6

US Welfare and the Trade Balance

The association between US welfare and the terms of trade drawn in chapter 5 rests heavily on the assumption that trade is balanced. This assumption also applies in the context of Paul Samuelson's (2004) Ricardian-based analysis of the possible effect of developing-country growth on US gains from trade. However, in our analysis of emerging-market-economy growth and US welfare, we need to take account of the fact that the United States has been running large trade deficits. This is necessary because the trade balance is likely to have an independent and systematic influence on the terms of trade. As we discuss in this chapter, larger trade deficits can induce higher terms of trade. Reducing the US current account to levels sustained in the early 1990s, for example, which requires a reduction in US spending relative to income, is likely to be associated with lower terms of trade. Consequently, a fair test of Samuelson's concerns needs to adjust for the effect of the trade deficit itself in boosting the terms of trade since the early 1990s.

This chapter isolates the contribution of the trade deficit to changes in the US terms of trade to allow for a more thorough evaluation of the effect of emerging-market economies on US welfare. The chapter first briefly describes the behavior of the current account from the early 1980s. We then explicate the theory of how changes in net foreign borrowing or lending (i.e., the current account) might affect the terms of trade. Finally, we draw on simulation models and econometric estimates of trade equations to isolate the net change in the terms of trade since 1990 after accounting for the effect of the trade balance.

The theory we will present suggests that because of a bias in preferences for home goods and/or the existence of nontraded goods, the impact of changes in the trade balance on the terms of trade can be captured in a

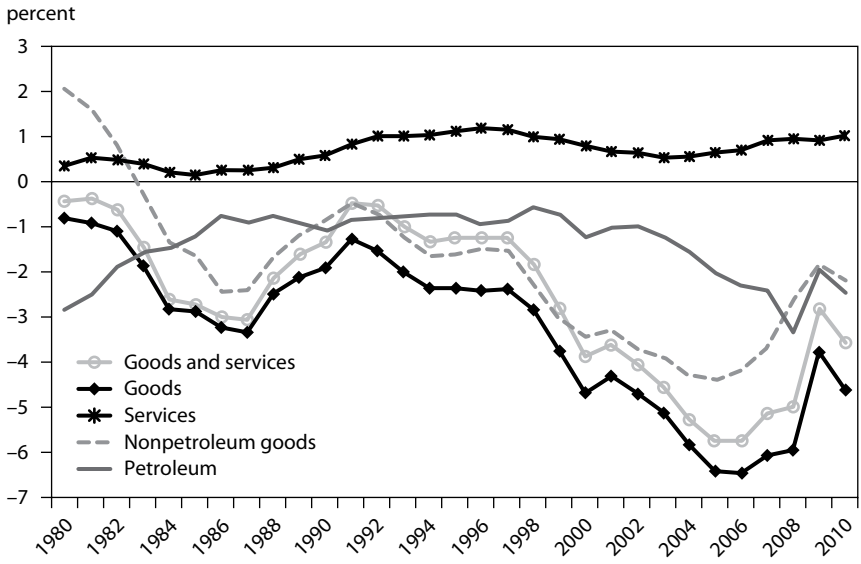
transfer schedule that should have a negative slope. In other words, larger deficits are associated with higher terms of trade. This theoretical expectation is confirmed in simple plots of the association between the US terms of trade and the trade balance in goods and services. We find that, as expected, there is a negative association between the variables. Between 1990 and 2002, in fact, the plots are almost aligned in the line we would expect if we had identified the transfer schedule. From 2003 onward, however, there is a clear downward shift in the relationship, and lower terms of trade are consistent with any given trade balance. However, this decline is entirely due to oil. Once oil is excluded, we find again that the implied schedule has two distinct phases. There is a stable negative relationship during the 1990s, but from 2004 onward, in contrast to the downward shift in the transfer schedule when oil is included, the nonoil schedule actually shifted upward. As a share of GDP, for example, the nonoil trade deficit in goods and services in 2009 was the same in 1998, yet the nonoil terms of trade were 7 percent higher. This recent upward shift in the relationship is contrary to what we would expect if Samuelson's concerns about import-biased growth in developing countries were increasingly relevant. Instead, the data suggest recent strong export-biased growth in emerging-market countries.

While these plots using after-the-fact data are suggestive, their implications need to be confirmed using structural models in which the impact of particular causes can be isolated. We therefore corroborate this implication using two methodologies. First, we draw on Maurice Obstfeld and Kenneth Rogoff (2004), who use a general equilibrium simulation model to estimate the terms of trade effects of eliminating the US current account deficit. Second, we use our own structural model that we have estimated using a conventional trade equation framework. Both approaches indicate that even if the US current account deficit were eliminated, the United States would have nonoil terms of trade that are better than it had in the early 1990s. In addition, our trade equations model reveals that even faster growth in developing countries would benefit the United States, both by increasing the demand for US exports, and thus reducing the decline in the terms of trade associated with eliminating the trade deficit, and by increasing the variety of products available to Americans.

The Trade Deficit

As can be seen in figure 6.1, the US trade deficit in goods and services increased from 1.3 percent of GDP in 1990 to a peak of 5.7 percent of GDP in 2006. The deficit subsequently declined, initially in response to the weaker dollar and then in response to the sharp contraction of imports during the recession of 2008–09. Nevertheless, by 2010, when the economy had started to recover, the deficit at 3.9 percent of GDP still exceeded the high deficits recorded during the mid-1980s and was considerably larger than in the mid-1990s. Let us briefly review this development in greater detail and then consider its implications.

Figure 6.1 US nominal trade balance as a share of GDP, 1980–2010



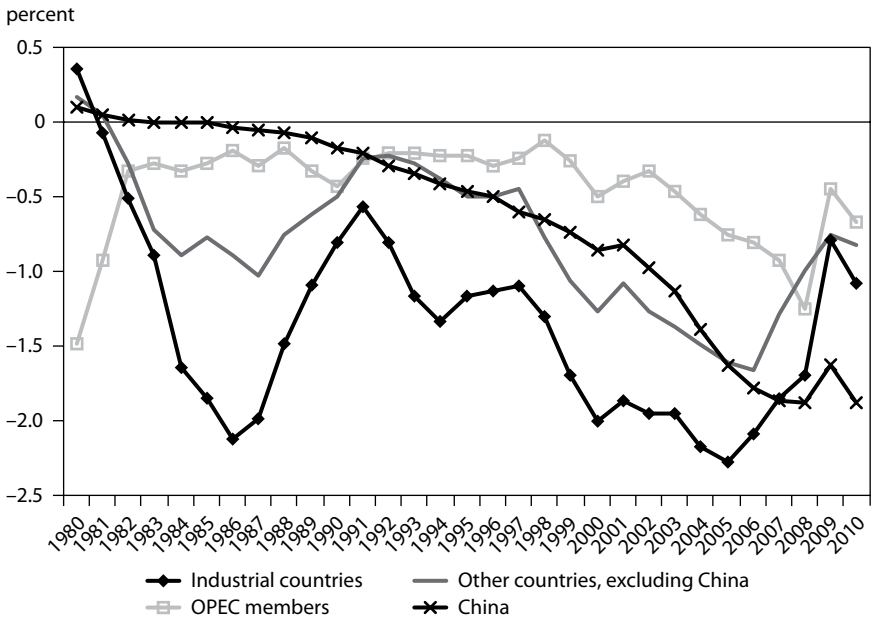
Sources: Bureau of Economic Analysis.

The aggregate balance for goods and services hides an interesting compositional story, which is that a third to half of the decline in the nominal trade balance can be attributed to petroleum products, a major US import. Oil imports rose from 1 percent of GDP in 2002 to 3.1 percent in 2008, substantially offsetting the improvement in the nonoil trade balance that took place after 2005–06. Oil import volumes represented a fairly constant share of real US GDP throughout the period, and the increased deficit associated with oil imports was the result of the rise in world prices from $27 a barrel in 2000 to a peak of almost $150 and an average of $95 in 2008.

Higher oil prices, however, are not the full story behind the growth in the trade deficit since the early 1990s. The oil price increase is concentrated in the post-2000 period, whereas the widening of the trade deficit commenced much earlier. The nominal trade deficit in nonpetroleum goods, for example, began to rise as a share of GDP after 1991, reaching a peak of 4.4 percent in 2005. This decline in the nonoil balance as a share of GDP was far greater than the decline attributable to oil in the post-2000 period.

The nonpetroleum trade deficit then narrowed from 2005 as US export volumes increased rapidly—averaging 7.9 percent per year—while nonoil import growth was slow. By the time of the financial crisis, the nominal trade deficit in the nonoil balance in goods and services, at 1.5 percent of GDP, was smaller than its 2000 ratio (a deficit of 2.6 percent of GDP), but it was still 1.9 percent larger than its peak in 1991, when it was in surplus. In other words,

Figure 6.2 US nominal bilateral merchandise trade balance as a share of GDP, 1980–2010



OPEC = Organization of Petroleum Exporting Countries

Source: Bureau of Economic Analysis.

while a substantial portion of the nonoil trade deficit had been eliminated, it nevertheless remained high relative to the early 1980s and 1990s.

In the 1980s, the United States had also experienced large changes and deficits in the trade balance. What makes the post-1990s period distinctive is the magnitude of the deficit relative to GDP in 2005 as well as the geographical and commodity composition of the deficit. The geographical relationship is clearly revealed in figure 6.2, which presents trends in bilateral merchandise trade balances relative to US GDP for other industrialized countries, China, members of the Organization of Petroleum Exporting Countries (OPEC), and other countries.

The figure suggests why there are concerns regarding the competitiveness of the United States vis-à-vis developing countries. In contrast to the 1980s, when the emergence of the deficit was driven most strongly by trade with industrial countries, nonindustrialized countries and China were prominent in the recent period. Most noticeable is the emergence of a trade deficit with China, which rose from balanced trade in the mid-1980s to a deficit of close to 2 percent of US GDP in 2008. By 2008, the US trade deficit with China exceeded that of all other industrialized countries combined. Further, in comparison to other countries, the trade deficit with China remained relatively

resilient throughout the period of the financial crisis. The overall trade deficit is therefore even more skewed toward China than prior to the crisis.

Similar trends are evident at the sector level, where the trade balance declined for all sectors except services, where it remained stable. There are nevertheless important variations. Two sectors—consumer goods, and computers, peripherals, and parts—require particular attention. The nominal trade balance in consumer goods declined from a surplus of 1.1 percent of GDP in 1990 to a deficit of 2.4 percent in 2005. The trade balance in computer products declined from a surplus of 0.05 percent of GDP in 1990 to a deficit of 0.38 percent in 2005. Moreover, unlike the other sectors, the trade balance in computer goods did not rise in response to the depreciation in 2002.

The trade balance in both these sectors is closely associated with trade with China.[1] In 1990, less than 1 percent of computer imports and 11 percent of consumer goods imports were sourced from China.[2] By 2006, the share of computer imports and consumer goods imports sourced from China had reached 46 and 35 percent, respectively. These trends, particularly for computer products, reflect a dramatic change in the geographical composition of US imports.

In sum, the nonpetroleum trade deficit widened for much of the post-1990 period. What differentiates this period from the early 1980s is the relative contribution of nonindustrialized countries and China in particular and the decline in the trade balances in consumer and capital goods—especially computers. These trends in the relative contribution of the deficit mimic changes in the debate on US competitiveness. Whereas in the early 1980s the fear was about the ability of the United States to compete against industrial countries like Japan and Germany, in the post-1990 period the debate is about competition from nonindustrialized countries in capital goods, especially electronics.

Correcting for the Trade Deficit

In Samuelson's paper and the other models we have discussed so far, it is assumed that trade is balanced. In reality, however, we have seen that over the period we are considering the United States experienced a substantial decline in its current account. As we have noted, this is a problem because theory suggests that there is likely to be a systematic relationship between the trade balance and the terms of trade. All else being equal, we would expect net capital inflows (as reflected in larger current account deficits) to induce higher terms

1. Consumer goods and computers together make up over 70 percent (76 percent in 1990 and 71 percent in 2006) of all merchandise imports from China.

2. Calculated using disaggregated trade data from the Center for International Data at the University of California, Davis, www.internationaldata.org (accessed on November 1, 2012). See Feenstra, Romalis, and Schott (2002) for details on the construction of the database. If trade with Hong Kong is included with that of China, the shares rise from just under 3 percent in 1990 to 38.5 percent in 2006.

of trade. Thus the effect of the trade deficit itself in boosting the terms of trade needs to be accounted for to provide a fair test of Samuelson's concern. In the US case, the relevant question is what would be the US terms of trade if the United States changed its spending patterns and thus restored the current account to its earlier levels.

The relationship between the current account (net borrowing) and the terms of trade in the face of spending changes is modeled in the theory known as the transfer problem.[3] The name comes from the recognition that in the short run international capital flows (or international grants) entail net transfers of goods and services from lenders to borrowers. The current account is by definition equal to the difference between national income and national spending. If international lending increases, the lenders must be reducing their spending relative to their incomes, while the borrowers must be increasing their spending relative to their incomes. Thus, globally, more spending will be undertaken by the borrowers and less by the lenders.

If, at the margin, borrowers and lenders spend their money on the same goods and services, relative prices in the world need not change. If Americans and Chinese spend their money equally between US and Chinese goods, for example, there would be no impact on the relative demand for US and Chinese goods if the Chinese save more and reduce their spending by a dollar and then lend it to the Americans, who reduce their saving and increase their spending by a dollar. Americans will simply buy the goods that the Chinese formerly bought. But if national spending patterns differ, relative prices may have to change in order to balance supply and demand in the product markets. If countries all have a higher propensity to buy their own goods and services, for example, we would expect that stronger terms of trade would be associated with larger trade deficits. If Americans and Chinese each allocate three-quarters of their money to their home goods, reducing spending by a dollar in China will reduce demand for Chinese goods by 75 cents, and increasing it in the United States by a dollar will increase the demand for Chinese goods by just 25 cents. Thus, home-biased spending implies that US borrowing will reduce the relative price of Chinese goods and services (and thus increase the relative price of American goods and services).

This relationship is incorporated in a number of simple theory-based models. Obstfeld and Rogoff (2004) constructed a two-country, three-good general equilibrium model to explore the implications for the US terms of trade as well as the US real exchange rate—the prices of goods and services in the United States relative to those in the rest of the world—of eliminating

3. There is a vast literature on the transfer problem, as indicated in the famous debate between John Maynard Keynes and Bertil Ohlin over the German transfer problem. A transfer could in principle move the terms of trade in either direction, depending on the relative marginal propensities to consume. The standard presumption, however, is that an inflow of capital (a transfer into a given country) will increase its terms of trade—the schedule slopes down to the right. Classic articles include Samuelson (1952, 1954), Johnson (1955b), Jones (1970), and Bhagwati, Brecher, and Hatta (1983).

the US current account imbalance.[4] Their model simply takes the spending changes necessary to eliminate the current account as given and does not capture the intertemporal and other considerations that might induce these.

The United States is assumed to be endowed with a fixed quantity of a tradable and nontradable good and, in addition, it imports a third good from abroad. A key assumption is that countries seek to consume more of their home products at given prices (home bias). If the US current account deficit is eliminated, the shift from US to foreign spending reduces the price of the US export good relative to the imported good. Within the United States, the price of the nontradable good relative to the tradable good also falls in response to the decline in domestic demand for US nontradables. The lower relative price of nontradables induces American consumers to shift their spending away from tradable toward nontradable goods, but encourages American producers to shift productive resources into the traded goods sector. Abroad, the price movements are in the opposite direction. All told, eliminating the US trade deficit worsens the US terms of trade and weakens the real US exchange rate. Prices in both US nontraded and export sectors decline. Thus, we are led to expect a downwardly sloped (negative) relationship between the terms of trade and the current account balance. Smaller deficits will be associated with worse terms of trade (and a weaker real exchange rate).

We should note that home bias is not required for this outcome. In theory, even if preferences are similar, the presence of trade transaction costs could also produce a negatively sloped function because the transaction costs make some goods and services nontradable—i.e., too expensive to trade. Again, Obstfeld and Rogoff (1996) develop a two-country, multigood Ricardian model with this property.[5]

Robert Dekle, Jonathan Eaton, and Samuel Kortum (2007) undertake a similar analysis in a multiproduct, multicountry Ricardian model. In the Ricardian framework, given relative productivity at home and abroad, relative wages will determine patterns of specialization. In a two-country framework, if the home country has wages that are twice as high as the foreign country, it will only be able to produce those goods in which it is at least twice as productive.[6] When there are nontraded goods and services, a reduction in domestic spending relative to incomes (i.e., net foreign lending) reduces the demand for nontradables. This leads to a reduction in relative nontraded prices and wages

4. A simple model of this process with two goods (one traded and one nontraded) can also be found in Krugman and Obstfeld (2003, 104–09).

5. In this model countries produce all goods for which their relative labor productivity exceeds their relative wages. See Dornbusch, Fischer, and Samuelson (1977).

6. In a multigood Ricardian framework, a uniform improvement in foreign productivity increases the range of industries in which it can compete. The home relative wage falls, and some industries migrate from the home country to the foreign country. However, the home country gains because its real wages rise. The relative price of the goods that the home country continues to produce rises. This case in discussed in Obstfeld and Rogoff (1996, 240–43), Dornbusch, Fischer, and Samuelson (1980), and Zhu (2007).

at home compared with those abroad. With given patterns of comparative advantage, lower relative wages at home increase the range of tradable products in which the lending (home) country is competitive and conversely reduce the range of goods in which the foreign country is competitive. Thus, production of some tradables shifts to the lending country and the terms of trade of the lending country decline. Large trade surpluses are therefore associated with lower US wages relative to the rest of the world and worse US terms of trade associated with lower real wages.[7]

Assessing Trade Performance

On the basis of this discussion we would expect that if the only change were in international lending and borrowing, there would be a negatively sloped relationship or schedule tracking the relation between the terms of trade and the trade balance. All else being equal, we would expect to find stronger US terms of trade associated with a larger US trade deficit.[8]

This is the schedule TT we have depicted in figure 6.3 as a downward-sloping schedule that relates the terms of trade to the trade balance. A pure transfer to the United States would move the economy from *A* to *B*, increasing the trade deficit (from *C* to *D*) but also increasing the terms of trade. Conversely, if the United States reduced its spending relative to income, i.e., borrowed less while the rest of the world did the opposite, i.e., lent less, the equilibrium would move from *B* to *A* and its terms of trade would decline as global spending on US products declined.

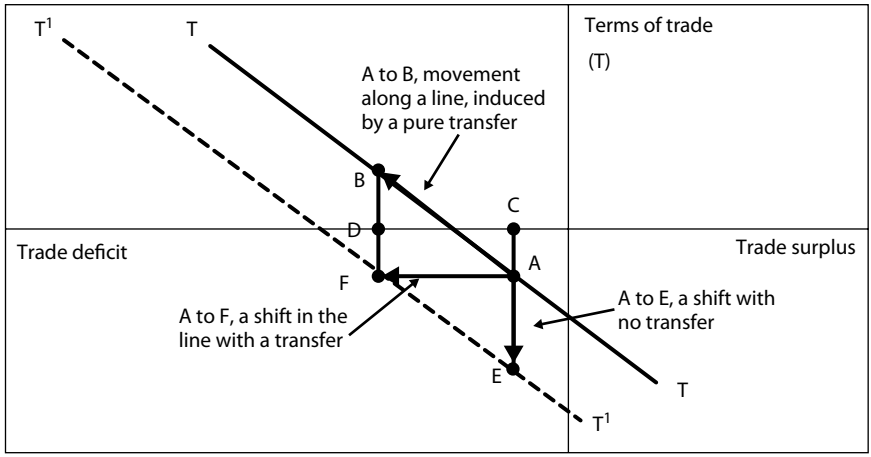
On the other hand, if there were a decline in US trade performance, (competitiveness) as captured in Samuelson's model because of import-biased growth abroad, the entire schedule would move downward (from TT to T^1T^1 in figure 6.3). With no additional capital, international borrowing, or lending, import-biased growth abroad would lower the terms of trade associated with any given trade balance, moving the economy to *E,* the point at which the trade balance is unchanged. In contrast, uniform technological change or export-biased growth abroad would shift the TT schedule upward for any given trade balance.

If we were to assume that the shocks that shift the transfer schedule up and down are separable from those that move the economy along the schedule, we could distinguish the effects of changes in the underlying determinants of the relative prices of international goods and services (tastes, incomes, factor endowments, technologies, microeconomic policies, etc.) from a movement along a given TT schedule that is due to changes in international borrowing and lending, i.e., expenditure changes. For example, although Samuelson's

7. This model is developed in Obstfeld and Rogoff (1996, 235–43). They present evidence of a positive slope in the relationship between changes in net foreign assets (i.e., current account surpluses) and real exchange rates.

8. For applications of this approach, see Baily and Lawrence (2006a, 2006b).

Figure 6.3 How shifts in the transfer schedule provide a measure of trade performance



Source: Authors' illustration.

example related to a foreign shock that reduced the US terms of trade with balanced trade, we can equate his concern in the context of unbalanced trade as a downward shift in the entire TT schedule.

We do need to be cautious in making such an assumption because the current account will be driven by intertemporal considerations. In a frictionless, multigood Ricardian model, unanticipated permanent changes might not change the balance between present and future spending and thus have no current account effects, so our separation would be valid and permanent shocks would shift the transfer schedule up and down. However, an unexpected temporary shock could affect the real interest rate and thus induce current account changes as well as terms of trade changes, and thus the separation assumption need not always be valid.[9] Temporary shocks could also lead to permanent changes in wealth that would not be taken into account when computing the welfare implications of such changes. Thus, the full effects on welfare are not fully captured by the terms of trade at a particular point in time. In addition, the intertemporal considerations need to be weighed.[10]

9. This example is discussed in Obstfeld and Rogoff (1996, 244–48).

10. A country might well be better off by borrowing at one point in time and repaying its debts later, even if ultimately it has worse terms of trade than if it had not borrowed. Consider a decline in the real interest rate that induces borrowing $1 today and paying back $2 tomorrow. The terms of trade improvement in the first period might be less than the decline in the second. Nonetheless, welfare might still be improved. Conversely, even if the United States does close its current account, it will still be left with the change in its international indebtedness, and this could imply lower living standards in the future.

Our interest in this study is the impact of foreign economic growth, but after the fact, many shocks both at home and abroad could affect the outcome. This implies that we need to be cautious about attributing shifts in the TT curve purely to foreign growth. Domestic policies and performance could be responsible. Import tariffs influence not only trade flows but also the terms of trade. By restricting imports through tariff protection, large countries such as the United States are able to drive down the price of their imports and hence raise their terms of trade. Reductions in US tariffs, or alternatively increases in foreign tariffs imposed on US exports, would therefore also shift the TT schedule downward. Population growth and demand shifts are other factors. In a simple, multigood Ricardian model, relatively strong population growth abroad places downward pressure on foreign wages but stimulates home wages and therefore the home country's terms of trade through increases in demand for home exports. Similarly, shifts in global preferences toward US goods are expected to raise the US terms of trade (Dornbusch, Fischer, and Samuelson 1977). All told, therefore, while the schedule we have illustrated is a useful heuristic, to apply it empirically, a means for sorting out these various shocks should be provided.

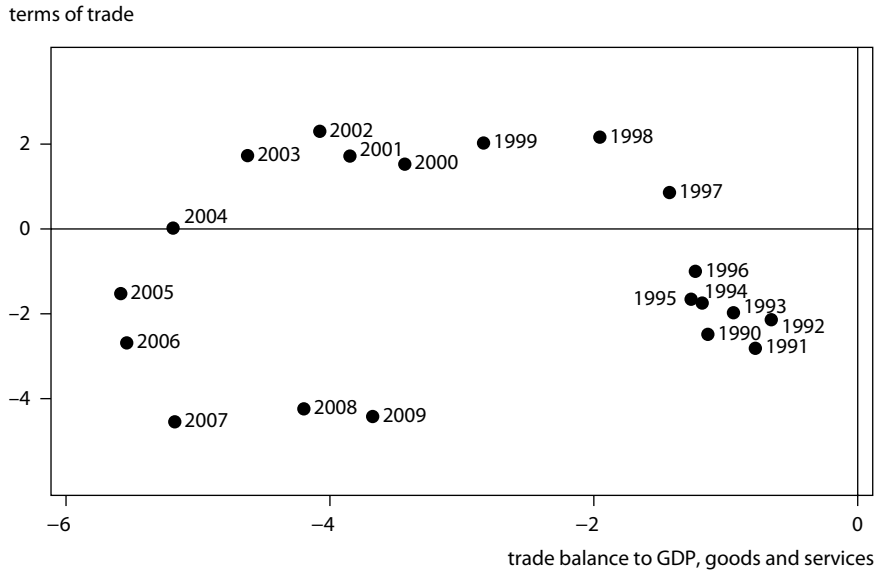
Graphical Analysis of the Relationship between Terms of Trade and Trade Balance

The transfer theory leads us to expect that the terms of trade will improve when countries run larger trade deficits. The simplest empirical approach is to plot the association between the trade balance and the terms of trade relationship. Bearing in mind the qualifications discussed above, this association should not be interpreted as causal. The plots capture the ex post relationship between two highly endogenous variables, and as we have noted, in theory, depending on what kinds of shocks are hitting the economies, the relationship between them could take many forms. Nevertheless, such diagrams are useful in evaluating whether shifts in the relationship between the trade balance and the terms of trade are consistent with the concerns raised by Samuelson. Figure 6.4 therefore plots the association between the trade balance in goods and services and the terms of trade for the years from 1990 to 2009.

Variable Construction

Various rigidities in adjusting prices, contracts, and production processes imply that the terms of trade and the trade balance do not immediately and simultaneously equilibrate in response to exogenous shocks, including, among others, consumer preferences, future expectations, tariff changes, and government expenditure. The trade balance in goods and services in figure 6.4 is therefore calculated as the three-year moving average ratio of the nominal trade balance in goods and services to GDP multiplied by 100. For our price

Figure 6.4 Nominal trade balance in goods and services and lagged terms of trade, 1990–2009



Note: The trade balance in goods and services is calculated as the three-year moving average ratio of the nominal trade balance in goods and services to GDP multiplied by 100. For our price variable we use the three-year moving average of the US terms of trade indices (in logs multiplied by 100).

Source: Authors' calculations using data obtained from the Bureau of Economic Analysis.

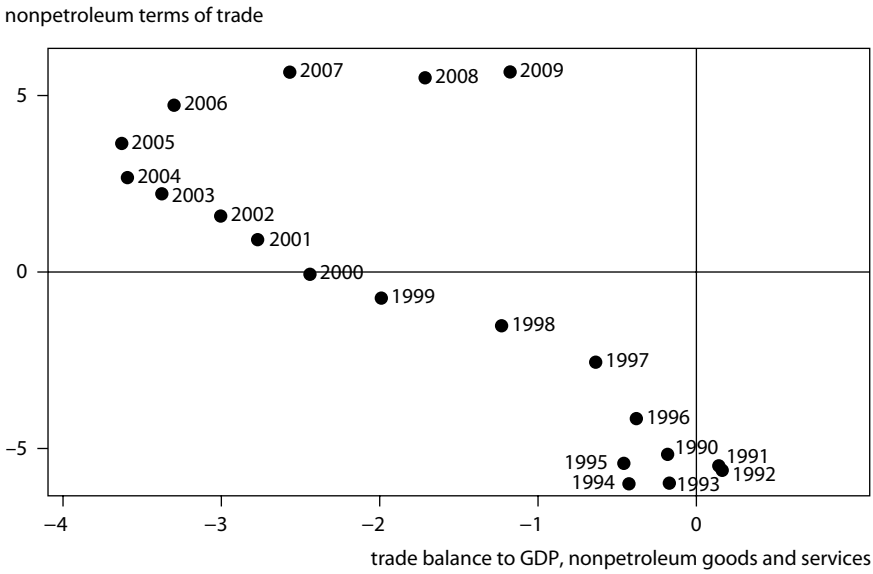
variable we use the three-year moving average of the US terms of trade indices (in logs multiplied by 100).[11]

During the 1990s, we find a negative, although variable, association between the trade balance and the terms of trade that is broadly consistent with our theoretical expectations—a rise in terms of trade is associated with a larger US trade deficit. However, looking at the more recent observations in the plot, there is a noticeable shift downward of the relationship. In 2000 and 2009, for example, the trade balance as a share of GDP was similar, but the terms of trade had fallen by around 6 percent.

The key factor explaining the decline after 2003 is oil. The increase in oil prices contributed substantially toward the widening of the trade deficit after 2000. This is made clear when we exclude oil imports (and oil import prices) from the estimates (figure 6.5). We now find that from the 1990s through 2004 the relationship traces out what appears to be a remarkably stable negatively sloped schedule that conforms to our expectations using the transfer

11. The relevant data are obtained from the Bureau of Economic Analysis.

Figure 6.5 Nominal nonpetroleum trade balance and lagged terms of trade, 1990–2009



Source: Authors' calculations using data obtained from the Bureau of Economic Analysis.

framework. As of 2004 we actually see a dramatic improvement in the nonoil terms of trade for any given trade balance (figure 6.5). By 2009, the nonpetroleum terms of trade were 7 log points greater than in 1998, despite similar ratios of the nonpetroleum trade balance to GDP. Further, if we project the slope of the nonoil transfer schedule from 1990 to 2003 to simulate a return of the three-year average trade-balance-to-GDP ratio from 2009 to 1990 levels, we find that the adjusted (nonoil) terms of trade in 2009 were 8.5 log points greater than in 1990.[12]

The US nonoil terms of trade were therefore higher in 2009 than in 1990, even after accounting for the increase in the trade deficit over this period. This shift is contrary to what we would expect if Samuelson's concerns about import-biased growth in developing countries were valid and were the dominant reason for the shift in the transfer schedule. Rather, the data are more consistent with strong nonoil export-biased growth in foreign countries that would have enhanced US welfare.

12. The slope of the schedule from 1990 to 2003 is –2.35. To return the three-year average nonoil trade-balance-to-GDP ratio in 2009 to the 1990 average level would require a reduction in the deficit of 1 percentage point and a decline in in the terms of trade from 5.66 to 3.32 (i.e., 2.3 log points). These adjusted terms of trade are 8.49 log points greater than the three-year moving average terms of trade in 1990 (–5.17).

In sum, the United States experienced dramatic increases in the trade deficit from the early 1990s, as trade with developing countries rose sharply. Increases in the oil price played a considerable role in increasing the deficit, and our diagrammatic analysis suggests that this reduced US living standards after 2002. During the 1990s and early 2000s, however, we find no support for Samuelson's concerns that developing-country growth is adversely affecting US living standards through the nonoil terms of trade. On the contrary, we find that the nonoil terms of trade associated with a given trade balance actually improved after 2004, leaving the US economy with a higher nonoil terms of trade in 2009 than in 1990, even after adjusting for the increase in the trade deficit. Outside of its impact on oil, the US terms of trade improvement therefore appears to have been beneficial to US welfare.

Welfare

Simulation Models

The figures presented are not structural models of the complex relationships underpinning shifts in both the trade balance and the terms of trade. The relationships depicted are nevertheless corroborated by theory-based structural models.

Obstfeld and Rogoff (2004), for example, use their two-country, three-good general equilibrium model to simulate the implications for the US terms of trade and the real exchange rate if the United States closed the current account deficit from 5 percent of GDP to full balance. They model spending behavior as reflecting choices between tradable and nontradable goods and services as well as between importables and exportables. This allows them to estimate changes in both the real exchange rate and the terms of trade associated with current account adjustment. They then assume that the deficit is closed through spending shifts—i.e., reductions in US aggregate demand and increases in foreign aggregate demand—while holding output at home and abroad constant.

They simulate achieving balance using a variety of calibration parameters and adjustment processes. They find that, depending on their assumptions about the responses of demand to relative prices, the real exchange rate depreciation required to facilitate balance varies between 33.6 and 14.7 percent. The terms of trade changes that are associated with these real exchange rate changes are, however, much smaller. Such changes require terms of trade declines of 7.1 and 3.4 percent, when the required real exchange change is 33.7 and 14.7 percent, respectively. Thus, each 1 percent decline in the real exchange rate results in changes in the terms of trade of between 0.21 percent (i.e., 7.1/33.7) and 0.23 percent (3.4/14.7).

The associated change in the terms of trade derived by Obstfeld and Rogoff is actually remarkably close to what would be predicted by a linear estimate of a transfer schedule over the period 1980–2003. When we ran a regression line

that relates the terms of trade to the current account balance (inclusive of oil) as a share of GDP over 1980–2003, we estimated a slope coefficient of –1.56 (the slope equals –1.41 over the shorter 1990–2003 period). According to this regression coefficient, the closing of a 5 percent of GDP deficit would historically be associated with a 7.805 percent decline in the terms of trade—a result that is very similar to the upper estimate of Obstfeld and Rogoff.

These simulations suggest that the nonoil terms of trade gains in recent years are unlikely to be fully offset, even if the United States were to close the current account. Using 2010 data, the trade balance would need to rise by 3.6 percent of GDP to eliminate the entire deficit. According to the Obstfeld-Rogoff simulations, this would reduce the US terms of trade by between 2.5 and 5.1 percent. Most of this adjustment in the current account is likely to come about through changes in the nonoil trade balance. Oil imports made up 15 percent of total imports of goods and services in 2010. Hence, the decline in the nonoil terms of trade if the entire adjustment were to come about through changes in the nonoil trade balance would be around 15 percent larger than the aggregate terms of trade, i.e., a decline of between 3 and 6 percent. These values are still smaller than the 7 to 8.5 percent upward shift of the nonoil terms of trade that we find in figure 6.5. This implies that even with Obstfeld and Rogoff's most adverse estimates of the terms of trade, a modest improvement in the nonoil terms of trade would remain if the United States were to restore balance, even taking into account the increased costs of imported oil.

These simulations suggest that the closing of a large US current account deficit could require fairly large movements in the real US exchange rate and quite substantial reductions in dollar wages in the United States compared with those in the rest of the world. However, the models also suggest that the changes relevant for living standards, such as the reductions in the terms of trade and the fall in real wages, are much smaller.[13]

This limited impact of real exchange rate adjustment on the US terms of trade and thus real US incomes reflects two key features of the US economy: first, a large share of the economy produces nontradables, and second, a large share of tradables production is consumed at home. A considerable part of the adjustment in the US current account requires shifting US spending away from tradable goods and services and US production toward these goods and services. But this occurs by changing the relative price of tradables to nontradables. While changes in the prices of nontradables will affect the real exchange rate and relative wages in the United States compared to the rest of the world, internal relative price changes do not affect aggregate US welfare or real wages in terms of nontraded goods. Whatever some Americans lose from these inter-

13. Simulations using the Dekle, Eaton, and Kortum (2007) model, for example, calculate that eliminating the 2004 US current account deficit would reduce wages in the United States relative to those abroad by 7 percent but that real wages in the United States would only fall by less than 1 percent.

nal shifts, other Americans will gain. Thus, the net real income and aggregate welfare effects operate only via trade, and given the small share of trade in the economy, the real income effects are quite modest. In addition, the more substitutable that foreign and domestic tradables are, the smaller the terms of trade shifts required to achieve any given trade balance.[14]

Trade Models

As described more fully in our background paper for this study (Edwards and Lawrence 2012), we have explained the evolution of the US nonoil trade balance by decomposing changes in the nominal trade balance into its structural determinants using standard trade equations. Our aim is to isolate how developing countries have influenced US trade flows and to explore the implications of developing-country growth on the US terms of trade in this framework. The analysis obtains on average a historical relationship between the real exchange rate and the terms of trade (the pass-through relationship) that resembles the relationship implied by Obstfeld and Rogoff. Indeed, we find that the pass-through may have recently declined. This lends support to the conclusion that even with balanced trade the United States would have experienced some improvement in its nonoil terms of trade.

As described more fully in the background paper, we have estimated trade prices and trade volumes separately. First we specify and estimate various equations for export prices, import prices, and the terms of trade following the standard approaches surveyed by Pinelopi Goldberg and Michael Knetter (1997).[15] We then estimate equations for import and export volumes, relating these to relative price and activity variables.

Our results have important implications for this discussion. First, there is a noteworthy decline in recent pass-through of exchange rates into prices that is evident in the data and confirmed by our regressions. In most periods up to 2002, there is a reasonably close association between the real exchange rate and the terms of trade. The terms of trade improved for most end-use categories during periods of dollar appreciation (1980–85 and 1995–2002) and worsened during periods of dollar depreciation (1985–90). This close association also explains the similar trends in the nonoil terms of trade and real exchange rate relative to the trade balance during these periods.

After 2002, however, the relationship between the terms of trade and real exchange rate reverses for many sectors. The dollar depreciated by 17 percent from 2002 to 2007, but the nonoil terms of trade actually improved. This is

14. Obstfeld and Rogoff (2004) show that higher elasticity of substitution between traded and nontraded goods (= 2) and between imported and exported goods (= 3) reduces the required depreciation (from 33.6 to 14.7 percent) and the decline in the terms of trade (3.9 percent).

15. We regress the growth in US export and import prices on domestic or foreign marginal production costs, the nominal effective dollar to foreign currency exchange rate, the price of foreign or US substitutes, the price of commodities, and the lagged dependent variable.

reflected in our regression coefficients. We find that the long-run exchange rate pass-through to the terms of trade of each 1 percent change in the dollar fluctuated between 0.3 and 0.4 percent up to the beginning of the 1990s, but then declined secularly, reaching less than 0.1 percent for the 15-year period ending in 2007. If shorter periods are selected, the pass-through coefficient actually becomes negative as the sample enters the post-2000 period. This suggests that the relationship between the terms of trade and the real exchange rate (the pass-through coefficient) derived by Obstfeld and Rogoff of around 0.22 percent is very reasonable.

The literature indicates that one source of the decline in pass-through to import prices is China. Mario Marazzi et al. (2005) find that the pass-through has declined most steeply in those product categories in which China expanded its import market share most rapidly. The effect is closely related to China's peg to the dollar over much of the post-2000 period. Paul Bergin and Robert Feenstra (2009) show theoretically that the rising import shares of countries with fixed exchange rates lead to a disproportionate reduction in the pass-through of exchange rates to US import prices. They estimate that the rising share of trade from China, or from all countries with fixed exchange rates, explains a decline in pass-through by about one-fifth of its size over the period 1993–2006.

In effect, by pegging its currency to the dollar, China (and other pegging countries) disciplines pricing behavior of other exporters. When currencies appreciate in other countries relative to the dollar, the presence of China seems to have restrained these countries' ability to pass on their higher dollar costs. The result is that the impact of China on the US terms of trade is actually greater than its share in US trade flows.

An important consequence is that the price effects of a Chinese appreciation in reducing this discipline could be considerable. An appreciation of the renminbi could lead to a more sizable decline in the US terms of trade as other developing countries raise their own export prices.

Changes in the composition of US imports have also contributed to a decline in the pass-through. Imports have shifted toward finished-goods imports (consumer goods, capital, and automotive products) where the pass-through is relatively low, and the decline is away from material-intensive goods (food and beverages, nonoil industrial supplies) where the pass-through is higher (Marazzi et al. 2005, Campa and Goldberg 2005).[16] The change in composition also explains the association between China's share and the decline in the pass-through, as it is in the finished products that China's import shares increased the most.

We have also estimated trade volume regressions and explored their stability. We find that for each 1 percent increase in US growth, imports rise by 1.6

16. However, Gita Gopinath and Roberto Rigobon (2008) find that within-product changes in the frequency of price adjustments are the main determinant of a decline in the average price stickiness of US imports.

percent. While 1 percent growth in foreign income raises US export volumes by 2.1 percent in the long run, it also raises US import demand in the form of new varieties by 0.78 percent.[17] All told, therefore, equal growth rates in the United States and the rest of the world will lead to larger trade deficits for the United States, but faster growth in the rest of the world increases US exports by more than US imports. Thus, had developing countries grown even faster, the variety of imports available to Americans would have been even greater and the terms of trade associated with any given trade balance even higher.

Finally, we use the structural trade volume and price equations to simulate the impact of a restoration of the US nonoil trade balance from 2007 to 1990 levels. According to our estimates, this would require a depreciation of 15 percent in the real dollar exchange rate. Using the average pass-through coefficient of 0.25, the required depreciation would be associated with a 3.75 percent reduction in the nonoil terms of trade. Yet the actual nonoil US terms of trade, after taking into account exchange rate and commodity price trends, improved by 8.8 log points from 1990 to 2007.

According to our estimates, therefore, a restoration of the US nonoil trade balance from 2007 to 1990 levels would still leave the United States with a 5 log-point improvement in the nonoil terms of trade. In addition, the country would enjoy an increase in the varieties of imports. We conclude, therefore, that foreign growth unambiguously improved aggregate US welfare over the period from 1990 to 2007 even when the trade deficit is taken into account.

In sum, our graphical analysis, the simulations based on Obstfeld and Rogoff, and our regression estimates all suggest that even taking into account the impact of larger trade deficits on the terms of trade, growth in developing countries has been good for the United States. Contrary to the concerns raised by Samuelson, the US nonoil terms of trade have increased from the early 1990s, even after accounting for the increase in the trade deficit. These trends are consistent with export-biased growth in developing countries, which has enhanced US gains from trade through improvements in the US nonoil terms of trade and increased the variety of products available to Americans.

17. This estimate is similar to those of the IMF (2007), Peter Hooper, Karen Johnson, and Jaime Marquez (2000), Paul Krugman and Richard Baldwin (1987), and Peter Hooper and Catherine Mann (1987) but exceeds those of Hendrik S. Houthakker and Stephen Magee (1969), who estimate a long-run foreign income elasticity close to 1. We are nevertheless concerned that the high-income elasticity arises from the use of hedonic price indices in the capital goods sector. Rapid improvements in the quality and characteristics of computer products increase the measured quantity of these goods, even if there is no change in the number of items produced. This effect is equivalent to an increase in varieties, which biases the estimated income elasticities upward. For a similar reason, computer products were excluded from the estimates in Lawrence (1990).