
Appendix A

Methodology for Reciprocity Measure and GDP Gains

The *reciprocity measure* is calculated using the change in revenue from tariff cuts and the revenue equivalent of concessions on tariff rate quotas, domestic support, and export subsidies. We then multiply tariff equivalents for all concessions by 2006 trade flows to “size up” the impact on the *reciprocity measure*. The general idea is that every billion dollars of *reciprocity measure* concessions has approximately the same political cost to the conceding country and generates approximately the same political gain to the receiving country (see boxes 2.1 and 2.2 for more details). The political cost side of the argument seems reasonable if each billion dollars of concessions corresponds to about the same amount of economic restructuring forced by trade liberalization. An ingenious survey by Valentin Zahrnt (2009) indicates that officials from developed and developing countries alike are highly concerned about the restructuring consequences of trade liberalization. The political gain side of the argument depends on a rough correspondence between the extent of new market access and each billion dollars of concessions by partner countries. Of course, this all is very rough political arithmetic, but trade negotiators who proclaim the virtue of reciprocity are seldom more specific.

A convenient way to summarize *GDP gains* that arise through multiple channels that are opened by trade expansion is through the use of coefficients that relate the growth in GDP to growth in two-way trade. We call these GDP coefficients “growth ratios,” and they can be calculated in at least two ways (yielding similar results):

- as the ratio between dollar *GDP gains* and dollar two-way *trade gains* (dollar ratios).

- as the ratio between the percentage *GDP gains* and the percentage increase in trade openness (openness ratios).¹

Note that two-way trade figures (rather than just exports or just imports) are used in both growth ratios, on the well-established proposition that both export and import gains serve to increase GDP.²

Table A.1 presents the underlying data for estimating growth ratios; the data are drawn from regression models and computable general equilibrium (CGE) models constructed by different scholars. Table A.2 presents the growth ratios calculated from the data in table A.1. The two-way trade figures used in several models are limited to merchandise trade, but the more ambitious studies also include services trade (a realm where the GDP payoff is likely to be high).

As can be seen from table A.2, a very large gap separates high and low estimates of growth ratios. This gap corresponds to the difference in professional opinion between economists who believe that expanded trade makes a major contribution to GDP growth and economists who believe that expanded trade is a “good thing” but not necessarily a “big thing.” We are squarely in the camp of economists who believe that expanded trade is indeed a “big thing,” in the sense that it significantly fuels the growth of national income. Rising trade to GDP ratios have, in our opinion, served as major drivers of global prosperity since the Second World War. Closely related drivers are rising foreign direct investment (FDI) to GDP ratios.³ Of course there are other drivers of economic growth, such as capital formation, education, and good governance, but we do not agree with those who assign a modest role to international trade and investment flows.

The smaller growth ratios recorded in table A.2 are derived from estimates of GDP gains that are generated by “plain vanilla” CGE models. Most CGE models start with the GTAP framework (Global Trade Analysis Project) of trade and production, created by Professor Thomas Hertel and his colleagues at Purdue University. In the “plain vanilla” GTAP framework, GDP gains largely correspond to the reallocation of productive resources from sectors of comparative disadvantage to sectors of comparative advantage. Measured in this way, the gains from expanded trade reflect the opportunity cost framework expounded by Gottfried von

1. In this formulation, the percentage increase in trade openness is calculated as the percentage change between the initial extent of trade openness and the postliberalization extent of trade openness, both expressed as ratios of two-way trade to GDP. Openness ratios can also be expressed as the ratio of the percentage *GDP gains* and percentage two-way *trade gains*.

2. See Bradford, Grieco, and Hufbauer (2005) for an exposition of the multiple channels by which export and import expansion enlarges GDP.

3. Rising FDI to GDP ratios are both a cause and an effect of rising trade to GDP ratios.

Haberler in 1937 and the welfare triangles portrayed in contemporary textbooks.⁴

Valuable as it is, this framework misses several big chunks of the trade story: gains from curtailing the power of local monopolies; from greater product variety both in exports and imports; from higher productivity in local firms that are forced to compete with imports; and from economies of scale and scope realized by both exporting firms and exporting industries. To capture the true role of international trade expansion, we favor the larger ratios reported in table A.2. These ratios are found in regression models that explain economic growth and in CGE models that add structural changes to the “plain vanilla” comparative advantage account. Two examples are the CGE models designed by Brown, Kiyota, and Stern (2005) and Decreux and Fontagné (2008).

It is worth noting that growth ratios estimated by CGE models for developed countries as a group often exceed those for developing countries as a group. We do not give much weight to this observation since the biggest economic success stories over the past 60 years are found among developing countries: Japan (in the 1950s and 1960s), the Asian tigers (in the 1960s, 1970s, and 1980s), Chile, and China (in the 1980s, 1990s, and 2000s). Moreover, after surveying several regression models, William Cline (2004) concluded that the relevant openness ratio for developing countries might be as large as 0.50, far larger than for developed countries.

Nevertheless, the wide variation in estimated national growth ratios in individual CGE models inspires caution on our part. For the calculations reported in this study, we use a single growth ratio for the world, recognizing that ratios may differ widely and in unknown ways from country to country. Hence any calculation of GDP gains for individual countries must contain a big dose of guesswork. Table 1.3 uses a single growth ratio to translate trade gains into GDP gains for the countries covered in this study. However, econometric techniques are not well enough advanced for us to be confident of GDP growth outcomes for individual countries and certainly not for the distribution of gains within countries. We therefore place less weight on the country figures. We are more confident about the gains from trade liberalization to the entire world.

To ensure that our calculations are simple and easily understood, we use a dollar ratio to estimate the world GDP gains that might be generated by a successful Doha Round.⁵ The dollar ratio we use is the simple average

4. See von Haberler (1937, chapter 12). For a modern exposition, see Krugman and Obstfeld (2003, 218–21).

5. The dollar ratio and the openness ratio both yield essentially the same GDP increase from the trade increase. The difference is that the dollar ratio gives the dollar amount of GDP increase while the openness ratio gives the percentage change in GDP. The dollar ratio is the ratio of dollar GDP growth to dollar trade growth from liberalization. The numbers for trade and GDP changes to calculate both ratios are taken from regression and CGE models.

of all the dollar ratio figures reported in table A.2, namely 0.46.⁶ This ratio suggests that, over the long term, a \$10 billion growth in two-way trade in goods and services will raise world GDP by \$4.6 billion. Is this relationship plausible? We think so. Total world two-way trade in goods and services increased by \$1 trillion between 2007 and 2008.⁷ We think it is plausible that global commerce made a contribution of \$460 billion (0.46 times \$1 trillion) to world GDP in 2008 (which was recorded at \$60 trillion), above what might have been achieved in a world of autarchic nations.

Based on this judgment, we think it is plausible that the agriculture and NAMA offers currently on the table would eventually generate annual world GDP gains of \$63 billion, that a 10 percent reduction in services barriers could yield another \$45.5 billion, and that free trade in the designated sectors could add as much as another \$56.4 billion. A robust agreement on trade facilitation, if properly implemented, could yield another \$117.8 billion in annual global gains (table 1.3).

Multiplying the dollar ratio by the estimated dollar trade increases from Doha Round liberalizations yields the calculated GDP increase. Here is an example based on India's potential gains from liberalization in agriculture and NAMA. The estimated trade increase in agriculture and NAMA for India is \$2.36 billion. The resulting GDP increase for India applying the dollar ratio of 0.46 is \$1.1 billion ($0.46 \times 2.36 \text{ billion} = \1.1 billion). We can walk through the same exercise using the openness ratio. Recall that the openness ratio is the percentage increase in GDP divided by the percentage increase in trade. Multiplying the openness ratio by the estimated percentage increase in trade from Doha Round liberalizations yields the calculated percentage increase in GDP. The estimated trade percentage increase for India is 0.84 percent. The resulting GDP percentage increase for India, applying the openness ratio of 0.16, is 0.13 percent ($0.16 \times 0.84 \text{ percent} = 0.13 \text{ percent}$). The GDP dollar increase from this percentage increase is found by multiplying India's 2007 GDP at the market exchange rate by the percentage change, giving \$1.5 billion ($1,136.9 \text{ billion} \times 0.13 \text{ percent} = \1.5 billion). As can be seen, both the dollar ratio and the openness ratio yield similar results.

6. This ratio can be compared with the US dollar ratio of 0.28 and the EU dollar ratio of 1.18 implied by a recent ECORYS Nederland (2009) study, which analyzed nontariff measures in EU-US trade and investment.

7. World GDP data (at market exchange rates) are from the International Monetary Fund (IMF) *World Economic Outlook*, October 2009. World two-way trade in goods and services data, intra-European Union trade, are from the United Nations (UN) Commodity Trade Statistics database and the UN Service Trade Statistics database. Intra-European Union trade data are from the World Trade Organization (WTO).

Table A.1 Trade growth, GDP growth, and openness ratio comparisons from regression and computable general equilibrium (CGE) models (billions of dollars or percent)

Study	Covered trade (base year)	Model type	Initial two-way trade	Dollar two-way trade growth	Percent trade growth	Initial GDP	Dollar GDP growth	Percent GDP growth	Initial trade openness	New trade openness	Trade openness growth
OECD (2003a)	Developed countries (2000)	Regression	15,051	1,505	10.0	36,163	723	2.0	41.6	45.8	10.0
Cline (2004)	Various developing countries	Regression	18,267	1,827	10.0	39,850	1,992	5.0	45.8	50.4	10.0
Freund and Bolaky (2008)	Global economic performance (2000)	Regression	15,120	1,512	10.0	31,853	1,134	3.6	47.5	52.2	10.0
Anderson, Martin, and van der Mensbrugge (2006)	Global liberalization (2008)	CGE	19,625	384	2.0	42,344	51	0.1	46.3	47.3	2.0
Brown, Kiyota, and Stern (2005)	Free Trade Area of the Americas (FTAA) (1997)	CGE	6,780	120	1.8	35,094	110	0.3	19.3	19.7	1.8
Brown, Deardorff, and Stern (2001)	Uruguay Round (1995)	CGE	6,552	157	2.4	33,997	75	0.2	19.3	19.7	2.4
Decreux and Fontagné (2009)	Goods, services, and trade facilitation (2020)	CGE	15,986	452	2.8	69,674	165	0.2	22.9	23.6	2.8
Decreux and Fontagné (2008)	Goods and services (2025)	CGE	15,987	73	0.5	47,502	70	0.1	33.7	33.8	0.5
Francois, van Meijl, and van Tongeren (2005)	Doha Round (2001)	CGE	12,181	1,376	11.3	31,744	155	0.5	38.4	42.7	11.3
Gilbert (2009)	Uruguay Round (2004)	CGE	20,690	1,275	6.2	41,728	74	0.2	49.6	52.6	6.2

(continued on next page)

Table A.1 Trade growth, GDP growth, and openness ratio comparisons from regression and computable general equilibrium (CGE) models (billions of dollars or percent) (*continued*)

Study	Covered trade (base year)	Model type	Initial two-way trade	Dollar two-way trade growth	Percent trade growth	Initial GDP	Dollar GDP growth	Percent GDP growth	Initial trade openness	New trade openness	Trade openness growth
Gilbert (2009)	Transportation costs (2004)	CGE	20,574	349	1.7	41,728	134	0.3	49.3	50.1	1.7
Scollay and Gilbert (2001)	APEC liberalization (1995)	CGE	3,563	1,102	30.9	15,955	129	0.8	22.3	29.2	30.9
Lodefalk and Kinnman (2006)	Doha Round (2001)	CGE	14,488	988	6.8	32,926	117	0.4	44.0	47.0	7.0

APEC = Asia Pacific Economic Cooperation forum

Notes: GDP growth is measured as equivalent variation in Gilbert (2009) and as welfare gains in Brown, Deardorff, and Stern (2001) and Brown, Kiyota, and Stern (2005). For Freund and Bolaky (2008), trade data and GDP data come from the World Bank, *World Development Indicators*, 2009. For Anderson, Martin, and van der Mensbrughe (2006), initial trade data come from UN Comtrade database, 2009; 2008 data used, or 2007 when 2008 data are not available. GDP data come from International Monetary Fund (IMF), *World Economic Outlook*, 2009; 2008 data used. For Brown, Kiyota, and Stern (2005) calculations, initial trade data come from UN Comtrade Database, 2009; 1997 data used. For Brown, Deardorff, and Stern (2001) calculations, initial trade data come from UN Comtrade Database, 2009; 1995 data used. For Francois, van Meijl, and van Tongeren (2005) calculations, country groups are not completely distinct. For example, Turkey is considered developed for trade growth and developing for GDP growth. For Gilbert (2009), covering Uruguay Round trade, the method involved backcasting to Uruguay Round bound rates for bilateral tariffs between the United States and its major partners. Initial GDP data for 2004 were taken from IMF, *World Economic Outlook*, April 2009. For Gilbert (2009), covering transportation costs, the method involved backcasting to 1980 transportation costs for bilateral costs between the United States and its major partners. Initial GDP data from 2004 were taken from IMF, *World Economic Outlook*, 2009. Scollay and Gilbert (2001) calculations used initial trade data from IMF, *Direction of Trade Statistics*, 2009; 1998 data were used. Initial GDP data were from IMF, *World Economic Outlook*, 2009; 1998 data were used. Lodefalk and Kinnmann (2006) provided data for the growth in openness ratios and GDP. Other data were collected by the authors of this policy analysis.

Sources: In addition to the studies in the table, UN Comtrade Database, 2009, via World Integrated Trade Solution; IMF, *World Economic Outlook*, April 2009, www.imf.org.

Table A.2 Alternative ratios of GDP growth and trade growth from regression and computable general equilibrium (CGE) models

Study	Covered trade (base year)	Model type	Dollar ratio	Openness ratio
OECD (2003a)	Developed countries (2000)	Regression	0.48	0.20
Cline (2004)	Various developing countries	Regression	1.09	0.50
Freund and Bolaky (2008)	Global economic performance (2000)	Regression	0.70	0.36
Anderson, Martin, and van der Mensbrugge (2006)	Global liberalization (2008)	CGE	0.13	0.06
Brown, Kiyota, and Stern (2005)	Free Trade Area of the Americas (FTAA) (1997)	CGE	0.91	0.18
Brown, Deardorff, and Stern (2001)	Uruguay Round (1995)	CGE	0.48	0.09
Decreux and Fontagné (2009)	Goods, services, and trade facilitation (2020)	CGE	0.37	0.08
Decreux and Fontagné (2008)	Goods and services (2025)	CGE	0.96	0.32
Francois, van Meijl, and van Tongeren (2005)	Doha Round (2001)	CGE	0.11	0.04
Gilbert (2009)	Uruguay Round (2004)	CGE	0.06	0.03
Gilbert (2009)	Transportation costs (2004)	CGE	0.39	0.19
Scollay and Gilbert (2001)	APEC liberalization (1995)	CGE	0.12	0.03
Lodefalk and Kinnman (2006)	Doha Round (2001)	CGE	0.12	0.06
Simple average			0.46	0.16

APEC = Asia Pacific Economic Cooperation forum

Notes: The dollar ratio is the ratio of the dollar increase in GDP over the dollar increase in two-way trade. As an example, the dollar ratio in Decreux and Fontagné (2009), from their simulation of a liberalization scenario in goods and services trade as well as trade facilitation improvement, is 0.37. This number is the ratio between the dollar GDP growth in this scenario, \$165 billion, and the related two-way trade growth, \$452 billion (for these numbers, see table A.1). The openness ratio is the ratio of the percentage increase in GDP over the percentage increase in two-way trade. As an example, the openness ratio in Decreux and Fontagné (2009), from their simulation of a liberalization scenario in goods and services trade as well as trade facilitation improvement, is 0.08. This number is the ratio between the GDP percentage growth from this scenario, 0.2 percent, and the related two-way trade percentage growth, 2.8 percent (for these numbers, see table A.1). For more detailed explanations regarding data and calculations, see table A.1.

Sources: In addition to the studies in the table, UN Comtrade Database, 2009, via World Integrated Trade Solution; IMF, *World Economic Outlook*, April 2009, www.imf.org.

