Chapter 9

The Long-Term Outlook for U.S.-China Trade

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Executive Summary

This report draws on gravity model analysis and other sources to forecast the growth of U.S. and Chinese bilateral trade, and the global trade positions of the two countries to 2022 – a decade into the future. Merchandise and services trade are distinguished, and exports and imports are separately identified.

Over the period 2000 to 2011, U.S. growth has averaged around 2%, while Chinese growth has often exceeded 10%. The U.S. has experienced a persistent global current account deficit, while China has experienced a persistent surplus. And while the U.S. has recorded a large global deficit in merchandise trade, it has also recorded a significant global surplus in services trade. China has experienced the opposite. Bilateral trade between the U.S. and China has followed these patterns. In 2010, the U.S. had a bilateral merchandise deficit of US$280bn with China and a bilateral services surplus of US$11bn. Since 2005, the renminbi (RMB) has appreciated both in real effective terms and in real bilateral terms against the U.S. dollar (US$). Over the entire period, the US$ has generally declined in real effective terms. (See Figures 1, 2 and 3 which provide historical data, starting in 2000, on U.S. and Chinese gross domestic product (GDP), global trade, current account balances, bilateral trade in goods and services, and real effective and bilateral exchange rates.)

Our core analysis draws on gravity model coefficients for bilateral trade – separating merchandise and services – between the U.S. and China. We calculated coefficients based on bilateral merchandise data from 2008 to 2011 for all-country trade, U.S.-only trade and China-only trade. We used a short time span for the merchandise calculations because the very rapid growth of Chinese merchandise exports following the country's accession to the World Trade Organization (WTO) in 2001 and the end of the Multi-Fiber Agreement in 2005 will probably not be repeated in the decade ahead[1]. Even so, some of the findings and forecasts are startling; others are mundane. A strong finding that nevertheless confirms common wisdom is that Chinese merchandise exports to the U.S. dramatically exceed any norm, no matter what set of coefficients are applied (see Table A4 in the Appendix to this chapter). As is well known, China has become the Asian assembly point for merchandise sold in America. Accordingly, if trade values were stated in value-added terms rather than sales terms, Chinese exports to the U.S. would be substantially reduced[2]. Our analysis, however, is based on conventional trade data, expressed in terms of bilateral exports and imports between countries.

Everyone expects U.S.-China bilateral trade – as conventionally measured – to grow over the next decade. However, if China's GDP expands at an average 7.5% annually (our medium forecast), and trade expansion springs from the 2011 base, the growth is immense, even after we dampen the projections to take into account economic features not captured in the standard gravity model. In 2011, two-way U.S.-China trade in goods and services totaled about US$570bn; starting with this base, in

1 We used a longer time span – 2000 to 2010 – to calculate gravity coefficients for services trade. Chinese services exports are small compared to merchandise exports, and a longer time span substantially enlarges the number of bilateral trade observations.

2 The Organization for Economic Co-operation and Development and WTO estimate that if measured in value-added terms, China's bilateral trade surplus with the U.S. would be 25% lower in 2009: US$131bn in value-added terms compared to US$171bn in gross sales terms. This is due both to the high level of foreign content in Chinese exports and the high level of U.S. value-added in Chinese imports.

2022, we forecast two-way trade of US$1.6tr (valued at 2011 prices). In 2011, two-way services trade was 5% of total two-way trade; in 2022, two-way services trade is forecast to reach 10% of the total.

Our baseline forecasts – while smaller in magnitude than those recently made by the International Monetary Fund (IMF) in its report "World Economic Outlook" (WEO) – project a large Chinese current account surplus, both globally and bilaterally with the U.S. in 2022. The baseline forecasts assume practically no change in the real effective exchange rate for the RMB, and no unilateral reduction by China in its tariff barriers. However, if the RMB is allowed to appreciate significantly over the next three years – continuing a trend in the real effective rate for the RMB since 2005 – our baseline forecasts envisage that China's present global current account surplus turns into a deficit, and a sharp shrinkage in China's bilateral surplus with the U.S. If China unilaterally abolishes its tariff barriers on merchandise imports (now averaging about 8% ad valorem), but did not allow the RMB to appreciate, the Chinese current account surplus would be narrowed, but still remain large – at around 2.5% of China's GDP in 2022.

Figure 1: U.S. and China Output, Growth and International Trade and Payments, 2000-11 (US$ billions at current prices)

	U.S.						China					
	International trade						International trade					
	Gross domestic output*	Growth (%)	Goods and services		Current account balance	GDP (%)	Gross domestic output*	Growth (%)	Goods and services		Current account balance	GDP (%)
			Exports	Imports					Exports	Imports		
2000	9,951	4.1	1,073	1,450	-416.3	-4.2	1,198	8.4	280	251	20.5	1.7
2001	10,286	1.1	1,008	1,369	-396.6	-3.9	1,325	8.3	299	271	17.4	1.3
2002	10,642	1.8	981	1,398	-457.2	-4.3	1,454	9.1	365	328	35.4	2.4
2003	11,142	2.5	1,024	1,515	-519.1	-4.7	1,641	10.0	485	449	43.1	2.6
2004	11,853	3.5	1,163	1,769	-628.5	-5.3	1,932	10.1	658	607	68.9	3.6
2005	12,623	3.1	1,287	1,996	-745.8	-5.9	2,257	11.3	837	712	132.4	5.9
2006	13,377	2.7	1,460	2,213	-800.6	-6.0	2,713	12.7	1,062	853	231.8	8.5
2007	14,029	1.9	1,655	2,351	-710.3	-5.1	3,494	14.2	1,342	1,034	353.2	10.1
2008	14,292	-0.3	1,843	2,541	-677.1	-4.7	4,520	9.6	1,582	1,233	420.6	9.3
2009	13,974	-3.1	1,575	1,956	-381.9	-2.7	4,991	9.2	1,333	1,113	243.3	4.9
2010	14,499	2.4	1,838	2,338	-442.0	-3.0	5,930	10.4	1,744	1,521	237.8	4.0
2011	15,076	1.8	2,105	2,665	-465.9	-3.1	7,298	9.2	2,087	1,898	201.7	2.8
2022	20,869#	…	…	…	…	…	16,170#	…	…	…	…	…

** For the gravity model estimations, we use real GDP at purchasing power parity (PPP) exchange rates. For our purposes here, we present GDP at current prices and market exchange rates.*
 # 2022 GDP figures (at 2011 prices) assume real medium growth projections for China (7.5% annually) and the U.S. (3.0% annually).

Source: International Monetary Fund; World Economic Outlook (October 2012); World Bank, World Development Indicators, December 2012

Figure 2: U.S. and China: International and Bilateral Trade in Goods and Services, 2000-11
(US$ billions at current prices)

	U.S. trade with World and China								China trade with World			
	Goods				Services				Goods		Services	
	World		China		World		China		World		World	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
2000	787	1,231	22	108	285	218	5.0	3.2	249	215	30	36
2001	734	1,153	26	109	273	216	5.4	3.6	266	232	33	39
2002	701	1,173	27	134	280	226	5.8	4.1	326	281	40	47
2003	733	1,271	34	163	290	243	5.7	3.8	438	394	47	55
2004	825	1,486	45	211	338	282	7.3	5.6	593	534	65	73
2005	916	1,693	49	260	372	303	8.4	6.2	762	628	74	84
2006	1,043	1,876	59	306	417	337	10.5	9.3	970	752	92	101
2007	1,168	1,984	70	340	487	367	13.0	10.7	1,220	904	122	130
2008	1,312	2,139	82	356	531	402	15.1	9.4	1,435	1,074	147	159
2009	1,074	1,576	78	310	501	380	16.0	8.2	1,204	954	129	159
2010	1,293	1,936	103	383	544	402	21.2	10.0	1,581	1,327	162	193
2011	1,502	2,237	123	417	604	428	…	…	1,904	1,660	183	238

	Payment balances on goods and services trade								
	Goods			Services			Goods and services		
	U.S.	China	U.S.-China	U.S.	China	U.S.-China	U.S.	China	U.S.-China
2000	-444	34	-85	67	-6	1.8	-377	29	-83
2001	-419	34	-83	57	-6	1.9	-362	28	-81
2002	-472	44	-106	54	-7	1.8	-417	37	-104
2003	-538	44	-129	47	-9	1.9	-491	36	-127
2004	-661	59	-166	55	-8	1.7	-605	51	-164
2005	-778	134	-211	69	-10	2.2	-709	125	-209
2006	-833	218	-246	80	-9	1.2	-753	209	-245
2007	-816	316	-271	119	-8	2.3	-697	308	-268
2008	-827	361	-275	129	-12	5.7	-698	349	-269
2009	-503	250	-232	121	-29	7.8	-381	220	-224
2010	-642	254	-280	142	-31	11.1	-500	223	-269
2011	-735	244	-294	175	-55	…	-560	188	…

Source: Organization for Economic Cooperation and Development; Statistics on International Trade in Services (December 2012); Peterson Institute for International Economics; Gravity Model Data Set (June 2012); World Bank, World Development Indicators (December 2012)

Figure 3: U.S. and China International Merchandise Trade, Import Tariffs and Exchange Rates, 2000-11 (US$ billions at 2011 prices)

	U.S.						
	International trade				Average import tariff (%)	Real effective exchange Rate	Real RMB/US$ exchange rate
	Goods and services		Goods imports				
	Exports	Imports	World	China			
2000	1,073	1,450	1,231	108	3.6	107.8	107.3
2001	1,008	1,369	1,153	109	3.5	113.9	105.0
2002	981	1,398	1,173	134	3.5	113.6	102.5
2003	1,024	1,515	1,271	163	3.4	106.4	101.4
2004	1,163	1,769	1,486	211	3.2	101.4	102.6
2005	1,287	1,996	1,693	260	3.2	100.0	100.0
2006	1,460	2,213	1,876	306	3.1	99.4	95.6
2007	1,655	2,351	1,984	340	2.9	94.7	93.0
2008	1,843	2,541	2,139	356	3.2	91.0	86.9
2009	1,575	1,956	1,576	310	3.0	95.1	85.1
2010	1,838	2,338	1,936	383	2.9	91.4	85.8
2011	2,105	2,665	2,237	417	…	86.9	83.8

	China						
	International trade				Average import tariff (%)	Real effective exchange Rate	Real RMB/US$ exchange rate
	Goods and services		Goods imports				
	Exports	Imports	World	U.S.			
2000	280	251	215	22	16.4	108.5	93.4
2001	299	271	232	26	15.4	113.2	95.4
2002	365	328	281	27	…	110.6	97.6
2003	485	449	394	34	10.7	103.3	98.7
2004	658	607	534	45	9.8	100.5	97.5
2005	837	712	628	49	9.2	100.0	100.0
2006	1,062	853	752	59	8.9	101.6	104.5
2007	1,342	1,034	904	70	8.6	105.6	107.6
2008	1,582	1,233	1,074	82	8.4	115.3	115.5
2009	1,333	1,113	954	78	8.2	119.2	117.9
2010	1,744	1,521	1,327	103	7.7	118.7	117.0
2011	2,087	1,898	1,660	123	…	121.9	119.9

Sources: International Monetary Fund; Peterson Institute for International Economics; Gravity Model Data Set (June 2012); World Bank, World Development Indicators (December 2012).
Note: Real bilateral exchange rates calculated by the authors.

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Assumptions and Scenarios

Within the gravity model framework, GDP levels are the dominant driver of bilateral trade flows. Hence the projected annual growth of real GDP in the U.S. and China is the most important factor in forecasting two-way trade in 2022. Our GDP growth projections are based on three different assumptions: low growth (U.S. 2.5%, China 6.5%); medium growth (U.S. 3.0%, China 7.5%); and high growth (U.S. 3.5%, China 8.5%). Population levels are another important driver, but population growth is subject to less uncertainty than GDP growth. We assume annual population growth rates of 0.9% for the U.S. and 0.5% for China.

We model two scenarios for the Chinese RMB: first, that it will stay the same in real terms over the next decade; second, that the RMB will appreciate in real terms through 2015 at the same pace experienced since 2005, about 3.4% per year. In the second scenario, real appreciation could be achieved by an unspecified combination of nominal appreciation of the RMB in trade-weighted terms and by faster inflation in China than in its principal trading partners. Side calculations illustrate the impact of the RMB value on China's global current account position and its bilateral trade surplus with the U.S.

In terms of trade policy, we consider three alternative scenarios. In the first scenario, there is no appreciable change in U.S. or Chinese tariff or non-tariff barriers. In the second scenario, China unilaterally eliminates its tariff barriers on merchandise imports on a most-favored-nation (MFN) basis. In the third scenario, the U.S. and China move towards the extent of preferential liberalization envisaged in a Free Trade Area of Asia and the Pacific (FTAAP) through mutual accommodation, eliminating both tariff and non-tariff barriers on goods and services trade and, in effect, establishing a basic free trade area (FTA) between the two countries. We use the adjective 'basic' because we do not envisage the extensive range of investment, intellectual property, environmental, labor or dispute settlement provisions contemplated in the Trans Pacific Partnership (TPP). Accordingly, in assessing this scenario, we start with partial equilibrium analyses of tariff and non-tariff barrier elimination and then, more ambitiously, examine the consequences if gravity model FTA coefficients are assumed for U.S.-China trade a decade hence.

Gravity Model in Brief

The dominant workhorse for our projections is the gravity model. For interested readers, DeRosa and Gilbert (2005) spell out the structure of the gravity model in detail and contrast the gravity model results with those from a computable general equilibrium (CGE) model. In this report we skip lightly over the major features of the gravity model and its application to U.S.-China trade forecasts. The models used in this report are broadly similar in specification to most gravity models, but are distinguished by important features. They explain not only bilateral (two-way) and one-way merchandise trade (separating exports and imports), but also bilateral and one-way services trade based on flows from 2008 to 2011 for merchandise and 2000 to 2010 for services, selectively using annual data from 170 countries[3]. The trade data were

3 For the years 2010 and 2011, bilateral trade data may be missing for some country pairs.

censored to exclude bilateral or one-way flows under US$10m (at 2011 prices) because we want to estimate coefficients that best describe significant trade flows without the influence of thousands of smaller bilateral flows that are captured in the database. A two-stage least squares approach was used to estimate coefficients.

The models used for this report calculate coefficients separately using nine different data sets as dependent variables:

- Bilateral trade between all countries in the data base;
- Exports of merchandise by the U.S. to all its partner countries;
- Imports of merchandise by the U.S. from all its partner countries;
- Similarly, exports of merchandise by China;
- Imports of merchandise by China;
- Exports of services by the U.S.;
- Imports of services by the U.S.;
- Exports of services by China; and
- Imports of services by China.

As expected, the estimated coefficients on the explanatory (independent) variables show that greater distance between partners reduces trade, while greater joint GDP of partners expands trade. The individual influence of other core explanatory variables is also sensible and generally conforms to the results of other gravity models. A common language or border between countries tends to expand bilateral commerce; as does being an island economy; sharing a colonial relationship with a trading partner; or being a beneficiary of the Generalized System of Preferences (GSP)[4]. Besides distance, the principal trade-resistance factor – according to the gravity model – is being a landlocked country.

The all-country model incorporates indicator variables for over 500 FTAs, grouped into nine prominent individual FTAs and groups of FTAs worldwide, including the North American Free Trade Agreement (NAFTA) and FTAs undertaken by the E.U.[5] The FTA indicators are dichotomous (0,1) variables, often termed dummy variables. They take a value of 1 if trade or investment partner countries are FTA members and their mutual trade agreement is in force; they otherwise take a value of 0[6]. However, FTA indicators are not used for the U.S.-only model or the China-only model because there was little change in U.S. or Chinese FTA partners during the period used for estimating coefficients (2008-11 for merchandise and 2000-10 for services).

The figures in the Appendix to this chapter present the gravity model coefficients estimated from the different data sets, and then apply these coefficients to forecast trade flows in 2022. Examination of Figures A3 through A6 reveals that gravity model coefficients estimated from different data sets yield substantially different trade forecasts. Accordingly, for forecasting purposes, we used a three-step approach. First, we selected the set of coefficients that yield trade predictions closest to actual values since 2000. Second, we applied ad hoc adjustment factors to the selected coefficients so as to yield predicted trade values reasonably close to actual trade values in recent years (the ad hoc adjustment factors are presented in Figure A7 in the Appendix to this chapter). For example, Chinese merchandise exports to the U.S. are, in the initial instance, forecast by using the Chinese export coefficients multiplied by an ad hoc factor of 1.5. Third, for the purpose of making forecasts to 2022, we modified our adjust-

4 Under the U.S. General System of Preferences, advanced countries extend trade preferences to less developed countries on a non-reciprocal basis. For program descriptions, see United Nations Conference on Trade and Development (UNCTAD) (2005).

5 The FTAs and preferential trade agreements are grouped as follows: European Union (E.U.); European Free Trade Area (EFTA); E.U. bilateral free trade agreements (E.U. FTAs); North American Free Trade Agreement (NAFTA); Southern Cone Common Market (Mercosur); Chile, Mexico, Australia and Singapore (CMAS) FTAs, separately distinguished because these are truly free trade countries; Association of Southeast Asian Nations (ASEAN) Free Trade Area (AFTA); South Asia Free Preferential Trading Arrangement (SAPTA); and all other customs unions and FTAs.

6 To illustrate, the NAFTA indicator variable for U.S.-Mexico trade would take a value of 0 until 1994, and a value of 1 in 1994 and later.

ment factors in a rough attempt to reflect economic developments not captured in the gravity model.

As mentioned earlier, the period 2001 to 2008 was extraordinarily favorable to Chinese exports because China joined the WTO in 2001 and slashed its tariff rates, thereby turning itself into an assembly plant for all of Asia. Moreover, in 2005, the Multi-Fiber Agreement was terminated, thereby opening world markets to Chinese exports of apparel and textiles.

External current account balances necessarily reflect internal savings, investment and government fiscal balances[7]. It seems likely that China's extraordinarily high internal net savings balance – which translates into an external current account surplus – will diminish in the decade ahead as the Standing Committee gives a stronger push on household consumption and the public safety net, and as the Chinese population ages. Meanwhile, it seems likely that the U.S. fiscal deficit will shrink and household savings may rise in the decade ahead.

China's labor costs are rising rapidly, while U.S. wage levels are practically flat. Consequently, Chinese exports are becoming less competitive in world markets, especially relative to India, Indonesia and Vietnam, while U.S. exports are becoming more competitive, especially relative to Canada, Europe and Japan. These competitive shifts portend faster export growth for the U.S. and slower export growth for China.

The range of goods suitable for 'made in China' assembly for the U.S. market may be nearing saturation; instead, Chinese firms might concentrate on new markets for their existing range of goods in Latin America, Africa and Asia.

The gravity model projections of bilateral U.S.-China trade do not directly indicate either country's current account balance with the world. However, in recent years, rather stable relationships have emerged between the bilateral U.S.-China current account balance and each country's current account balance with the world[8]. We have used these relationships to generate gravity model projections of each country's current account balance with the world. In turn, as explained in the next section, those global current account balances are tested against projections made by the IMF.

Supplementary Sources

The gravity model is not good at forecasting the impact of exchange rate or trade barrier changes. The fundamental reason is that the gravity model identifies underlying forces that impact trade flows that differ in size over several orders of magnitude (e.g. US$10m to US$100bn). Across this immense range, exchange rate and trade barrier changes exert only a modest impact compared to distance, GDP levels and common borders. Yet changes in exchange rates and trade barriers are of great interest, for they are directly influenced by government policy and they clearly affect year-to-year trade performance and current account positions.

Accordingly, for this report, we have drawn on supplementary sources to assess the impact of exchange rate changes, tariff changes and non-tariff barrier changes on trade positions of the U.S. and China in 2022. We have used the IMF's 2012 WEO forecasts through 2017 as a benchmark for the trade balance implications derived from the gravity model. WEO forecasts are made in the context of constant real exchange rates, and in our baseline scenario we assume that the RMB real exchange rate

7 This follows from the basic arithmetic of national accounts in which the current account balance must equal the national (private plus public) investment-savings gap: (M-X) = (I+G) – (S+T), where (M-X) is the current account balance (M represents imports, X represents exports); I is investment expenditure (both households and business); G is all government expenditure; S is private savings (households and business); and T is all taxes.

8 From recent data on the external accounts of the two countries, we observe that the U.S.-China current account balance equals about 60% of the overall U.S. current account balance. At the same time, we find that the U.S.-China current account balance is nearly equal to the overall China current account balance with the world. These relationships may be seen, for instance, during 2009 and 2010, when the U.S.-China bilateral current account balance averaged 60% of the U.S. global current account balance and 100% of the China global current account balance (see Figure A8 in the Appendix to this chapter).

changes very little through 2017. We have extended the WEO forecasts on a straight-line basis to 2022. It turns out that the WEO forecasts – so extended for the U.S. global current account deficit and the Chinese global current account surplus in 2022, as well as the bilateral current account balances – are somewhat larger than those implied by the gravity model using the baseline medium GDP growth projections (U.S. 3.0% growth; China 7.5% growth). The WEO suggests a U.S. bilateral current account deficit with China of US$660bn in 2022; the gravity model suggests a bilateral deficit of US$412bn. Correspondingly, the U.S. global current deficit is projected at US$686bn in 2022 (somewhat less than the WEO forecast of US$734bn), and the Chinese global current account surplus is projected at US$412bn (markedly smaller than the WEO forecast of US$698bn).

As mentioned, the gravity model forecasts do not attempt to reflect exchange rate changes, a feature which puts them on the same footing as the WEO forecasts. Discussed in more detail later, our projections for the U.S. current account deficit with China and the U.S. global current account deficit with the world are cut very substantially if China continues to appreciate its real exchange rate by about 3.4% per year through 2015.

We have drawn on William Cline and John Williamson (2012) to calculate the impact of continued real appreciation of the RMB at 3.4% per year – the pace experienced since 2005. We assume this pace continues through 2015 and then stops. In other words, we assume that the RMB appreciates by 14.3% in real terms over a period of four years, starting in 2011 (1.034 raised to the power of four).

Our unilateral liberalization scenario for tariffs on merchandise imports draws on other sources. The World Bank – relying on trade protection data compiled by the World Trade Organization and United Nations Conference on Trade and Development (UNCTAD) – reports the average Chinese ad valorem tariff on imports is 7.7%[9]. We assume that the US$ value of Chinese imports of goods increases by 1% for each one percentage point decrease in the tariff rate. This impact reflects the assumption that the RMB *value* of Chinese merchandise imports does not change because the real quantity of imports rises by 1% for each 1% fall in their price in RMB terms (i.e. by the percentage of RMB appreciation). However the US$ *value* of Chinese merchandise imports increases by the percentage rise in the real quantity of Chinese imports.

Our unilateral liberalization scenario for non-tariff barriers on services draws on work by Hufbauer, Schott and Wong (2010). Conservatively, they estimate the tariff equivalent of non-tariff barriers on Chinese service imports as 68%. This is high, but the World Bank (2012) reports a slightly higher figure. Based on estimates summarized in Hufbauer et al. (2010), the demand elasticity for imported services is about -1.37. Eliminating service barriers – in the context of a mutual accommodation scenario – would challenge China politically as well as economically, but liberalization would both deliver huge gains to the Chinese economy and reduce China's bilateral trade surplus with the U.S. Prices for key services would drop in China – for example, finance, telecoms, health, education, retail – while U.S. exports would increase dramatically (see Figure 4).

Forecasts for 2022

We start by summarizing what the alternative growth projections imply for U.S. and Chinese GDP measured at 2011 prices. For our trade forecasts, we focus on the medium growth projections: U.S. GDP rises at 3.0% annually and China GDP rises at 7.5% annually. The trade forecasts are examined in four scenarios:

9 World Bank, World Development Indicators, World Databank, http://databank.worldbank.org/data/home.aspx, as of December 2012.

Figure 4: Impact on U.S.-China Services Trade From Eliminating Tariff Equivalents of Services Barriers

	Tariff Equivalent Barriers*	Price Elasticity	2022 projections of U.S.-China trade in services with no liberalization ($ bill)#			Trade gains from eliminating tariff equivalents of services barriers ($ bill)			2022 projections of U.S.-China trade with complete liberalization ($ bill)		
			Low	Medium	High	Low	Medium	High	Low	Medium	High
U.S. exports to China	67.9	-1.37	167.8	256.0	389.4	156.1	238.1	362.2	323.9	494.1	751.6
China exports to U.S.	6.0	-1.37	30.1	37.7	47.0	2.5	3.1	3.9	32.6	40.8	50.9

** TEBs come from Hufbauer, Schott and Wong 2010. The World Bank (2012) estimates TEBs of 3.8 percent for the U.S. and 76.2 percent for China. For our purposes we use the more conservative estimates from Hufbauer, Schott and Wong 2010.*
 # Low projections for U.S. service exports to China correspond to China GDP growth of 6.0 percent per annum; medium projections correspond to 7.0 percent per annum; high projections correspond to 8.0 percent per annum. Low projections for Chinese service exports to the United States correspond to U.S. GDP growth of 2.0 percent per annum; medium projections correspond to 2.5 percent per annum; high projections correspond to 3.0 percent per annum. See table 7.

Sources: The World Bank, 2012, http://iresearch.worldbank.org/servicetrade/; Hufbauer, Schott and Wong 2010.

Figure 5: U.S.-China Trade and Payments, 2005-11 and Projections to 2022 (US$ billions at 2011 prices)

Year and scenario	U.S.				China			
	Current account Balance	Trade with China			Current account Balance	Trade with U.S.		
		Goods and services balance	Goods exports	Service exports		Goods and services balance	Goods exports	Service exports
2005	-746	-209	49	8.4	132	209	260	6.2
2006	-801	-245	59	10.5	232	245	306	9.3
2007	-710	-268	70	13.0	353	268	340	10.7
2008	-677	-269	82	15.1	421	269	356	9.4
2009	-382	-224	78	16.0	243	224	310	8.2
2010	-442	-269	103	21.2	238	269	383	10.0
2011	-466	…	123	…	202	…	417	…
2022								
IMF WEO (October 2012)								
1. No RMB real appreciation	-734	-660	…	…	698	698	…	…
Gravity model-based projections								
1. No RMB real appreciation	-686	-412	508	104	412	412	964	60
2. RMB appreciation to 2015	-455	-181	580	119	-295	181	828	51
3. China trade liberalization	-650	-375	545	104	375	375	964	60
4. U.S.-China basic FTA	-442	-167	545	342	167	167	992	63

Source: Organization for Economic Cooperation and Development; Statistics on International Trade in Services (December 2012); Peterson Institute for International Economics; Gravity Model Data Set (June 2012); World Bank, World Development Indicators (December 2012)

Scenario 1: Business as usual

The first scenario is 'business as usual', which uses projections straight from the gravity model coefficients with adjustments, as explained in the Notes to Figure 4 and in the Appendix to this chapter in Table A7. In this scenario, there is no change in the RMB real exchange rate and no liberalization of Chinese or U.S. tariff or non-tariff barriers. The U.S. current account deficit in 2022 (at 2011 prices) is forecast at US$686bn, and the bilateral goods and services trade deficit with China at US$412bn, respectively 3.3% and 2% of U.S. GDP in 2022, somewhat higher than in 2011. In broad terms, global current account balances for the two countries – as projected by the gravity model with adjustments – are substantially less than the balances projected by the IMF in its WEO (see Figure 5). Moreover, there is a change in the composition of U.S. exports to

China in 2022: services exports are projected by the gravity model at US$104bn, about 20% of U.S. exports of goods, projected at US$508bn, as compared to just 17% of U.S. exports of goods in 2011.

Apart from the rapid growth of U.S. service exports, the standout feature of this and other scenarios is the huge amount of Chinese merchandise exports to the U.S., between US$800bn and US$1,000bn in 2022. This represents more than a doubling of China's outsized role as 'factory Asia' for the U.S. market – even after taking into account the adjustment factors mentioned earlier. To be sure, the U.S. bilateral trade deficit with new 'factory Asia' powers might well rise as they crowd into China's traditional export markets. Accordingly, it would be a mistake to equate a smaller U.S.-China bilateral trade deficit (smaller than the WEO forecast) with an equivalent shrinkage of the U.S. global current account deficit. In fact, while our baseline forecast shows a U.S. bilateral trade deficit (goods and services), almost US$250bn smaller than the WEO forecast for 2022, the U.S. global current account deficit only shrinks by US$50bn.

Scenario 2: RMB real appreciation

In the second scenario, we consider the consequences of continued RMB appreciation through 2015, to a point where China incurs a global current account deficit in 2022, calculated at US$295bn (about 1.8% of China's GDP valued at the market exchange rate). The pace of real appreciation is the same as allowed by the Chinese authorities since 2005, about 3.4% annually.

RMB appreciation exerts a strong impact on China's global current account balance, if one accepts (as we do) the Cline and Williamson (2012) coefficient[10]. According to their calculations, each 1% appreciation in the real effective exchange rate of the RMB diminishes China's current account surplus (measured at market exchange rates) by 0.31% of China's GDP.

According to our forecasts, even significant RMB appreciation leaves a U.S. current account deficit, both globally and bilaterally. However, among the scenarios we have modeled, the U.S. external deficits are smallest in the RMB appreciation scenario. Globally, the U.S. current account deficit shrinks from our baseline scenario projection of US$686bn to US$455bn in 2022, some 2.2% of U.S. GDP, and bilaterally the trade deficit shrinks from our baseline scenario projection of US$412bn to US$181bn, about 0.9% of U.S. GDP. As emphasized in the discussion in Scenario 1, if China sheds part of its role as 'factory Asia', that would shrink the U.S. bilateral trade deficit, but the U.S. global current account deficit would not shrink as much.

Scenario 3: Unilateral China tariff elimination

Both the U.S. and China maintain non-tariff barriers on merchandise imports. Scenario 3, however, assumes that China unilaterally eliminates just its merchandise tariffs over the next decade and does not reduce its barriers to service imports. China's current average ad valorem tariff is 7.7%. Like other analysts, we assume that a one percentage point reduction in the average Chinese tariff increases merchandise imports by 1% in volume terms; hence total elimination increases Chinese imports by almost 8%. This 'unitary coefficient', while widely assumed, may be too conservative. As the calculations in Figure 4 indicate, improvements in the U.S. current account deficit and bilateral trade deficit seem fairly modest by comparison with the baseline forecasts, under US$35bn in each case. Correspondingly, the calculated impact on China's current account surplus and bilateral trade surplus are also modest.

Again, as emphasized in Scenario 1, China's 'factory Asia' role makes a huge difference in the outcome. If 'factory Asia' migrates to other locations, China's external surpluses will decline. However, unilateral tariff elimination would, if anything,

10 Note the skeptical view as to the impact of exchange rate changes on trade flows, expressed by Edward P. Lazear in his op-ed, "Chinese 'Currency Manipulation' is Not the Problem", Wall Street Journal, 8 January 2012, p. A17.

work to China's advantage in retaining assembly plants, because exporting firms could more easily access the inputs they need from global sources.

Viewed from a political standpoint, unilateral tariff elimination would be a dramatic step, widely applauded by all China's trade partners. The trade impact would possibly be twice as large as we have calculated. In any event, the ratio between economic cost – viewed through a mercantilist lens – and political payoff appears quite favorable for China.

Scenario 4: Mutual accommodation

Our fourth and final scenario is more speculative than the others. We label the scenario a 'basic FTA' or 'mutual accommodation': both China and the U.S. eliminate – on a preferential basis – tariffs on merchandise and non-tariff barriers on services. The service barriers are critical to this scenario; in political terms, however, elimination might be very difficult for China. Service exports are America's comparative advantage, and China's service barriers, expressed in tariff equivalent terms, are very high – almost 70%. Our calculations on the possible enlargement of U.S.-China trade suggest that the U.S. global current account deficit might drop to US$442bn in 2022 in this scenario, and the bilateral trade deficit could decline to US$167bn. In terms of shrinking U.S. external deficits, Scenario 4 is as powerful as Scenario 2, which envisages RMB appreciation. However, and we emphasize this point again, Scenario 4 critically depends on dramatic liberalization of China's barriers to U.S. service exports. Moreover, in Scenario 4, U.S. service exports to China are three times as large as in baseline Scenario 1 – US$342bn annually versus US$104bn.

While we think it is a stretch to project a trade agreement between the U.S. and China with the depth and coverage of the U.S.-Korea FTA, an agreement that eliminated barriers to merchandise and services trade on a preferential basis does not seem impossible. Accommodation might be achieved within the framework of an FTAAP by bringing together members of the Trans Pacific Partnership (TPP) with Asian countries linked to China through the ASEAN Free Trade Agreement (AFTA) and other arrangements. We picture the 'accommodation scenario' through partial equilibrium calculations of bilateral trade created by eliminating tariff barriers on merchandise and non-tariff barriers on services.

Perhaps these calculations are too conservative. Therefore, we also consider the expansion of bilateral trade if accommodation between the U.S. and China reached the same level of ambition as a number of recent FTAs. In fact, our gravity model estimates for several prominent bilateral and regional trading agreements (see Figures A1 (merchandise trade) and A2 (trade in services) in the Appendix to this chapter) imply much larger trade impacts than we find using the simple partial equilibrium calculations. Based on the array of coefficient estimates that we find for the several FTAs represented in the gravity model, a conservative coefficient estimate for a basic U.S.-China FTA would be 0.25 for trade in both merchandise and services between the two countries. Such an estimate implies that bilateral trade between the U.S. and China should be expected to expand by 28% (explained in the first section of text in the Appendix to this chapter). This magnitude is much greater than the modest trade gains found by our main side calculations for goods trade between the two countries and for China's service exports to the U.S. (less than 10%).

But it must be emphasized that the magnitude of trade expansion implied by our gravity model coefficients for the experience of past FTAs falls considerably short of the huge gain in U.S. service exports to China projected by our side calculations. The reason is straightforward: even the most ambitious FTAs implemented so far fall far short of eliminating barriers to services trade. Hence the gravity model coefficients in figure A2 in the Appendix to this chapter reflect much less liberalization than we contemplate in a U.S.-China accommodation scenario.

Figure 6: Trade Expansion and Growth Rate Scenarios U.S.-China Merchandise and Service Exports, 2000-22

Year and scenario	U.S.				China			
	U.S. merchandise exports to China		U.S. service exports to China*		China merchandise exports to the U.S.		China service exports to the U.S.*	
	End to beginning trade expansion	Compounded growth rate (%)	End to beginning trade expansion	Compounded growth rate (%)	End to beginning trade expansion	Compounded growth rate (%)	End to beginning trade expansion	Compounded growth rate (%)
Actual trade, 2000-11	4.4	14.5	3.5	13.2	3.1	10.9	2.6	9.9
Predicted trade, 2011-22								
1. No RMB real appreciation#	4.1	13.8	4.8	14.0	2.3	7.9	5.8	15.8
2. RMB appreciation to 2015	4.7	15.1	5.5	15.3	2.0	6.4	5.0	14.4
3. China trade liberalization	4.4	14.5	4.8	14.0	2.3	7.9	5.8	15.8
4. U.S.-China basic FTA	4.4	14.5	15.9	25.9	2.4	8.2	6.1	16.3

** Trade expansion and growth rate calculations for bilateral service exports based on the time periods 2000-10 for actual trade and 2010-22 for predicted trade.*
 # 2022 projection assumes medium-growth scenario for the U.S. and China.

Alternative GDP Growth Projections

We conducted some sensitivity analysis under alternative growth projections for the U.S. and China (the results are shown in Figures A3 through A6 in the Appendix to this chapter). In addition to the medium-to-medium (M-M) growth rate assumption used in our baseline trade projections for 2022, trade forecasts were also calculated for low-to-low (L-L) and high-to-high (H-H) growth scenarios for the decade ending 2022, and also a low-to-high (L-H) scenario in which the U.S. grows at 2.5% and China grows at 8.5%.

As might be expected, trade forecasts for merchandise and service exports by China and the U.S. increase incrementally as growth projections are revised upwards. Yet the alternative growth scenarios collectively confirm the core findings of our baseline Scenario 1: a sustained U.S. current account deficit, both globally and bilaterally with China in 2022, and conversely sustained Chinese current account surpluses, both globally and bilaterally. Within a fairly wide range, varying the growth assumptions does not alter the tenor of our findings.

Figure 7: Growth Scenario Assumptions, 2012-22 (% per annum)

Growth scenario	Real GDP		Population	
	U.S.	China	U.S.	China
Low	2.5	6.5	0.9	0.5
Medium	3.0	7.5	0.9	0.5
High	3.5	8.5	0.9	0.5
Low U.S./High China	2.5	8.5	0.9	0.5

Trade Expansion and Export Growth Rate Scenarios

The forecasts in the four main scenarios confirm an expected expansion of U.S.-China bilateral trade. The detailed breakdown of growth rates of U.S.-China merchandise and service exports highlights the patterns and drivers of projected trade expansion. Figure 6 shows the trade expansion and growth rate scenarios for U.S.-China exports for actual trade from 2000 to 2011 and projected trade from 2011 to 2022. Two observations are particularly illustrative. Overall, across the four scenarios, projected Chinese merchandise exports to the U.S. will grow at a slower pace than in the past decade, while projected U.S. merchandise exports to China will maintain the pace of past growth. However, projected U.S. and China services export growth rates in the decade ahead outpace growth rates in the decade past: in nearly all scenarios, services trade expan-

sion from 2010 to 2022 more than doubles the extent of services trade expansion from 2000 to 2010. Projected U.S. service exports to China in the first three scenarios show an average compound growth rate in the decade ahead that is only 1% to 2% faster than the 13% growth rate experienced in the decade past. However, annual growth of U.S. service exports to China is particularly rapid in Scenario 4, the 'mutual accommodation' scenario, exceeding 25% annually. Across the scenarios, projected Chinese service exports to the U.S. will grow at an average compound rate of around 16%, compared to 10% in the last decade.

Restrictions on High-Tech Exports

Chinese trade specialists commonly assert that U.S. export restrictions are an important factor limiting U.S. merchandise exports to China. On the face of it, this assertion has merit. The U.S. export control apparatus historically divided trading partners into four tiers: Tier 1 – 'highly trusted', illustrated by NATO allies and Japan; Tier 2 – 'trusted', illustrated by Estonia and Romania; Tier 3 – 'risky', illustrated by China, India and Russia; and Tier 4 – 'threat', illustrated by Cuba, Iran and North Korea. In 2001, Tiers 1 and 2 were consolidated for export control purposes, but China remains in the Tier 3 category of 'risky' or 'moderate threat' countries, a designation which entails more restrictive export controls. From this cursory survey, it appears plausible that the U.S. is losing high-tech exports to China and other Tier 3 destinations.

In their Working Paper, Asha Sundaram and J. David Richardson (forthcoming 2013) have deployed a gravity model to estimate U.S. high-tech export shortfalls compared both with other advanced countries (France, Germany, Japan and the U.K.) and emerging export powers (Brazil, China, India, Israel and Mexico). For their analysis, Sundaram and Richardson focused on seven three-digit harmonized tariff system (HTS) categories, illustrated by chemical products (352), electrical machinery (383) and scientific equipment (385).

Surprisingly, for 2004 the authors found that the U.S. enjoyed 'over-exports' to Tier 3 countries, in the aggregate amount of US$25bn for all seven HTS categories. In particular, U.S. high-tech exports to China in 2004 were US$10bn *higher* than the gravity model norm. There was no high-tech export shortfall. Instead, the U.S. did well, both compared to its advanced rivals and to emerging export powers. What explains these surprising results?

Sundaram and Richardson believe that U.S. export success – despite the apparatus of U.S. controls – can be explained by two factors. First, while the control system has a Byzantine character, it has been liberalized considerably since the Cold War years, and further liberalization is underway. For example, in December 2012, Congress enacted legislation that could liberalize satellite exports through a presidential waiver of the statutory prohibition[11]. Second, U.S.-based multinational corporations (MNCs) are extremely energetic in developing new high-tech products and marketing them at home and abroad. Exports of most high-tech products are not, in fact, restricted and U.S. MNCs are often a step or two ahead of their European and Japanese rivals.

Based on the findings presented by Sundaram and Richardson, we conclude that U.S. controls are a minor factor in limiting U.S. exports to China. Very probably, their aggregate impact is close to zero; at most the export shortfall induced by controls does not exceed US$5bn annually. In the context of mutual accommodation, further relaxation of U.S. export controls would make a great deal of sense, but it should not be expected to yield a big jump in U.S. exports.

11 See Jon Ostrower, "Satellite-Export Rule to Ease", *Wall Street Journal*, 21 December 2012, p. B4. Unfortunately, the new presidential waiver authority does not extend to China. The original prohibition was enacted in 1996, following the crash of a Chinese rocket carrying a satellite built by Loral Space Communications (Loral was acquired by Boeing in 2000). Search of the wreckage uncovered a secret encoded circuit board, which in turn prompted a wave of accusations.

Conclusions from the Scenarios

The trade forecasts of the four scenarios collectively imply sustained current account deficits for the U.S., both bilaterally and globally, and reciprocally, current account surpluses for China. The U.S. bilateral deficit is projected at US$400bn in 2022, while the global deficit could reach US$700bn. A major contraction of the U.S. external deficit appears to require significant structural changes by comparison with the coefficients estimated from our gravity equations for the period 2000 to 2011 (see Figures A1 and A2 in the Appendix to this chapter).

What structural changes might change the picture? One possibility is more RMB appreciation, as contemplated in Scenario 2. Another possibility is faster and more drastic liberalization, especially of services, as contemplated in our Scenarios 3 and 4.

Still another possibility – outside the scope of this study but very likely – is a dramatic shift of the U.S. position as net energy importer in 2011 (energy deficit of US$331bn) to zero net energy imports, or even net energy exports in the mid-2020s[12]. This could be the big payoff from the revolution in shale gas and oil, now underway across the U.S. A simple calculation translates this change in U.S. energy outlook into potential shrinkage of the U.S. global current account deficit. Assuming the U.S. eliminates its 'energy deficit' by 2022, and assuming no other changes, our calculations for the U.S. global current account deficit follow: baseline Scenario 1 (business-as-usual) drops from US$686bn to US$355bn; Scenario 2 (RMB appreciation) drops from US$455bn to US$124bn; Scenario 3 (unilateral liberalization) drops from US$650bn to US$319bn; and baseline Scenario 4 (mutual accommodation) drops from US$442bn to US$111bn. While eliminating the U.S. energy deficit does not eliminate the U.S. global current account deficit in our models, it would shrink the deficit dramatically.

The foregoing discussion emphasizes trade deficits and surpluses because of their salience in political relations between the U.S. and China. However, no one should lose sight of the tremendous gains in GDP and living standards that result from an expansion in trade, whether or not it is 'balanced' on a bilateral basis. According to our baseline (Scenario 1) estimates, in 2022, two-way trade in goods and services between China and the U.S. will reach US$1.6tr, up from US$0.6tr in 2011. Research summarized elsewhere indicates that, through multiple channels, national GDP increases by at least US$4 for every US$10 increase in two-way trade[13]. An expansion of bilateral trade by US$1.0tr over 10 years could deliver GDP gains of US$400bn each to the U.S. and China in 2022, compared to the GDP levels that would otherwise be reached. Gains of this magnitude amount to 2.0% to 2.5% of projected U.S. and Chinese GDP levels ten years from now – a huge payoff by any standards.

Appendix

Technical Background

This appendix summarizes the technical apparatus used to estimate the gravity model coefficients, and additional sources we used to supplement the gravity model in order to evaluate three other scenarios: RMB appreciation, unilateral tariff liberalization and mutual accommodation.

Gravity Model Coefficients

Our analysis starts with Figures A1 and A2 which show, respectively, the regression coefficients estimated (using the two-stage least squares approach) for merchandise trade and services trade. The alternative dependent variables, shown at the top of columns, are logarithmic values – all-country exports, U.S. exports to all partner countries, U.S. imports

12 The U.S. Energy Information Administration (EIA) provides the most recent projections in its "Annual Energy Outlook 2013", finding U.S. production of natural gas will likely outpace domestic consumption by 2020 and spur net exports. Much the same could happen with oil.

13 See Figuring Out the Doha Round: Policy Analyses in International Economics 91, Gary Clyde Hufbauer, Jeffrey J. Schott and Woan Foong Wong, Peterson Institute for International Economics, 2010.

from all partner countries, China exports to all partner countries and China imports from all partner countries. To avoid giving excessive weight to small trade values when estimating regression coefficients, trade values less than US$10m were excluded from the data set. The data set comprises trade and other values for the period 2000 to 2010/11, depending upon the availability of the most recent observations on bilateral trade and national explanatory variables. All monetary values are expressed in US$ in real terms: GDP levels are evaluated on a purchasing power parity basis at 2005 prices and exchange rates, while bilateral trade values are deflated by the U.S. consumer price index and, for these projections, are presented at 2011 prices.

Independent variables are shown in the rows in Figures A1 and A2. The basic structure of the regression equation combines logarithmic and semi-logarithmic independent terms. Continuous variables, such as distance and joint per capita GDP, are expressed in logarithmic terms. On-off variables, such as the existence of a common colonizer between two partner countries or the presence of an FTA between the partners, are expressed as two dummy variables – 0 for off, 1 for on. The character of landlocked or island partner countries are expressed as three dummy variables – 0 for none, 1 for one, 2 for both.

When the independent variable is continuous and therefore expressed in logarithmic terms, the coefficient can be interpreted as an elasticity value. For example, a coefficient of 0.086 on joint per capita GDP means that, if the product of per capita GDP increases by 10%, trade between the partners – or exports from one partner to the other – increases by 0.86%. When the independent variable is on-off, a small transformation is needed to derive the impact. For example, the coefficient of 0.277 for E.U. member country merchandise exports to other E.U. members implies that the existence of the E.U. increases member country exports to one another by 32% in exports, calculated as [100*{exp(0.277) – 1.00} = 32%]. In this expression, exp (0.277) means the natural number *e* raised to the power of 0.277.

The all-country export coefficients for merchandise are based on nearly 23,000 observations, and for services on 25,000 observations. However, the export and import coefficients for the U.S. and China with their respective partners are necessarily based on much smaller data sets, around 400 observations for merchandise and 200-to-400 observations for services trade.

Alternative Export and Import Projections

Figures A3 through A6 present alternative gravity model projections to 2022, assuming the alternative growth projections (low, medium and high – see note 2 in Figure 6) and different coefficient sets (all-country, U.S. and China). Readers will quickly see that different coefficient sets generate very different trade projections for 2022. We chose the coefficient set that most closely mirrors actual trade in recent years (2000-11), and then we applied ad hoc adjustment factors to more closely reflect actual trade flows. The adjustment factors are spelled out in the notes to Figure 4 and in Figure A7 in the Appendix. From this work we generated the baseline U.S.-China trade projections that appear in figure 4 (Scenario 1) for merchandise trade and services trade. Table A7 shows the actual to predicted ratios of bilateral U.S.-China merchandise and services trade to illustrate how the adjusted coefficients approximate actual trade flows from 2000 to 2011.

Comparison with WEO Projections

Figure A8 explains the International Monetary Fund (IMF) World Economic Outlook (WEO) past data and projections for the U.S. and Chinese current account balances and bilateral trade deficits and surpluses, and provides a side-by-side comparison with our gravity model past data and projections. The WEO projections only extend to 2017; accordingly we extrapolated the WEO figures to the gravity model end date, 2022. The WEO projections do not indicate bilateral merchandise and service trade flows; however, the WEO

projections for current account and bilateral balances are in the same ball park as the gravity model projections. The WEO projections assume near-constant real effective exchange rates while the baseline gravity model projections do not have an exchange rate term (nor do they have terms for tariff and non-tariff barriers). Accordingly the baseline gravity model projections should be viewed as assuming no change in the RMB exchange rate, or in Chinese or U.S. trade policy.

Calculations of Alternative Scenarios

Alternative gravity model scenarios reflect assumed RMB appreciation and two versions of trade liberalization. These scenarios require supplementary calculations, because the gravity model is not suited to identify the impact either of exchange rate changes or the reduction of trade barriers. Figures A9, A10 and A11 show the calculations used to generate, respectively, Scenario 2 (RMB appreciation), Scenario 3 (unilateral Chinese tariff elimination) and Scenario 4 (mutual trade accommodation between the U.S. and China).

The Scenario 2 calculations rely on the RMB exchange rate impact parameter estimated by William Cline and John Williamson (2012). The Scenario 3 calculation adopts a conventional unitary response coefficient for Chinese tariff rate reduction (one percentage point ad valorem tariff reduction increases imports by 1%). The Scenario 4 calculations assume preferential liberalization between the U.S. and China. They adopt the same tariff rate assumption as Scenario 3, but separately add the impact of service trade liberalization, drawing on Hufbauer, Schott and Wong (2010). Because Chinese service trade barriers are high, liberalization would sharply increase U.S. service exports to China, and this is the big feature of Scenario 4.

Figure A1: Two-Stage Least Squares Gravity Model Estimates for Aggregate Merchandise Trade (SITC 0-9), Specifying Major Customs Unions and Free Trade Agreements, and Dropping Bilateral Trade less than $10 Million in 2011 U.S. dollars, 2008-2011

		All-country exports	U.S. exports	U.S. imports	China exports	China imports
Log distance	Estimate	-0.724***	-1.515***	-0.859***	-0.232	-0.510
	(s.e.)	(0.024)	(0.161)	(0.292)	(0.153)	(0.336)
	(t-statistic)	(-30.433)	(-9.412)	(-2.941)	(-1.518)	(-1.517)
Log product real GDP (PPP)	Estimate	0.959***	1.017***	1.103***	0.857***	0.585***
	(s.e.)	(0.031)	(0.091)	(0.165)	(0.102)	(0.126)
	(t-statistic)	(30.723)	(11.199)	(6.672)	(8.432)	(4.642)
Log product real GDP (PPP) p/c	Estimate	0.074**	0.321**	0.302	0.167*	0.632***
	(s.e.)	(0.029)	(0.132)	(0.220)	(0.098)	(0.185)
	(t-statistic)	(2.531)	(2.427)	(1.371)	(1.694)	(3.410)
Common language	Estimate	0.435***	0.529***	0.429	2.675***	3.855***
	(s.e.)	(0.040)	(0.139)	(0.274)	(0.553)	(0.776)
	(t-statistic)	(10.831)	(3.797)	(1.565)	(4.837)	(4.969)
Land border	Estimate	0.760***	-0.389	0.569	0.162	-0.080
	(s.e.)	(0.070)	(0.365)	(0.563)	(0.314)	(0.481)
	(t-statistic)	(10.914)	(-1.067)	(1.011)	(0.517)	(-0.167)
Number landlocked	Estimate	-0.150***	-0.268*	-0.375	-0.246	-0.281
	(s.e.)	(0.028)	(0.160)	(0.345)	(0.163)	(0.290)
	(t-statistic)	(-5.269)	(-1.677)	(-1.085)	(-1.504)	(-0.966)
Number islands	Estimate	0.211***	0.453**	0.053	-0.038	0.129
	(s.e.)	(0.038)	(0.202)	(0.327)	(0.147)	(0.531)
	(t-statistic)	(5.532)	(2.244)	(0.161)	(-0.258)	(0.242)
Log product land area	Estimate	-0.118***	-0.017	-0.016	0.083	0.527***
	(s.e.)	(0.016)	(0.061)	(0.097)	(0.062)	(0.112)
	(t-statistic)	(-7.286)	(-0.279)	(-0.168)	(1.350)	(4.717)
Common colonizer	Estimate	0.746***			-3.594***	-2.580***
	(s.e.)	(0.073)			(0.694)	(0.770)
	(t-statistic)	(10.282)			(-5.178)	(-3.352)
Ever colony	Estimate	0.406***	-0.091	-0.126	1.082**	1.264*
	(s.e.)	(0.083)	(0.286)	(0.464)	(0.517)	(0.650)
	(t-statistic)	(4.895)	(-0.319)	(-0.273)	(2.093)	(1.945)
GSP	Estimate	-0.059**	0.498***	0.582*	0.353**	0.397
	(s.e.)	(0.028)	(0.171)	(0.318)	(0.162)	(0.391)
	(t-statistic)	(-2.065)	(2.917)	(1.833)	(2.184)	(1.015)
E.U.	Estimate	0.277***				
	(s.e.)	(0.050)				
	(t-statistic)	(5.571)				
European Free Trade Area	Estimate	0.579***				
	(s.e.)	(0.110)				
	(t-statistic)	(5.269)				
E.U. FTAs	Estimate	-0.031				
	(s.e.)	(0.053)				
	(t-statistic)	(-0.586)				
NAFTA	Estimate	1.101***				
	(s.e.)	(0.224)				
	(t-statistic)	(4.914)				

Mercosur	Estimate	0.629**				
	(s.e.)	(0.254)				
	(t-statistic)	(2.474)				
CMAS FTAs	Estimate	0.652***				
	(s.e.)	(0.131)				
	(t-statistic)	(4.977)				
AFTA	Estimate	0.981***				
	(s.e.)	(0.174)				
	(t-statistic)	(5.646)				
SAARC	Estimate	-1.043***				
	(s.e.)	(0.354)				
	(t-statistic)	(-2.947)				
Other FTAs	Estimate	0.665***				
	(s.e.)	(0.068)				
	(t-statistic)	(9.792)				
Constant	Estimate	-24.889***	-29.431***	-39.256***	-29.967***	-34.560***
	(s.e.)	(0.781)	(2.473)	(4.102)	(3.807)	(5.248)
	(t-statistic)	(-31.872)	(-11.903)	(-9.571)	(-7.872)	(-6.585)
Observations		22,654	439	394	441	375
R-squared		0.642	0.903	0.740	0.922	0.720
Adjusted R-squared		0.642	0.901	0.733	0.920	0.712
RMSE		1.183	0.713	1.240	0.625	1.328
F-statistic		…	…	…	…	…
Number of clusters		8472	150	136	151	131

*Note 1: Two-stage least squares with robust standard errors determined by clustering ordered country pairs. Dependent variable is log real bilateral trade, Tij (country i exports to importing country j). Instruments for the (assumed) endogenous purchasing power parity GDP variables are the contemporaneous product of population levels in partner countries, one-year lagged value of the product of purchasing power parity GDP levels in partner countries, and one-year lagged value of the product of GDP per capita levels in partner countries. *,**,*** denote statistical significance at the 10, 5, and 1 percentage levels.*

Note 2: Trade agreements represented by indicator variables are: European Union (E.U.); European Free Trade Area (EFTA); EU bilateral free trade agreements (EU FTAs); North American Free Trade Area (NAFTA); Southern Common Market (Mercosur); Chile, Mexico, Australia, and Singapore bilateral free trade agreements (CMAS FTAs); ASEAN Free Trade Area (AFTA); SAARC Preferential Trading Arrangement (SAPTA); and all other customs unions and free trade agreements (Other FTAs).

Note 3: No coefficient estimate is reported when there is insufficient variation in the explanatory variable. Trade agreement variables are dropped from the U.S. and China. regressions.

Figure A2: Two-Stage Least Squares Gravity Model Estimates for Aggregate Trade in Services (All Categories), Specifying Major Customs Unions and Free Trade Agreements and Dropping Bilateral Trade less than US$10m in 2011 US$, 2000-10

		All-country exports	U.S. eExports	U.S. imports	China exports	China imports
Log distance	Estimate	-0.543***	-2.039***	-0.505	-1.467***	-1.242
	(s.e.)	(0.031)	(0.671)	(0.556)	(0.414)	(0.793)
	(t-statistic)	(-17.419)	(-3.037)	(-0.909)	(-3.547)	(-1.567)
Log product real GDP (PPP)	Estimate	0.891***	1.051***	0.945***	1.062***	1.209***
	(s.e.)	(0.032)	(0.092)	(0.100)	(0.163)	(0.308)
	(t-statistic)	(28.228)	(11.478)	(9.433)	(6.520)	(3.924)
Log product real GDP (PPP) p/c	Estimate	0.381***	0.655***	0.732***	0.798***	1.121**
	(s.e.)	(0.036)	(0.226)	(0.201)	(0.288)	(0.436)
	(t-statistic)	(10.640)	(2.902)	(3.639)	(2.768)	(2.572)
Common language	Estimate	0.804***	1.319***	0.691**	2.301***	2.365*
	(s.e.)	(0.064)	(0.397)	(0.297)	(0.824)	(1.342)
	(t-statistic)	(12.651)	(3.328)	(2.327)	(2.792)	(1.762)
Land border	Estimate	0.563***	-2.011**	0.279	-0.554	0.167
	(s.e.)	(0.092)	(0.982)	(0.863)	(0.642)	(1.195)
	(t-statistic)	(6.146)	(-2.047)	(0.323)	(-0.863)	(0.139)
Number landlocked	Estimate	0.006	-0.132	-0.433	-0.236	0.206
	(s.e.)	(0.043)	(0.401)	(0.352)	(0.322)	(0.527)
	(t-statistic)	(0.140)	(-0.329)	(-1.232)	(-0.734)	(0.391)
Number islands	Estimate	0.221***	0.569**	-0.064	-0.102	0.184
	(s.e.)	(0.060)	(0.231)	(0.271)	(0.566)	(1.027)
	(t-statistic)	(3.667)	(2.464)	(-0.236)	(-0.181)	(0.179)
Log product land area	Estimate	-0.165***	-0.079	-0.085	-0.062	-0.170
	(s.e.)	(0.017)	(0.060)	(0.056)	(0.129)	(0.208)
	(t-statistic)	(-9.427)	(-1.331)	(-1.512)	(-0.484)	(-0.820)
Common colonizer	Estimate	1.114***				
	(s.e.)	(0.206)				
	(t-statistic)	(5.410)				
Ever colony	Estimate	0.814***	-1.263**	0.124		
	(s.e.)	(0.094)	(0.512)	(0.340)		
	(t-statistic)	(8.649)	(-2.466)	(0.364)		
GSP	Estimate	0.238***	0.049	-0.254	0.367	0.944**
	(s.e.)	(0.046)	(0.312)	(0.163)	(0.278)	(0.415)
	(t-statistic)	(5.117)	(0.155)	(-1.557)	(1.322)	(2.275)
E.U.	Estimate	0.231***				
	(s.e.)	(0.059)				
	(t-statistic)	(3.911)				
European Free Trade Area	Estimate	0.606***				
	(s.e.)	(0.128)				
	(t-statistic)	(4.738)				
E.U. FTAs	Estimate	-0.130**				
	(s.e.)	(0.052)				
	(t-statistic)	(-2.514)				
NAFTA	Estimate	0.405***				
	(s.e.)	(0.138)				
	(t-statistic)	(2.945)				

Mercosur	Estimate					
	(s.e.)					
	(t-statistic)					
CMAS FTAs	Estimate	0.841***				
	(s.e.)	(0.258)				
	(t-statistic)	(3.262)				
AFTA	Estimate					
	(s.e.)					
	(t-statistic)					
SAARC	Estimate					
	(s.e.)					
	(t-statistic)					
Other FTAs	Estimate	0.078				
	(s.e.)	(0.104)				
	(t-statistic)	(0.751)				
Constant	Estimate	-28.840***	-32.626***	-41.206***	-41.750***	-55.280***
	(s.e.)	(0.995)	(8.812)	(6.796)	(6.277)	(13.842)
	(t-statistic)	(-28.996)	(-3.702)	(-6.063)	(-6.651)	(-3.994)
Observations		25,367	398	398	263	250
R-squared		0.620	0.855	0.849	0.842	0.675
Adjusted R-squared		0.619	0.851	0.845	0.837	0.663
RMSE		1.094	0.567	0.562	0.725	1.102
F-statistic		…	…	…	…	…
Number of clusters		3491	38	38	28	29

*Note 1: Two-stage least squares with robust standard errors determined by clustering ordered country pairs. Dependent variable is log real bilateral trade, Tij (country i exports to importing country j). Instruments for the (assumed) endogenous purchasing power parity GDP variables are the contemporaneous product of population levels in partner countries, one-year lagged value of the product of purchasing power parity GDP levels in partner countries, and one-year lagged value of the product of GDP per capita levels in partner countries. *,**,*** denote statistical significance at the 10, 5, and 1 percentage levels.*

Note 2: Trade agreements represented by indicator variables are: European Union (E.U.); European Free Trade Area (EFTA); EU bilateral free trade agreements (EU FTAs); North American Free Trade Area (NAFTA); Southern Common Market (Mercosur); Chile, Mexico, Australia, and Singapore bilateral free trade agreements (CMAS FTAs); ASEAN Free Trade Area (AFTA); SAARC Preferential Trading Arrangement (SAPTA); and all other customs unions and free trade agreements (Other FTAs).

Note 3: No coefficient estimate is reported when there is insufficient variation in the explanatory variable. Trade agreement variables are dropped from the U.S. and China. regressions.

Figure A3: U.S. Aggregate Merchandise Exports (SITC 0-9): Actual vs Predicted Trade, 1995-2022 (US$ millions at 2011 prices)

				Predicted U.S. exports using		
Year	Export country	Import country	Actual U.S.-China trade	All-country coefficients	U.S. export coefficients	China import coefficients
1995	U.S.	China	22,499	9,055	5,445	29,347
1996	U.S.	China	21,951	10,366	6,455	34,002
1997	U.S.	China	21,640	11,873	7,658	39,417
1998	U.S.	China	21,908	13,406	8,920	44,953
1999	U.S.	China	24,772	15,166	10,417	51,413
2000	U.S.	China	27,769	17,172	12,183	58,897
2001	U.S.	China	31,699	18,833	13,678	65,054
2002	U.S.	China	32,199	20,971	15,666	73,196
2003	U.S.	China	39,533	23,714	18,309	83,918
2004	U.S.	China	51,214	27,134	21,724	97,533
2005	U.S.	China	54,590	31,232	25,977	114,161
2006	U.S.	China	64,819	36,275	31,426	135,043
2007	U.S.	China	74,261	42,399	38,335	160,979
2008	U.S.	China	85,157	46,551	43,125	178,281
2009	U.S.	China	79,803	49,090	46,053	188,362
2010	U.S.	China	104,438	56,005	54,457	218,367
2011	U.S.	China	123,124	62,088	62,076	245,009
2022 L	U.S.	China	…	166,340	215,138	721,121
2022 M	U.S.	China	…	195,518	265,292	872,759
2022 H	U.S.	China	…	229,526	326,605	1,054,722
2022 L/H	U.S.	China	…	205,529	283,018	925,627

Note 1: Authors' calculations using the accompanying gravity model coefficient estimates for 2008-11 (shaded years), for trade by all countries, trade by the U.S. only and trade by China only. Trade predictions for 2022 are based on the accompanying low (L), medium (M), and high (H) growth scenarios for the decade ending 2022 for the U.S. and China, assuming current population growth rates in the two countries. The L/H scenario predictions assume low U.S. growth and high China growth for the decade ending 2022.

Note 2: For the purposes of making projections to 2022, an adjustment factor of 2.6 was applied to the predicted value in 2022 using all-country coefficients. The adjustment factor is based on the average annual change in the ratio of U.S. actual to predicted exports to China for 2000-2011, projected forward from 2011 to 2022, and the authors' judgment.

Figure A4: China Aggregate Merchandise Exports (SITC 0-9): Actual versus Predicted Trade, 1995-2022 (US$ millions at 2011 prices)

				Predicted China exports using		
Year	Export country	Import country	Actual U.S.-China trade	All-country coefficients	China export coefficients	U.S. import coefficients
1995	China	U.S.	67,706	9,055	39,771	10,453
1996	China	U.S.	73,911	10,366	45,382	12,507
1997	China	U.S.	87,364	11,873	51,811	14,975
1998	China	U.S.	97,445	13,406	58,321	17,588
1999	China	U.S.	111,583	15,166	65,779	20,714
2000	China	U.S.	133,558	17,172	74,262	24,430
2001	China	U.S.	132,249	18,833	81,250	27,603
2002	China	U.S.	157,664	20,971	90,251	31,845
2003	China	U.S.	190,127	23,714	101,803	37,525
2004	China	U.S.	240,936	27,134	116,177	44,928
2005	China	U.S.	291,009	31,232	133,365	54,229
2006	China	U.S.	334,156	36,275	154,471	66,264
2007	China	U.S.	363,152	42,399	180,048	81,674
2008	China	U.S.	371,901	46,551	197,247	92,464
2009	China	U.S.	317,681	49,090	207,638	99,110
2010	China	U.S.	389,305	56,005	236,306	118,232
2011	China	U.S.	417,303	62,088	261,444	135,705
2022 L	China	U.S.	…	166,340	684,681	502,810
2022 M	China	U.S.	…	195,518	803,686	626,480
2022 H	China	U.S.	…	229,526	942,203	779,236
2022 L/H	China	U.S.	…	205,529	844,460	670,486

Note 1: Authors' calculations using the accompanying gravity model coefficient estimates for 2008-11 (shaded years), for trade by all countries, trade by the U.S. only and trade by China only. Trade predictions for 2022 are based on the accompanying low (L), medium (M), and high (H) growth scenarios for the decade ending 2022 for the U.S. and China, assuming current population growth rates in the two countries. The L/H scenario predictions assume low U.S. growth and high China growth for the decade ending 2022.

Note 2: For the purposes of making projections to 2022, an adjustment factor of 1.2 was applied to the predicted value in 2022 using China's export coefficients. The adjustment factor is based on the average annual change in the ratio of Chinese actual to predicted exports to the U.S. for 2000-11, projected forward from 2011 to 2022, and the authors' judgment.

Figure A5: U.S. Aggregate Exports of Services (All Categories): Actual vs Predicted Trade, 1995-2022 (US$ millions at 2011 prices)

				Predicted U.S. exports using		
Year	Export country	Import country	Actual U.S.-China trade	All-country coefficients	China export coefficients	U.S. import coefficients
1995	U.S.	China	…	914	811	317
1996	U.S.	China	…	1,072	1,002	421
1997	U.S.	China	…	1,259	1,239	560
1998	U.S.	China	…	1,454	1,497	722
1999	U.S.	China	4,978	1,682	1,815	935
2000	U.S.	China	6,233	1,950	2,206	1,215
2001	U.S.	China	6,551	2,174	2,545	1,472
2002	U.S.	China	6,859	2,470	3,014	1,848
2003	U.S.	China	6,644	2,861	3,663	2,404
2004	U.S.	China	8,325	3,363	4,539	3,210
2005	U.S.	China	9,430	3,982	5,680	4,344
2006	U.S.	China	11,462	4,767	7,213	6,000
2007	U.S.	China	13,896	5,752	9,259	8,410
2008	U.S.	China	15,743	6,426	10,720	10,238
2009	U.S.	China	16,413	6,833	11,616	11,389
2010	U.S.	China	21,512	8,005	14,336	15,133
2011	U.S.	China	…	9,059	16,892	18,883
2022 L	U.S.	China	…	28,709	77,578	146,319
2022 M	U.S.	China	…	35,683	103,849	217,951
2022 H	U.S.	China	…	44,276	138,702	323,648
2022 L/H	U.S.	China	…	38,159	113,622	246,432

Note 1: Authors' calculations using the accompanying gravity model coefficient estimates for 2008-11 (shaded years), for trade by all countries, trade by the U.S. only and trade by China only. Trade predictions for 2022 are based on the accompanying low (L), medium (M), and high (H) growth scenarios for the decade ending 2022 for the U.S. and China, assuming current population growth rates in the two countries. The L/H scenario predictions assume low U.S. growth and high China growth for the decade ending 2022.

Note 2: For the purposes of making projections to 2022, an adjustment factor of 1.0 was applied to the predicted value in 2022 using U.S. export coefficients. The adjustment factor is based on the average annual change in the ratio of U.S. actual to predicted exports to China for 2000-10, projected forward from 2010 to 2022, and the authors' judgment.

Figure A6: China Aggregate Exports of Services (All Categories): Actual vs Predicted Trade, 1995-2022 (US$ millions at 2011 prices)

				Predicted China exports using		
Year	Export country	Import country	Actual U.S.-China trade	All-country coefficients	China export coefficients	U.S. import coefficients
1995	China	U.S.	…	914	621	895
1996	China	U.S.	…	1,072	780	1,100
1997	China	U.S.	…	1,259	982	1,352
1998	China	U.S.	…	1,454	1,204	1,626
1999	China	U.S.	3,345	1,682	1,484	1,962
2000	China	U.S.	3,954	1,950	1,832	2,372
2001	China	U.S.	4,293	2,174	2,139	2,727
2002	China	U.S.	4,788	2,470	2,569	3,215
2003	China	U.S.	4,429	2,861	3,173	3,890
2004	China	U.S.	6,407	3,363	4,003	4,795
2005	China	U.S.	6,913	3,982	5,105	5,970
2006	China	U.S.	10,183	4,767	6,617	7,541
2007	China	U.S.	11,419	5,752	8,677	9,626
2008	China	U.S.	9,775	6,426	10,167	11,103
2009	China	U.S.	8,427	6,833	11,085	12,000
2010	China	U.S.	10,188	8,005	13,926	14,739
2011	China	U.S.	…	9,059	16,638	17,301
2022 L	China	U.S.	…	28,709	86,589	76,402
2022 M	China	U.S.	…	35,683	119,014	101,776
2022 H	China	U.S.	…	44,276	163,178	135,277
2022 L/H	China	U.S.	…	38,159	131,277	111,184

Note 1: Authors' calculations using the accompanying gravity model coefficient estimates for 2008-11 (shaded years), for trade by all countries, trade by the U.S. only and trade by China only. Trade predictions for 2022 are based on the accompanying low (L), medium (M), and high (H) growth scenarios for the decade ending 2022 for the U.S. and China, assuming current population growth rates in the two countries. The L/H scenario predictions assume low U.S. growth and high China growth for the decade ending 2022.

Note 2: For the purposes of making projections to 2022, an adjustment factor of 0.5 was applied to the predicted value in 2022 using China's export coefficients. The adjustment factor is based on the average annual change in the ratio of Chinese actual to predicted exports to the U.S. for 2000-10, projected forward from 2010 to 2022, and the authors' judgment.

Figure A7: Actual-to-Predicted Ratios: Bilateral U.S.-China Trade Using 'Sliding' Adjustment Factors, 2000-22

	U.S.				China			
	U.S. merchandise exports to China[1]	Adjustment factor	U.S. service exports to China[2]	Adjustment factor	China Merchandise exports to the U.S.[3]	Adjustment factor	China service exports to the U.S.[4]	Adjustment factor
2000	0.99	(1.6)	1.03	(2.7)	1.06	(1.7)	0.96	(2.3)
2001	1.01	(1.7)	1.00	(2.6)	0.97	(1.7)	0.99	(2.0)
2002	0.91	(1.7)	0.94	(2.4)	1.05	(1.7)	1.03	(1.8)
2003	0.97	(1.7)	0.80	(2.3)	1.14	(1.6)	0.86	(1.6)
2004	1.07	(1.8)	0.86	(2.1)	1.28	(1.6)	1.09	(1.5)
2005	0.98	(1.8)	0.83	(2.0)	1.36	(1.6)	1.03	(1.3)
2006	0.98	(1.8)	0.85	(1.9)	1.36	(1.6)	1.31	(1.2)
2007	0.94	(1.9)	0.85	(1.8)	1.28	(1.6)	1.24	(1.1)
2008	0.97	(1.9)	0.89	(1.7)	1.21	(1.6)	1.01	(0.9)
2009	0.84	(1.9)	0.91	(1.6)	0.99	(1.5)	0.89	(0.9)
2010	0.95	(2.0)	1.03	(1.5)	1.08	(1.5)	0.96	(0.8)
2011	0.99	(2.0)	…	…	1.06	(1.5)	…	…
2022	…	(2.6)	…	(1.2)	…	(1.0)	…	(0.5)

Note: 'Sliding' adjustment factors are based on the average annual change in the ratio of actual to predicted bilateral exports for 2000-11 (2000-10 for service exports). Adjustment factors for 2022 are 2011 (or 2010) adjustment factors projected forward to 2022, with judgements by the authors.

1 Actual-to-predicted trade calculated using all-country coefficients (see Figure A3) and adjustment factor rising at 1.9% per annum.
2 Actual-to-predicted trade calculated using U.S. export coefficients (see Figure A5) and adjustment factor declining at -1.1% per annum.
3 Actual-to-predicted trade calculated using China export coefficients (see Figure A4) and adjustment factor declining at -6.1% per annum.
4 Actual-to-predicted trade calculated using China export coefficients (see Figure A6) and adjustment factor declining at -10.3% per annum.

Figure A8: U.S.-China Trade Analysis – Four Scenarios (Simulation results in US$ billions)

	WEO (U.S.)		WEO (CHN)		Gravity Model (U.S.)				Gravity Model (CHN)			
	U.S. CAB	U.S.-CHN CAB	CHN CAB	U.S.-CHN CAB	U.S. CAB	U.S.-CHN CAB	Gds Xs U.S.⇒CHN	Svcs Xs U.S.⇒CHN	CHN CAB	U.S.-CHN CAB	Gds Xs CHN⇒U.S.	Svcs Xs CHN⇒U.S.
Year	At current prices											
2000	-416.3	-83.4	20.5	83.4	-416.3	-83.4	22.4	5.0	20.5	83.4	107.6	3.2
2001	-396.6	-81.3	17.4	81.3	-396.6	-81.3	26.2	5.4	17.4	81.3	109.4	3.6
2002	-457.2	-104.5	35.4	104.5	-457.2	-104.5	27.3	5.8	35.4	104.5	133.5	4.1
2003	-519.1	-127.5	45.9	127.5	-519.1	-127.5	33.9	5.7	43.1	127.5	163.3	3.8
2004	-628.5	-164.1	68.7	164.1	-628.5	-164.1	44.8	7.3	68.9	164.1	210.5	5.6
2005	-745.8	-208.8	134.1	208.8	-745.8	-208.8	48.7	8.4	132.4	208.8	259.8	6.2
2006	-800.6	-245.3	232.7	245.3	-800.6	-245.3	59.3	10.5	231.8	245.3	305.8	9.3
2007	-710.3	-268.2	353.9	268.2	-710.3	-268.2	69.6	13.0	353.2	268.2	340.1	10.7
2008	-677.1	-269.0	412.4	269.0	-677.1	-269.0	81.6	15.1	420.6	269.0	356.3	9.4
2009	-381.9	-224.0	261.0	224.0	-381.9	-224.0	77.8	16.0	243.3	224.0	309.5	8.2
2010	-442.0	-269.2	237.6	269.2	-442.0	-269.2	102.7	21.2	237.8	269.2	383.0	10.0
2011	-465.9	…	201.7	…	-465.9	…	123.1	…	201.7	…	417.3	…
	Projections at 2011 prices											
2012	-478.7	-430.8	185.8	185.8	…	…	…	…	…	…	…	…
2013	-484.8	-436.3	211.8	211.8	…	…	…	…	…	…	…	…
2014	-500.9	-450.8	258.6	258.6	…	…	…	…	…	…	…	…
2015	-532.5	-479.2	315.4	315.4	…	…	…	…	…	…	…	…
2016	-575.6	-518.0	399.8	399.8	…	…	…	…	…	…	…	…
2017	-623.0	-560.7	488.0	488.0	…	…	…	…	…	…	…	…
2018	-643.7	-579.3	524.2	524.2	…	…	…	…	…	…	…	…
2019	-665.1	-598.6	563.2	563.2	…	…	…	…	…	…	…	…
2020	-687.3	-618.6	605.0	605.0	…	…	…	…	…	…	…	…
2021	-710.2	-639.2	649.9	649.9	…	…	…	…	…	…	…	…
	2022 projections at 2011 prices											
Scenario 1												
a. M - M	-733.8	-440.3	698.2	698.2	-686.2	-411.7	508.3	103.8	411.7	411.7	964.4	59.5
b. L - L	…	…	…	…	-591.4	-354.9	432.5	77.6	354.9	354.9	821.6	43.3
c. H - H	…	…	…	…	-794.6	-476.8	596.8	138.7	476.8	476.8	1,130.6	81.6
d. L (US) - H (CHN)	…	…	…	…	-718.3	-431.0	534.4	113.6	431.0	431.0	1,013.4	65.6
Scenario 2	…	…	…	…	-455.2	-180.7	580.1	118.5	-294.9	180.7	828.3	51.1
Scenario 3	…	…	…	…	-649.7	-375.2	544.9	103.8	375.2	375.2	964.4	59.5
Scenario 4	…	…	…	…	-441.9	-167.4	544.9	341.9	167.4	167.4	991.6	62.6
Proportional trade gains	…	…	…	…	…	…	1.07	3.29	…	…	1.03	1.05

U.S. = United States; CHN = China; CAB = Current account balance; Gds Xs = Goods exports; Svcs Xs = Services exports; RMB = Renminbi

Note 1: Trade figures for 2000-11 are historical values at current prices. Values projected for 2012-22 are at constant 2011 prices. The WEO projections are calculated by the authors using WEO projections for rates of growth and current account balances relative to GDP through 2017, and then assumed constant thereafter. Based on recent observations, the WEO U.S.-China CAB is assumed equal to 60% of the WEO projection of the overall U.S. CAB, while the WEO China-U.S. CAB is assumed equal to the WEO projection of the overall China CAB.

Note 2: Scenario 1 results assume no RMB real appreciation and are calculated for four different growth scenarios: low (L), medium (M), and high (H) growth scenarios for the decade ending 2022 in the U.S. and China, and the L/H growth scenario which assumes low US growth and high China growth (see Figure 6). Scenario 1a represents the central scenario of the analysis; Scenario 2 results assume RMB real appreciation through 2016; Scenario 3 results from China unilateral merchandise trade liberalization (applied tariffs, n = -1.0); Scenario 4 results from U.S.-China mutual accomodation towards FTAAP (with services trade liberalization). Proportional trade gains under U.S.-China mutual accommodation calculated as Scenario 4/Scenario 1.

Figure A9: Scenario 2 – RMB Real Appreciation

Note: Change in CAB relative to GDP equals Cline-Williamson (CW) parameter times the proportional change in REER assuming 7.5% per annum growth in China GDP, 2012-22

China CAB
CH_CAB / GDP = CW Parameter * (%CH_REER / 100)
CAB = [CW Parameter * (%CH_REER / 100) * GDP_2022] + CAB_2022
CAB = [CW Parameter * (%CH_REER / 100) * GDP_2022] + CAB_2022
CAB = [CW Parameter * ((REER / REER_2022) - 1) * GDP_2022] + CAB_2022
CAB = [(-0.31) * (0.14) * (16169.8)] + 411.7
CAB = -290.1 (result reflects rounding)

US Exports to China, assuming US$/RMB and RMB REER appreciate at same rate and import price elasticity n = -1
USxCHN = $USxCHN_2022 + [%CH_USxCHN * $USxCHN_2022]
USxCHN = $USxCHN_2022 + [n * (-1 * (REER / REER_2022) - 1) * $USxCHN_2022]
USxCHN = 508.3 + [-1 * (-1 * 0.14)] * 508.3
USxCHN = 579.5 (result reflects rounding)

China exports to the US, assuming US$/RMB and RMB REER appreciate at same rate and import price elasticity n = -1
CHNxUS = $CHNxUS_2022 + [%CH_CHNxUS * $CHNxUS_2022]
CHNxUS = $CHNxUS_2022 + [n * (1 * (REER / REER_2022) - 1) * $CHNxUS_2022]
CHNxUS = 964.4 + [-1 * (1 * 0.14)] * 964.4
CHNxUS = 829.4 (result reflects rounding)

US-CHN CAB (= - CHN-US CAB)
CAB_US-CHN = CAB_US-CHN_2022 + CH_TRDBAL_US-CHN + CH_SVCBAL_US-CHN
CAB_US-CHN = -411.7 + 207.8 + 23.1
CAB_US-CHN = -180.8 (result reflects rounding)

US CAB
CAB_US = CAB_US_2022 + CH_CAB_US-CHN
CAB_US = -686.2 -180.8 + 411.7
CAB_US = -455.3 (result reflects rounding)

US = United States; CHN = China; CAB = Current account balance; RMB = Renminbi; REER = Real Effective Exchange Rate

Figure A10: Scenario 3 – China Unilateral Merchandise Trade Liberalization

Note: Change in CAB equals negative change in merchandise imports owing to tariff elimination, assuming import price elasticity n = -1

US exports to China
USxCHN = $USxCHN_2022 + [%CH_USxCHN * $USxCHN_2022]
USxCHN = $USxCHN_2022 + [n * (-1 * t_2022 / (1 + t_2022)) * $USxCHN_2022]
USxCHN = 508.3 + [-1 * (-1 * 0.077 / 1.077)] * 508.3]
USxCHN = 544.6 (result reflects rounding)

US-CHN CAB (= - CHN-US CAB)
CAB_US-CHN = CAB_US-CHN_2022 + CH_TRDBAL_US-CHN
CAB_US-CHN = -411.7 + 36.3
CAB_US-CHN = -375.4 (result reflects rounding)

US CAB
CAB_US = CAB_US_2022 + CH_CAB_US-CHN
CAB_US = -686.2 + 36.3
CAB_US = -649.9 (result reflects rounding)

US = United States; CHN = China; CAB = Current account balance

Figure A11: Scenario 4 – U.S.-China Mutual Accommodation towards FTAAP (with Services Trade Liberalization)
Note: Change in imports owing to tariff elimination on merchandise trade, assuming import price elasticity n = -1, and service trade liberalization

US Exports to China
USxCHN = $USxCHN_2022 + [%CH_USxCHN * $USxCHN_2022]
USxCHN = $USxCHN_2022 + [n * (-1 * t_2022 / (1 + t_2022)) * $USxCHN_2022]
USxCHN = 508.3 + [-1 * (-1 * 0.077 / 1.077)] * 508.3]
USxCHN = 544.6 (result reflects rounding)

China goods exports to the US
CHNxUS = $CHNxUS_2022 + [%CH_CHNxUS * $CHNxUS_2022]
CHNxUS = $CHNxUS_2022 + [n * (-1 * t_2022 / (1 + t_2022)) * $CHNxUS_2022]
CHNxUS = 964.4 + [-1 * (-1 * 0.029 / 1.029)] * 964.4]
CHNxUS = 991.6 (result reflects rounding)

US-CHN CAB (= - CHN-US CAB) – with services trade liberalization
CAB_US-CHN = CAB_US-CHN_2022 + CH_TRDBAL_US-CHN + CH_SVCBAL_US-CHN
CAB_US-CHN = -167.3 (result reflects rounding)

US CAB
CAB_US = CAB_US_2022 + CH_CAB_US-CHN
CAB_US = -686.2 + 244.3
CAB_US = 441.9 (result reflects rounding)

TL = Trade liberalization; FTAAP = Free Trade Area of the Asia-Pacific; CAB = Current account balance; US = United States; CHN = China

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