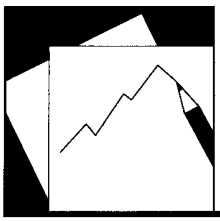
WP/10/165



IMF Working Paper

China's Economic Growth: International Spillovers

Vivek Arora and Athanasios Vamvakidis

INTERNATIONAL MONETARY FUND

 WP/10/165

IMF Working Paper

Asia and Pacific Department and Strategy, Policy, and Review Department

China's Economic Growth: International Spillovers

Prepared by Vivek Arora and Athanasios Vamvakidis[1]

July 2010

Abstract

This paper presents some facts on China's role in the world economy and measures the impact of China's growth on growth in the rest of the world in the short and long term. Short-run estimates based on VARs and error-correction models suggest that spillover effects of China's growth have increased in recent decades. Long-term spillover effects, estimated through growth regressions based on panel data, are also significant and have extended in recent decades beyond Asia. The estimates are robust to the effects of global and regional shocks, changes in model specification, and sample period.

JEL Classification Numbers: F15, F43

Keywords: China, growth, spillovers

Author's E-Mail Address: varora@imf.org; avamvakidis@imf.org

[1] The authors are grateful to Tam Bayoumi, Nigel Chalk, Stephan Danninger, Ken Kang, Prakash Loungani, Martin Muhleisen, and Hui Tong for helpful comments and to Zhang Shi Ting and Adil Mohommad for assistance with the data. We are solely responsible for the contents of the paper.

Contents Page

I. INTRODUCTION

The pace and scale of China's economic development since the launch of its "reform and opening-up" strategy in 1978 is one of the most significant economic stories of our times. The size of the economy has increased nearly twenty-fold in U.S. dollar terms in the last 30 years. Real GDP growth has averaged 10 percent annually, with the implication that GDP has doubled every 7–8 years. Several hundred million people have risen out of poverty and living conditions have improved in a variety of dimensions. These improvements have occurred at a faster pace than was experienced in Europe during the Industrial Revolution or in the United States after the opening up of the American West in the 19th century. As Summers (2007) points out, the fact that these developments have influenced a population that accounts for one-fifth of the world's people makes China's rapid growth one of the most important economic developments of our lifetimes.

In addition to its domestic implications, China's rapid and sustained growth in recent decades has had implications for the global economy. "Opening up", as the name implies, has involved growing linkages between China and the rest of the world that are reflected in China's growing share in world trade, in global markets for several goods, in capital flows to and from the rest of the world, in the use of China's currency in other countries, and in a closer correlation of market sentiment in China and the rest of Asia (and, more recently, the world). And the "reforms" that have given the private sector larger play in the Chinese economy include a role for the foreign private sector in a variety of sectors, including producers of exports from China, suppliers of intermediate products and commodities, and producers of final goods and services.

Yet little empirical work has been done to assess the implications of China's economic growth for the rest of the world. Such analysis as exists has focused on China's role in specific markets, such as its demand for commodities, automobiles, processing inputs, and, in terms of financial assets, U.S. Treasury securities. An important paper is Eichengreen and Tong (2006) that examines how China's exports affect the exports of other countries and assesses the impact of China's foreign investment flows. Less attention has been paid in the literature, however, to the impact of China's economic growth on its neighbors and on the world at large. This paper attempts to provide such an assessment by providing estimates of the impact of China's economic growth on growth in the rest of Asia and in the world economy over the past 5 decades.

China's growth could influence other countries' growth through a number of channels. First, China's imports of commodities, processing inputs, and, increasingly, final products has a direct positive impact on partner countries' exports and GDP. In turn, China's exports of goods to other countries have a negative direct effect on those countries' net exports. The indirect effects on welfare and GDP could, however, be positive as the availability of relatively low-cost products from China raises consumption and production possibilities in partner countries. Second, China's demand for key inputs, such as commodities, can affect

the world prices for these inputs and thus influence the terms of trade for other countries. Third, China's role in processing trade has implications for other Asian countries that constitute the "Asian supply chain," where final goods are exported from China but use for their production substantial inputs from the rest of Asia. As Deichmann and Gill (2008) point out, this supply chain allows other Asian countries, particularly smaller countries, more access to global markets than they would have otherwise had. Fourth, capital flows to China, in the form of FDI and portfolio flows, and from China, in the form of Chinese purchases of foreign Treasury and private securities, can have an impact on the global demand and supply of capital. Fifth, developments in China seem to have spillover effects on market confidence in other countries. And the list can go on.

This paper presents a quantification of the overall impact of China's growth on growth in the rest of the world using data for the last 5 decades. It assesses the impact both over the business cycle and over the long term. In light of the multiple channels by which China's growth could influence growth in other countries, and the difficulty of identifying (leave alone quantifying) each channel, the analysis does not attempt to isolate each such channel. It focuses instead on quantifying the aggregate impact. Future research could assess the importance of alternative channels through which the growth spillovers might be transmitted.

The rest of the paper is organized as follows: section II discusses China's role in the world economy based on several metrics, particularly its share in the external trade of other countries; section III assesses the impact of China's growth on other countries at a business-cycle frequency using vector autoregressions (VARs); section IV assesses the longer-term impact based on countries' average growth rates during 5-year sub-periods that avoid the impact of shorter-run macroeconomic fluctuations that may be associated with transitory shocks and business cycles; and section V concludes.[2]

II. China as a Trade Partner

China's shares in world trade and GDP have increased several-fold over the last 3 decades with the implementation of its "reforming and opening-up" strategy. China's rapid growth has contributed to an increase in its share in world GDP from 2 percent (PPP basis) in 1980 to nearly 12 percent in 2008. And, with respect to world trade, in 1980 China accounted for just 1 percent of world trade flows, while by 2008 it accounted for over 8 percent (Table 1). Put another way, trade with China accounted for just 0.3 percent of world GDP (market exchange rates) in 1980 while by 2008 it accounted for 4.4 percent of world GDP. In part reflecting China's large trade surplus, China accounts for a larger share of other countries' imports than of their exports. As of 2008, China accounted for 6 percent and 10 percent,

[2] The methodology in Section IV is similar to the one used by Arora and Vamvakidis (2004, 2005a) to examine growth spillovers in other parts of the world.

respectively, of the rest of the world's exports and imports, compared with just 1 percent each in 1980.

While China's share in world trade has increased dramatically in recent decades it is still small compared with the United States. The size of China's GDP at current exchange rates is only one-fifth that of the United States, and that of its private consumption is only around one-eighth that of the United States (IMF, 2009). Moreover, China accounts for only 3 percent of world imports of consumer goods and for only 4 percent of world import growth. China could not, therefore, replace the United States as a "global consumer" in the short run. However, it is still an important trading partner for many countries and its growth could have spillover effects on growth in other countries through its demand for specific products, or through indirect channels.

The increase in China's share of world trade is particularly striking in the markets for certain products. China's share in world imports of commodities grew from negligible levels in the 1980s to 4 percent by 2000, and further to 8 percent by 2008 (Figure 1). Its share in world exports of medium- and high-technology manufactured goods rose from similarly low levels in the 1980s to 5 percent by 2000, and to 12 percent by 2008 (Figure 2).[3] During this period, China moved from being an exporter mainly of apparel and oil products to becoming a major exporter of electronic and information technology products, such as consumer electronics and office and communications equipment. Since 2002, for example, China has been the largest supplier of U.S. consumer electronics products (e.g., DVD players, notebook computers, and mobile phones) and information technology hardware (Branstetter and Lardy, 2006).

China's rising share in world trade over the past 3 decades is underpinned by a rise in its share in the external trade of each major region (Table 2). Indeed, the rise has to be counted in multiples, and not in percentages. China's share is, perhaps unsurprisingly, largest in the trade of other emerging Asian countries, accounting for nearly 12 percent of both their exports and imports in 2008. The share of China in other Asian countries' exports and imports increased 10-fold and 5-fold, respectively, during 1980–2008. During the past decade, China accounted for 8 percent of the rest of Asia's trade, compared with just 2 percent during 1980–89 (Figure 3).[4] Among African and Middle Eastern countries, external trade with China accounts for just over and just under one-tenth of total external trade,

[3] The high market share in "high-tech" goods overstates, however, China's technological input in these products. Some goods (such as computers) are classified in the trade data as high-tech, although their production is largely standardized and is based in large part on imported inputs. In a much-quoted example in popular discussion, the typical iPod, for example, leaves the factory gate at a price of $150, of which all but $5 is based on imported inputs and technology.

[4] The share, while rising rapidly, is still smaller than the share of the United States in the external trade of other Western Hemisphere countries (around 25 percent during 2000-2009) and also smaller than the share of Japan in the rest of Asia's trade (14 percent). The share of Japan is, however, just half of its level 2 decades ago.

respectively, compared with negligible proportions in 1980. For Western Hemisphere countries, China's share in external trade rose 15-fold during 1980–2008, to nearly 8 percent. And for the European Union, it rose 10-fold to 4 percent.

The rising share of China in the external trade of each major region is reflected in turn in the trade of major countries (Table 3). For the United States, the share of China in its trade rose to 12 percent by 2008, compared with just 1 percent in 1980. For France, Germany, Italy, and the UK, the share of China rose to 3–5 percent in 2008 from one-tenth that level in 1980. Among the Asian G-20 countries, China's share in external trade ranges from 10 percent (Indonesia) to 22 percent (Korea). The increase relative to 1980 is, again, to be measured in multiples. The share of China in India's trade, for example, has grown from less than 1 percent to nearly 12 percent. Its share has also multiplied several times in the trade of Argentina, Brazil, Mexico, and South Africa.

In public discussion, a common way of framing the role of China in world trade is to discuss the contribution of net exports to China to countries' GDP growth. On this basis, as China's trade surplus has grown over time, the arithmetic would suggest that the direct impact of net exports to China on growth should be negative for most countries.[5] This in fact turns out to be the case, although the impact is relatively small (Table 4). In the United States, the growing trade deficit over the past decade was reflected in a -0.1 percentage contribution of total net exports to GDP growth annually during 2001–08, with net imports from China making a slightly larger contribution relative to the total. A similar negative impact was recorded for the UK, while for France, Germany, and Italy net imports from China made a very small (less than -0.1 percentage point) negative contribution. A striking exception is Asia, where net exports to China have made relatively large positive contributions to growth in many economies, in part reflecting the inputs that other Asian economies export to China as part of the "Asian supply chain." Growth contributions have been particularly large for Hong Kong SAR, Korea, Malaysia, the Philippines, and Taiwan Province of China.

However, the direct contribution of net exports to growth does not tell a full story, and perhaps not even an accurate one, about the impact of growth spillovers from one country to others. It misses other potential gains from trade, including technological spillovers, efficiency gains, and impacts on sectors not directly involved in bilateral trade. Indeed, countries can benefit from trade even when their net exports are not increasing. Furthermore, the spillover effects of China's growth are likely to extend beyond just the trade channel, including through an influence on business and consumer sentiment in other countries and through financial linkages, particularly with Chinese capital flows being increasingly important for other countries. FDI inflows into China, for example, accounted for 7 percent

[5] That is, the contribution of a country's real net exports (NX) to its real GDP (Y) growth in year t can be calculated as $\Delta NX_t/Y_{t-1}$, and the contribution of its real net exports to China (NX^{China}) can be calculated as $\Delta NX_t^{China}/Y_{t-1}$.

of gross world FDI inflows in 2009, compared with only 1 percent in 1980. FDI outflows from China are a more recent phenomenon, rising from a negligible share of gross global outflows as recently as 2004 to 4 percent of global outflows as of 2009 (Figure 4). A proper analysis of the impact of Chinese growth thus requires a more formal econometric estimation that accounts for all of these spillover channels. This is taken up below.

III. Growth Spillovers: Impact of China's Economic Growth over the Business Cycle

Estimation and results

Given China's close trade and capital linkages with other countries, fluctuations in China's GDP growth might be expected to have a nearly immediate impact on GDP growth in neighboring countries and in the world at large. This section analyzes this potential impact estimating an unrestricted panel VAR and a vector error correction model. We also estimate the extent to which this impact is transmitted through trade channels. Estimates from variance decomposition allow one to examine the importance for other countries' growth of shocks from growth in China relative to shocks from other external variables. The sample is an unbalanced panel of annual data, for 172 economies, for the period 1960–2007. Taking into account this relatively long period allows for comparisons that put the estimates for recent decades into perspective.

The results suggest that the role of China's growth in explaining output fluctuations in other countries has increased substantially in recent decades, and is now one of the key external variables that explain such fluctuations. An unrestricted panel VAR shows that the cumulative response of GDP growth in the rest of the world to a Cholesky 1-standard-deviation in China's GDP growth, while close to zero for the full 1960-2007 period, is large for the last 2 decades. The cumulative response reaches 0.4 percentage points after 3 years and 1 percentage point after 5 years (Table 5, row 2).[6] To express it as an elasticity, a 1 percentage point shock to China's GDP growth is followed by a cumulative response in other countries' GDP growth of 0.4 percentage points over 5 years. About 60 percent of the impact of China's growth seems to be transmitted through trade channels, as suggested by a comparison of the response of domestic growth to growth in China with and without the inclusion of trading partner growth as an exogenous variable in the VAR (Table 5, rows 2

[6] To estimate how structural innovations affect the dependent variables, we use a recursive system in which growth in the rest of the world is affected by structural innovations in growth in both the rest of the world and China. But growth in China is affected only by its own structural innovations. This recursive system is a triangular decomposition, also called a Cholesky decomposition. The resulting test statistics depend on the ordering of the variables in the VAR. The impulse responses of growth in the rest of the world to growth in China are statistically significant for the last two decades.

and 3).[7] Estimates from an error correction model confirm, and are even larger than, the VAR estimates. The comparable Cholesky 1-standard-deviation reaches 1.2 percentage points in 3 years and 3.2 percentage points in 5 years (Table 5, row 5).

The VAR results hold when we restrict the sample to only Asia, with some differences (Table 5, row 4). Focusing on 1988–2007, which is the period that drives the results, the estimated impact of growth in China on the rest of Asia is higher than on the rest of the world during the first 3 years. The relatively higher short-term impact of growth in China on the rest of Asia than on the rest of the world is consistent with the discussion in the previous section and the fact that China's net export growth contribution is positive in Asia, but somewhat negative for several large countries in other parts of the world. Once one controls for the effects of trading partner growth, however, the spillover from China on Asian growth is stronger than its spillover on the rest of the world for the full 5 years. The results suggest that over the medium-term other channels dominate the "net exports" channel, as indeed results for the long-term in the next section suggest.

The significant spillover effects from China's growth are also evident under an alternative approach that examines the importance of China's growth relative to the importance of other external variables in explaining world output fluctuations. The approach follows a methodology proposed by Ahmed and Loungani (1999) that uses a dynamic model comprising both domestic variables (real GDP, inflation, and CPI-based real effective exchange rate, all in first differences) and external variables (the real price of oil and the terms of trade, both in first differences, and weighted average growth in trading partners).[8] In addition to these variables, China's real GDP growth is included as an external variable. Given that China's growth is already subsumed in trading partner growth, adding growth in China separately captures spillovers from nontrade-related channels.[9] A variance decomposition from an error correction model then indicates the role of each variable in explaining output fluctuations. Focusing only on external variables, the importance of each variable can be assessed by the forecast error variance of GDP growth explained by each external variable as a percent of variance explained by all external variables.

The results under this approach confirm China's key role compared with other external variables in explaining output fluctuations in other countries (Table 6). As expected, foreign

[7] This approach to estimating the importance of the trade channel follows Bayoumi and Swiston (2007).

[8] Data for GDP and the real effective exchange rate are from the World Bank's World Development Indicators. Data for the oil price, the terms of trade, and inflation are from the IMF's World Economic Outlook database. Growth in trading partners is estimated using data from the IMF's Direction of Trade Statistics, as described in Arora and Vamvakidis (2005).

[9] China's growth enters on a weighted basis as part of trading partners' growth and on an unweighted basis as a separate variable.

output shocks, which comprise shocks coming from trading partner (including Chinese) growth, explain most of the variance in GDP growth that is driven by external variables. They explain 85 percent of the variance one year after the shock, to 79 percent 4 years later. Shocks from oil prices come second, explaining 8–10 percent of output fluctuations during the same period. Shocks from growth in China are next, explaining over 8 percent of the output fluctuations explained by external variables 4 years after the shock. This impact from China's growth is distinct from, and in addition to, the impact from shocks in China's growth that is transmitted through trade channels and is already captured by shocks in trading partner growth. Moreover, the variance decomposition suggests that shocks from growth in China matter more for domestic output fluctuations than do terms of trade shocks.

IV. Growth Spillovers: Implications of China's Economic Growth Over the Long Term

Moving from business-cycle frequencies to the longer term, a panel regression with fixed country effects is used to estimate the impact of long-term growth in China on long-term growth in the rest of the world. The panel controls for other variables that have been found in the literature to have a statistically significant impact on GDP growth. The inclusion of fixed-country effects allows the constant term to differ across cross-section units and captures the time series dimension of the effect of growth in China after controlling for other growth determinants.

The results suggest that growth in China started playing a role in growth in the rest of the world in the last 2 decades, consistent with the above evidence, although countries in Asia were affected by growth in China even in earlier periods. Overall, the links between growth in China and the rest of the world have increased in recent decades, particularly for countries that are relatively far from China. Therefore, distance from China has become less of an obstacle to spillover effects from China over time. Trade is one of the channels of such spillover effects, but there seem to be other channels as well, also consistent with the above evidence.

The empirical framework follows Arora and Vamvakidis (2004 and 2005). It starts with a growth regression specification that is standard in the literature:[10]

$$(\text{Real GDP per capita growth})_i = c_i + \beta X_i + u, \qquad \text{for country } i = 1,\ldots, n \qquad (1)$$

The dependent variable is the average per capita real GDP growth rate (in constant 2000 U.S. dollars); c_i is the matrix of constant terms for each country i; β is the matrix of

[10] See, for example, Barro and Sala-ì-Martin (1995).

parameters to be estimated, X_i is the matrix of independent variables, and u is the error term. The independent variables, X_i, comprise variables that are standard in growth regressions:

- convergence (the logarithm of per capita real GDP in the initial year of the period under consideration);
- demographic developments (age dependency ratio);
- investment in physical capital (gross domestic investment as a percent of GDP);
- human capital (secondary school enrollment ratio);
- trade openness (exports plus imports in percent of GDP);
- size of government (government consumption spending in percent of GDP);
- macroeconomic stability (inflation); and
- a time trend.

In addition, to estimate the impact of growth in China on the rest of the world, X_i includes:

- the growth rate of real per capita GDP in China; and
- interaction terms of the growth rate of real per capita GDP in China with a time trend, the distance from China,[11] the ratio of exports to China and to Hong Kong to GDP, and a dummy variable for Asia.

Finally, in order to test whether the results are driven by trade or by global trends, X_i includes:

- world real per capita GDP growth; and
- growth of real per capita GDP in trading partners.

All data are from the World Bank's World Development Indicators, except when indicated otherwise. Growth in trading partners is estimated using data from the IMF's Direction of Trade Statistics, as described in Arora and Vamvakidis (2005). The regression is estimated using 5-year averages for the time period 1963–2007, except for the initial GDP per capita, which takes the value of the first year of each five-year period.[12] To test robustness, we also estimate specifications for a more recent period, namely 1988–2007. The sample includes all economies with available data, a total of 151 economies.[13] The use of a fixed rather than a random-effects model is justified by a Hausman test, which rejects the hypothesis that the individual effects are uncorrelated with the other regressors.

[11] Weighted distance of each capital from Beijing.

[12] The results are robust if we use ten-year averages instead.

[13] This is an unbalanced panel, but the results are robust if the sample is limited to countries with observations for the whole period. China is excluded from the sample as its growth rate is one of the independent variables.

The simple growth regression at first seems to suggest that growth in China does not matter for the rest of the world when the whole 1963–2007 period is considered. In a baseline specification for a growth regression that adds the growth rate of real per capita GDP in China as an independent variable, the estimated coefficient of China's growth is statistically insignificant and close to zero (first specification in Table 7). The estimates and levels of significance of the other independent variables, however, are what one would expect from the literature: growth is positively correlated with investment and trade, and negatively correlated with initial per capita GDP, age dependency, government consumption, and inflation. The estimate of secondary school enrollment is not statistically significant, but, as shown below, this depends on the time period. The estimate of the time trend also is not statistically significant, but, as also shown below, this depends on the specification.

However, controlling for the possibility that the spillover impact of China's growth may have changed over time shows that China does matter for the world economy. An interaction term of growth in China with the time trend is positive and statistically significant, while the estimate of growth in China is now negative and statistically significant (second specification in Table 7). These results suggest that the spillover effects from growth in China to the rest of the world have increased over time. The negative estimate when growth in China enters the regression on its own is hard to explain, but, as shown below, is not robust, unlike the positive estimate when China's growth is interacted with a time trend. These results also help to explain why growth in China is not found to matter in the first specification that does not control for its increasing impact over time. The estimates suggest that faster growth in China's per capita GDP by 1 percent is correlated with faster growth in the rest of the world by 0.8 percent in the last period of the sample, controlling for everything else. The estimates suggest that this impact turned positive in the 1980s.

Distance from China also seems to affect the strength of the spillovers from its growth (Table 7, 3rd specification). When an interaction term is added of growth in China with weighted distance from China, the estimated coefficient on China's growth becomes positive and statistically significant, while the estimate of the interaction term is negative and statistically significant. These results suggest that growth in other countries is positively correlated with growth in China, but that the correlation decreases with distance. Controlling for everything else, the estimates suggest that an increase of growth in China by 1 percent is correlated with faster growth by 0.32 percent in Korea, the country that is the closest to China based on our measure of distance. The correlation becomes zero (or negative) for countries at least as far from China as Jamaica (28 countries, out of 151 countries in our sample).

Although the above results suggest that both time and distance affect the links between the Chinese economy and the rest of the world, we find that the role of distance has diminished over time. Over time, China's growth has started affecting countries that are relatively distant

from China. The fourth specification of Table 7 includes, in addition to the interaction term of growth in China with a weighted distance from China, an interaction term of growth in China with a weighted distance from China and with a time trend. The estimate of growth in China is positive and statistically significant, suggesting that faster growth in China is correlated with faster growth in the rest of the world. The estimate of the interaction term of growth in China with weighted distance from China is, as before, negative and statistically significant, suggesting that the positive link between growth in China and in the rest of the world weakens with distance. And the estimate of the interaction term of growth in China with a weighted distance from China and a time trend is positive and statistically significant, suggesting that the role of distance in determining the extent to which China's growth may affect the rest of the world diminishes over time.

Robustness

Tests for robustness using alternative specifications of the regression serve to reinforce the conclusion that links between growth in China and the rest of the world have increased over time, particularly for countries that are relatively far from China.

- When the sample period is changed to include only the last 2 decades, then even in the baseline specification, with no interaction terms, a positive correlation emerges between growth in China and in the rest of the world. The first specification in Table 8 is estimated for the period 1988–2007. The estimate of growth in China is now positive and statistically significant, although at the 10 percent level.

- To test whether trade affects the correlation, the second specification in Table 8 includes an interaction term of growth in China with the ratio of exports to China (including Hong Kong SAR) to GDP.[14] The interaction term is positive and statistically significant, although at the 10 percent level, suggesting that China's growth may have a relatively larger effect on countries that trade more with China.

- The role of distance can be tested by interacting growth in China with a dummy variable for Asia. In the third specification in Table 8, this interaction term has a positive and statistically significant estimate, while the estimate of growth in China is insignificant, suggesting that growth in China matters only for Asia. This is, however, no longer true in recent decades, as shown in the fourth specification of Table 8, where the interaction term of growth in China with the Asia dummy variable is not statistically significant for the period 1988–2007 while the estimate of growth in China is positive and statistically significant, although at the 10 percent level.

[14] We include exports to both China and Hong Kong SAR to address the possibility that some exports to China go through Hong Kong SAR.

- Finally, the results are robust to the inclusion of world growth trends. The fifth specification in Table 8 includes, for each economy, the growth rate of trading partners weighted by export shares. The estimate of trading partner growth is positive and statistically significant (consistent with the results in Arora and Vamvakidis (2005)). The estimate of the interaction term of growth in China with the time trend remains positive and statistically significant, although it is now smaller (compared with the estimate in the second specification in Table 7). The results suggest that although growth spillovers from China do depend on trade, as argued above, there are also other transmission channels. Finally, the last specification in Table 8 includes growth in average world per capita GDP. World per capita GDP growth does not turn out to have a statistically significant estimate and its inclusion does not alter the main results. This suggests that the estimated impact of China's growth is separate from "common shocks" that influence simultaneously growth in both China and the rest of the world.

V. CONCLUSIONS

China's rapid economic growth since 1978 has resulted in a doubling of the country's GDP every 7–8 years. Accompanying, and contributing to, this rapid growth has been a significant expansion in China's external trade. The fact that such a large economy has grown so fast and has become increasingly and quickly integrated with the world economy carries with it a presumption that the spillovers to other countries must have been appreciable. Yet, little work has been done to estimate the size of such spillovers.

This paper estimates such spillovers for both short-run business-cycle frequencies and longer-run averages. Although the estimates are not definitive or comprehensive, they provide a starting point for a quantitative discussion of growth spillovers from China. VAR estimates suggest that the cumulative impact on the rest of the world of a 1-standard deviation shock in Chinese growth reaches 0.4 percentage points over 3 years and 1 percentage point over 5 years. Alternative estimates based on error-correction models and a dynamic model based on domestic and external variables support the conclusion of such a large and significant short-term spillover impact of Chinese growth. Over the longer term, panel regressions based on the last 2 decades also suggest a positive spillover impact of China's growth, with a 1 percentage point increase in China's growth being correlated with an average of 0.5 percentage point increase in the growth of other countries. Moreover, while China's spillovers initially only mattered for neighboring countries, the importance of distance has diminished over time.

China's growth can affect other countries in a number of ways. This paper represents only a first step toward assessing this influence, and tries to quantify only the aggregate impact. In future work, it would be useful to document and quantify the various channels of transmission, which may themselves change over time with changes in the structure of the Chinese economy and of the composition of its trade and capital flows.

Figure 1.

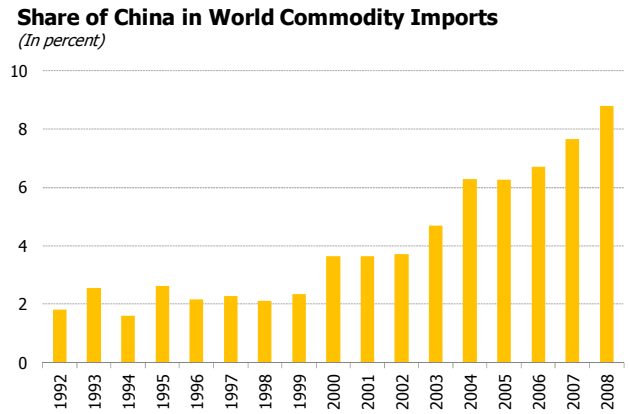


Figure 2.

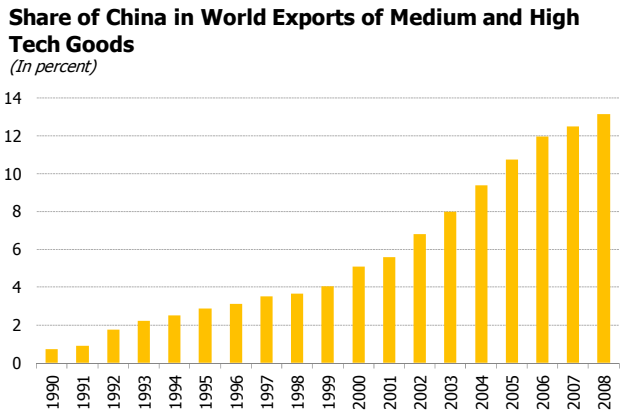


Figure 3.

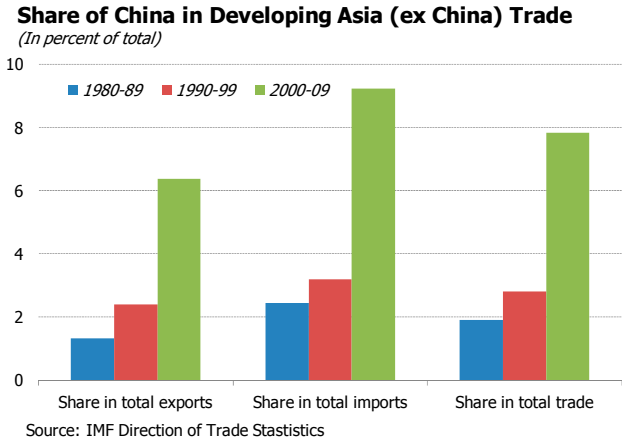
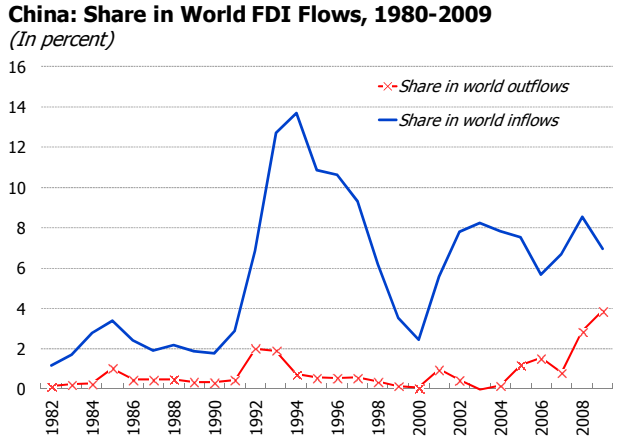


Figure 4.



Source: IMF *World Economic Outlook* database.

Table 1. China in the World Economy

	1980	1990	2000	2002	2007	2008
China's share in world GDP						
At market exchange rates	2.6	1.7	3.8	4.4	6.2	7.3
At purchasing power parity	2.0	3.6	7.2	8.1	10.8	11.5
China's role in world trade						
Share in world trade	1.0	1.7	3.7	4.8	7.7	8.2
Trade with China as share of world GDP 1/	0.3	0.5	1.5	1.9	4.0	4.4
China's share in developing Asia's GDP						
At market exchange rates	40.4	35.1	51.8	54.9	57.6	60.8
At purchasing power parity	27.8	35.5	47.5	49.7	53.8	54.5
China's role in developing Asia's trade						
Share in developing Asia trade	2.0	2.1	4.1	5.8	11.3	12.1
Trade with China as share of developing Asia GDP 1/	5.3	6.5	7.2	7.8	8.5	9.1

Sources: IMF Direction of Trade Statistics and World Economic Outlook.

1/ GDP at market exchange rates.

Table 2. Share of China in Merchandise Trade of Selected Regions, 1980-2008
(In percent)

	1980	1990	2000	2005	2008
World trade: China's share	1.0	2.0	4.7	7.5	8.3
Share of ROW exports to China	1.0	1.4	3.3	5.7	6.2
Share of ROW imports from China	1.0	2.5	6.0	9.3	10.3
European Union	0.4	0.7	1.8	3.2	4.0
Share of China in EU exports	0.4	0.5	1.0	1.6	2.0
Share of China in EU imports	0.4	0.9	2.6	4.9	5.9
Africa	0.5	0.7	3.0	7.2	10.5
Share of China in African exports	0.3	0.4	2.9	6.9	9.7
Share of China in African imports	0.8	1.1	3.3	7.6	11.2
Developing Asia	1.8	2.3	5.2	9.9	11.7
Share of China in rest of Asia's exports	1.1	2.1	5.9	12.4	11.7
Share of China in rest of Asia's imports	2.4	2.4	4.7	8.7	11.7
Middle East	0.4	0.8	4.1	6.3	8.6
Share of China in Middle Eastern exports	0.2	0.2	3.8	5.8	7.5
Share of China in Middle Eastern imports	1.0	1.7	4.7	7.0	10.4
Western Hemisphere	0.5	0.6	1.5	5.0	7.7
Share of China in W. Hemisphere exports	0.6	0.7	1.0	3.3	5.2
Share of China in W. Hemisphere imports	0.5	0.5	2.0	6.8	10.0

Source: Authors' calculations, based on data in IMF Direction of Trade Statistics.

Table 3. Selected Countries: Share of Trade with China in Total Merchandise Trade, 1980-2008
(in percent)

	1980	1990	2000	2005	2008
United States	1.0	2.3	6.1	11.4	12.3
Canada	0.7	1.0	2.0	4.6	5.9
Japan	3.5	3.5	10.0	17.0	17.4
France	0.3	0.8	1.6	2.7	3.1
Germany	0.5	1.0	2.4	4.3	4.7
Italy	0.4	0.8	1.8	3.1	4.0
United Kingdom	0.3	0.5	1.6	3.4	5.2
Russia	na	na	4.5	6.0	7.6
Argentina	1.2	1.5	3.8	7.9	11.5
Brazil	0.8	1.1	2.0	6.4	11.5
Mexico	0.5	0.5	0.9	4.5	4.3
Australia	2.4	2.6	6.8	12.7	15.0
India	0.5	0.1	2.4	7.0	11.5
Indonesia	0.6	3.1	5.0	8.7	10.1
Hong Kong SAR	13.4	30.7	38.8	45.0	47.5
Korea	na	na	9.4	18.4	22.3
Malaysia	2.0	2.0	3.5	8.8	12.6
New Zealand	1.9	1.1	4.7	8.2	9.7
Philippines	1.9	1.1	2.0	8.0	17.9
Singapore	2.1	2.5	4.6	9.4	9.8
Taiwan Province of China	na	na	3.6	16.4	22.7
Thailand	3.4	2.4	4.7	8.9	10.2
Vietnam	na	0.2	9.8	13.2	15.2
South Africa	na	na	na	6.1	9.6

Source: Authors' calculations, based on data in IMF Direction of Trade Statistics.

Table 4. Selected Countries: Contribution to Real GDP Growth of Total Net Exports and of Net Exports to China, 1990-2008 1/

	1990-1995		1996-2000		2001-2008	
	Total	China Trade	Total	China Trade	Total	China Trade
United States	-0.10	-0.07	-0.66	-0.11	-0.13	-0.17
Canada	0.67	-0.04	0.28	-0.14	-1.10	-0.22
Japan	n.a.	-0.03	n.a.	-0.06	n.a.	0.01
France	0.26	-0.03	-0.08	-0.04	-0.32	-0.03
Germany	-0.12	-0.02	0.31	-0.06	0.70	-0.04
Italy	0.50	-0.01	-0.43	-0.06	-0.01	-0.09
United Kingdom	0.35	-0.02	-0.54	-0.05	-0.60	-0.15
Russia	n.a.	n.a.	1.35	0.21	-0.18	-0.29
Argentina	-0.64	-0.10	-0.07	0.00	-0.12	0.13
Brazil	n.a.	-0.01	0.24	-0.01	0.14	-0.03
Mexico	0.22	-0.02	-0.76	-0.08	-0.24	-0.21
Australia	0.62	-0.04	0.26	-0.08	-0.91	-0.02
India	-0.12	-0.03	-0.11	-0.01	-1.22	-0.18
Indonesia	-0.22	0.03	2.68	0.06	0.87	-0.14
Hong Kong SAR	-2.59	-0.31	0.46	-1.26	-0.42	1.20
Korea	-1.15	0.05	1.35	0.18	0.88	0.26
Malaysia	-1.94	0.10	5.08	-0.09	0.38	0.18
New Zealand	-0.01	-0.07	-0.06	-0.16	-0.88	-0.19
Philippines	-1.95	-0.03	1.84	0.07	0.20	0.65
Singapore	1.49	-0.15	1.70	-0.18	1.41	0.01
Taiwan Province of China	-0.39	n.a.	0.28	0.02	1.77	2.02
Thailand	-0.83	-0.05	3.46	-0.05	0.65	-0.16
Vietnam	n.a	0.06	2.62	0.07	-3.89	-2.38
South Africa	-0.29	n.a.	0.38	n.a.	-1.51	-0.15

Sources: Calculations based on IMF Direction of Trade Statistics and World Economic Outlook.
1/ Merchandise trade. Data refer to averages during the periods shown.

Table 5. Estimation of a VAR and an ECM: Accumulated Response of GDP Growth to Cholesky One Standard Deviation in China's GDP Growth (in percent)

Years	1	2	3	4	5
Rest of the world (VAR)					
1960-2007	0.00	0.07	0.03	-0.02	-0.05
1988-2007	0.00	0.08	0.42	0.81	1.02
1988-2007 (controlling for trading partner growth)	0.00	0.00	0.12	0.31	0.41
Rest of Asia (VAR)					
1988-2007	0.00	0.27	0.54	0.65	0.58
Rest of the world (ECM)					
1988-2007	0.00	0.46	1.20	2.19	3.20

Note: Estimates from an unrestricted panel VAR and a Vector Error Correction model with 2 lags. Annual data for 172 economies in the sample for the rest of the word and 38 economies for the sample of the rest of Asia.

Table 6. Variance Decomposition from a Panel Error Correction Model:
Forecast Error Variance of GDP growth Explained by Each External Variable, in percent of Variance Explained by all External Variables: 1988-2007

	2	3	4	5
Oil price shock	7.9	11.9	11.3	10.0
Terms of trade shock	4.0	2.7	2.3	2.1
Foreign output shock	85.3	82.6	78.7	79.5
Shocks from growth in China	2.8	2.8	7.7	8.4

Note: Estimates from a panel error correction model with 2 lags. The dynamic model includes domestic variables and external variables. The domestic variables include real GDP, inflation, and the CPI-based real effective exchange rate, all in first differences. The external variables include the real price of oil, the terms of trade, the weighted average of growth in trading partners, and the growth of real GDP in China, the first two in first differences. Annual data for 172 economies.

Table 7. Growth in China Growth and in the Rest of the World over the Medium Term: Panel Regression with Fixed Country Effects

Specifications Independent Variables	Baseline specification	Interacting with a time trend	Controlling for Distance	The role of distance over time
Per capita real GDP growth in China	-0.00 (-0.01)	-0.70 (-5.03)	1.14 (2.84)	1.73 (4.62)
(Per capita real GDP growth in China) x (Time trend)		0.17 (6.24)		
(Per capita real GDP growth in China) x (Distance from China)			-0.12 (-2.80)	-0.26 (-5.07)
(Per capita real GDP growth in China) x (Distance from China) x ((Time trend)				0.02 (5.86)
ln (initial GDP per capita)	-4.15 (-6.17)	-4.01 (-6.55)	-4.17 (-6.69)	-3.92 (-5.79)
Age dependency ratio	-4.18 (-3.20)	-3.55 (-3.30)	-4.84 (-2.68)	-3.72 (-3.02)
Investment/GDP	0.18 (7.28)	0.16 (7.30)	0.17 (6.65)	0.16 (6.15)
Secondary school enrollment	-0.01 (-0.73)	0.01 (0.55)	0.01 (0.90)	0.00 (0.13)
Trade/GDP	0.03 (4.96)	0.02 (4.06)	0.03 (4.25)	0.02 (4.56)
Government consumption/GDP	-0.14 (-3.57)	-0.12 (-3.22)	-0.14 (-3.37)	-0.12 (-3.10)
Inflation rate	-0.003 (-3.00)	-0.003 (-2.80)	-0.003 (-2.87)	-0.003 (-2.56)
Time trend	0.17 (1.04)	-1.24 (-4.04)		-1.09 (-3.73)
Adjusted R-squared	0.48	0.54	0.49	0.54

Notes: Dependent variable: real GDP per capita growth (2000 constant US$). The period is 1963-2007. Heteroskedasticity-consistent t-statistics in parentheses.

Table 8. Growth in China Growth and in the Rest of the World over the Medium Term: Panel Regression with Fixed Country Effects, Alternative Specifications and Robustness Tests

Specifications Independent Variables	1988-2007	Controlling for exports to China and HK	Asia vs. rest of the world	Asia vs. rest of the world, 1988-2007	Controlling for trading partner growth	Controlling for world growth
Per capita real GDP growth in China	0.42 (1.89)	0.001 (0.15)	0.01 (0.10)	0.40 (1.85)	-0.53 (-6.24)	-0.53 (-5.29)
(Per capita real GDP growth in China) x (Exports to China and Hong Kong/GDP)		0.01 (1.70)				
(Per capita real GDP growth in China) x (Asia dummy variable)			0.09 (2.02)	0.15 (1.01)		
(Per capita real GDP growth in China) x (Time trend)					0.11 (5.73)	0.12 (4.71)
ln (initial GDP per capita)	-6.14 (-4.44)	-3.91 (-7.43)	-4.03 (-6.87)	-6.24 (-4.54)	-3.50 (-6.41)	-3.51 (-7.60)
Age dependency ratio	-8.38 (-2.12)	-3.96 (-2.37)	-4.74 (-2.64)	-8.49 (-2.14)	-2.93 (-2.27)	-2.96 (-2.08)
Investment/GDP	0.19 (8.73)	0.17 (5.70)	0.17 (6.86)	0.19 (9.32)	0.18 (6.11)	0.18 (8.06)
Secondary school enrollment	0.01 (1.99)	0.00 (0.50)	0.00 (0.78)	0.01 (2.02)	0.01 (0.73)	0.01 (0.71)
Trade/GDP	0.03 (3.98)	0.03 (3.89)	0.03 (4.24)	0.03 (3.79)	0.02 (3.80)	0.02 (3.70)
Government consumption/GDP	-0.11 (-2.32)	-0.13 (-2.89)	-0.14 (-3.48)	-0.11 (-2.41)	-0.12 (-2.88)	-0.13 (-4.06)
Inflation rate	-0.004 (-7.59)	-0.003 (-3.48)	-0.003 (-2.99)	-0.004 (-7.57)	-0.002 (-2.75)	-0.002 (-4.36)
Time trend					-0.76 (-3.20)	-0.79 (-3.43)
Growth in trading partners' GDP per capita					0.55 (4.16)	0.57 (4.54)
World GDP per capita growth						-0.06 (-0.29)
Adjusted R-squared	0.57	0.49	0.48	0.57	0.56	0.56

Notes: Dependent variable: real GDP per capita growth (2000 constant US$). The period is 1963-2007, except when indicated otherwise. Heteroskedasticity-consistent t-statistics in parentheses.

REFERENCES

Ahmed, S., and P. Loungani, 1999, "Business Cycles in Emerging Market Economies," Monetaria, Vol. XXII (October–December), Centro de Estudios Monetarios Latinoamericanos (CEMLA).

Arora, V., and A. Vamvakidis, 2005a, "The Implications of South African Economic Growth for the Rest of Africa," *South African Journal of Economics,* 73(2), June, pp. 229-42.

———, 2005b, "How Much Do Trading Partners Matter for Economic Growth?" *Staff Papers*, International Monetary Fund, Vol. 52 (1), pp. 24–40.

———, 2004, "The Impact of U.S. Economic Growth on the Rest of the World: How Much Does It Matter?" *Journal of Economic Integration*, Vol.19 (March), pp. 1–18.

Barro, R., and X. Sala-í-Martin, 2004, *Economic Growth*, second edition. (New York: McGraw Hill).

Bayoumi, T., and A. Swiston, 2007, "Foreign Entanglements: Estimating the Source and Size of Spillovers across Industrial Countries," IMF Working Paper 07/182 (Washington: International Monetary Fund).

Branstetter, L., and N. Lardy, 2006, "China's Embrace of Globalization," NBER Working Paper No. 12373 (Cambridge, MA: National Bureau of Economic Research).

Deichmann, U., and I. Gill, 2008, "The Economic Geography of Regional Integration," *Finance and Development,* Vol. 45 No. 4 (December).

Eichengreen, B., and H. Tong, 2006, "How China is Reorganizing the World Economy," *Asian Economic Policy Review* (2006) 1, pp. 73–97.

International Monetary Fund, 2009, "Global Shifts in Demand: Making Up for Weaker Consumption in the United States," Box 1.8 in *October 2009 Asia and Pacific Regional Economic Outlook*, pp. 36–37.

Simpfendorfer, B., 2008, "Exposed: Who Loses if China Slows?" Royal Bank of Scotland Research note, February 5.

Summers, L., 2007, Interview with Charlie Rose, iTunes\iTunes Music\Charlie Rose_Lawrence Summers, A.m4b, August 21.

Wang, T., 2009, "Who Benefits the Most from China's Recovery?" UBS Global Economics Research note, August 20.