–0.0544	0.0785	–0.4721	0.2478
Fiscal balance to GDP[1]	–0.0123	0.0552	–0.4710	0.3733
Old-age dependency[1]	–0.0946	0.0304	–0.1790	0.0362
Population growth[1]	0.0122	0.0099	–0.0268	0.0528
Net foreign assets to GDP	–0.7162	0.7291	–10.1421	0.4170
Oil trade balance to GDP	–0.0063	0.0915	–0.3002	0.6143
Income per capita (relative to United States)	0.0682	0.0513	0.0076	0.2671
Per capita real GDP growth[1]	–0.0104	0.0509	–0.3038	0.2800
Aid flows to GDP[1]	0.0874	0.0984	–0.0369	0.8246
Concessional loans	0.0265	0.0357	–0.0889	0.4347
Net grants to GDP	0.0623	0.0733	0.0008	0.7781
Terms of trade, goods and services	4.6358	0.2763	3.7473	5.9550
Capital account liberalization (other)	0.4414	0.3366	0.0000	1.0000
Capital account liberalization	0.5082	0.2777	0.0000	1.0000
Log of REER (IMF-INS)	4.6565	0.3428	2.6794	5.8910
Log of REER (PWT)	–0.7972	0.4644	–2.2663	1.5944
NFA (w/NPV debt) to trade	–2.5941	3.5943	–24.5817	1.0167
Government consumption to GDP[1]	–0.0378	0.0568	–0.1454	0.3731
Terms of trade, goods (log)	4.6677	0.3125	3.2149	6.1624
Fertility[1]	2.7400	1.3487	–0.5279	4.8621
GDP per worker, PWT (log)	8.4248	0.8345	6.6902	10.0493
Trade restrictions[1]	0.1729	0.1858	–0.2463	0.8064
Administered agricultural prices[1]	0.0223	0.3242	–0.3087	0.9738
Maximum agricultural price intervention[1]	0.1833	0.4988	–0.5313	0.9372
Natural disaster	0.5195	0.4998	0.0000	1.0000
Violent political transition	0.0680	0.2518	0.0000	1.0000
Public debt to trade	3.2464	3.3911	0.0080	28.7196
Relative productivity (log)[1]	–1.9131	0.6679	–3.5656	0.0631
Domestic financial liberalization[1]	–0.2942	0.1710	–0.6908	0.1458
Constraint on executive	3.6352	1.9312	1.0000	7.0000
NPV of external debt to trade	2.2657	2.4506	0.0323	21.4463

Note: IMF-INS = IMF's Information Notice System; NFA = net foreign assets; NPV = net present value; PWT = Penn World Table; REER = real effective exchange rate; .
[1]Deviation from trading partners.

exchange rate and the official nominal exchange rate, both in local currency per U.S. dollar. The data are annual averages of the monthly data from Reinhart and Rogoff (2004).

Demographics

Fertility

Total fertility from the United Nations population data is defined as the average number of children a hypothetical cohort of women would have at the end of their reproductive period if they

were subject during their whole lives to the fertility rates of a given period and if they were not subject to mortality (United Nations, 2006). It is expressed as children per woman.

Infant Mortality Ratio

Infant mortality rate from United Nations (2006) is defined as infant deaths per 1,000 live births.

Old-Age Dependency Ratio

The old-age dependency ratio captures the share of people older than 64, relative to the working-age population, defined as the 15–64-year-old age group. The data were based on UN data, annualized by the World Bank. The variable was computed in deviations from trading partners.

Population Growth

Population growth data were computed from World Bank data, extended with UN projections.

External

Current Account

The current-account-to-GDP ratio is based on the IMF's *World Economic Outlook* (WEO) data (IMF, 2009).

Net Foreign Assets

- Net foreign assets (NFA), lagged one year, was computed relative to average trade for the real exchange rate regressions approach and relative to GDP for the current account regression (net foreign assets regressions encompass various versions of this indicator, as discussed in the text). Data on NFA in nominal terms were provided by Gian Maria Milesi-Ferretti. Trade data are from the WEO or from the IMF's *International Financial Statistics* (IFS) spliced with WEO data. For the few countries for which NFA data were unavailable, the cumulative current account was used.
- Data on NFA in net present value terms were computed by adding back into NFA the measure of total debt, and then subtracting time series data on the present value of debt from the World Bank. Because the World Bank measure of the present value of debt is based only on long-term public and publicly guaranteed debt as well as use of IMF credit, the analysis also subtracted short- and long-term private nonguaranteed debt (which is not likely to be subject to any substantial element of concessionality). For the few countries without data for the present value of debt, the nominal value was used.

Aid Flows to GDP

This measure of foreign aid was computed by Roodman (2006). It was based on official development assistance data from the Development Assistance Committee of the Organization for Economic Cooperation and Development (OECD) and was computed as total net aid minus debt forgiveness plus offsetting entries for debt relief. The data are in millions of U.S. dollars and are computed relative to WEO nominal GDP in millions of U.S. dollars. The estimations included concessional loans and net grants. The loans were constructed as foreign aid minus the net grants, and net grants were constructed as total grants minus debt forgiveness grants.

Oil Trade Balance

The oil-trade-balance-to-GDP ratio was from the WEO.

Fiscal

Fiscal Balance

The general government balance relative to GDP was obtained using the central government balance for some countries for which the general balance was not available. The data were from the WEO.

Government Consumption

Government consumption relative to GDP was from the OECD, spliced with data from the IFS and the WEO.

Income-Related Variables

GDP per Capita Growth

Growth rate of GDP per capita is from the WEO.

Relative Productivity

The baseline measure of productivity was measured as real purchasing-power-parity GDP per capita from the Penn World Table, extended with data from World Development Indicators (World Bank, 2008).

GDP per Worker

- Real GDP per worker is real GDP divided by the number of workers, from the Penn World Table.

Relative Income per Capita

Relative income per capita is purchasing power parity income per capita, relative to the United States. The data were from the World Bank.

Income Groups

Income groups were aggregated on the basis of World Bank income group classifications.

Shocks

Natural Disasters

Natural disaster data were from the International Disaster Database of the Centre for Research on the Epidemiology of Disasters, and include binary dummy variables (1 for event, zero for no event) for drought, earthquake, flood, and windstorm. The binary dummy indicator used in the regression analysis is equal to 1 if any of these four indicators is equal to 1, and is equal to zero otherwise.

Wars

War dummies from the Uppsala Conflict Data Program/International Peace Research Institute Armed Conflict Dataset, Version 4-2006 (Gleditsch and others, 2002; Harbom, Högbladh, and Wallensteen, 2006), are based on four types of conflicts: (1) extrasystemic armed conflict (between a state and a nonstate group outside its own territory)—these conflicts are by definition territorial because the government side is fighting to retain control of a territory outside the state system); (2) interstate armed conflict (between two or more states); (3) internal armed conflict (between the government of a state and one or more internal opposition groups); and (4) internationalized internal armed conflict (between the government of a state and one or more internal opposition group(s), with intervention from other states on one or both sides). Each of the four types of conflicts was coded as zero: no conflict; 1: minor; 2: intermediate; and 3: war (at least 1,000 deaths per year).

Terms of Trade, Goods

The natural logarithm of terms of trade of goods is from the WEO.

Terms of Trade, Goods and Services

The natural logarithm of terms of trade of goods and services is from the WEO.

Commodity-Based Terms of Trade

- The analysis also uses for robustness the ratio of a weighted average price of the main commodity exports to a weighted average price of the main commodity imports. The index for six commodity goods is constructed as in Ricci, Milesi-Ferretti, and Lee (2008). The index for 32 commodities encompasses aluminum,

bananas, beef, cocoa, coconut oil, coffee, copper, corn, cotton, crude oil, fishmeal, gold, hard log, hides, iron, lamb, lead, nickel, palm oil, rice, rubber, shrimp, soybean meal, soybean oil, soybeans, sugar, sunflower oil, tea, tin, wheat, wool, and zinc.

Structural Reforms

Capital Account Liberalization

- The capital account liberalization measure from the IMF Research Department's structural reform database (IMF, 2009) is an index, normalized between zero and 1. It is computed by Dennis Quinn, as an update of Quinn (1997), and measures restrictions on capital account transactions.
- An alternative measure of capital account liberalization is taken from Abiad, Detragiache, and Tressel (2008).

Domestic Financial Reforms

The domestic financial reform measure is an index, coded between zero and 1. It is from the IMF Research Department's structural reform database.

Price Controls

- "Administered agricultural prices" is a 0,1 dummy reflecting the strong presence of price controls in the agricultural sector (from the agricultural product market index of the IMF Research Department's structural reform database).
- "Maximum agricultural price intervention" is a 0,1 dummy reflecting the presence of marketing boards setting the prices (from the agricultural product market index of the IMF Research Department's structural reform database).
- "Administered prices" is a measure of price controls based on the share of administered prices in the consumer price index from the European Bank for Reconstruction and Development, available for transition economies only.

Trade Restrictions

- Data on trade restrictions are from the IMF Research Department's structural reform database. The series is based on data for average tariffs and is normalized between zero and 1 on the basis of smallest and largest observation in the sample.
- An alternative measure of trade restrictions is from Wacziarg and Welch (2003), who extended the liberalization years suggested by Sachs and Warner (1995).

Institutions

Constraint on the Executive

Constraint on the executive variable (*xconst*), where negative values have been replaced by a zero, is from the Polity IV project of the Center for Systemic Peace.

Violent Political Transition

This is a dummy variable equal to 1 whenever constraint on the executive is negative, and equal to zero otherwise.

Other Controls

Other controls include a change in the ratio of private credit to GDP, where private credit is defined as credit by domestic depository institutions to the nonbank private sector (see Beck, Demirgüç-Kunt, and Levine, 2000).

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