# 3

# Has US Comparative Advantage Changed? Does This Affect Sustainability?

*The evidence is overwhelmingly persuasive that the massive increase in world competition—a consequence of broadening trade flows—has fostered markedly higher standards of living . . . this surge in competitive trade has clearly owed, in large part, to significant advances in technological innovation.*

—Alan Greenspan, chairman of the Federal Reserve Board, "Technology and Trade," remarks before the Dallas Ambassadors Forum, Dallas, Texas (16 April 1999)

*[T]he globalization system . . . is not static, but a dynamic ongoing process: globalization involves the inexorable integration of markets, nation-states and technologies to a degree never witnessed before—in a way that is enabling individuals, corporations and nation-states to reach around the world farther, faster, deeper and cheaper than ever before. . . .*

—Thomas L. Friedman, *The Lexus and the Olive Tree* (1999)

## Why Trade?

People trade because they want different things, have different skills, and earn different amounts of money. With individuals represented by their national aggregates, countries trade for the same reasons. Countries differ from one another in terms of resources and the techniques firms use to produce goods and services. People value goods and services differently, depending on their income and tastes. Investors in financial assets have different preferences for risk, return, and diversification. These differ-

ences are reflected across countries as differences in costs of production, prices for products and services, and rates of return on and "exposures"[1] to financial assets.

Because costs, prices, and returns differ across countries, it makes sense for a country to trade some of what it produces most cheaply and holds less dear to people who want it more and for whom production is costly or even impossible. While this may be most obvious in the case of goods, the concept holds as well for services and financial assets, and is applicable to rich and poor, large and small countries alike.

This concept is known as "comparative advantage." The goods and services that are *relatively* cheaper to produce and have the *relatively* lower price, or financial assets that have a *relatively* more advantageous risk-return profile, are those in which a country has comparative advantage. The country will export these to obtain other products and assets that are different and more desired.

## Where Does Comparative Advantage Come From?

Comparative advantage motivates people to trade. Because comparative advantage comes from differences in *relative prices*, it means that characteristics of both supply and demand matter. Thus comparative advantage for a country results from a complex combination of the characteristics that are difficult to change (such as natural resource endowments), characteristics of the overall country that change relatively slowly (such as the share of production and consumption of services relative to the share of manufacturing, agriculture, and mining), characteristics of production technology that in some cases can change relatively quickly (such as through turnkey production technology), and characteristics of individual preferences (such as for a particular kind or quality of products, services, or financial assets).

Some easy examples of comparative advantage come from trade in commodities, where resource endowments are quite important. For example, the United States imports coffee and tea because people want to drink these beverages, but the North American climate is not suitable for the plants that produce the beans and leaves. Similarly, the United States buys oil on international markets because it can import it at a price lower than the cost of extracting it from US oil wells—current production technology combined with resource endowments and the substantial US use

1. Financial "exposure" is a way of describing the characteristics of a financial asset held by an investor. Financial exposure incorporates country, firm, currency, maturity, volatility, and other characteristics.

**Table 3.1 US government bonds in the global bond market, 1997**

| | |
|---|---|
| Global bond market, total outstanding (trillions of US dollars) | 24.1 |
| Government bond share (percentage) | 59.6 |
| Share of US government bonds in global bond market (percentage) | 27.6 |
| Share of Japanese government bonds (percentage) | 11.7 |
| Share of EMU government bonds (percentage) | 14.7 |

EMU = European Monetary Union
Note: The EMU government bond percentage is the sum of government bonds issued by Germany, Italy, France, the Netherlands, Belgium, Spain, Austria, Finland, and Ireland.
*Source:* Merrill Lynch (1998).

of oil mean that the Middle East has a comparative advantage in oil production, so Middle Eastern nations export oil to the United States.

An example of comparative advantage in financial assets seems a bit more complicated, but the principle emerges nonetheless. The United States has a very mature market for government bonds. Any investor who wishes to hold risk-free and liquid assets at maturities ranging from 30 days to 30 years can buy US government assets. Because the market is so well developed, the United States has a comparative advantage in government-backed financial instruments and hence exports them to investors around the world (table 3.1).

## "Two-Way" Trade in Similar Products Is the Largest Component of US Trade

A substantial amount of US trade consists of "two-way" trade (importing and exporting) of similar types of goods, services, and assets, ranging from autos to tourism to bonds. This trade is sometimes called intra-industry trade, because it was first analyzed for trade in goods. "Industry" is a bit of a misnomer now, since there is tremendous cross-border trade in services and assets as well as in goods.

While such two-way trade would seem to run counter to comparative advantage, in fact it confirms the principle. Why would a country import and export things that seem to be similar in use and are classified as such by the statistical agencies? A clear example is tourism, where the unique attributes of a country are the reason for the trade. To experience Rio or New York, you have to go there. Tourism creates a natural two-way trade flow as Brazilians visit New York and US citizens visit Rio.

Another example is in products that are similar in terms of how they are used—and therefore are classified in the same grouping by statistical agencies—but differ in quality or functionality. Polartec anoraks and polyester windbreakers are both jackets, but they satisfy different consumer tastes and pocketbooks in the United States and abroad. So the United States

imports polyester windbreakers (which are cheaper to produce abroad) and exports Polartec anoraks (which are produced in the United States using special production inputs and techniques). Supercomputers and desktop models are both computers, but their functionality is different. Both types of computers are produced in the United States as well as abroad, with different specifications. Since some consumers and businesses in the United States and abroad need supercomputers and some need desktop models, the United States exports and imports both.

Trade in financial assets offers another example of two-way trade. Investors buy and sell assets to achieve a desired risk, return, and diversification profile for their portfolio of wealth. US investors buy financial assets issued by corporations and governments abroad in order to diversify their portfolio—to increase returns and/or to alter the volatility of returns compared to what they could obtain if they held a portfolio with only US assets. A diversified portfolio of financial assets allows the investor to achieve a more favorable risk-return frontier (a higher return for a given risk) compared to holding a portfolio that contains only domestic assets (figure 3.1).

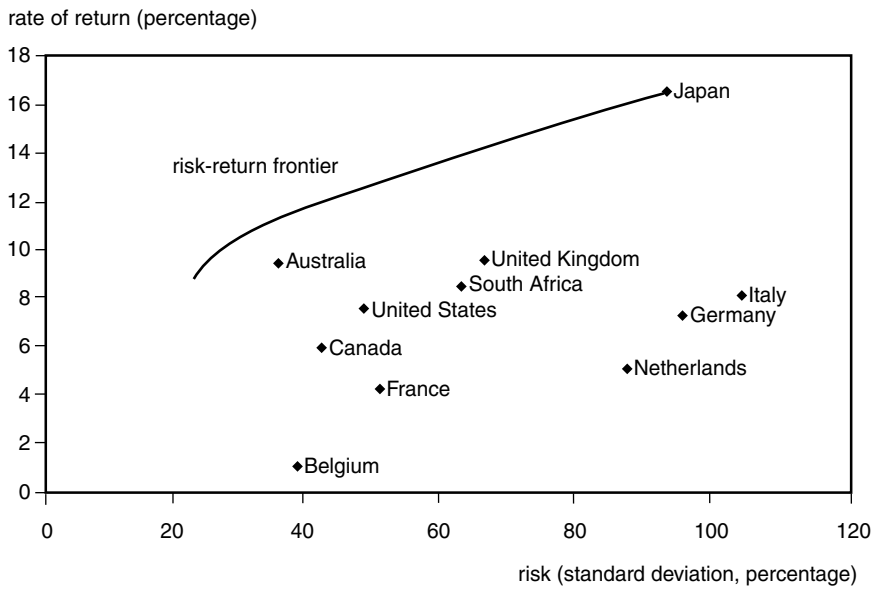
A third kind of intra-industry trade comes from differences in consumer tastes combined with economies of scale in production technology. Intra-industry trade in automobiles offers a classic example. BMW, Jaguar, and Cadillac all produce expensive, high-performance automobiles. Because there are economies of scale in the production of a particular kind of car, it does not make sense to produce at home only a small run of a particular variety of car, just enough to satisfy the domestic demand. Instead firms choose a production location where a large run of cars can be produced and transported most cheaply to their final destination and then trade cars across borders to satisfy demand abroad. Hence automobile imports and exports satisfy the full range of tastes for different kinds of cars in the populations of the United States and of other countries.

As countries become more similar in terms of the resources they have and the production technologies they employ, differences in tastes become the driving force behind trade flows. Table 3.2 illustrates that an index of two-way trade in goods of similar use but different characteristics is greatest for high-income areas that are broadly similar to the United States—such as Canada and Europe. The index for two-way trade with countries with different resources and with per capita incomes substantially below that of the United States, such as China and India, is generally low.

## What Do We Trade and How Has It Changed over Time?

The broadest decomposition of US trade is into the categories of goods (often called merchandise), services, and financial assets. Of course, bal-

**Figure 3.1 Risk, return, and the efficient international diversified portfolio**




Note: Data are estimated, 1959-66.

*Source:* Grubel (1968).

ance of payments convention puts goods and services on one side of the ledger and financial assets on the other. Breaking each of these categories down further, as illustrated in table 3.3, helps in analyzing what the United States trades, how that has changed over time, and how trade is related to the domestic economy.

For goods, one useful classification is "end-use."[2] This grouping reflects stage of processing (e.g., autos vs. industrial supplies) and ultimate buyer (capital goods—generally purchased by businesses—versus consumer goods—generally purchased by households). The end-use classification can be matched up to the broad categories of consumption and investment in the national income and product accounts.

Among services, a helpful decomposition distinguishes between "locomotive" services (e.g., travel, passenger fares, or other transportation);

2. Other groupings include the Standard Industrial Classification (SIC), which was replaced by the North American Industry Classification System (AICS) in 1997, and the Standard International Trade Classification (SITC), which was replaced by the Harmonized System (HS) in 1995. Each highlights a particular feature of the good or service. Depending on the question, one or another of the statistical disaggregations could be best, but none is perfect for all questions. A key difficulty is that the disaggregation schemes commonly used for domestic data match up rather poorly with data on internationally traded goods and services.

**Table 3.2 Index of two-way trade in selected product categories**

| Item | High income | Middle income | Low income |
|---|---|---|---|
| Crude materials, inedible, except fuels | 85 | 63 | 36 |
| Petroleum, petroleum products, and related materials | 29 | 28 | 7 |
| Chemicals and related products, n.e.s. | 98 | 34 | 76 |
| Medicinal and pharmaceutical products | 98 | 24 | 72 |
| Textile yarn, fabrics, made-up articles, related products | 97 | 94 | 34 |
| Power generating machinery and equipment | 88 | 82 | 36 |
| General industrial machinery and equipment | 83 | 64 | 39 |
| Electrical machinery, apparatuses, and appliances | 99 | 96 | 88 |
| Travel goods, handbags, and similar containers | 56 | 7 | 2 |
| Articles of apparel and clothing accessories | 75 | 36 | 3 |
| Footwear | 29 | 4 | 1 |

n.e.s. = not elsewhere specified
Note: Index = {(X – M) – |X – M|} / (X + M) * 100.

*Source:* Statistics Canada, *World Trade Analyzer 1997.*

"other private" services (e.g., education, financial services, and business and professional services); service flows based on intellectual property (e.g., royalties and license fees); and service flows between governments (e.g., military services).

Finally, in the category of financial flows, a common disaggregation is based on who issued the obligation (official versus private entity), what is the extent of ownership and control (direct investment vs. portfolio investment), and within portfolio investment, whether or not the obligation has a fixed principal value (bond vs. equity). These distinctions are useful when considering how economic data and policies affect investor behavior and thus affect trade in financial assets.

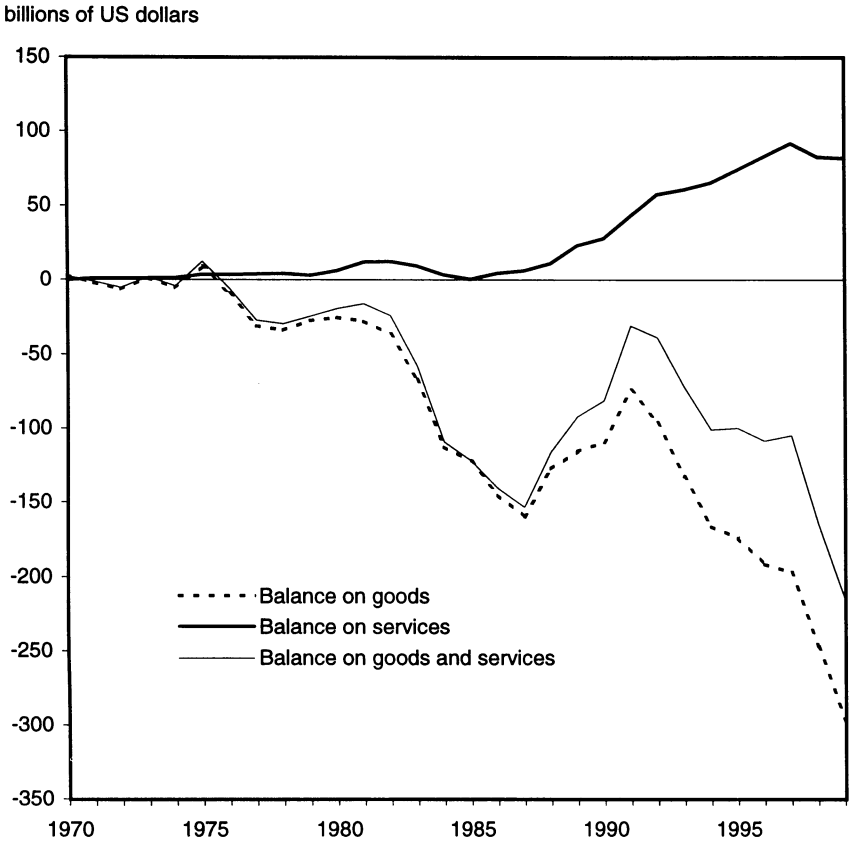
Since 1975 the composition of US exports and imports—and particularly the latter—has become more concentrated in particular sectors, yet at the same time more trade is two-way trade. In exports, the share of services has increased, with "locomotive" services and "other private" services predominating. The comparative advantage enjoyed by the United States in the service-sector industries is reflected not only in their rising share in total exports but also in the positive and increasing net export balance in services (figure 3.2). Among goods, capital goods in particular have risen in share of total exports, and both capital and consumer goods have increased dramatically in share of total imports. The extent of two-way trade in capital goods and consumer goods is quite different, however, and may have important implications for the sustainability of the

**Table 3.3 Composition of US trade in goods, services, and financial accounts** (nominal, percentage of total)

| | 1975 | 1997 |
|---|---|---|
| **Exports** | 100.0 | 100.0 |
| *Goods* | 80.8 | 72.5 |
| Foods, feeds, and beverages | 14.4 | 5.5 |
| Industrial supplies and materials | 22.5 | 16.9 |
| Capital goods, except autos | 27.4 | 31.4 |
| Automotive vehicles, engines, and parts | 7.6 | 7.8 |
| Consumer goods, except autos | 4.9 | 8.3 |
| Other | 4.8 | 2.6 |
| *Services* | 19.2 | 27.5 |
| Travel and passenger fares | 4.3 | 10.0 |
| Other transportation | 4.4 | 2.9 |
| Other private | 2.2 | 9.0 |
| Royalties and license fees | 3.2 | 3.6 |
| Military and government | 5.1 | 2.0 |
| **Capital outflow** | 100.0 | 100.0 |
| *Government assets* | 10.9 | 0.2 |
| *Private assets* | 89.1 | 99.8 |
| Direct investment | 35.9 | 25.5 |
| Foreign securities | 15.7 | 18.4 |
| Foreign stocks | n.a. | 8.6 |
| Foreign bonds | n.a. | 9.8 |
| Other claims (includes banks) | 37.5 | 56.0 |
| **Imports** | 100.0 | 100.0 |
| *Goods* | 81.7 | 83.7 |
| Foods, feeds, and beverages | 8.0 | 3.8 |
| Industrial supplies and materials | 40.9 | 20.7 |
| Capital goods, except autos | 8.5 | 24.3 |
| Automotive vehicles, engines, and parts | 9.7 | 13.4 |
| Consumer goods, except autos | 11.0 | 18.4 |
| Other | 2.3 | 2.8 |
| *Services* | 18.3 | 16.3 |
| Travel and passenger fares | 7.2 | 6.6 |
| Other transportation | 4.7 | 2.8 |
| Other private | 1.3 | 4.6 |
| Royalties and licence fees | 0.4 | 0.9 |
| Military and government | 4.6 | 1.4 |
| **Capital inflow** | 100.0 | 100.0 |
| *Foreign official assets* | 40.9 | 2.2 |
| *Other assets* | 59.1 | 97.8 |
| Direct investment | 15.2 | 12.7 |
| US Treasury securities and currency | 23.8 | 23.4 |
| Other securities | 14.6 | 26.8 |
| Stocks | n.a. | 9.0 |
| Bonds | n.a. | 17.8 |
| Other liabilities (includes banks) | 5.5 | 34.9 |

*Sources:* US Department of Commerce, *Survey of Current Business; International Transactions Tables.*

**Figure 3.2 US balance on goods and services, 1970-99 (1Q)**



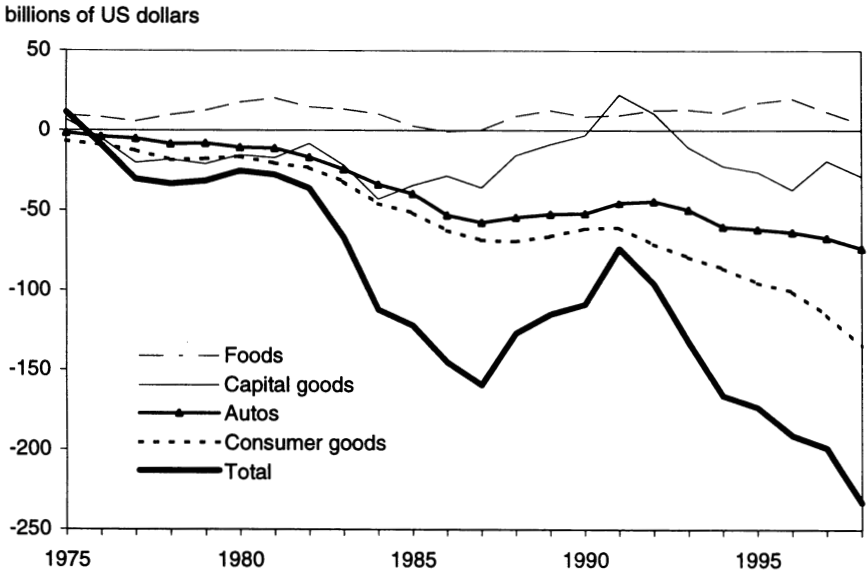

Note: Figures for 1999 are based on first-quarter data.

*Sources:* Bureau of Economic Analysis, *International Transactions Tables,* Historical Data; US Department of Commerce, *Survey of Current Business.*

current account deficit (figure 3.3). A zero balance of trade within a category (when averaged over the business cycle) implies a high degree of two-way trade. Two-way trade measured over all trading partners is lowest for consumer goods and autos.[3]

3. If the overall trade balance is in deficit, then some sectors will have to be in deficit as well. However, if the extent of two-way trade is equal across all sectors, then all would be in deficit to some degree—more explicitly in deficit in proportion to the size of the sector in overall trade. The inference about the degree of two-way trade in the end-use categories of US trade comes from the persistence and trend behavior of the consumer goods and auto sectors.

**Figure 3.3 Balance on goods, by sector: Evidence of two-way trade**




*Sources:* Bureau of Economic Analysis, *International Transactions Tables*, Historical Diskette; US Department of Commerce, *Survey of Current Business*.

## Rising Services Trade and Implications for Sustainability

The rising importance of exports of services reflects the ongoing shift in the US economy toward a service-sector base. In the past 20 years the share of the service sector in US GDP increased from about 60 percent to 72 percent. The demand for high-quality services at home contributes to a global comparative advantage in the delivery of many different professional services.

Studies by McKinsey Global Institute (1992) of selected service-sector industries suggest that labor productivity in the United States in these sectors exceeds that of its major competitors (Germany, France, United Kingdom, and Japan) by perhaps 30 percent in airlines, 30 to 40 percent in retail banking, and 20 to 50 percent in telecommunications. In part because the domestic market is so well developed, the United States is also the world's leading exporter of business and professional services.

Properly accounting for service-sector transactions is difficult enough in the domestic economy, but it is even more challenging when services cross borders. One type of business that is important in both the US domestic economy and international trade but is increasingly difficult to value properly is packaged computer software (see OECD 1998; see also

**Table 3.4 US exports of software: Alternative measures**

| | Firms' sales | US BOP data | |
|---|---|---|---|
| US global exports, 1995 (billions of US dollars) | 13 | 3 | |
| | US BOP data | OECD data | Japanese survey data |
| US exports to Japan, 1994 (millions of US dollars) | 260 | – | – |
| Japanese imports from the United States, 1994 (millions of US dollars) | – | 210 | 2,400 |

BOP = balance of payments

*Source:* OECD (1998a, 11-13).

the discussion in the addendum to chapter 2). Valuing trade transactions in computer software is particularly challenging because different countries account for them in different ways and because there are so many modes of delivery. For example, packaged software can be recorded as an export on a CD-ROM in a box or loaded on a computer; through license fees for printing via a "gold master" disc; via affiliate sales, in which profits accrue in investment income; and, finally, via Internet digital delivery. It is safe to say that no national statistical system is sophisticated enough or flexible enough to handle this range of modes of delivery.

How important is this industry that is so hard to track? The Organization for Economic Cooperation and Development (OECD), using firms' sales data, estimates that the total value of software sales by leading US vendors was $29 billion in 1995, of which sales outside the United States amounted to $13 billion (table 3.4). Thus sales are large and increasing, and the share of exports is nearly 50 percent. Yet data in the US balance of payments statistics report software exports of just $3 billion (OECD 1998, 13 [table 7]).

Bilateral data are no better. US balance of payments data on exports of software media (e.g., diskettes, CD-ROMs) to Japan differ from the corresponding OECD data on Japan's imports from the United States by 20 percent ($260 million vs. $210 million). Moreover, a survey from Japan estimated the value of software products imported from the United States at $2.4 billion, an order of magnitude larger than the OECD data.[4]

The share of services in US exports should increase further as our trading partners grow, mature, and demand more services. In general, the service sector as a share of GDP is lower in middle- and lower-income countries than it is in the high-income countries, and the share of services in US

4. The statistical agencies are working to improve the data, in cooperation with their counterparts in other countries, and addressing ways to improve coverage of small-value exports and services. How to deal appropriately with computer software and other such products presents a particularly vexing, but critical, challenge.

**Table 3.5 Role of services, 1995** (percentage)

| | Service share of GDP | Service share of US exports to the country/region |
|---|---|---|
| World | 49.6[a] | 22.0 |
| Europe | 69.1[b] | 34.6 |
| South and Central America | 56.6 | 25.4 |
| South Korea and Singapore | 57.5 | 18.6 |
| China and India | 36.6 | 18.1[c] |

a. Average of 129 countries where data are available.
b. Average of Austria, France, Netherlands, and Norway, because of limited availability of data.
c. China only.

*Sources:* World Bank, *World Development Indicators;* US Department of Commerce, *Survey of Current Business* (October 1998); *International Transactions Tables; US International Sales and Purchases of Private Services.*

exports to these countries tends to be lower than the average share for services in total exports (table 3.5). In addition, liberalization of the service sector (even in the upper-income countries) has just begun, with the adoption of the General Agreement on Trade in Services (GATS) in the Uruguay Round of the General Agreement on Tariffs and Trade. The proper protection and accounting for intellectual property such as computer software was also addressed in the Uruguay Round.[5] While two-way trade in services will also increase, maintaining a US comparative advantage in services and opening markets abroad will help to ensure that net trade in services contributes positively to the overall US trade balance.

## Globalization of Production Is Essential for Comparative Advantage in Some Products

A key feature of US trade is the decomposing of the production process into separable functions that can then be allocated around the world to countries that possess comparative advantage in that particular phase of the production process. The pieces are then brought together for final assembly and sale.

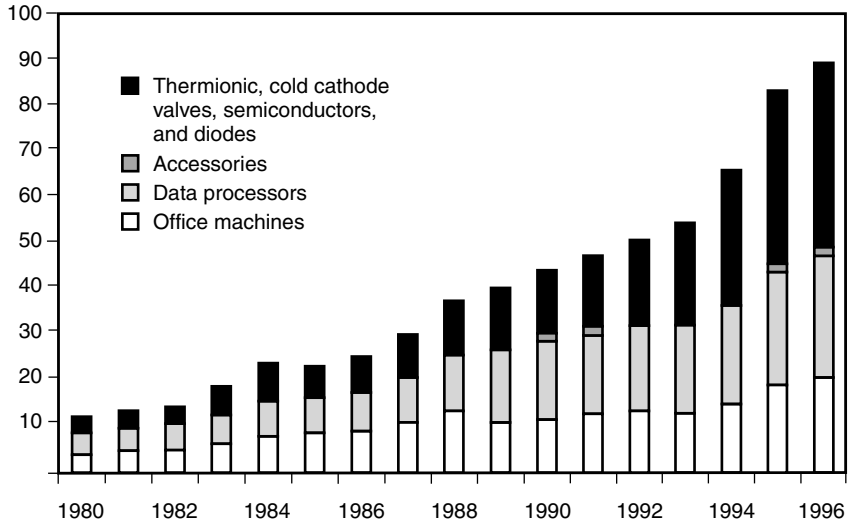
Such globalization of production is particularly prevalent in computers and related products; the two-way trade measure in this industry is quite high (figure 3.4). Semiconductors, computers, and parts and accessories,

5. For more on the GATS agreement and the Uruguay Round, see Schott (1994, 1996).

## Figure 3.4 Semiconductors, computers, and peripherals in US trade, 1980-96

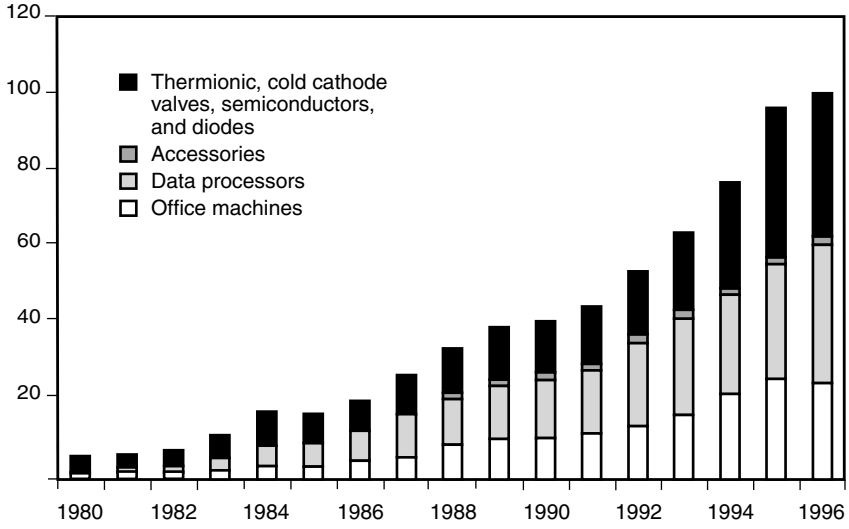
**A. Exports**

billions of US dollars




**B. Imports**

billions of US dollars




*Source:* Statistics Canada, *World Trade Analyzer.*

which are classified as capital goods, are fast-growing segments of both exports and imports. These categories combined now account for about 40 percent of trade in capital goods (30 percent of exports and about 40 percent of imports). The rapid growth of this sector is a primary reason for the large and increasing share of capital goods in both US exports and imports. Why is there so much exporting and importing in this category of goods?

The extent of two-way trade reflects the advantages that accrue to producers when they decompose production into stages of processing that are distributed to the most advantageous locations worldwide. The United States has the comparative advantage in producing and exporting certain parts of the production process (the high-value-added processor chips, the innovative and complex software, and the fully assembled product), but has relinquished parts of the production process to other countries where that stage of processing can be completed more cheaply (memory chips, "canned" software, and most peripherals). The United States cannot have comparative advantage in the export of the final product if it cannot combine its own comparative advantage in the initial ingredients with the comparative advantage of other countries applied to the production process at critical stages. Comparative advantage thus can be a function of trade itself.

## Two-Way Trade in Financial Assets Reveals US Comparative Advantage

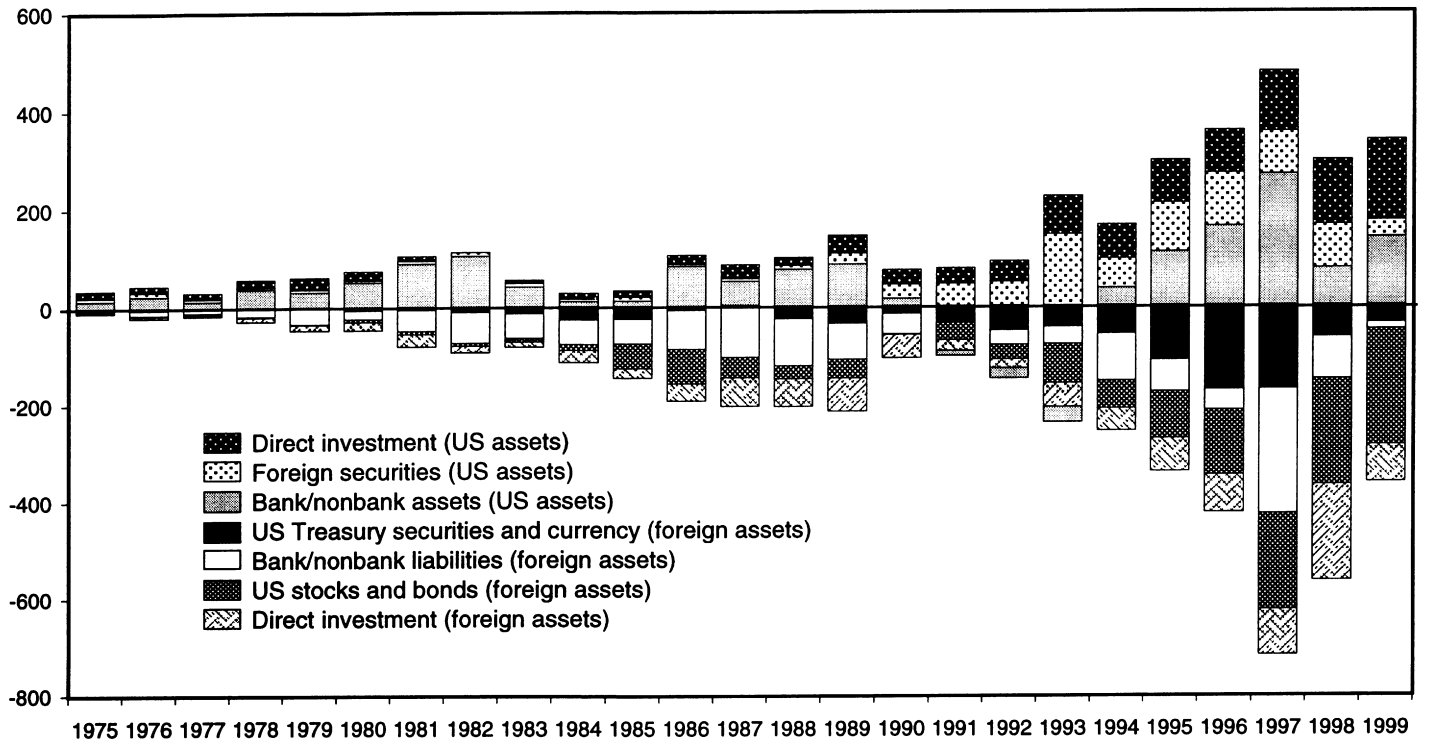
The US current account has been in deficit for nearly 20 years. From an accounting standpoint, this means that the United States has been a borrower for this whole period. Does this mean that capital flows have run only in one direction, into the United States? Not at all. Throughout this period, there have been two-way flows of different kinds of financial assets. In recent years, even as the trade deficit has widened, the two-way flows have exploded, and gross flows are simply huge.

Figure 3.5 details the types of financial products and ownership relationships that characterize US trade in financial assets. Net US investment abroad (capital outflows) is above the zero line, and net foreign investment in the United States (capital inflows) by the rest of the world is below the line. While financial flows have always been two-way, the two directions of trade expand and contract together, broadly following the US and global business cycles. That is, when the US economy slows (as it did in 1982, 1990-91, and 1994) or foreign economies slow (as they did in 1997-98), net *cross-border* investment flows slow as well. This behavior is consistent with investment and financial flows *within* an economy over the business cycle.

Examining the detail of net capital flows reveals that there is substantial two-way trade in similar kinds of financial assets. For example, two-

## Figure 3.5 Selected US and foreign financial transactions, 1975-99 (1Q)

billions of US dollars




*Sources:* Bureau of Economic Analysis, *International Transactions Tables,* Historical Data; US Department of Commerce, *Survey of Current Business.*

way flows through banks were particularly important through the mid-1980s, and were the principal form of capital flows. Such two-way flows can result when firms export to or move to a foreign market but continue to do their banking business with a firm at home. In this case, two-way flows of goods can contribute to two-way flows of bank finance.

More recently, the internationalization and liberalization of financial markets and growing wealth in the United States and abroad have fueled huge increases in cross-border investment in stocks and bonds. But the portfolio compositions of US and foreign investors are somewhat different. US net investment (capital outflows) into private foreign assets are a bit overweighted toward bank/nonbank flows, with private securities and direct investment each a significant share of the set of investments. US investors hold virtually no foreign government securities. In contrast, foreign investors in US assets hold a portfolio heavily weighted toward US government securities. In recent years, about one-third of net financial flows have been into these securities. Private bank/nonbank and securities flows have also been important, and direct investment was particularly large in 1998.

That US government securities have an international comparative advantage among financial assets appears clear. But this comparative advantage could come from the greater availability of these assets (as noted in table 3.1) or from a greater desire on the part of the foreign investor to hold high-yielding, nearly risk-free assets that they apparently cannot obtain from any source other than the US government.

In the future, if the US fiscal balance remains near zero, fewer government bonds will be available for investors. If the preference remains strong abroad for this type of asset, then foreign demand for US government securities will help sustain the current account deficit. In addition, the strong demand with reduced supply could reduce US government borrowing rates. On the other hand, should the market for US government securities dry up (say, if the publicly held component of the national debt were retired using federal budget surpluses), then foreigners might be less willing to buy US government securities. Once again, comparative advantage is not exogenous but is the outcome of complex interaction among economic forces and actors.

## Conclusion

### Summary

- Countries trade because differences in resources, technologies, and tastes lead to differences in costs, prices, and rates of return. Consumers, producers, and investors benefit from these differences when they trade goods, services, and financial assets.

- In trade between countries that have similar resources and income levels, typically there is substantial two-way trade in what might appear to be similar products but which satisfy tastes that are not identical.
- The composition of US trade reflects changing tastes and comparative advantage at home and abroad as well as the global integration of production and distribution. The example of computers shows that the success and growth of the US computer industry depends on combining US comparative advantage in both the initial and the final stages with comparative advantage abroad in intermediate stages of production.
- The desire to diversify financial portfolios as well as the desire to globalize the production and distribution of goods and services has led to a remarkable rise in the two-way flows of financial assets. Only in the case of US government securities do there appear to be few comparable assets abroad.

## Policy Discussion

- Policies that limit trade restrict the benefits that come from cost, price, and variety. Equally important, restrictions on moving part of the production process abroad or limiting certain imports can undermine exports and may hurt the creation of comparative advantage for new final goods.
- The US service sector has global comparative advantage. As our trading partners develop and grow, their demand for services will rise. Ensuring open markets for competitive US exporters will raise US export levels and will benefit the recipients. A comparative advantage in services and a growing service-sector trade surplus would help sustain the overall trade deficit. Service-sector trade negotiations should be a priority.
- Foreign demand for US government securities has been an important source of financing of the US external deficit. The maturity and liquidity of the US government securities market has no equal in the world now. But will this strong demand continue as the Japanese government securities market develops and as government bonds in Europe are increasingly issued in euro, or will competition ensue? If the strong demand continues even as the US budget position stays in surplus, the value of the US instruments should rise. On the other hand, if both US and foreign investors increasingly see foreign government instruments as substitutes for US government securities, we should see increasing two-way trade in government securities. Moreover, if the federal budget surplus is used to retire the national debt, the market for US government securities would no longer be so liquid.