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The Payoff to America from Global Integration

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Since the end of the Second World War, the United States has led the world in negotiating freer international trade and investment. Eight multilateral bargains have been concluded under the auspices of the General Agreement on Tariffs and Trade (GATT) and its institutional successor, the World Trade Organization (WTO). GATT/WTO agreements have been supplemented by regional and bilateral pacts, notably the European Union, the North American Free Trade Agreement (NAFTA), and numerous other regional and bilateral free trade agreements (FTAs).

Postwar commercial negotiations, both in GATT/WTO and in regional accords such as NAFTA, have devoted far greater attention to trade barriers than investment barriers. In fact, most investment liberalization over the past 50 years has resulted from unilateral policies, as one country after another has sought to improve its standing in the global beauty contest. Various international agreements cemented unilateral liberalization: OECD codes, bilateral tax and investment treaties, and chapters in trade agreements (e.g., Chapter 11 in NAFTA). While investment liberalization largely reflects national policy initiatives rather than international accords, the benefits of trade and investment liberalization go hand in hand.

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Box 2.1 Channels through which trade increases output[1]

Comparative advantage. David Ricardo's classic analysis, which dates to 1816, holds that free trade between countries with different cost structures enables each nation to specialize in producing goods that it makes most efficiently relative to its trading partners and import goods that it makes less efficiently. Trade thereby allows a country to consume more goods than it could produce on its own with the same resource endowments (capital, land, and labor).

Economies of scale. Firms and industries become more efficient when they increase their output, both during a year and over a period of years. At the firm level, scale economies result from spreading fixed costs—such as plant and research outlays—over a larger quantity of output. Firms also capture scale economies by discovering and applying better techniques as they repeat their production cycles again and again over a period of years. At the industry level, scale economies result from sharing experience as skilled personnel move between more firms and as each firm learns from the best practice of numerous competitors. Freer trade enables both firms and industries to achieve greater economies of scale by enabling them to sell to a larger market and to interact with more firms in the same industry.

Technological spillovers. International trade and investment flows increase the speed at which new production and distribution techniques spread from country to country, increasing the level of productivity in all countries. Innovations created by market leaders—such as Siemens, Sony, Intel, and Wal-Mart—are shared with (or emulated by) less advanced firms and countries through investment and trade. These firms and countries enjoy the potential for closing their productivity gap more quickly than if they had to create the technology themselves. At the same time, a firm with operations

(box continues next page)

Deeper investment ties foster more intense trading relationships and vice versa (Graham 2000, appendix B).

Almost all economists advocate trade liberalization as a proven method of increasing national income (measured by gross domestic product, GDP) and thereby per capita GDP and GDP per household. Contrary to popular wisdom, which celebrates exports and questions imports, economists attribute gains to *both* exports and imports. Indeed, imports are often a more important driver of economic growth than exports.

Before summarizing the gains already realized through postwar trade and investment liberalization, and the gains that remain to be harvested through future liberalization, we briefly identify four basic channels through which exports and imports increase income; these channels are discussed further in box 2.1:

- Comparative advantage allows countries to specialize in those goods they are relatively efficient at producing.
- Economies of scale occur when firms spread fixed cost by producing for a larger market.

Box 2.1 *(continued)*

spread throughout the world is best positioned to acquire new techniques wherever they may be created.

Import competition. While import competition is politically sensitive, rising imports boost the incomes not only of buyers (both households in their daily shopping and firms as they purchase intermediate inputs) but also of domestic competitors as they improve their performance in response to the loss of market share.

- *Consumers benefit directly:* When more firms compete for market share—either through exports or foreign direct investment (FDI)—household consumers and industrial purchasers benefit in two distinct ways. First, market entrants erode the monopolistic power of local suppliers, with the consequence that markup margins are compressed. Second, consumers can choose from a wider variety of products and thus achieve a closer match between their own needs and the available array of goods and services.
- *Domestic productivity increases:* When buyers (whether firms or households) shift from domestic products to imports, less productive domestic firms in import-competing industries lose market share. These firms either shrink or boost their own productivity. Some unproductive firms will be forced to close. The reallocation of resources that results when unproductive firms shed capital and labor may be politically unpopular, but it enables more productive firms to expand, thereby benefiting the economy as a whole.

1. To some extent, the channels overlap and reinforce one another.

- Technological spillovers accelerate the dissemination of technology throughout the world.
- Import competition reduces the monopoly power of domestic firms.

In light of the hugely successful postwar record of trade and investment liberalization, this chapter summarizes the payoff to the United States as a nation and to average individuals and households.[1] We draw on the ex-

1. We do not dwell on the security benefits from freer trade, but in the mind of Cordell Hull (Franklin Roosevelt's secretary of state from 1933 to 1944) Depression-era trade restrictions were a contributing cause of the Second World War. Hull believed that a postwar agenda of freer trade would serve as a bulwark for peace. In Europe, Jean Monnet—sometimes referred to as the architect of the European Union—viewed freer trade as an essential element of a plan to unite Europe and ensure peaceful relations on the continent and avoid a third world war. Another aspect of postwar trade history that we mention and pass over is the enormous drive that US economic policy imparted to the world commercial system. Without US leadership, it would have been difficult or impossible for other nations to slash their barriers and open their markets. In the first decades after the war, Europe, Japan, and the

isting empirical literature to quantify these various gains. To this end, we survey different methodologies and estimates; taken together they suggest very substantial past and future payoffs to the United States from expanded trade and investment ties with the global economy. We express gains in three common metrics: contribution to total GDP, GDP per capita, and GDP per household in 2003 (all measured in 2003 dollars). Since policy liberalization and lower transportation and communication costs permanently raise national income (unless liberalization is rolled back, as in the 1930s), these gains are enjoyed annually.[2]

Table 2.1 previews our results. We use four very different methods to estimate past gains. Each of these methods entails its own set of assumptions. Estimated annual gains are on the order of $1 trillion. The estimated gain in 2003 income is in the range of $2,800 to $5,000 additional income for the average person and between $7,100 and $12,900 for the average household. Future gains are harder to quantify, not surprisingly since the future is always difficult to predict. The estimates range from $450 billion to $1.3 trillion.

Although we express estimated gains in a comparable metric, the methods themselves are not directly comparable. In table 2.2, we summarize the basic differences between the methods and leave further explanation to the remaining sections. Some methods tally gains only on the production side of the economy, while others do so only on the consumption side. More importantly, some of the methods focus solely on liberalization policy (the outcome of multilateral, regional, and bilateral agreements, as well as unilateral policy changes) while others include deeper trade integration resulting from better transportation and communication technologies (e.g., container ships, air freight, and voice and data transmission), and an income elasticity of demand for imported products that exceeds unity.[3] As might be expected, methods that focus solely on policy reforms indicate somewhat smaller gains than methods that combine the effects of policy reforms, technological innovation, and rising income. Since we do not attempt to guess the pace of future innovation, or the

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Asian tigers all came to view participation in the world economy as central to their development strategies. Chile, Mexico, China, and even India have followed suit. Widespread adoption of market-oriented policies, including freer trade and investment, contributed to the best half-century of world economic growth since the time of Christ (Maddison 2003, table 8b; Bhalla 2002).

2. For simplicity, our calculations leave aside arguments that liberalization can permanently increase the *rate* of per capita income growth (Romer 1996, Baldwin and Forslid 2000) and instead concentrate on the one-time boost in the *level* of per capita income due to economic integration. This tenet of "endogenous growth theory" implies that our calculations understate the total gains, perhaps by a great deal.

3. When the income elasticity of demand for imported products exceeds unity, the ratio of trade to GDP will rise as income rises. This has been the case within the United States during the postwar era (Marquez 2002, chapter 3).

Table 2.1 Summary of results: Past and future annual payoff from US trade and investment liberalization

Method	Methodology source	Percent of 2003 GDP	2003 billion dollars	2003 dollars per capita	2003 dollars per household
Past gains					
Output elasticity (1950–2003)	OECD (2003)	13.2	1,451	5,000	12,900
Sifting and sorting (1947–2003)[a]	Bernard et al. (2003)	8.6	940	3,200	8,400
Smoot-Hawley CGE (1947–2003)[a]	Bradford and Lawrence (2004b)	7.3	800	2,800	7,100
Intermediate imports (1960–2001)[b]	Richardson (2004)	9.6	1,058	3,635	9,377
Future gains					
Global free trade CGE	Brown, Deardorff, and Stern (2003)	5.5	600	2,000	5,000
Market fragmentation	Bradford and Lawrence (2004a)	4.1	450	1,500	4,000
US-world FTA	Rose (2003) and OECD (2003)	12.0	1,307	4,500	11,600

Memorandum:	
2003 GDP (trillions of 2003 dollars)	11
2003 population (millions)	291
2003 GDP per capita (2003 dollars)	37,748
2003 GDP per household (2003 dollars)	97,390

CGE = computable general equilibrium model
FTA = free trade agreement

a. Includes estimate of gains due to increased product variety between 1972 and 2001, 2.8 percent of GDP (Broda and Weinstein 2004).
b. Presented in appendix 2A.

Source: Authors' calculations.

Table 2.2 Methodology comparisions

Method	Source of growth	Products counted	Gains realized in
Past gains			
Output elasticity (1950–2003)	Policy and technology	All merchandise and services	Production and consumption
Product variety (1972–2001)	Policy and technology	All merchandise	Consumption
Sifting and sorting (1947–2003)	Policy	All merchandise	Production[a]
Smoot-Hawley CGE (1947–2003)	Policy	All merchandise	Production and consumption[a]
Intermediate imports (1960–2001)[b]	Policy and technology	Manufacturing	Production
Potential future gains			
Global free trade CGE	Policy	All merchandise and services	Production and consumption
Market fragmentation	Policy	All merchandise and services[c]	Production and consumption
US-world FTA	Policy	All merchandise	Production and consumption

a. The estimates shown in table 2.1 for these methods incorporate the estimate for the product variety method.
b. Presented in appendix 2A.
c. The reported calculations are extrapolated from potential benefits from liberalizating merchandise trade in industrial countries.

future rise in GDP, our estimates of potential gains focus strictly on the consequences of policy liberalization.[4]

Finally, some of the methods measure the effect of liberalization only in merchandise trade (leaving aside services) or specifically in manufactures trade (leaving aside agriculture and minerals, as well as services). While trade in manufactured goods has been the focus of postwar liberalization, attention is increasingly drawn to agriculture and services. Our estimates suggest that gains due to liberalization of services trade will be a much higher component of future gains than past gains. This is partly a measurement issue. Some of the methods used to estimate past gains simply neglect services. In addition to measurement issues, a change may be taking place in the relative importance of goods trade versus services trade. With Internet technology, and widespread FDI in services, the international exchange of services could outstrip trade in goods within a few decades.

4. Our estimates of potential future gains should be viewed as the gains from wholesale reforms that would move the current trading system to *complete* liberalization. Ongoing negotiations (WTO Doha Development Round, Free Trade Area of the Americas, among others) are not that ambitious.

The Payoff from Past Liberalization

First, we consider how far the world has come since 1945. The initial round of GATT negotiations (the Geneva Round) was completed in 1947 between 23 countries. The current Doha Development Round, the ninth set of multilateral negotiations, includes 147 countries. Meanwhile, important regional and bilateral agreements have been concluded. In this section, we present three calculations of the payoff from past trade and investment liberalization, accompanied in some of the calculations by the trade-enhancing benefits of lower transportation and communication costs. (Estimates from the product variety method are not presented as standalone estimates of postwar gains. In table 2.1, the consumer benefits of enhanced product variety are grouped with producer benefits from greater efficiency.) A fourth methodology is reported in appendix 2A.

An important qualification applies to the calculations of past gains. Since the Second World War, the US economy has undergone tremendous transformation. Many of the inputs to our calculations (such as population, share of manufacturing value added, and labor productivity) rise or fall dramatically over the full period. For this reason, where possible, we break the full period down into several subperiods and then perform intermediate calculations to arrive at the total postwar gains.[5]

Output Elasticity: Cross-Country Estimates of Trade and Growth

The first approach draws on an OECD study designed to determine the sources of economic growth through cross-national econometric analysis (OECD 2003, chapter 2). The aim of the study was to identify economic attributes and policies that have the strongest effect on per capita income growth.[6] The study used a pooled mean group technique to estimate the effect of identified variables on per capita output. This technique allows a distinction between long-term determinants of growth and short-term fluctuations that are more likely to be country specific. Long-term determinants are expressed as level variables and are assumed to have the same effect in all countries.

5. However, the intermediate results that appear in the tables—gains *due* to liberalization—do *not* reflect gains realized solely during that subperiod. Most of the structural changes set in motion by trade openness take a decade or longer to mature in terms of greater productivity and higher income. Thus, our subperiod figures are an estimation of annual gains that will eventually result from policy liberalization or technology changes that occurred in the subperiod. We then add up subperiods to arrive at a final figure of annual gains due to policy and/or technology liberalization.

6. Among the attributes and policies are physical and human capital accumulation, inflation (both level and volatility), government spending, taxes, research and development spending, financial sophistication, and trade exposure.

Among other results, the OECD study calculates the positive effect on per capita income from a higher long-term level of trade exposure. The technique does not identify the individual channels through which increased trade increases per capita output; instead it imputes a broad relationship between the two based on their statistical correlation.[7] Interpreting the OECD study, we assume that it broadly captures the effect of all channels at play that lead from more trade to higher output.[8] Moreover, the OECD study uses observed trade exposure as its instrument (adjusted as described below), and does not explore the extent to which policy, technology, or other factors influenced the change in trade levels. Cline (1997, 265) makes a rough guess that about half the increase in trade levels reflects policy liberalization (lower tariffs, fewer quotas) and half reflects better transportation and communication technology. If this partition is roughly correct, then about half the estimated gains in the OECD study can be attributed to policy liberalization.

A traditional measure of merchandise trade exposure is the ratio of a country's total trade to GDP, expressed as (X+M)/GDP.[9] However this quantity is strongly influenced by a country's size and geography.[10] For example, Singapore, a small economy with a strategically placed port, has a trade exposure of over 100 percent. Such a figure would be incredible for a large country like the United States or Japan.[11] To control for country

7. Questions of causality (i.e., whether faster output growth increases trade or vice versa) and the possibility that omitted variables explain the statistical connection between trade and growth have bedeviled this line of inquiry (Berg and Krueger 2003, Hallak and Levinsohn 2004). Frankel and Romer (1999) use instrumental variables based on gravity models to make a strong case that trade causes growth rather than vice versa. Berg and Krueger (2003) survey the literature and summarize the cases for and against; they conclude that the literature shows that "openness is fairly robustly a cause of growth," although "there is substantial uncertainty surrounding these estimates."

8. This analysis also captures any effects of trade that would lower per capita output. For example, if a large number of workers were unemployed as a result of expanded trade, output would be depressed and the estimated coefficient would be reduced. As expected, the sign of the trade to output level coefficient is positive and statistically different from zero in all of the reported OECD regressions.

9. The OECD study uses a slightly different measure, (X/GDP) + [M/(GDP – X + M)], which scales imports by domestic consumption rather than GDP. The difference is slight, and we disregard it for clarity. Other studies, most notably Sachs and Warner (1995), have constructed policy-based indices in an attempt to focus directly on a liberal trade policy rather than trade levels. Rodriguez and Rodrik (2001) point out several methodological problems with these studies. However, other authors argue that the Sachs and Warner technique is relatively successful (Berg and Krueger 2003, Cline 2004).

10. Dollar and Kraay (2004) argue that while the level of trade exposure depends on size and geography, *changes* in the level of trade exposure over the medium term (e.g., a decade) do not depend on size or geography, since these factors are invariant in the medium term. We adopt this logic in our analysis of subperiods (table 2.3).

11. However, a large country enjoys the economic stimulus of *intra*national trade and investment, which boosts output according to the same channels as international trade and investment.

size, the OECD calculated a regression equation of trade exposure as determined by population size. The country residuals from the predicted regression equation values were then used to measure whether a country was relatively closed or open, given its population size.[12]

In order to estimate the response of per capita income to trade exposure, the OECD growth regression equation was written in log-log form.[13] The trade variable was lagged by one year. Across several specifications of the model, the long-term coefficient on trade exposure was consistently about 0.2 and statistically significant. On balance, holding everything else equal, a 10 percent rise in a country's long-term trade exposure (imports plus exports) results in a 2 percent increase in the level of annual per capita output (or income, which is the same thing).[14]

Comparing the OECD result with similar studies, Cline (2004, table 5.1) found the coefficient of 0.2 to be relatively low. One possible explanation is that the other studies surveyed by Cline covered a wider range of poorer countries than the comparatively affluent OECD area. Developing countries might well experience greater output gains from openness because they have more scope for adopting beneficial technology. If this explanation is correct, it means that the lower OECD coefficient is more appropriate for measuring the payoff to the United States from freer trade.

Armed with the estimate that a long-term increase in trade exposure boosts per capita output (or income) with an elasticity of 0.2, we can cal-

12. The residual is the difference between the actual value and the estimated value from the regression equation. If a country's actual trade exposure is greater than the "adjusted trade exposure" predicted by the model, the residual is positive, and the country is considered relatively open. The OECD study defines the "adjusted trade exposure" as the residual of the simple regression on population plus the constant term. In other words, "adjusted trade exposure" is the predicted trade exposure for the country after removing the effect of population.

13. The dependent variable was the natural logarithm of per capita output (income), while the independent variable of interest for our purposes was the natural logarithm of the trade exposure level adjusted for population (see previous footnote). With this formulation, the estimated coefficient represents an elasticity measure, namely the percentage change in per capita output for each 1 percent change in the adjusted trade exposure. We apply this elasticity to the percent change in actual US trade exposure to arrive at a figure for growth due to increased trade exposure. Assuming that changes in the population of the United States over the estimation periods (decades) are modest, the percent change in the actual trade exposure is a very close approximation to the percent change in adjusted trade exposure.

14. OECD (2003) explains its result by saying that a 10-percentage-*point* increase in trade exposure will typically result in a 4 percent increase in per capita output. The OECD assumes that typical trade exposure level is 50 percent of GDP. Thus, a 10-percentage-*point* increase from 50 to 60 percent of GDP represents a 20 percent increase in exposure, and 20 percent times 0.2 is a 4 percent increase in per capita output. For another example, the current US trade exposure is 24 percent, so a 10-percentage-point rise over the next decade would bring US trade exposure to 34 percent, a 42 percent increase in the exposure ratio. Under these hypothetical conditions, the OECD coefficient would predict an 8 percent increase in US per capita output.

Table 2.3 Output elasticity: Benefits of increased trade exposure

Year	Centered three-year trade exposure[a] (percent)	Period change (percent)	Per capita output growth due to trade[b]		Benefit in 2003[b,c] (billions of 2003 dollars)
			Percent	2003 dollars	
1950	8.8				
1960	9.2	4.5	0.9	112	33
1970	10.9	18.4	3.7	537	156
1980	19.8	81.8	16.4	3,213	935
1990	20.2	2.3	0.5	111	32
2003	23.7	17.0	3.4	1,011	294
Total				**4,986**	**1,451**

a. Calculated as (X+M)/GDP. 2003 figure is 2001–03 average.
b. Subperiod gains are an intermediate calculation, not an estimate of short-term gains from liberalization. Gains due to liberalization may require 10 to 20 years to be fully realized.
c. Benefit in 2003 is calculated by multiplying the benefit per capita measured in 2003 dollars by population in 2003.

Note: In order to better account for changes to the US economy over time, this table presents total gains from liberalization as the sum of subperiods. If instead a single calculation is used to estimate gains between 1950 and 2003, the total gains are estimated to be $1,218 billion. Numbers may not sum evenly due to rounding.

Sources: BEA (2004b), OECD (2003), and authors' calculations.

culate the effect of increased trade on GDP, per capita income, and household income. We apply the 0.2 coefficient to decadal changes in US trade exposure, using a three-year average centered on the decade turning year (1950, 1960, etc.) to dampen the effect of year-to-year fluctuations.

Table 2.3 shows the evolution of US trade exposure (including goods and services), together with the calculated payoff in terms of higher income levels. The fourth column is the eventual increase in per capita income, expressed in 2003 dollars, generated by the increase in trade exposure during each decade. The sum of this column, $5,000, is the total increase in per capita GDP resulting from deeper trade exposure in each of the decades between 1950 and 2003. The payoff of $5,000 per person represents 20 percent of the total per capita GDP gains over this period. It represents an additional $1.45 trillion of GDP, or a $12,900 increase in annual GDP per household.[15]

Product Variety

We now try to quantify a narrow portion of the benefits realized by domestic consumers. While this measure is significant in its own right, we

15. In 2003, the US population was 291.1 million persons, with an average of 2.58 persons per household (US Census Bureau 2003, table 65).

do not present it as a stand-alone estimate of postwar gains. Instead, where appropriate, we add the result to other methods that clearly do not account for variety-based gains in order to estimate the total payoff to the US economy.

Consumers gain when they are able to acquire a larger array of goods and services with the same budget. Import competition thus benefits consumers through lower prices and greater choice. Lower prices translate statistically into a reduced rate of inflation. However, it is far from clear that trade liberalization played a major role in the US disinflation process of the past two decades.[16] Nor is it clear—once inflation falls below the double-digit level—that further reductions contribute significantly to GDP growth. For both reasons, we do not pursue the anti-inflation line of analysis, but we do summarize the research in box 2.2.

Gains due to greater product variety would seem even more difficult to measure. A recent paper by Christian Broda and David E. Weinstein (2004) takes up the challenge. They find that the number of varieties available to US consumers increased by a factor of four between 1972 and 2001.[17] The benefits of new varieties are not taken into account in the conventional import price indexes, which evaluate price changes only for goods that are available in both periods. Broda and Weinstein attempt to remedy this shortcoming. They extend Feenstra's (1994) work on single goods to develop an aggregate "exact" price index.

To abbreviate their method, Broda and Weinstein hypothesize that the benefit of a new variety for a given good is positively related to expenditure on the new variety relative to existing varieties and negatively related to the elasticity of substitution between varieties of the good (if the varieties are perfectly substitutable, consumers will be indifferent to the introduction of a new variety). The Broda-Weinstein exact import price index implies that the conventional import price index overstated import inflation by 28.1 percent from 1972 to 2001 (an average overstatement of 1.2 percent—*not* percentage points—per year). Using product-level data on the fraction of imported goods in total consumption, the authors cal-

16. Clark (2004) reasoned that, while global inflation has fallen precipitously in the last two decades and while goods inflation (which is more susceptible to import competition) has declined relative to services inflation, much of the decline within the United States was due to dollar appreciation. In Clark's view, increased global competition played only a supporting role.

17. Broda and Weinstein (2004) define a variety as an 8-digit or 10-digit (HS or TSUSA system, respectively) good produced in a particular country for export to the United States. For example, if red wine is a product, French red wine is a single variety; Chilean red wine is a second variety. Given the way Broda and Weinstein measure variety, their estimate does not reflect the gains from greater variety introduced by US producers intending to meet an export market or preserve their domestic market share from foreign competition.

Box 2.2 Trade openness, inflation, and per capita output

Arguments can be made in both directions about the connection between trade openness and inflation. On the one hand, greater openness increases a country's exposure to foreign inflation generally and to industry-specific shocks, such as a surge in oil prices. When prices rise worldwide, an open country is more vulnerable, through higher import and export prices. On the other hand, increased trade openness reduces the power of domestic producers to raise prices and may permit a country to "export" its own inflationary policies (easy money and fiscal deficits) by borrowing from foreign capital markets.

Truman (2003) used cross-country data to analyze the connection between trade openness and inflation and found a small but significant and negative correlation. Using Truman's estimates, a 10-percentage-point increase in the trade openness coefficient reduces the annual inflation rate by as much as 0.2 percentage points.

The next question is the effect of a lower inflation rate on per capita output. In a cross-country regression of OECD countries, OECD (2003, table 2.8) found that a 1 percent reduction in the inflation level, acting through increased investment, would result in a 0.4 to 0.5 percent increase in per capita income. In addition, the study found that a 1 percent reduction in the volatility of inflation—measured as the three-year standard deviation—would directly affect economic efficiency and boost per capita income by 2 percent. However, this study covered the years 1971–98, bridging periods of high and low inflation, and the experience of the 1970s may have less salience in today's environment, where inflation rates are well below 10 percent.

It is generally accepted that extremely high rates of inflation have a disastrous effect on economic performance (Fischer, Sahay, and Végh 2002). However, there is little consensus on whether reducing an inflation rate that is already below 5 percent will significantly increase output. Andrés and Hernando (1997) estimate that, at inflation levels of 3 to 4 percent annually, a 1-percentage-point reduction in inflation will result in an average 1 percent increase in steady-state income. However, reviewing the inflation and growth literature, Fischer (1996) reports that "the overall conclusion must be that it is not possible at this stage to draw any firm conclusion on the relationship between inflation and growth at very low inflation rates. . . . The data leave open the possibility that there is a negative relationship between growth and inflation at rates of inflation as low as 1 to 3 percent. Or, there may be no significant relationship."

With the exception of the late 1970s and early 1980s, the United States has subscribed to low inflation policies since the Second World War, and greater openness over the past two decades played at most a supporting role in the disinflation process (Clark 2004). Even under optimistic assumptions, the contribution to GDP from trade-induced disinflation is likely to be modest. Therefore, we do not attempt to quantify the trade-inflation-output linkage.

culate that the increase in consumer purchasing power is the equivalent of a 2.8 percent increase in GDP, or $300 billion annually.[18]

This estimate of product variety benefit is a narrow measure of the total benefits to consumers from import competition—for example, it does *not* reflect the compression in markup margins as a result of import competi-

18. This estimate requires the assumption that an increase in imported variety has no effect on domestic varieties. If new foreign varieties substitute for domestic varieties, this model overstates variety-based income gains (see Rutherford and Tarr 2002). Alternatively, if foreign variety allows increased vertical specialization and complementary domestic varieties are introduced, income gains are understated.

tion. Since consumers realize product variety benefits in addition to the "standard" efficiency gains from greater international trade, we can combine the measured effect with some of the production-based estimates presented below.[19]

Sifting and Sorting: The Microdata

In this section, we consider the effects of liberalization and international integration on productivity.[20] In both traditional and new models of global market integration, "differences" are the foundation. Differences (on both a macro and micro scale) stimulate trade and investment and underpin the payoff from liberalization. The traditional and new models emphasize complementary differences:

- Traditional models emphasize differences across industries and countries in factor input intensities, differences across countries in factor endowments and technologies, and differences in the extent of scale economies between industries.
- New models add an emphasis on differences across *firms* in innovation, product differentiation, production techniques, productivity, and size.
- Traditional models show how a country's comparative advantage—defined in terms of differing degrees of competitive advantage across industries relative to global benchmarks—underlies its trade and investment performance.
- New models add reasons why competitive advantage at the *firm* level—relative to benchmark firms in the same industry at home and abroad—*also* underlie a country's trade and investment performance.

Microdata on individual plants make it possible to measure the differences between the new and old foundations for trade and investment. For almost every sector of the world economy, such measurements show that differences across firms *within* an industry are larger than differences *between* industries in characteristics of the average firm and larger also than most differences *between* countries in endowments, technologies, and other traditional determinants of trade. To quote one group of scholars (Foster, Haltiwanger, and Krizan 2001): "Within-sector differences dwarf between-sector differences in behavior." To quote another scholar: "A

19. Because the output elasticity method is based on a statistical correlation of openness and growth, without asserting how growth is achieved, we do not add the product variety method to that calculation.

20. Large portions of this section are paraphrased from Richardson (2004).

large number of studies have documented a strong correlation between firm exit and low [firm] productivity" (Melitz [2003, 1695], citing Roberts and Tybout [1996] and Davis and Haltiwanger [1999]). Quoting still another (Klein, Schuh, and Triest 2003, 10): "Membership in a particular broad *industry* group explains little of the behavior of job creation and job destruction for *firms* in the most narrowly defined industrial categories" (emphasis added).

The strong inference from such findings is that differences among firms are critical in tracing the payoff from global trade and investment. Some abbreviate this inference by saying that "differences *within* are as important as or more so than differences *between*" industries and countries. Several important messages emerge from the new models:[21]

- Increased global market opportunities—declining tariffs and transportation costs, declining start-up costs of marketing abroad, and opening of new, formerly closed foreign markets—can *all* cause favorable gains in industry-level and aggregate productivity. More productive firms tend to expand when they come into contact with the global market, while less productive firms tend to contract. The result is an increase in *average* productivity of the industry even though there may be *no* effect on any single firm's productivity. This can happen because more productive firms gain market share while less productive firms lose market share.
- The "sifting and sorting" mechanism by which these productivity gains emerge reflects market selection among heterogeneous firms that differ either in their inherent overall productivity or in their access to worker pools of varying skills, creativity, and reliability. As a result, (1) increased global market opportunities enable higher-productivity firms everywhere to begin exporting or to increase exporting; and (2) the ensuing cross-penetration of markets reduces the residual demand facing lower-productivity firms (which generally serve only domestic markets). The least productive firms are forced out of business.
- Models describe how the sifting and sorting mechanisms can affect productivity in *every* industry, whether export oriented or import oriented. However, the quantitative magnitude of the sifting and sorting is greatest in *export*-oriented industries, as is the corresponding job churning (job losses *and* job gains).
- Bernard and Jensen (2004) find that together, intraindustry and interindustry reallocation contribute roughly equally to account for 40

21. Summary points come from Melitz (2003); Yeaple (2003); and Bernard, Redding, and Schott (2004).

percent of all productivity growth in US manufacturing industries.[22] But sifting and sorting also *magnifies* the favorable productivity effects of deeper global integration because average productivity increases most in those industries that already constitute a country's comparative advantage, thereby magnifying the traditional gains from trade.

Drawing on the new view, some scholars have tried to estimate the firm-level payoff from trade and investment liberalization, where sifting and sorting is the main mechanism. Econometric results are still at a preliminary stage.[23] However, a simulation by Bernard et al. (2003) suggests that a 5 percent reduction of global trade barriers (tariffs and other costs expressed on an ad valorem basis) could lead to the closure of 3.3 percent of US firms. At the same time, according to their simulation, the sifting and sorting of resources toward more productive firms could boost overall US manufacturing productivity by 4.7 percent. In a moment, we borrow this simulation coefficient—approximately one-to-one—to calculate US productivity gains from the sifting and sorting process. But it is important to emphasize that the coefficient is derived from a model simulation, not a longitudinal estimate. The actual coefficient could be higher or lower than one-to-one.

US productivity research (without regard to global integration) has underscored the role of the sifting and sorting mechanisms that are emphasized in the new models. For example, almost half of the productivity growth of US manufacturing from 1977 into the late 1990s can be associated with entry, exit, and reallocation of market shares toward high-productivity plants and away from low-productivity plants (Foster, Haltiwanger, and Krizan 2001; and Foster, Haltiwanger, and Syverson 2004). Even stronger results are estimated for retailing and other services industries.[24]

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22. Bernard and Jensen provide a wide range for this estimate. As a lower bound, some 8 percent of total factor productivity growth in the US manufacturing sector was due to sifting and sorting caused by export activity; as an upper bound the estimate was 65 percent.

23. Bernard, Jensen, and Schott (2003, table 3) used an econometric model to further examine this relationship. For the 67 US industries (at the SIC 4-digit level) that represent the upper one-third of industries in terms of OECD import penetration (e.g., industrial machinery, electronics, transportation equipment, and instruments), a 1 percent reduction in trade costs over five years led to a 1.6 percent increase in labor productivity. However, for all SIC 4-digit industries, the relationship was not statistically significant.

24. For example, in US retailing, virtually *all* of the 11.4 percent growth in labor productivity between 1987 and 1997 can be associated with new entry of higher-than-average-productivity retailers and exit of lower-than-average-productivity retailers (a little more than half for entry, a little less than half for exit). See Foster, Haltiwanger, and Krizan (2001, 2002). Note that only labor productivity growth is examined in the services industries, whereas both labor productivity and overall (total, or multifactor) productivity are evaluated in manufacturing, with similar findings.

Corroborating worldwide evidence can be found in case studies and panel econometric analysis. For example, Eslava et al. (2004) find that, for Colombian manufacturing, virtually all the productivity growth from 1982 to 1998 can be associated with growing market shares of high-productivity plants and shrinking market shares of low-productivity plants.[25] Other scholars have examined panel data to discern the effects of "competition" on aggregate productivity, both levels and growth. For example, Disney, Haskel, and Heden (2003) find that several indicators of competition correlate with accentuated plant-level productivity gains from sifting and sorting in British manufacturing from 1980 to 1992.[26]

The sifting and sorting methodology estimates production-based gains but from a "bottom-up" rather than "top-down" perspective. Gains are realized through the same channels as other methods that concentrate on production efficiencies: import competition, economies of scale, and comparative advantage; but the gains are examined at the firm level. At the grass roots, these microdata correlations between performance and global integration are impressive. While there is still no definitive method for "adding up" microdata patterns, we draw on the reported simulation coefficient—that a one-percentage-point decrease in trade barriers raises manufacturing productivity by about 1 percent (Bernard et al. 2003)—to make a guess.[27]

Other methods of summarizing gains are possible, but all require some speculation. In appendix 2A (based on Richardson 2004), we present a separate methodology that examines the growing use of intermediate imports in US manufacturing. The intermediate imports method calculates benefits of roughly the same magnitude as those in the text (table 2.1). However, in the paragraphs below, we assume a coefficient—the reported simulation coefficient, one-to-one—running from a decrease in trade barriers to an increase in productivity.

Using this coefficient to estimate the benefits from sifting and sorting, our first task is to calculate the postwar reduction in US trade barriers. To do this, we look at the difference between the simple average column

25. Other studies on the causes of productivity growth in manufacturing include Lewis (2004) and Baily and Gersbach (1995).

26. Trefler (2004) uses Canadian plant-level data to estimate productivity improvements as a result of the Canada-US FTA. Other competition studies include Bayoumi, Laxton, and Pesenti (2004) and Carlin, Schaffer, and Seabright (2004). Corroborating worldwide evidence is found in empirical studies of the effects of regulatory barriers to entry on aggregate productivity levels and growth: Djankov et al. (2002); Hoekman and Kee (2003); Klapper, Laeven, and Rajan (2004); and Nicoletti and Scarpetta (2003).

27. There is support for a relationship of this magnitude in the econometric analysis of Bernard, Jensen, and Schott (2003). We assume that a one-to-one payoff also results when agriculture and mining trade barriers are decreased.

(2) ad valorem rate in the US tariff schedule—essentially the Smoot-Hawley tariffs inherited from the 1930s—and the simple average applied tariff rate in 2001.[28] The column (2) rates—rates imposed on the bulk of US imports immediately after the Second World War and now imposed on only three US diplomatic enemies (North Korea, Cuba, and Laos)—have a simple average of about 40 percent.[29] In 2001, the simple average applied rate for other countries (except FTA partners like Canada and Mexico) was 3.9 percent (WTO 2003, USITC 2004). We take the difference of 36.1 percentage points as a rough estimate of the decline in tariff barriers from the first GATT agreement to the present day.[30]

While early multilateral trade rounds focused almost exclusively on merchandise tariffs, later rounds have turned to other liberalization issues (e.g., regulation of services industries, agricultural subsidies, and other nontariff barriers). These elements of liberalization are not captured by our tariff barrier measure; hence the estimate of induced sifting and sorting may be conservative.[31]

Trade liberalization has typically been negotiated and comes in spurts rather than a smooth decline in barriers. To take this into account, we examined the trend in the ratio of duties collected to dutiable imports between 1947 and 2002 (USITC 2004) and used the figures to construct a rough estimate of the path of the simple average tariff barrier at five-year intervals from 40 percent in 1947 to 3.9 percent in 2002.[32] The constructed percentage point changes for each period are shown in table 2.4. They indicate that the bulk of US tariff reduction occurred in three periods:

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28. The simple average applied tariff rate is the simple average of so-called most favored nation (MFN) or normal trade relations (NTR) rates applied in 2001.

29. This figure is the simple average tariff rate of 10,704 tariff lines for which a column (2) specific or ad valorem rate is reported in the 2004 Harmonized Tariff Schedule of the United States, accessed via the USITC (2004). For tariff rate quota lines (e.g., cane and beet sugar), we assume a 100 percent ad valorem tariff equivalent. In cases where a specific rate was assessed (e.g., 25 cents per kilogram) we add 20 percentage points to the reported ad valorem rate (if any).

30. This method ignores nontariff barriers. In the aftermath of earlier GATT rounds, nontariff barriers may have been substituted for tariff reductions, dampening the effect of liberalization. In later trade rounds, reductions to nontariff barriers were negotiated, but these reductions have no effect on the simple average applied tariff.

31. The tariff decline from 40 to 3.9 percent could leave the false impression that little US liberalization is left for future negotiations. In reality, much liberalization remains to be accomplished. For example, Brown, Deardorff, and Stern (2003) attributed over 80 percent of the US benefits of a proposed Doha Round cut in trade barriers to commerce in services. Furthermore, the tariff measure refers only to US merchandise imports; the United States generally faces higher tariff barriers on its merchandise exports.

32. In order to divide the period into 11 five-year intervals, we use the simple average of US applied tariff lines measured in 2001 (3.9 percent) as the figure for 2002.

Table 2.4 Sifting and sorting: Productivity benefit of reduced import tariff barriers

Period	Estimated ad valorem tariff at end of period (percent)	Estimated ad valorem tariff reduction[a] (percentage points)	Average share of traded goods sectors in US value added[b] (percent)	Growth in output per worker in full economy due to tariff change[c]		Benefit in 2003[c,d] (billions of 2003 dollars)
				Percent	2003 dollars	
1947	40.0					
1947–52	22.7	17.3	37.7	6.5	1,905	262
1952–57	18.9	3.8	36.5	1.4	466	64
1957–62	21.5	–2.6	33.9	–0.9	–336	–46
1962–67	21.2	0.2	31.7	0.1	32	4
1967–72	12.7	8.6	29.3	2.5	1,241	171
1972–77	4.9	7.8	27.7	2.2	1,148	158
1977–82	3.9	1.0	27.2	0.3	141	19
1982–87	4.6	–0.7	24.5	–0.2	–96	–13
1987–92	4.6	0.0	21.3	0.0	0	0
1992–97	3.2	1.4	20.1	0.3	188	26
1997–02	3.9	–0.7	17.8	–0.1	–88	–12
Total					**4,601**	**633**

a. Estimated productivity growth in traded goods sector due to tariff reduction.
b. Traded sectors are manufacturing, agriculture, and minerals.
c. Subperiod gains are an intermediate calculation, not an estimate of short-term gains from liberalization. Gains due to liberalization may require 10 to 20 years to be fully realized.
d. Benefit in 2003 is calculated by multiplying the benefit per worker measured in 2003 dollars by total employment in 2003.

Note: In order to better account for changes to the US economy over time, this table presents total gains from liberalization as the sum of subperiods. If instead a single calculation is used to estimate gains between 1947 and 2002, the total gains are estimated to be $404 billion.

Sources: USITC (2004), CEA (2004), BEA (2004a), WTO (2003), and authors' calculations.

1947–52, 1967–72, and 1972–77.[33] However, the economic payoff is spread over much longer periods since structural responses take a decade or two to play out.

Applying the one-to-one coefficient gleaned from the literature—that a 1-percentage-point ad valorem decline in tariff or other barriers will induce a 1 percent improvement in labor productivity in traded goods sectors (i.e., manufacturing, mining, and agriculture)—we use the constructed series in table 2.4 as a measure of induced productivity gains in the traded goods sectors for each period as a result of tariff cuts.[34] To find the productivity improvement to the entire economy due to reduced tariff barriers, we multiply this figure by the average share of traded goods sectors in the total economy.[35] Based on these productivity increases (and in some cases, decreases) for the 11 periods, we estimate an annual GDP benefit of $2,200 per capita and $5,600 per household for all liberalization between 1947 and 2002. This equates to a benefit of $600 billion to the US economy in 2003 (measured in 2003 dollars). Unlike the OECD output elasticity calculation, which reflects both policy and technology liberalization, the sifting and sorting estimates reflect only policy liberalization.

Moreover, since the sifting and sorting estimate measures just productivity gains due to resource reallocation, we can combine this estimate—a gain of approximately 5.8 percent of GDP from lower tariff barriers—with the additional 2.8 percent gain calculated by Broda and Weinstein (2004) for greater product variety.[36] The result is an increase of 8.6 percent of GDP, or roughly $940 billion of annual GDP in 2003 dollars. This equates to an additional $3,200 of GDP per capita due to liberalization annually, or $8,400 per household. The bulk of these gains are a direct result of

33. By this measure, the Uruguay Round and Tokyo Round negotiations reduced tariff barriers by only a small extent. This may be due to the changing composition of trade, partly in response to tariff cuts on products that still had higher-than-average tariffs after the cuts. According to WTO (2004), the first five GATT rounds collectively reduced US industrial product tariffs by 36 percent, and the Kennedy, Tokyo, and Uruguay rounds reduced industrial product tariffs of developed countries by 37, 33, and 38 percent, respectively (weighted by preround imports).

34. In some periods, the ratio of duties collected to dutiable value actually rises (again, most likely due to shifts in the structure of imports; see previous footnote), causing a rise in our tariff barrier estimate. We treat these increases as costs to productivity and account for them when summing the total gains in output per worker.

35. This methodology assumes that workers moving from agriculture, mining, and manufacturing to other industries (such as services) maintain their productivity levels. Given the studies presented above on the positive effects of capital and labor reallocation between industries, this assumption appears to be reasonable.

36. While the production side measures gains between 1947 and 2003, the Broda and Weinstein (2004) estimate applies to the period between 1972 and 2000. By adding these two estimates together, we implicitly assume that product variety gains before 1972 and after 2000 were zero, an obvious underestimate.

changes in public policy and do not encompass additional gains due to improved communication and transportation technology or trade enhancement on account of import demand elasticities greater than unity. Taking these factors into account could reconcile the higher figure from the OECD study ($1,450 billion annually) with the somewhat smaller figure from the sifting and sorting method ($940 billion annually).

Smoot-Hawley CGE: Writing History Backward

The third approach we report imagines a world in which postwar liberalization had never occurred. Using a computable general equilibrium (CGE) model, Bradford and Lawrence (2004b) have attempted to construct this world. The CGE model is first calibrated using base-year data (in this case, 1997) on tariffs, nontariff barriers, trade, production, the extent of monopolistic competition, and a set of embedded parameters. The CGE model used by Bradford and Lawrence includes monopolistic competition, scale economy features, and capital accumulation, as well as the standard efficiency gains from better exploitation of comparative advantage.

Bradford and Lawrence then imposed a hypothetical tariff regime on the model, specifically the highly restrictive Smoot-Hawley Tariff of 1930. Except for countries with which the United States negotiated reciprocal trade agreements in the 1930s and 1940s, this was the generally applicable US tariff schedule after the Second World War.[37] To complement the Smoot-Hawley tariff and mimic the rash of tariff retaliation in the 1930s, Bradford and Lawrence imposed similar restrictive tariffs on US exports to the trading partners identified in the CGE model. The calculated decrease in national income can be interpreted as a lower-bound estimate of the payoff from postwar liberalization.

The results from the simulation, which boil down to the difference in income levels under the current tariff profile and the Smoot-Hawley tariff, appear in table 2.5.[38] We briefly note two lessons from the international calculations. First, as a consequence of retrenchment, world income falls, and losses are suffered in every country or region measured. Second, much of the harm is self-inflicted. While the United States is among the largest losers when the Smoot-Hawley regime is imposed by itself, US

37. The Reciprocal Trade Agreement Act of 1934 authorized bilateral trade agreements for the reciprocal reduction in tariffs. After the Second World War, a successor edition of the act was invoked to permit US participation in the first few rounds of GATT negotiations.

38. In the parlance of CGE models, the figures presented in table 2.5 represent "equivalent variation." Roughly, this is the increase in purchasing power as a result of the new trade regime, measured in the prices of the base year. For our purposes, we treat this figure as an increase in GDP.

Table 2.5 Smoot-Hawley CGE: Effect of reverting to 1930s tariff regimes (percent of GDP)

Impact on	US reverts to Smoot-Hawley	All countries retaliate with equivalent regime
Australia	–0.77	–8.39
Canada	–5.71	–11.95
Germany	–0.64	–10.40
Italy	–0.47	–15.10
Japan	–0.34	–0.84
Netherlands	–0.81	–20.75
United Kingdom	–0.64	–9.37
United States	**–2.40**	**–4.47**
China	–0.99	–4.74
South Korea	–0.83	–1.97
Rest of Asia	–1.62	–13.01
Brazil	–0.67	–3.62
Rest of Latin America	–3.60	–10.95
Rest of Europe	–0.44	–13.91
Middle East	–1.39	–11.53
Rest of the world	–0.35	–7.60
World	**–1.33**	**–7.35**

Source: Bradford and Lawrence (2004b).

losses are modest compared with what other countries suffer once they join the tariff retaliation game.[39]

Turning to the United States, the reintroduction of the Smoot-Hawley tariff regime causes GDP to decline by 2.4 percent. The introduction of reciprocal tariff regimes by US trading partners further contracts the US economy by 2.1 percent. In all, the Bradford and Lawrence simulations indicate that the US economy is 4.5 percent larger due to sharply lower worldwide tariff barriers since 1947. This equates to $500 billion in 2003.

The calculated decrease of $500 billion in US GDP illustrates the impact of a shock back to 1930s-style protectionism rather than a parallel universe without liberalization over the past 50 years. The Bradford and Lawrence calculation does not purport to measure the expansion of trade owing to the dramatic fall in transportation and communication costs. Nor does it capture technological spillovers that resulted from interaction between US firms and foreign markets. Perhaps for these reasons, the Bradford and Lawrence calculation suggests a lower US payoff from global integration than the OECD coefficient.

39. Terms-of-trade effects that would likely favor the United States under the Smoot-Hawley regime are included in this calculation. However, US terms-of-trade gains are overwhelmed by other losses in the simulation.

As with previous methods, we can add the consumption variety gains estimated by Broda and Weinstein (2004) to gains estimated using the Bradford and Lawrence CGE model.[40] The result is a total estimate of 7.3 percent of GDP. This equates to $800 billion of GDP, an increase in annual per capita income of $2,800, and an increase in average annual household income of $7,100.

Using three different methodologies (four, including the methodology reported in appendix 2A) to calculate the payoff from the postwar reduction in trade barriers and transportation/communication costs, we find results that are of the same order of magnitude: roughly $1 trillion of annual US GDP is attributable to global integration.

The Payoff from Future Liberalization

In light of the great progress made in trade and investment liberalization (reflected in the falling US ad valorem tariffs portrayed in table 2.4), it might be questioned whether the United States will realize substantial benefits from eliminating its remaining barriers. Indeed, the classic Ricardian model indicates that the deadweight loss due to a trade barrier is roughly proportional to the height of the barrier squared.[41] Since remaining US tariff barriers are low on average, the prospective benefits of future liberalization in terms of enhancing US productivity and reducing prices would appear to be modest.

Against this view, three points may be made. Many industries remain highly protected—not only abroad but also in the United States. Many countries continue to sharply restrict trade and investment in services, ranging from finance to health care. Indeed, while many estimates of past gains ignore the services sector, the potential gains to the United States from the future liberalization of services trade may exceed the gains that can be derived from the future liberalization of merchandise trade. Even so, substantial gains remain to be achieved in merchandise trade. Agriculture is notorious for its high trade barriers and expensive subsidies. The United States and many other countries severely limit textile and clothing imports. The same is true of leather goods, ceramic dishware, cast iron grates, and a number of other low-technology imports.

40. The Bradford and Lawrence CGE model itself reflects the benefit of lower consumer prices for the goods identified in the model. However, it does not reflect the variety increase measured by Broda and Weinstein (2004).

41. In the classic (though perhaps simplistic) Ricardian framework, deadweight loss is represented as a triangle with the height equal to the size of the trade barrier and base equal to the amount of trade displaced by the barrier. If the amount of trade displaced varies linearly with the height of the barrier, the deadweight loss simplifies to a constant times the height of the barrier squared.

Second, average protection levels in many developing-country markets are much higher than those in the United States. Negotiated tariff reduction with these countries holds the potential for high payoffs from larger US exports.

The third important point is that complete elimination of trade barriers creates an atmosphere of commercial certainty—because it is politically hard to walk away from an FTA or customs union. In a moment, we report on "border effect" research that implies substantial gains could be captured by the final march to free trade in the context of binding agreements.

In several estimates of past gains, the results of policy liberalization, technological innovation, and income elasticities are entangled. By contrast, all estimates of future gains are based on policy liberalization alone. Technological innovations that reduce trade costs (e.g., information technology) will produce gains in addition to those described below. The same is true of trade expansion that results from high income elasticities of import demand. With that preamble, we report on three approaches that scholars have used to estimate the unrealized payoff from future liberalization.

Global Free Trade CGE: Writing History Forward

CGE models were first devised to forecast the outcome of reducing tariff and nontariff barriers—multilaterally, regionally, or bilaterally. Brown, Deardorff, and Stern (2001, 2003), for example, use their Michigan Model of World Production and Trade to envisage (among other outcomes) a world of zero tariff and nontariff barriers. The Michigan Model adds several useful features to the standard CGE model—accounting for economies of scale, less monopolistic competition, and greater product variety.[42] Moreover, and this is quantitatively very important, the Michigan Model calculates gains from liberalizing trade in services as well as goods. Like other CGE models, the Michigan Model is concerned with policy liberalization, not lower transportation and communication costs.

In the Michigan Model, the world is divided into 20 countries or regions, and traded products are classified into 18 sectors. The base year for the model was constructed by projecting 1995 data to 2005 (including liberalization agreed in the Uruguay Round). From this point, the model is used to estimate the GDP payoff from global free trade. The payoff figure is $2.1 trillion for the world as a whole and a 5.5 percent increase in GDP for the United States, equivalent to $600 billion in 2003 (Brown, Deardorff,

42. The Michigan model does not, however, assume capital accumulation or technological improvements as a consequence of freer trade. For a complete formal description of the Michigan Model, see www.fordschool.umich.edu/rsie/model (accessed July 19, 2004).

and Stern 2003, table 1). For the US population in 2003, this equates to an annual payoff of $2,000 per capita or $5,000 per household.[43]

When compared with other CGE results, the Michigan Model predicts a relatively large gain for the United States through multilateral liberalization. One reason may be the use of increasing returns to scale and other elements of new trade theory. Perhaps most importantly, the Michigan Model accounts for liberalization in the services sector; by contrast, many CGE models only account for liberalization in merchandise trade, a shrinking share of the US economy. As much as 4.1 of the total 5.5 percent of GDP increase due to global free trade calculated by the Michigan Model may be due to liberalization in services.[44]

Market Fragmentation: A Price Convergence Approach

In a theoretical world of perfect competition and free trade, arbitrage would enforce the law of one price for most goods and some services: The price of an identical product in two locations would differ only by the cost of transportation from one place to another. In the real world, this rarely happens. Imperfect competition is the rule, and firms discriminate in quoted prices across space and time. However, political barriers to trade are responsible for a large portion of the price gaps between states.[45] As barriers to trade and investment fall, the world moves closer to the law of one price. For example, Rogers, Hufbauer, and Wada (2001) showed that between 1990 and 1999, the EU single market and common currency reduced the dispersion of prices for traded goods between Euroland cities to approximate the dispersion found between US cities.[46]

43. The payoff, of course, would not be instantaneous. A period of five to ten years might be required for complete adjustment. Like all CGE models, this method internalizes terms-of-trade losses and contraction of import-competing industries into its calculation of production gains.

44. In a separate experiment, the Michigan Model indicates that a one-third reduction in world service barriers would boost US GDP by 1.48 percent, more than three times the income benefit (0.48 percent) of a one-third reduction in manufactures barriers (Brown, Deardorff, and Stern 2003, table 1). We assume a proportional distribution of gains in the total liberalization experiment.

45. Using a gravity model with log price differentials as the dependent variable, Anderson and Smith (2004) have shown that the effect of an international border is a significant disruption of the arbitrage process, whereas the effect of distance, while positive, is not statistically significant. Anderson and van Wincoop (2004) show that total international trade costs are roughly 74 percent ad valorem, consisting of a 21 percent cost for transportation and a 44 percent cost due to border-related trade barriers (0.74 = 1.21*1.44-1).

46. Other studies, among them ECB (2002), have reported less significant declines in European dispersion. See Engel and Rogers (2004) for a more current discussion of European integration and price convergence.

When prices converge, benefits are realized from *both* falling and rising prices. This is a direct result of the law of comparative advantage. The price of an item tends to be less than the world price in places and times where it is efficiently produced, so a price rise generates gains for producers that more than offset the losses to consumers. Meanwhile, the price of an item tends to be higher where it is less efficiently produced, so a price fall benefits consumers more than it hurts producers.

In an early application, Hufbauer, Wada, and Warren (2002) estimated that world GDP would increase by 2 to 6 percent (weighted by market exchange rates or purchasing power parity, respectively) if world prices converged to the level of dispersion found between US cities.[47] Subsequently, Bradford and Lawrence (2004a) used OECD price data on consumer and capital goods in eight countries to develop a "fragmentation index" based on the ratio of a good's producer price to a constructed landed price (i.e., including transportation costs) from the most competitive foreign market.[48] This ratio can be considered the average *effective* ad valorem barrier (including tariff and nontariff barriers).[49] Using a CGE model based on Harrison, Rutherford and Tarr (1997), the authors calculate that the removal of fragmentation (i.e., the removal of price differences that are created by tariff and nontariff barriers) in the eight countries would increase US GDP by 1 percent.[50] Scaled to 2003 GDP and population, this would amount to an increase of $110 billion in GDP, an additional $400 per capita or $900 per American household annually.

This result is significantly smaller than that of the Michigan Model (reported earlier). However, the Michigan Model calculates the result of global free trade in both goods and services whereas the Bradford and Lawrence experiment involves the removal of barriers on goods trade alone by only eight industrial countries (these eight countries account for about 86 percent of the GDP of the industrialized world, roughly 65 percent of total world GDP).[51] Ignoring services barriers leaves out a large

47. The authors used data from the Economist Intelligence Unit for their calculations.

48. The countries are Australia, Canada, Germany, Italy, Japan, the Netherlands, the United Kingdom, and the United States.

49. Since the fragmentation index applies only to final goods, the barrier used for each product is a weighted average of the GTAP database tariff and the fragmentation index for that product. The share of final goods imported in the product category weights the fragmentation index. In sectors where a barrier was not estimated, most notably all services sectors, the GTAP barrier is used.

50. Unlike the Michigan Model, the Harrison, Rutherford, and Tarr (1997) model allows for dynamic capital accumulation. The model provides for increasing returns to scale, monopolistic competition, and product differentiation in 25 of 33 sectors. The model is publicly available at http://dmsweb.badm.sc.edu/Glenn/ur_pub.htm (accessed July 27, 2004).

Table 2.6 MFN applied tariffs for all products and estimated tariff equivalents in traded services (percent)

Country/region	Simple average merchandise tariff	Business and financial services	Construction
India	31.4	13.1	61.6
Brazil	14.6	35.7	57.2
China	12.4	18.8	40.9
Russia, central and eastern Europe[a]	10.7	18.4	51.9
Turkey	10.2	20.4	46.3
South Africa	5.8	15.7	42.1
North America[a]	5.4	8.2	9.8
Western Europe[b]	4.4	8.5	18.3
Australia and New Zealand[a]	4.0	6.9	24.4
Japan	3.3	19.7	29.7

MFN = most favored nation

a. Average merchandise tariff weighted by 2002 imports.
b. Merchandise tariff of the European Union.

Note: Tariff reported for latest available year, 2001 or 2002. Services barriers estimated using a gravity model.

Sources: WTO (2003), Francois (1999) cited in Deardorff and Stern (2004, table 9).

portion of potential gains, since barriers within the services sector are relatively high (table 2.6).[52] Another difference worth emphasizing is that the Bradford and Lawrence experiment only covers trade between industrial countries. Developing-country trade barriers tend to be much higher than those in industrial countries (table 2.7). CGE modeling by Anderson et al. (2001) indicates that the potential gains to North American income from liberalized merchandise trade with developing countries are more than twice the potential benefits of liberalized trade with industrialized countries.[53]

51. Bradford and Lawrence (2004a) did not estimate fragmentation in services industries and some goods industries (particularly agriculture and natural resources). In these cases, they instead use the protection level from the GTAP 5 database (also used by Harrison, Rutherford, and Tarr 1997). This database assumes the protection level of its three services sectors to be 0 in the eight countries considered by Bradford and Lawrence, an obvious underestimate (Bradford and Lawrence 2004a, table 4.4). For more on the GTAP 5 database and subsequent improvements, see www.gtap.org (accessed August 3, 2004).

52. As well as being high, barriers to services trade are difficult to measure. The estimates presented in table 2.6 compare predicted services trade using a gravity model with the actual level of services trade. See Deardorff and Stern (2004) for more on this and alternative methods for estimating barriers in services.

53. Anderson et al. (2001, table 4) report that total gains to North America from developing-country merchandise trade liberalization would be $19 billion, while "rich-country" liberalization would provide only a $3 billion benefit. However, the rich-country benefit can be decomposed into a *cost* of $9 billion due to a terms-of-trade loss from rich-country liberalization of manufactures, offset by an $11 billion gain in primary merchandise. Ignoring the terms-of-trade loss, gains from developing-country liberalization still constitute the bulk of potential North American gains.

Table 2.7 Simple average applied MFN tariff, selected countries (percent)

Country/region	Tariff
Bradford-Lawrence study	
European Union	4.4
United States	3.9
Australia	4.1
Canada	4.1
Japan	3.3
Selected other countries	
India	31.4
Pakistan	20.1
Egypt	19.9
Brazil	14.6
Poland	13.9
China	12.4
Korea	12.4
Colombia	12.2
Russia	9.9
Malaysia	7.3
Indonesia	6.9
South Africa	5.8

Note: Tariff in latest available year, 2001 or 2002.

Source: WTO (2003); Bradford and Lawrence (2002).

To better compare the Bradford and Lawrence methodology with other approaches, we made two extrapolations. First, we scaled up US gains to reflect the elimination of fragmentation vis-à-vis the entire world. Together, the seven partners of the Bradford and Lawrence study account for 45 percent of US merchandise exports. As table 2.7 illustrates, these countries have low tariff barriers compared with other US trading partners. However, we have no data on fragmentation (reflecting both tariff and nontariff barriers) for other countries. Separate simulations performed by Bradford (2004) allow us to extrapolate the gains that might be realized from complete liberalization with the rest of the world. Bradford shows that when estimates of barriers from the GTAP database alone are removed from the eight countries in the Bradford-Lawrence study (i.e., tariff barriers only), US income grows by 0.33 percent of GDP. However, full tariff liberalization by all countries provides US gains of 0.85 percent of GDP.[54] Given the large additional gains that accrue to the United States when tariff elimination by the Bradford-Lawrence countries

54. GTAP barriers are typically drawn from tariff measures, so we characterize them roughly as a measure of tariff barriers, while market fragmentation estimates take into account both tariff and nontariff barriers to trade. When Bradford estimates the removal of fragmentation in Bradford-Lawrence countries, simultaneously with the removal of tariff-based barriers elsewhere, US gains are 1.18 percent of GDP.

is extended to the entire world (more than doubling US gains), it seems logical that the removal of market fragmentation worldwide would likewise have an amplified effect. To be conservative, we scale Bradford and Lawrence's estimated gains from eight countries by a factor of 2 to encompass the merchandise trade with the entire world.[55] This calculation yields total gains of roughly 2.04 percent of US GDP due to full merchandise liberalization.[56]

Second, we scale up the potential gains from free trade in goods to estimate the additional gains from free trade in services. Barriers to services trade are much higher, on average, than barriers to merchandise trade (Findlay and Warren 2000; Stephenson, Findlay, and Yi 2002). Studies project that gains due to services liberalization may be extremely large (Bradford 2005, forthcoming). As mentioned earlier, Brown, Deardorff, and Stern (2003) estimate that gains from services liberalization amount to four times those of goods liberalization (despite the fact that US total trade in services was less than one-fourth that of goods in 2003). From this evidence, we conservatively assume that gains in services-sector liberalization will be at least as large as those calculated for the goods sector. Therefore, we estimate potential US income gain of 2.04 percent of GDP due to global liberalization of services.

In combination, these assumptions (built around the fragmentation index) allow us to speculate that elimination of policy barriers would raise US GDP by about 4.1 percent. Scaled to 2003, this amounts to an additional $450 billion in US GDP, $1,500 per capita, or $4,000 income increase per household annually.

US-World FTA: A Gravity Model Estimate

In the past decade, empirical and theoretical research has revived the gravity model, which posits that bilateral trade between two countries is directly proportional to their size and inversely proportional to their distance (Frankel 1997).[57] The gravity model can be extended to quantify the

55. We do not scale the 1.02 from Bradford-Lawrence country liberalization by the full 2.5 due to the conventional wisdom that industrial countries tend to rely on nontariff barriers more heavily than developing countries, which typically protect through high tariffs. Against this, we note that the gains from liberalization in Bradford-Lawrence countries expand by a factor of 3 when using Bradford-Lawrence fragmentation estimates versus the GTAP barriers (typically tariff barriers).

56. The findings of Anderson et al. (2001), together with the observation that trade barriers in the developing world are significantly higher than those imposed in the OECD (table 2.7), suggest that freeing $10 billion of representative US trade with developing countries will deliver more gains than freeing $10 billion of representative trade with OECD countries.

57. The gravity model was used as early as 1946 to analyze trade. Linnemann (1966) provided significant refinements to the technique.

Table 2.8 US-world FTA: US merchandise trade with FTA and non-FTA partners, 2003 (billions of dollars)

	Total	FTA[a]	Non-FTA
US imports	1,259	376	884
US exports	724	274	449
Total trade	1,983	650	1,333
Estimated total trade if United States had an FTA with all countries[b]	3,163	650	2,513
Change (percent)	59.5	0.0	88.5
Memorandum:			
Estimated percent gain in GDP			11.9

a. Existing FTA partners in 2003 were Canada, Mexico, Israel, and Jordan.
b. The estimate assumes that a network of bilateral FTAs would boost bilateral trade by 89 percent, based on Rose (2003), adjusted as explained in the text.

Sources: USITC (2004), Rose (2003), and authors' calculations.

effects of common language, shared borders, postcolonial relationships, and other variables that potentially affect the size of bilateral trade flows.

Andrew Rose (2003) extended the gravity model to test the influence of international institutions (the GATT/WTO, IMF, OECD, and regional or bilateral FTAs) on bilateral trade.[58] Using IMF data on bilateral merchandise trade between 178 countries over 1948–99, he reports that participation in a regional FTA is strongly positive.[59] In particular, Rose estimates that a regional FTA can increase bilateral trade by 118 percent.[60] For reasons explained below, we adjust this coefficient downward to 89 percent. We then borrow this adjusted coefficient of 89 percent to estimate the increase in US merchandise trade if FTAs were concluded with all trading partners. This is the same as assuming that all countries eliminated their policy barriers to merchandise trade with the United States and vice versa. In 2003, the United States had FTAs in force with four countries, Canada, Mexico, Israel, and Jordan, which together accounted for roughly one-third of US trade (mostly NAFTA trade).[61] Applying Rose's adjusted coefficient, concluding FTAs with all other trading partners would have increased total US trade by 60 percent (table 2.8).

58. Rose has made his data set publicly available at http://faculty.haas.berkeley.edu/arose/RecRes.htm (accessed July 27, 2004).

59. In the same model, Rose also tried to assess the effect of GATT/WTO, IMF, and OECD membership on bilateral trade. Subramanian and Wei (2003) dispute Rose's result that GATT/WTO membership does not have a strong positive impact on trade linkages. Rose (2004) offers a riposte to their arguments. As we do not employ Rose's result pertaining to GATT/WTO, we do not pursue this debate.

60. The dependent variable was the natural log of bilateral trade, the regional FTA coefficient controlling for fixed country-pair effects is 0.78, 100*(exp(0.78)-1)=118 percent. This is the smallest regional FTA coefficient of the three reported benchmark regressions.

61. US FTAs with Singapore and Chile entered into force in January 2004.

The rationale for the downward adjustment from 118 percent to 89 percent is to reflect trade diversion.[62] Bilateral and regional free trade agreements increase trade among members both through trade creation (increased trade as a result of relative efficiency) and trade diversion (increased trade as a result of privileged access).[63] CGE estimates by DeRosa and Gilbert (2004, table A.6) for 14 prospective US FTAs enacted simultaneously suggest that trade diversion—measured as the dollar decline in nonpartner trade—could account for up to 25 percent of the gross gain in trade with partner countries. In view of this estimate, we reduce the gravity model trade augmentation effect from 118 to 89 percent.

While the gravity model estimate of regional trade agreements nevertheless appears large, research into so-called border effects puts the Rose coefficient into perspective.[64] McCallum (1995) launched this literature by comparing trade between Canadian provinces with their trade with US states and found that interprovince trade tended to be 22 times larger than state-province trade, controlling for size and distance.[65] Anderson and van Wincoop (2003) made several refinements, arguing that theory expects the border effect to be higher from the Canadian perspective—as Canada has fewer options for *intra*national trade—than from the US perspective.[66] Anderson and van Wincoop estimate the border effect of the US-Canada border—expressed as the ratio of trade with a domestic partner to a foreign partner controlling for size and distance—to be 11 from the Canadian perspective and 2 from the US perspective *in the presence of an FTA*.[67] Even so, the Anderson and van Wincoop calculations suggest that US trade with Canada would increase by between 79 and 144 percent if the border effect could be eliminated.[68] Given their interlocking cultures,

62. The 118 percent coefficient may also be exaggerated because of selection bias—the tendency of countries to put priority on FTAs with partners that promise the largest trade gains. However, in the case of the United States, noneconomic factors appear to play a large role in the selection of FTA partners (e.g., Bahrain); see Schott (2004, 365-73).

63. The trade diversion gains to partner countries of course become diluted as more nations enter into FTAs.

64. As it is used in this context, the term "border effect" is somewhat of a misnomer. The term refers to the difference in trade intensity due to separation into distinct political units. The border effect is present regardless of whether the two units share a border.

65. McCallum uses data from 1988, the year before the Canada-US FTA entered into force; Anderson and van Wincoop (discussed below) used 1993 data, the year before NAFTA entered into force.

66. Intuitively, the border effect must *both* decrease international trade *and* increase intranational trade. In Canada, the increase in intranational trade is more noticeable, since the Canadian economy is small relative to that of the United States.

67. The US-Canada FTA had been in force for four years at the time of the Anderson and van Wincoop data, and the border effect was still large.

68. Depending on whether a multicountry model (including Japan, Europe, Australia, and other developed nations) or a two-country model, respectively, is used.

common language, and lengthy trading history, it seems safe to assume that the US-Canada border effect is relatively small compared with other bilateral trading relationships. With this in mind, Rose's adjusted coefficient indicating that a regional FTA could augment trade by 89 percent—reducing, but far from eliminating, the border effect—seems plausible.

Bearing such caveats in mind, we calculate how incomes would be affected by a world where the United States concluded FTAs with all its trading partners, resulting in an increase in US trade of 60 percent. Applying the OECD (2003) per capita income coefficient of 0.2, as outlined above, suggests an increase in per capita income of 12 percent. In 2003 dollars this increase equates to $4,500 per capita, or $11,600 per household.[69] In the aggregate, GDP would increase by $1.3 trillion. Neither the Rose nor the OECD methodologies identify specific channels through which bilateral agreements affect bilateral trade or increased trade affects output per person, so we must assume that all channels play a role in this very large figure.

Conclusion

Past integration, through both policy liberalization—fostered by every postwar president—and technological progress, has been an unambiguous boon to the US economy. We have presented four very different methods of estimation—each of which entails its own set of assumptions—and have estimated gains of roughly $1 trillion. While the estimates are speculative, the important result of this exercise is that gains are consistently estimated to be large and positive.

Our estimates of future gains range from $450 billion to $1.3 trillion. To be conservative, we settle on a range defined by the market fragmentation method and the Michigan Model. These two approaches (which both make use of CGE models) suggest that removing all remaining barriers to trade would increase US production approximately $450 billion to $600 billion annually.[70] Gains in this range would increase US per capita income between $1,500 and $2,000 annually and US household income between $4,000 and $5,300 annually. The "final push" to free trade might

69. Rose's coefficient is a prediction of the increase in trade in merchandise only, while the OECD (2003) trade ratio includes both merchandise and services. When applying the OECD coefficient to the predicted rise in merchandise trade, we assume that the coefficient relating total trade to output per capita is the same for the goods and services sectors.

70. CGE models may understate gains because they ignore technological spillovers and the increased efficiency through the sifting and sorting of firms that usually accompanies increased trade. Furthermore, they do not account for the "certainty" effect of trade agreements—that tariffs are eliminated by international agreement. Some credit the certainty effect for the boom in US imports after NAFTA, since US tariffs on imports from Mexico were low prior to the agreement.

generate gains that are nearly half the size of the gains already realized through the reduction of policy barriers and transportation costs from the formation of the GATT in 1947 to the full implementation of the Uruguay Round and NAFTA in 2003.

Readers might ask why potential future gains are so large, since the United States has *already* dramatically slashed its average tariff barriers—from 40 percent in 1947 to 4 percent today. Clearly, far less room remains to cut US tariff barriers in 2003 than in 1947. On the precept "no pain, no gain," the fact that there is far less room for future pain implies far less room for future gain from US liberalization. We have three answers to this critique.

First, US liberalization still has a long way to go—not only in agriculture, textiles, clothing, and similar politically sensitive merchandise sectors but also in services. As internet technology has opened new vistas for offshore sourcing—both inward and outward—the potential scope for services trade and the importance of services barriers is much larger today than just a decade ago. Moreover, the decline in the simple average tariff rate does not reflect the enduring prevalence of nontariff barriers. Investigations of geographic price convergence and market fragmentation indicate that nontariff barriers continue to impose barriers to trade (Bradford and Lawrence 2004a, Anderson and Smith 2004, Anderson and van Wincoop 2004). Second, barriers abroad, particularly those surrounding developing markets, are very high and have not been reduced nearly to the same extent as barriers surrounding OECD markets. Third, certainty and lock-in effects of eliminating all trade barriers—in the context of a binding agreement (such as NAFTA)—spur trade and investment to a highly disproportionate extent. In other words, eliminating the last 4 percentage points of a tariff barrier probably makes a greater difference than reducing tariffs from 12 to 8 percent.

In this chapter, we have expressed gains in terms of the average person and the average household. We have not tried to express the gains in terms of benefits to wealthy, middle class, and poor individuals and households.[71] Moreover, the gains summarized in this chapter inevitably entail adjustment costs that fall disproportionately on unlucky individuals, industries, and communities. In appendix 2B, we estimate that the lifetime cost of all worker dislocations that were triggered by expanded trade in 2003 could be as high as $54 billion, although probably much less. While the gains from increased trade generate a permanent rise in

71. The distribution of gains from trade—the benefits to poor versus middle-class or wealthy households—is an important issue in the political economy of trade liberalization. This topic is taken up in the chapter by Lori Kletzer and Howard Rosen in this book, as well as in the Globalization Balance Sheet Series—including Kletzer (2001), Lewis and Richardson (2001), and Richardson (forthcoming)—published by the Institute for International Economics.

income, the associated losses are temporary. Nevertheless, they are very real, and are concentrated on a small fraction of Americans. Uncompetitive firms fail, jobs disappear, and some communities wither. While general safety net programs (such as unemployment insurance and urban grants) assist workers and communities that bear the costs of globalization, the US federal government spends less than $2 billion annually on explicit trade adjustment assistance (OMB 2004, 708)—less than 1 percent of prospective annual benefits from complete free trade.

It would take us far afield to explore trade adjustment policies or the distribution of benefits across American households. However, the *permanent* gains from past and potential liberalization are so enormous that the United States can easily afford the modest sums necessary to alleviate the *temporary* pains of adjustment. In the future as in the past, free trade can significantly raise income—and quality of life—in the United States.

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Appendix 2A
Intermediate Imports: Gains Through Worker Productivity

The growth accounting technique adapted by J. David Richardson (2004) analyzes the gains to firms through a portion of the import competition channel, namely productivity gains to domestic firms that result from more intense use of *imported* intermediate inputs by US firms.[72] Roughly half of US imports are intermediate goods; the fact that they are purchased by US firms reveals superiority in quality or price to domestic alternatives. The growth accounting technique captures not only output gains from the use of superior or cheaper inputs but also gains that arise from sifting and sorting when less efficient suppliers of intermediate inputs shrink in the face of import competition, and their resources (capital and labor) are used by more efficient firms in the US economy.

To estimate the role of imported intermediates on a macro level, Richardson (2004) extends the basic growth accounting model—which expresses total production (Q, defined as value added, or GDP) as a function of technological knowledge (A), physical and human capital (K), and labor (L) as inputs—to include imported inputs (M).

$$Q = A(L, K, M) \tag{2.1}$$

Richardson then expresses the production function on a per worker basis, by dividing all variables by the number of workers (L). This causes the labor term to drop out of equation (2.1). The per worker production function can be written using lowercase variables.[73]

$$q = A(k, m) \tag{2.2}$$

Equation (2.2) suggests that to increase output per worker (defined as value added per worker), the country has three options:

- Increase A, the level of technological expertise (total factor productivity) so that the same amount of capital and imported inputs can produce more output. The benefits of trade through technology spillovers and more competitive markets would raise A. Since this approach does not estimate technology benefits of global integration, it understates the total payoff from greater trade.
- Increase the amount of physical and human capital each worker has to work with, k. Indirectly, an increase in trade can boost k by increas-

72. This section draws heavily on a draft appendix prepared by Richardson (2004).

73. Therefore, q is output (value added) per worker, k is the capital-labor ratio, and m is imported inputs per worker. We assume that equation (2.1) is homogenous of degree 1 with respect to L, K, and M.

ing the profitability of new investment, both in physical capital and training. Again, this approach does not measure the capital-deepening channel.

- Increase the amount of intermediate imports per worker, m. This is the focus of Richardson's approach. It assumes that firms import intermediate inputs only when such imports lower the overall cost of production. To pay for imports, the country must export goods and services that it produces at a comparative advantage. If there were no cost savings from switching from domestic to imported intermediate imports, and no improved productivity due to rationalization of domestic industry, the shift (accompanied by an increase in exports) would result in an increase in trade but no change in output.

When imports and exports both increase or decrease by the same amount, with no induced change in productivity, measured GDP does not change (recall the accounting identity: $Q = C + I + G + [X - M]$). Richardson's approach assumes that firms would have no reason to switch from domestic to imported intermediate inputs unless the switch yielded higher output per worker (q). He quantifies the gains using the methodology of growth accounting. However, as discussed in a moment, the mechanics of growth accounting may attribute too much or too little importance to imported intermediate inputs.

As a first-order simplification, an increase (or decrease) in q can be decomposed into three changes: a change in A, a change in k, and a change in m. In a standard growth accounting framework, the contribution that changes in k and m make to increase q are calculated by multiplying their respective percentage changes by their shares in total production costs.[74] Using S_k to denote the share of capital (human and physical) in total production costs (measured in percent of GDP), S_m to denote the share of imported inputs in total production costs, and $\%\Delta$ to denote the percentage change in a variable, equation (2.2) can be expressed as:

$$\%\Delta q = \%\Delta A + S_k \%\Delta k + S_m \%\Delta m \qquad (2.3)$$

The key assumption of the growth accounting model is that the share of imported inputs in production costs accurately reflects the contribution of those inputs to higher output. On the one hand, if intermediate inputs are only slightly better than their domestic counterparts, the share coefficient (S_m) will overstate their importance. On the other hand, if imported inputs set off a chain of sifting and sorting among domestic producers (as

74. This calculation assumes a constant-returns-to-scale production function, usually a Cobb-Douglas function. Any economies of scale are then captured in the technology term, A.

described in the text), S_m may understate their importance. We mention these possibilities without attempting to resolve them.

Returning to equation (2.3), economic statistics can be used to estimate five of the six variables, namely $\%\Delta q$, S_k, $\%\Delta k$, S_m, and $\%\Delta m$. Equation (2.3) can then be solved to determine an estimate of the technology variable, $\%\Delta A$, which measures total factor productivity.

On the basis of data gathered by Huether and Richardson (2001, table 1), it can be estimated that imported inputs (M) grew from $383 billion in 1989 to $940.1 billion in 2000 (measured in 2003 dollars).[75] Over the same period, employment (L) grew from 117.3 million to 136.9 million workers (CEA 2004, table B-36); hence intermediate imports per worker ($m = M/L$) increased by 110.4 percent over the period. Since the average share of imported intermediate imports in total production costs was 7.1 percent, the contribution of imported inputs to output per worker between 1989 and 2000 was

$$S_m \%\Delta m = .071 \times 110.4\% = 7.9\% \qquad (2.4)$$

The 7.9 percent increase due to increased trade represents *more than one-third* of the total increase in output per worker over this period. Expressed another way, increased imports of intermediate inputs were responsible for an additional $4,900 in income per worker (measured in 2003 dollars).[76] This equates to an additional $681 billion in GDP, or $2,300 income per capita and $6,000 income per household in 2003 due to increased trade between 1989 and 2000.[77]

To apply this analysis over a longer period, we classify US imports by 3-digit commodity into intermediate, capital, and final categories.[78] Between 1961 and 1989, intermediate imports to the United States (M) rose from $41 billion to $329 billion (valued in 2003 dollars), a 702 percent increase. During the same period, since the labor force (L) almost doubled, from 66 million to 117 million, the net result was a 350 percent increase in intermediate input imports per worker (m). The ratio of intermediate imports to total production (measured in percent of GDP) steadily increased from 1.5 to 4.5 percent. As with our analysis above, we divide this long pe-

75. Since the original Huether and Richardson calculation was in constant 1992 dollars, we inflate these figures using the NIPA GDP deflator (BEA 2004b).

76. This calculation assumes that employment growth was not influenced by the increase in trade. Several scholars contend that increased trade and overseas investment tend to increase employment. See Slaughter (2004).

77. Employment growth outpaced population growth over this period, so the payoff in terms of GDP per capita exceeded the payoff in terms of output per worker.

78. We use the OECD International Trade by Commodity Statistics database (ITCS) available through http://new.sourceoecd.com (accessed August 9, 2004) by subscription. The list of 3-digit SITC codes we assign to the intermediate category is available upon request.

Table 2A.1 Productivity benefit of increase in imported intermediate inputs, 1961–2000

Period	Change in intermediate imports per worker (%Δm) (percent)	Share of intermediate imports in production cost (S_m) (percent)	Growth in output per worker due to intermediate import deepening[a] (S_m%Δm)		Benefit in 2003[a,b] (billions of 2003 dollars)
			Percent	2003 dollars	
1961–68	50.1	1.68	0.84	346	48
1968–75	99.9	2.69	2.68	1,364	188
1975–82	33.9	4.04	1.37	727	100
1982–89	11.9	4.51	0.53	295	41
1989–2000[c]	110.4	7.13	7.87	4,946	681
Total					
1961–2000				7,678	1,058

a. Subperiod gains are an intermediate calculation, not an estimate of short-term gains from liberalization. Gains due to liberalization may require 10 to 20 years to be fully realized.

b. Benefit in 2003 is calculated by multiplying the benefit per worker measured in 2003 dollars by total employment in 2003.

c. Changes in intermediate imports are calculated using Huether and Richardson (2001, table 1).

Note: In order to better account for changes within the US economy over time, this table presents total gains from liberalization as the sum of subperiods. Because of a change in sources, we do not present a single period figure.

Sources: OECD (2004), CEA (2004, tables B-22, B-36), Huether and Richardson (2001), and authors' calculations.

riod into four smaller periods to perform the growth calculation. The results are reported in table 2A.1. In summary, increased intermediate imports accounted for an output increase of 6.6 percent or \$2,700 per worker (measured in 2003 dollars) between 1961 and 1989, roughly 13 percent of the total growth in output per worker over the period. In 2003, this increase accounted for an additional \$380 billion of GDP, \$1,300 per capita, and \$3,400 per household annually.

We sum Richardson's results and the calculations sketched above to come up with a figure for increased growth due to intermediate import deepening for the full 1961–2000 period. We estimate a gain of \$1.1 trillion for the full period, equating to an additional \$3,600 per capita and \$9,400 per household.

Appendix 2B
An Estimate of Labor Adjustment Costs

This chapter has calculated large gains from liberalization. However, our methods aggregate national benefits over the medium term and do not highlight the short-term, but significant, costs of worker dislocation. In this appendix, we make a back-of-the-envelope calculation to size up the adjustment costs incurred by dislocated workers in the US economy.

Adjustment costs occur when firms contract as a result of increased trade. We measure these costs through lost wages from time spent out of work and lower wages once reemployed.[79] Adjustment gains occur in expanding industries through an employment surge and higher wages in more productive firms. These gains will offset adjustment losses. However, to isolate the downside of globalization, we ignore adjustment gains.

Job Losses

Calculating the number of jobs gained and lost by trade agreements is one of Washington's favorite parlor games. In reality, separating trade-related job losses from other job losses is extremely difficult. Accordingly, we present several estimates.

First, we offer trade adjustment assistance (TAA) certifications as a proxy for job losses: 199,424 persons were certified for TAA in 2003 (Public Citizen 2004).[80] This is the most concrete figure available on trade-impacted job losses, but it contains elements of understatement and overstatement. The figures are understated because not all workers that are displaced by trade apply for TAA benefits. The figures are overstated because TAA certification only requires a showing that the job was adversely affected by imports or that the firm moved to a free trade partner or preference country; no evidence is required that policy liberalization *caused* either the imports or the relocation of the firm.[81]

79. Labor economists might point out that our calculation takes no account of the value of leisure time. For this and other reasons mentioned below, we regard this estimate as an upper bound.

80. The states administer the TAA program, so no official national statistics on certifications are available. Public Citizen collects state data on certifications and compiles it into a national database. While certifications may occur before or after job loss, we assume the rate of certifications is roughly equal to the rate of job loss. In October 2002, the TAA program was combined with the NAFTA-TAA program, which was originally designed to assist workers affected by trade with Canada and Mexico. The 2003 figure, approximately 200,000, is in line with the sum of TAA and NAFTA-TAA certifications in previous years.

81. It is possible to be certified for TAA even without losing a job, if increased imports are shown to be suppressing wages.

Our second estimate is based on an estimate of the relationship between manufacturing employment, domestic output, and imports. Hufbauer and Wong (2004, appendix table 8.1), using data on quarterly US manufacturing output and employment from 1990 to 2003, estimated that $1 billion of additional annual output would increase manufacturing employment by 8,178 workers. We make the exaggerated assumption that every dollar increase in US manufacturing imports displaces a dollar of domestic manufacturing output.[82] Between 1997 and 2003, US manufacturing imports rose from $750 billion to $1.1 trillion, an increase of about $52 billion annually (USITC 2004).[83] Applying the Hufbauer-Wong coefficient of 8,178 jobs per billion dollars suggests job displacement of up to 422,000 workers annually.

Finally, Baily and Lawrence (2004) use the trade deficit and US worker productivity to estimate job declines. To create a range, they measure productivity both in terms of gross manufacturing output per manufacturing worker and manufacturing value added per manufacturing worker. Between 2000 and 2003, they estimate that trade has caused the loss of between 85,000 and 197,000 manufacturing jobs per year.[84] After surveying these methods—none particularly realistic—we average them to produce an annual job displacement figure of approximately 226,000.[85] We consider this figure to be a high estimate.

The Displacement Experience

To get a handle on the private cost of a dislocated job, we define the loss in terms of forgone wages. Kletzer (2001) offers summary statistics based on displaced worker surveys collected by the US government covering worker experience from 1979 to 1999. We assume that all 226,000 jobs displaced each year are in "high import-competing industries," where dislo-

82. Hufbauer and Wong (2004, appendix table 8.2) show that the size of the trade deficit is *positively* correlated with manufacturing output. This is explained by the fact that both manufacturing output and imports tend to rise and fall with the overall US economy. Nevertheless, for purposes of this exercise, we assume that rising manufactured imports in a particular sector displace sales by firms in that sector, even though overall manufacturing output may be rising thanks to a buoyant economy.

83. Manufacturing imports are defined as NAICS 31–33.

84. This range is set by defining productivity in terms of gross output or value added. The gross production number tends to understate job loss because it does not account for increases in imported inputs. The value-added number tends to overstate job losses in manufacturing because it compares a value-added figure (manufacturing output) with a gross value figure (the trade deficit). The authors argue that the true number is likely to be at the low end of this range, since much of the job loss over this period is a result of the decline in exports.

85. We use both the lower and upper numbers of the Baily and Lawrence range in calculating this average.

cated workers fare the worst. In this category, the average age of a dislocated worker was 39. After dislocation, only 63.4 percent of dislocated workers were reemployed at the time they were surveyed, and of those that were employed, average earnings had declined 13.2 percent from their predisplacement earnings.[86] Finally, we assume that displaced workers were making the average weekly earnings of all manufacturing production workers—$646 in 2003 (BLS 2004).

We first consider the 36.6 percent of displaced workers who were still unemployed at the time of the survey. We assume, somewhat pessimistically, that these workers lose 10 years of employment as a consequence of the displacement episode.[87] Calculating in 2003 dollars (assuming wage increases would have kept pace with inflation), these workers lose $27.8 billion in lifetime earnings owing to long stretches of unemployment. To account for the remainder of time these workers are of working age, we assume they are forced to take a 13.2 percent pay cut for 16 years (bringing them to 65 years of age, on average), costing them another $5.9 billion in lifetime wages.[88]

Next, we consider lost wages of the 63.4 percent who were reemployed at the survey date. We assume it takes each reemployed worker one year to find new employment.[89] Lost wages during the job search period are then estimated to be $4.8 billion. Once reemployed, these workers take an average pay cut of 13.2 percent compared with predisplacement earnings. While we have no data beyond initial earnings, the gap likely narrows over time as the worker gains skills in the new job. However, we assume that the gap is maintained, in constant dollar terms, for the remainder of the worker's tenure—25 years.[90] Based on this assumption, displaced workers lose $15.9 billion due to lower reemployment wages over the remainder of their working lives.

86. We have no information on the size of fringe benefits, predisplacement versus postdisplacement, so we do not include fringe benefits in this estimate.

87. Obviously, this is one of many possible scenarios, and we do not argue that it is a typical outcome. It seems very unlikely that a worker could spend 10 years unemployed and then get a full-time job. Workers may choose to exit the labor force early; or they may work part-time jobs and spend less time totally unemployed. We offer the 10-year unemployment scenario merely as a way of arriving at a dollar figure for lifetime costs; we believe it is pessimistic.

88. We believe this to be a significant exaggeration. Workers who were not reemployed at the time of the survey tended to be older so they had fewer years left in the labor force. Kletzer (2001, table 4.1) indicates that workers in the 20 to 44 age group are roughly 10 percent more likely to be reemployed than those 45 and older.

89. Again this is a large overestimate. According to Kletzer (2001, 40) 73 percent of reemployed workers found a job within six months.

90. Recalling that the average age of a dislocated worker is 39, we assume they are out of work for one year and then exit the labor force at age 65.

It deserves mention that the 13.2 percent average wage loss represents a *private* cost of worker adjustment, not a *social* cost. Lower wages reflect the "opportunity value" (in the terminology of economics) of work in the new jobs—in other words, what the new work is worth when goods and services are sold in the market. Since workers are paid less in their new jobs than their old jobs, US buyers of goods and services enjoy the benefit of lower prices.

Summing these values, the lifetime losses incurred by workers displaced in 2003 is estimated to be $54.4 billion. If the number of workers displaced each year due to globalization and expanded trade proves to be a constant feature of the economy, this could be viewed as the annual private cost of labor adjustment.[91] Even so, the private costs are significantly lower than the past or potential annual social gains due to policy and technology liberalization. However, the costs are significantly larger than annual federal outlays (about $2 billion in 2003 [OMB 2004, 708]) designed to alleviate worker pains specifically caused by trade expansion.

91. As contrasted with the benefits of liberalization, which are permanent, adjustment costs are temporary. Once the economy has fully adjusted to a new plateau of trade and globalization, there would be no further adjustment costs of the kind we have calculated, but the economy would continue to enjoy a higher level of GDP.