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Potential Implications of China's Rebalancing on China, the United States, and the Bilateral Economic Relationship

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Abstract

Recent research has examined trade statistics from a value-added perspective and it has traced global value chains (GVC) through countries' domestic production, exports and imports. Research by Koopman et al., Johnson and Noguera, Timmer, and OECD-WTO has made clear that our understanding of trade linkages based on statistics in gross values can be very different from our understanding of trade based on value-added terms. This paper discusses the potential implications for the U.S. economy and its trade arising from China's efforts to rebalance its economy and promote consumption-led growth. Our analytical framework is a multiregional computable general equilibrium (CGE) trade model. The model is calibrated to a global data set derived from version 8 of the GTAP database (Narayanan, Aguiar, and McDougall, 2012). This data set has additional information about the sourcing of imports obtained from a global value chains data (Tsigas, Wang, and Gehlhar, 2012). The model has a focus on the United States, China, and their top trade partners. Twenty six regions and 41 production sectors in each region are specified to represent the world economy. The presentation in the GTAP Conference would focus on the additional insights obtained from including the GVC information in the analysis.

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Introduction

China's GDP growth has been rapid and sustained, averaging 9.9 percent during 1995-2010 (World Bank and the DRC, 2013). China is now the second largest economy in the world. China's savings (as a percent of GDP) has been high, much higher than world averages, and much higher than competing economies. Investment in China is also very high. China's savings-investment gap has resulted in a current account surplus, much of which is coming from trade with the United States and the European Union. This has also led to occasional trade frictions despite the fact that a considerable amount of trade is being conducted by foreign firms which are deeply integrating China into global supply chains.

China's growth has largely resulted from structural changes. Labor and output moved from agriculture to industrial and service sectors. China's now dominant manufacturing sector is the world's largest and has helped China become the world's largest goods exporter. China's expected decline in its supply of labor will add even greater pressures towards reallocation towards industry and services as fewer unskilled resources will be able to be drawn from agriculture.

Recent research has examined trade statistics from a value-added perspective and it has traced global value chains (GVC) through countries' domestic production, exports and imports. Research by Koopman et al., (2008, 2010 and 2014), Johnson and Noguera (2012), Timmer, ed., (2012), and OECD/WTO (2013) has made clear that our understanding of trade linkages based on statistics in gross values can be very different from our understanding of trade based on value-added terms. In this paper we examine how using information contained in these new datasets on trade in value-added (TiVA) in a computable general equilibrium (CGE) trade model can influence results from experiments. Our results suggest that the new data sets could improve empirical information used to support policy making. We first build a CGE model that uses information derived from the USITC global value chains work. In this paper we analyze the implications of two scenarios. The first scenario assumes no policy intervention and slower growth in China. The second scenario assumes that China rebalances based on projection in the World Bank and the DRC work (World Bank and the DRC, 2013).

The CGE model

The multiregional CGE model used in this paper is similar to models widely used to analyze the impact of trade and trade policies (Shoven and Whalley, 1984 and 1992; Francois and Shiells; Hertel, Ianchovichina, and McDonald). The model incorporates considerable detail on sectoral output and trade flows, both bilateral and global. The model may be linked to a macroeconomic model generating macro scenarios. Given a macro scenario, this dynamic CGE model may then be used to determine the implied trade flows and sectoral structural adjustments for each region in a recursive dynamic framework that are consistent with the macro scenarios. Under assumptions for a likely path of future world economic growth, the CGE model may generate the pattern of production and trade resulting from world economic adjustment to the economic shocks specified in the alternative scenario.

The CGE simulation model used in this paper can be thought of consisting two parts. The first part is a comparative-static CGE model that simulates changes within a given year. The second part of the CGE model provides the dynamic linkages and simulates changes between years. We first discuss the comparative-static model and then the dynamic linkages.

The comparative-static CGE model

The model has a focus on the United States and China as well as their top trade partners. Twenty six regions and 41 production sectors in each region are specified to represent the world economy (**table 1**). China and Mexico have export processing zones and these zones are modeled as separate economies. Thus the total number of economies in the model is 28.

For each economy in the model we specify a utility function for its representative household and production functions for its producing sectors. Subject to transportation costs, the representative household and producing sectors engage in commodity and services trade with households and producing sectors in all other regions in the model. The representative household represents private and government expenditures.

All economic agents are price-takers and their demands for commodities and primary factor services are based on cost minimizing and utility maximizing behavior subject to production function and budget constraints. Producing sectors produce a single commodity. Intermediate and final demand users of commodities and services are assumed to differentiate a commodity and services by its region of origin, i.e., the *Armington specification* is applied (Armington 1969a and 1969b).

On the final demand side of the model, households purchase commodities and services and they save part of their income, which consists of returns to primary factors and net tax collections. In each region, aggregate investment in new capital goods is represented by the output of a "capital goods" sector. Globally, the sum of household savings is equal to the sum of investment expenditures. Commodity and services prices in each region are determined by market clearing through international trade.

Welfare and household demands. It is assumed that preferences are separable, which allows expressing total utility as a function of sub-utilities, which in turn have deeper sub-groupings within them. At the top of the utility tree, regional welfare is derived from private household expenditures, government expenditures, and savings. It is assumed that the simulations do not change the distribution of regional income across private and government expenditures, and savings. This assumption is implemented by applying a Cobb-Douglas function to describe substitutions between the three components of welfare. Currently, there is no economic mechanism that links government expenditures to government revenues. Household demands for composite commodities are specified with Cobb-Douglas functions.

Industrial sector demands. Producing sectors demand two types of inputs: primary factors and intermediate inputs. The primary factor composite is a CES aggregate of unskilled labor, skilled labor, and capital. The elasticity of substitution between primary factors is industry specific. There is no substitution between the primary factor composite and intermediate inputs, i.e., a Leontief technology is assumed.

International trade. The main features of the model treatment of trade are the Armington assumptions discussed earlier. The determination of the sourcing of imports is placed at the producer and consumer level instead of at the national level. Thus in this model we have substituted the standard CGE model assumption that affects bilateral trade (i.e., sourcing of imports for the economy as a whole) with a micro-based determination of bilateral trade (i.e., sourcing of imports at the agent level). Placing the sourcing of imports at the agent level reduces the power of the terms-of-trade effects. Our database differentiates the sourcing of imports for producers from the sourcing of imports for households.

There are two additional mechanisms in the model that affect the international linkages in the model. The specification of both of these mechanisms draws on the GTAP model (Hertel and Tsigas). First, a global sector demands services from each regional transportation services sector, to provide a composite service which is used for shipping commodities across regions. In value terms, each region's relative contribution to the global transportation sector does not change due to the simulation performed. It is also assumed that shipping services are required in fixed proportions with the quantity of a particular commodity shipped along a particular route.

The second global sector intermediates between regional savings and regional investment. This global sector has a portfolio of regional net investments which are offered to regional households to satisfy their demand for savings. Regarding the regional composition of net investment, the model assumes that there is a negative relationship between the (expected) regional rate of return on capital and the amount of investment undertaken in a region.

Primary factor mobility. Each region has fixed endowments of skilled and unskilled labor, and capital. Labor services and services from existing capital stock are assumed to be intersectorally perfectly mobile, but region specific. This implies that all sectors, in a region, face the same market price for labor services and the same market price for capital services. It is assumed that labor and capital can move freely between the export processing zone and the rest of the economy in China and Mexico.

Dynamic linkages in the CGE model

The comparative-static model discussed thus far is used to simulate changes within a given year t. To simulate changes between years t and t+1, our simulation framework incorporates physical capital accumulation for the economy as a whole:

$$K_{r,t+1} = (1 - D_r) \times K_{r,t} + I_{r,t}$$

where $K_{r,t}$ is the quantity of capital available for use in region r during year t;

$I_{r,t}$ is the quantity of new capital created in region r during year t; and

D_r is the rate of capital depreciation in economy r and it is treated as a parameter.

The level of new capital goods or investment $I_{r,t}$ is determined by the comparative-static model and under the assumption of static expectations we generate a "baseline" which describes the evolution of the world economy in the absence of the change that we wish to analyze. Our baseline runs from 2007 to 2030 and projections for land availability, labor, population and GDP growth rates. Population and labor and land availability are exogenous variables in the CGE model. Thus these variables are shocked in every year according to the projections we use. Gross domestic product, however, is an endogenous variable in the CGE model. To target GDP, we change the closure of the model and allow an economy-wide technology parameter to adjust accordingly.

The simulation of a shock that we wish to analyze generates a "policy" line. The policy simulations include the baseline population, labor and land shocks used to generate the baseline simulations; the shocks for the economy-wide technology parameter that was determined in the baseline simulations; and the shocks that we wish to analyze. For a particular variable, e.g., total U.S. exports, the distance between the "policy" line and the "baseline" is the effect of the shock that we wish to analyze. The policy shocks that we simulate in this paper occur during 2014. Thus the first year that the policy line deviates from the baseline is 2014.

The Data set

Trade flows in this model are represented by gross trade figures. The global value chain aspect of current international trade is reflected in the GVC model via the particular implementation of the Armington specification. In the GVC model, commodities (and services) are assumed to be differentiated by their region of origin, i.e., the Armington specification is applied (Armington 1969a and 1969b).

Because of additional data work done for the development of the GVC data, it is possible to place the sourcing of imports in the GVC model at the agent level. In the GVC model, a particular producer decides not only how much to import of a particular good, but also where to source these imports from. Thus in the GVC model we have potentially established tight linkages between sectors located in different economies. We have also substituted an aggregate mechanism that determines bilateral trade, i.e., sourcing of imports for the economy as a whole, with a micro-based mechanism of bilateral trade, i.e., sourcing of imports at the agent level.

The GVC database. We have constructed a 2007 IO table based on version 8 of the GTAP database (Narayanan, et al., 2012) and processing trade information from China and Mexico. This database is discussed in detail in Tsigas, Wang, and Gehlhar, 2012. The initial allocation of bilateral trade flows in the GTAP database into intermediate and final uses is based on the UN BEC (Broad Economic Categories) method. We use China's expanded IO table with a separate account for processing exports from Koopman, Wang and Wei (2008) and the 2003 Mexico IO table with separate domestic and Maquiladora accounts from the Instituto Nacional de Estadística, Geografía e Informática (INEGI). We integrate China and Mexico's IO tables with version 8 of the GTAP database by a quadratic mathematical programming model to minimize the deviation between the resulting new data set and the original GTAP data.

Scenarios

The base line scenario reflects no policy intervention, slower economic growth in China, and declines in the available supply of skilled and unskilled labor due to demographic changes.

In the policy scenario, China starts rebalancing in 2014 according to World Bank and DRC projections. The China rebalancing policy scenario includes the following shocks: (1) GDP growth rates as projected by the World Bank and the DRC work and a reduction in saving rates; (2) changes in consumer demands driven by preference changes; and (3) increase in labor productivity.

Simulated effects

Figure 1 shows simulation results for China's global trade balance, global exports less global imports. The black line shows the baseline evolution of the balance of trade. The red line shows the evolution of the balance of trade under the combined policy shocks. The blue and the green lines decompose the policy simulation. The blue line, labeled "Policy decomposition 1," includes two shocks: economy-wide productivity changes as implied by the GDP growth rates, and the reduction in the savings rate. The green line, labeled "policy decomposition 2" includes in addition to policy decomposition 1 (productivity changes and savings rate reduction) the strong increase in the private household consumption of services. The distance between the "baseline" and the green "policy decomposition 2" line is the additional effect obtained from labor productivity gains.

Summary

This paper discusses the potential implications for the U.S. economy and its trade arising from China's efforts to rebalance its economy and promote consumption-led growth. Our analytical framework is a multiregional computable general equilibrium (CGE) trade model. The model is

calibrated to a global data set derived from version 8 of the GTAP database. This data set has additional information about the sourcing of imports obtained from a global value chains data. The model has a focus on the United States, China, and their top trade partners. Twenty six regions and 41 production sectors in each region are specified to represent the world economy. The presentation in the GTAP Conference would focus on the additional insights obtained from including the GVC information in the analysis.

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Table 1 Regions and sectors in the CGE model

Regions		Sectors	
1	China	1	Crops
2	China - export processing zones	2	Liv estock
3	Hong Kong	3	Forestry
4	Taiwan	4	Fishing
5	Japan	5	Coal
6	Korea	6	Oil and gas
7	Indonesia	7	Minerals nec
8	Philippines	8	Meat and dairy products
9	Malaysia	9	Other foods
10	Singapore	10	Beverages and tobacco products
11	Thailand	11	Textiles
12	Vietnam	12	Wearing apparel
13	India	13	Leather products
14	Australia, New Zealand	14	Wood products
15	Canada	15	Paper products, publishing
16	United States	16	Petroleum, coal products
17	Mexico	17	Chemical, rubber, plastic products
18	Mexico - export processing zones	18	Mineral products nec
19	Brazil	19	Ferrous metals
20	European Union - 12	20	Metals nec
21	European Union - 15	21	Metal products
22	Russia Federation	22	Motor vehicles and parts
23	South Africa	23	Transport equipment nec
24	Rest of high income countries	24	Electronic equipment
25	Rest of South America	25	Machinery and equipment nec
26	Rest of Asia	26	Manufactures nec
27	Rest of East Asia	27	Electricity
28	Rest of the world	28	Gas manufacture, distribution
		29	Water
		30	Construction
		31	Trade
		32	Transport nec
		33	Water transport
		34	Air transport
		35	Communication
		36	Financial services nec
		37	Insurance
		38	Business services nec
		39	Recreational and other services
		40	Public Admin., Defense, Educ., Health
		41	Dwellings

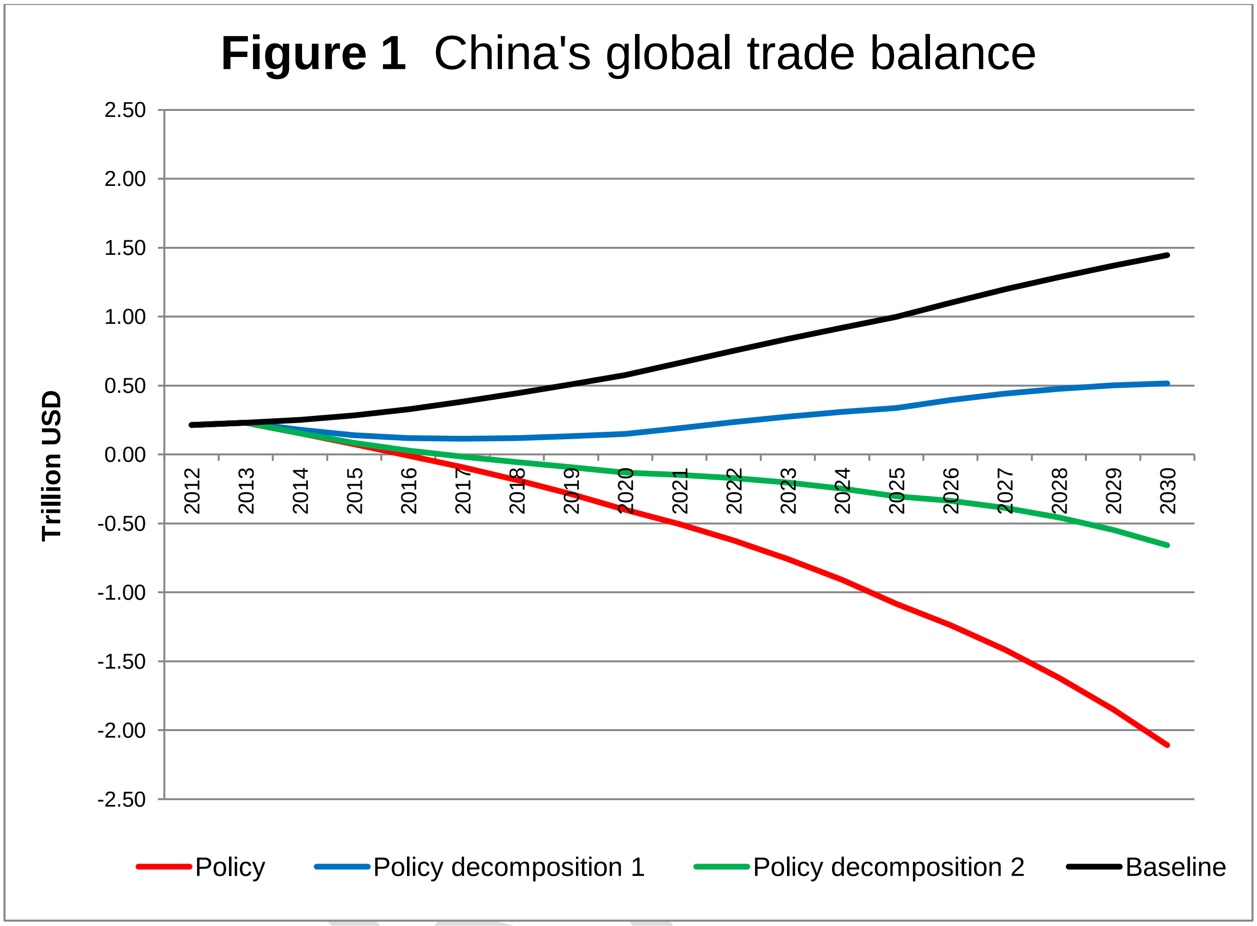
Figure 1 China's global trade balance
Trillion USD
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
Policy
Policy decomposition 1
Policy decomposition 2
Baseline