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Abstract

Global logistics companies can reduce the cost of international trade and increase consumer welfare. By reducing total transportation costs and increasing production and distribution efficiencies, these companies allow both exporting and importing countries to use fewer scarce resources to meet the needs of producers and consumers. This paper will employ a computable general equilibrium (CGE) model to quantify the economic impacts of global logistics companies in United States. As a major exporter and importer of goods and services, the United States is in a position to affect the consumer welfare of people around the globe. The CGE model will measure the effect of lowering costs in transportation and logistics for trade between the United States and the world. Results show significant increases in trade and consumer welfare, and interesting shifts in production and consumption. The United States in particular would stand to benefit.

Index terms—

improve by $0.8 billion, $8.2 billion, and $11.9 billion, respectively. Meanwhile, every other region of the world experiences worsening trade balances in each of these sectors.

? U.S. exports decrease in heavy manufacturing (3.0 percent), light manufacturing (3.2 percent), agriculture (2.2 percent), utilities and construction (3.7 percent), and other services (3.7 percent). U.S. imports increase in heavy manufacturing (1.6 percent), light manufacturing (2.2 percent), agriculture (2.0 percent), utilities and construction (2.5 percent), and other services (2.2 percent).

1 ?

As the U.S. exports less of most everything, the rest of the world exports more of almost everything. The trade balances in heavy manufacturing impove in the EU by $10.2 billion, in Japan by $3.0 billion, in East Asia by $2.1 billion, and in China by $1.2 billion.

A similar pattern is seen for light manufacturing, where trade balances improve in the EU ($6.6 billion), Japan ($2.0 billion), the Rest of North America ($1.8 billion), and East Asia ($1.3 billion).

2 ?

The United States would enjoy a 1.04 percent increase in GDP. In contrast, GDP falls in every other region of the world, including the EU (-0.51 percent), Japan (-0.48 percent), China (-0.31 percent), East Asia (-0.37 percent), and the Rest of North America (-0.30 percent).

? U.S. heavy manufacturing falls by $26.4 billion, while light manufacturing falls by $8.9 billion. Similarly, more efficient transport sectors use less energy in the U.S., resulting in a decrease of U.S. imports in the extraction sector (-1.2 billion). Likewise, U.S. domestic production in the extraction sector falls by almost $1 billion.

3 ?

The decrease in U.S. manufacturing and extraction frees up productive resources in the United States, for use in other sectors. Production in every other U.S. sector significantly increases, including that of capital goods ($32.2 billion), utilities/construction ($15.1 billion), other services ($3.4 billion), and agriculture ($1.3 billion).

Michael P. Barry his paper uses a large computable general equilibrium (CGE) model to ask a question. What would happen to the U.S. economy and that of its trading partners if the United States were to achieve a 10 percent increase in productivity in its logistics and transport sectors? As expected, the largest results were seen for the American economy, but the model produces measureable results for sectors and countries around the world. Some of the most significant findings include the following: T increases in the EU ($5.8 billion), Japan ($2.6 billion), Canada and Mexico ($2.1 billion), East Asia ($1.9 billion), and China ($1.7 billion).

4 Introduction

This paper will employ a computable general equilibrium (CGE) model to quantify the economic impacts of global logistics companies in the United States. As a major exporter and importer of goods and services, the U.S. is in a position to affect the consumer welfare of people around the globe. The CGE model will measure the effect of lowering costs in transportation and logistics for trade between the U.S. and the world. Results show significant increases in trade and consumer welfare, and interesting shifts in production and consumption. Global logistics and supply chain management includes the management of upstream and downstream value-added flows of materials, final goods, and related information among and within companies, suppliers, resellers, and final consumers, across national borders and within a domestic economy. A major goal is the more efficient use of resources in production, transportation, and distribution.

5 II. Introduction to Global Logistics

Global logistic companies can act as intermediaries and consultants, helping importers and exporters find these increased efficiencies. Examples of services provided by global logistic companies include: As logistics firms use these and other services to lower the cost of trade, presumably more trade will occur, and fewer resources are used. Both exporting and importing countries stand to gain. A CGE model can be used to capture these multi-regional, multisectoral effects. General equilibrium, a concept which dates back to Leon Walras (1834-1910), is a pillar of modern economic thought. General equilibrium recognizes that there are many markets in an economy, and that these markets all interact in complex ways with each other. In rough terms, everything depends on everything else. Demand for any one good depends on the prices of all other goods and on income. Income, in turn, depends on wages, profits, and rents, which depend on technology, factor supplies and production, the last of which, in its turn, depends on sales (i.e., demand). Prices depend on wages and profits and vice versa (Hertel, et al., 2007).?

6 III. CGE Modeling for Global Logistics

Computable General Equilibrium (CGE) modeling specifies all economic relationships in mathematical terms and puts them together in a form that allows the model to predict the change in variables such as prices, output and economic welfare resulting from a change in economic policies. To do this, the model requires information about technology (the inputs required to produce a unit of output), policies and consumer preferences. The key of the model is "market clearing," the condition that says supply should equal demand in every market. The solution, or "equilibrium," is that set of prices where supply equals demand in every market-goods, factors, foreign exchange, and everything else (Hertel, et al., 2007).

A CGE model is a closed system. This means that no production or financial flow escapes the system and none are created outside of the system. In basic closure terms, we assume output will equal income. Households, businesses, the government, and the financial sector, and the foreign sector are all connected by real flows and financial flows. Intuitively, the idea of a "general" equilibrium is captured; any given market is connected to all of the other markets for the system.

Over the last 25 years, CGE models have become an important tool for analyzing economic issues, including trade policy, taxation policy, technological growth, energy policy, environmental issues, and even warfare. This development is explained by the ability of CGE models to provide an elaborate and realistic representation of the economy including the linkages between all agents, sectors and other economies. While this complete coverage permits a unique insight into the effects of changes in the economic environment throughout the whole economy, single country, and especially global CGE models very often include an enormous number of variables, parameters and equations (Brockmier, 2001).

CGE modeling is a very powerful tool, allowing economists to explore numerically a huge range of issues on which econometric estimation would be impossible; in particular to forecast the effects of future policy changes. The models have their limitations, however. First, CGE simulations are not unconditional predictions but rather 'thought experiments' about what the world would be like if the policy change had been operative in the assumed circumstances and year. The real world will doubtless have changed by the time we get there. Second, while CGE models are quantitative, they are not empirical in the sense of econometric modeling: they are basically theoretical, with limited possibilities for rigorous testing against experience. Third, conclusions about trade and other policies are very sensitive to data assumption. One can readily do sensitivity analysis on the parameter values assumed for economic behavior, although less so on the data, because altering one element of the base data requires compensating changes elsewhere in order to keep the national accounts and social accounting matrix in balance. Of course, many of these criticisms apply to other types of economic modeling, and therefore, while imperfect, CGE models remain the preferred tool for analysis of many global issues.

7 b) The Global Trade Analysis Project

One of the most widely-used CGE models is the GTAP Model.

The Global Trade Analysis Project (GTAP), with headquarters at Purdue University, has organized a consortium of national and international agencies which provide guidance and base-level support for the Project (GTAP, 2008).

GTAP is a multi-regional CGE model which captures world economic activity in 57 different industries of 66 regions. The underlying equation system of GTAP includes two different kinds of equations. One part covers the accounting relationships which ensure that receipts and expenditures of every agent in the economy are balanced. The other part of the equation system consists of behavioral equations which based upon microeconomic theory. These equations specify the behavior of optimizing agents in the economy, such as demand functions (Brockmier, 2001). Input-out tables summarize the linkages between all industries and agents.

The mathematical relationships assumed in the GTAP model are simplified, though they adhere to the principle of "many markets." The simplification is that thousands of markets are "aggregated" into groups. For example, 'transport and communications services' appear as a single industry. In principle all the relationships in a model could be estimated from detailed data on the economy over many years. In practice, however, their number and parameterization generally outweigh the data available. In the GTAP model, only the most important relationships have been econometrically estimated. These include the international trade elasticities and the agricultural factor supply and demand elasticities. The remaining economic relationships are based on literature reviews.

8 c) Structure of this Paper's Model

The model employed in this paper is that of the GTAP project. While the core database has 57 sectors and 66 regions, we have aggregated the matrices to simplify the world into just nine sectors (plus capital investment goods), nine regions, and five factors of production. This aggregation is described in Table 1.

The data is first, "calibrated," meaning the model is solved for its original equilibrium prices and volumes in all markets. This baseline is meant to represent the economy as is, before any shock takes place. Thousands of equations are created, each representing supply and demand conditions in markets inside each region, including markets for goods, services, factors of production, savings, government expenditure, and more. Equations are also generated for trade of all goods between each of the regions, separately created for each industry. The calibrated result is a large set of simultaneous equations, of which the solution matches the existing prices and quantity levels of the economy. Source: Generated by Author A "shock" is then introduced to system. Mathematically, a "shock" is the alteration of a single parameter or variable in the giant system. That change acts like a stone thrown in a pond, with waves created throughout every one of the thousands of equations in the system. The model is re-solved with the one autonomous change, and the effects on the system are then measured.

The "shock" in this model is the introduction of a 10 percent productivity increase to the Sea Transport, Air Transport, and Other Transport sectors in the United States. These increases are meant to capture the further development of global logistics companies doing work in both U.S. exports and U.S. imports with the rest of the world.

The role of a CGE model is to trace and quantify the direction and magnitude of these changes. More inputs are used to produce more output, and the economy consumes a different mix of goods.

9 IV.

10 Model Results

A computable general equilibrium model can generate an enormous array of matrix results. In this model, results are grouped into the following sections: 1) international trade; 2) output and income; 3) market prices; 4) the labor market; and 5) welfare effects.

11 a) International Trade

Model results suggest that the largest effects of reduced costs in U.S. tranportation and logistics would be in the U.S. trade balance with the world. Cheaper transport costs would result in a $27.2 billion worsening of the U.S. trade balance. In contrast, the trade balances of every other region in the world would improve, including those for the EU ($13.0 billion), Japan ($5.1 billion), the Rest of North America ($1.6 billion), and China ($1.2 billion). Trade balances are presented in Table 2. U.S. transport and logistics services become more competitive around the world. Exports of U.S. transport services increase for sea transport (15.7 percent), air transport (27.2 prcent), and other transport (33.7 percent). At the same time, U.S. imports for these services all decrease (by 13.2 percent for sea trasnport, 13.6 percent for air trasnport, and 13.8 for other trasnport). All told the U.S. trade balances in sea, air, and other transport services improve by $0.8 billion, $8.2 billion, and $11.9 billion, respectively. Meanwhile, every other region of the world experiences worsening trade balances in each of the three logistics and transport sectors. Trade balances by sector are presented in Table **??**.

Excluding transport and extraction sectors, the United States imports more of everything else and exports less of everything else. This means a worsening in U.S. trade balances for heavy manufacturing ($22.0 billion), light manufacturing ($16.2 billion), agriculture ($2.6 billion), utilities and construction ($0.3 billion), and other services ($9.1 billion). (Table **??**).

As shown in Table **??**, U.S. exports decrease in heavy manufacturing (3.0 percent), light manufacturing (3.2 percent), agriculture (2.2 percent), utilities and construction (3.7 percent), and other services (3.7 percent). Table 5 presents regional imports by sector. U.S. imports increase in heavy manufacturing (1.6 percent), light manufacturing (2.2 percent), agriculture (2.0 percent), utilities and construction (2.5 percent), and other services (2.2 percent). As the U.S. exports less of most everything, the rest of the world exports more of almost everything. The trade balances in heavy manufacturing impove in the EU by $10.2 billion, in Japan by $3.0 billion, in East Asia by $2.1 billion, and in China by $1.2 billion. A similar pattern is seen for light manufacturing, where trade balances improve in the EU ($6.6 billion), Japan ($2.0 billion), the Rest of North America ($1.8 billion), and East Asia ($1.3 billion). U.S. bilateral exports are presented in Table **??**, while its bilateral imports are shown in Table **??**. U.S. exports of tansport services increase by roughly 40 percent to each of its trading partners, while U.S. imports of transport services decrease by roughly 13 percent from each partner. Exports of all other U.S. sectors decrease by roughly 2-4 percent to each partner, while U.S. imports from each region increase by roughly 1-3 percent. As the United States improves its transport efficiences, it enjoys a 1.04 percent increase in GDP. In contrast, GDP falls in every other region of the world, including the EU (-0.51 percent), Japan (-0.48 percent), China (-0.31 percent), East Asia (-0.37 percent), and the Rest of North America (-0.30 percent). GDP Changes are presented in Table **??**.

Given cheaper transport options and large import increases, U.S. manufacturing significantly decreases. U.S. heavy manufacturing falls by $26.4 billion, while light manufacturing falls by $8.9 billion. Similarly, more efficient transport sectors use less energy in the U.S., resulting in a decrease of U.S. imports in the extraction sector (-1.2 billion). Likewise, U.S. domestic production in the extraction sector falls by almost $1 billion. (Table 10).

The decrease in U.S. manufacturing and extraction frees up productive resources in the United States, for use in other sectors. Production in every other U.S. sector significantly increases, including that of capital goods ($32.2 billion), utilities and construction ($15.1 billion), other services ($3.4 billion), and agriculture ($1.3 billion).

Much of the world's manufacturing production moves from the United States to the EU, Japan, East Asia, China, Canada, and Mexico. Heavy manufacturing increases in the EU ($9.8 billion), Japan ($4.3 billion), East Asia ($2.8 billion), and China ($1.2 billion). Similarly, light manufacturing increases in the EU ($5.8 billion), Japan ($2.6 billion), Canada and Mexico ($2.1 billion), East Asia ($1.9 billion), and China ($1.7 billion).

Capital goods output moves to the United States from the rest of the world. U.S. capital goods output increases by $32.2 billion, while such output falls in every other region of the world. The largest such decreases are seen in the EU (-$13.1 billion), Japan (-$5.8 billion), East Asia (-$1.8 billion), and Canada and Mexico (-$1.8 billion). Investors are attracted by the increased returns on capital investment in the United States. The return on capital increases in the United States by 1.1 percent, but falls in every other region of the world. Returns on capital fall the most in Australia (-0.6 percent), Japan (-0.5 percent), South Asia (-0.4 percent), East Asia (-0.4 percent), China (0.3 percent), and Canada and Mexico (-0.3 percent). (Table 11).

Global output of transport services clearly moves to the United States. While output in the transport sectors increase in the United States, such output falls in every other region of the world. U.S. output increases in sea transport ($2.5 billion), air transport ($12.9 billion), and other transport ($21.0 billion). The biggest losers in transport sector output include the EU (-$13.7 billion total in the three sectors), East Asia (-$4.4 billion), Japan (-$1.7 billion), and China (-#1.3 billion). Not surprisingly, the largest price declines are found in U.S. transport sectors. U.S market prices decrease for sea transport (-9.6 percent), air transport (-9.8 percent), and other transport (9.6 percent). Such price declines ripple throughout transport markets in all of the other regions. As other countries' demand for U.S. transport increases, their own domestic transport demand decreases, causing significant domestic price declines. In the EU, domestic transport market prices fall by 0.6 percent in both sea and air transport, and by 0.5 percent for other transport. Similar declines are seen in Japan, China, East Asia, South Asia, Australia, and the rest of the world. Indeed, outside of the United States, every sector in every region sees a significant decline in market prices. (Table 12). And for imports, prices decline in every sector of every region, including those in the United States. (Table 13).

In the United States, domestic market prices in several sectors increase. This includes U.S. agriculture (0.24 percent), other services (0.67 percent), utilities and construction (0.4 percent), and light manufacturing (0.23 percent). [1] [2] [3]

[1] 20 2 61

[3] 20 2

Figure 1:

The largest such

decreases are seen in the EU (-$13.1 billion), Japan

(-$5.8 billion), East Asia (-$1.8 billion), and Canada
and Mexico (-$1.8 billion).

? Investors are attracted by the increased returns on
capital investment in the United States. The return

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Returns on capital fall the most in Australia (-0.6

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percent), East Asia (-0.4 percent), China (0.3

percent), and Canada and Mexico (-0.3 percent).

domestic
transport demand decreases, causing significant domestic price declines in almost every single sector.
? American transport sectors demand less energy, but more land, labor, and capital to fuel greater U.S.
ouput. This result is reflected in the prices of the world's primary factors of production. The price of natural resources (including energy) decreases in every region of the world except Australia. The largest decreases are seen in the United States (-2.51 percent), Canada and Mexico (-1.42 percent), China (-0.61 percent), South Asia (-0.53 percent), and East Asia (-0.49 percent). In Australia, the price
of natural resources increases by 0.49 percent.

welfare gains are experienced by the United States,
which would see a $76.2 billion welfare gain ($73.8
billion of which comes from technological gains
brought by improvements in U.S. logistics and
transport methods).
? In contrast, much of the rest of the world would be
worse off after the improvements to U.S. logistics
and transport. Large net welfare losses would be
seen in the EU (-$3.0 billion), Canada and Mexico (-$573.5 million), Japan (-$751.4 million), and
Australia (-$203.0 million). China and East Asia
would be better off (by $385.5 million and $306.4
million, respectively).
? Gains from greater savings and investment would
accrue to the United States at the expense of every
other region of the world. Here the U.S. would
experience a welfare gain of $3.1 billion, while large
welfare losses would accrue to the EU (-$792.2
million), Japan (-$418.6 million), China (-574.9
million), and East Asia (-$483.2).
I.

transportation requirements?
With billions of dollars' worth of merchandise moving between China and the United States, inefficiencies can add significantly to costs. What if Trek bicycle Company of Waterloo, Wisconsin buys parts from a Chinese manufacturer, but only needs enough to fill half of a shipping container? What if Peerless Pump, with 65 manufacturing facilities across Asia and the world, loses track of inventories and shipments to all of its distribution centers? How can Chemtura, a global chemical company with facilities in every major market in the world, avoid costly inventory overflows and mismatched production? And how can major U.S. retailers organize and manage thousands of suppliers in China, each with various costs, tariffs and customs, and

Figure 3:

1

Regions	Sectors	Factors
United States	Sea Transport	Land
China	Air Transport	Unskilled Labor
Japan	Other Transport	Skilled Labor
European Union	Agriculture	Capital
Rest of North		Natural
America	Extraction	Resources
East Asia	Light Manufacturing	
South Asia	Heavy Manufacturing	
	Utilities	and
Australia	Construction	
Rest of World	Other Services	
	Capital Goods	

Figure 4: Table 1 :

2

	Millions of dollars
USA	-27222.73
China	1198.87
Japan	5080.96
EU_25	12983.49
RestNAmerica	1590.92
EastAsia	1068.01
SouthAsia	733.69
Australia	750.88
RestofWorld	3815.92
Source:	

Figure 5: Table 2 Change in Trade Balance DTBAL

DTBALi	USA	China	Japan	EU_25	RestNAmerica	EastAsia	SouthAsia	Australia	R
SeaTransport	878.26	-135.15	-210.65	-1155.36	-52.45	-282.21	-52.05	-14.63	-4
AirTransport	8238.37	-231.16	-610.81	-4452.67	-498.02	-1379.56	-61.27	-407.27	-16
OtherTransp	11891.6	-738.05	-412.52	-4910.47	-809.97	-1707.09	-157.04	-178.55	-38
Agriculture	-2581.58	49.03	308.21	1043.27	257.69	168.54	36.68	175.97	10
Extraction	1956.92	54.49	269.84	623.14	-426.52	73.27	175.75	-39.57	-22
LightMnfc	-16195.6	916.31	1996.13	6584.82	1767.74	1348.28	335.27	392.01	35
HeavyMnfc	-22081	1206.76	3005.52	10242.67	900.34	2116.84	354.05	577.24	54
Util_Cons	-262.78	-8.93	39.45	113.03	21.39	8.18	3.32	1.16	85
OthServices	-9066.91	85.58	695.79	4895.02	430.73	721.77	98.99	244.54	18

Source: Generated by author

Figure 6: Generated by author Table 3 Change in Trade balance by Sector (millions of dollars)

Table 4

Exports by Sector (percent change)

qxw	USA	China	Japan	EU_25	RestNAmerica	EastAs
SeaTransport	15.7	-0.69	-0.21	-0.45	-1.19	
AirTransport	27.18	-4.89	-4.32	-4.84	-8.26	
OtherTransp	33.65	-6.94	-7.68	-3.32	-6.93	
Agriculture	-2.24	0.25	0.97	0.33	0.61	
Extraction	0.12	0.57	2.6	0.19	-0.39	
LightMnfc	-3.19	0.68	1.3	0.52	0.84	
HeavyMnfc	-3.01	0.42	0.9	0.55	0.13	
Util_Cons	-3.69	-0.47	0.07	0.03	0.67	
OthServices	-3.72	0.06	0.85	0.66	0.51	

Source: Generated by author

Table 5

Imports by Sector (percent change)

qim	USA	China	Japan	EU_25	RestNAmerica	EastAs
SeaTransport						
AirTransport						
OtherTransp						
Agriculture						
Extraction						
LightMnfc						
HeavyMnfc						
Util_Cons						
Oth						

qxs[**USA]	China	Japan	EU_25	RestNAmerica	EastAs
SeaTransport	-14.17	-13.52	-13.42	-13.99	
AirTransport	-14.38	-13.69	-13.71	-14.54	
OtherTransp	-14.03	-13.61	-13.45	-14.21	

Table 8
Real GDP

vgdp	Percent Change
USA	1.04
China	-0.31
Japan	-0.48
EU_25	-0.51
RestNAmerica	-0.3
EastAsia	-0.37
SouthAsia	-0.4
Australia	-0.6
RestofWorld	-0.49

Source: China c) Market Prices			Japan	EU_25	RestNAmerica	EastAsia	SouthAsia	Austr
SeaTransport	4.56	-0.13	- 0.14	-0.44	-1.21	- 0.06	-0.35	- 0.45
AirTransport	6.63	-2	- 2.54	-2.95	-5.03	- 3.12	-1.62	- 2.08
OtherTransp	4	-0.72	- 0.24	-0.83	-1.34	- 1.44	-0.18	- 0.47
Agriculture	0.15	0.04	0.04	0.06	0.09	0.09	0.03	0.4
Extraction	- 0.49	-0.04	0.02	0.04	-0.15	- 0.02	-0.02	0.16
LightMnfc	- 0.47	0.22	0.28	0.17	0.46	0.34	0.22	0.22
HeavyMnfc	- 0.98	0.08	0.27	0.24	0	0.21	0	0.37
Util_Cons	0.8	-0.12	- 0.34	-0.27	-0.29	- 0.23	-0.14	- 0.31
OthServices	0.28	0.03	0	0.05	0.01	0.06	0.03	0.02
CGDS	1.46	-0.16	- 0.53	-0.52	-0.5	- 0.38	-0.28	- 0.46

Source: Generated by author

Figure 8: Generated by author Table 9 Change in Output (percent change) qo USA

The price of natural resources (including energy) decreases in every region of the world except Australia. The largest decreases are seen in the United States (-2.51 percent), Canada and Mexico (-1.42 percent), China (-0.61 percent), South Asia (-0.53 percent), and East Asia (-0.49 percent). In Australia, the price of natural resources increases by 0.49 percent. For every other primary factor, prices increase in the United States but decrease in every other region. In the Unoted States, prices increase for land (1.31 percent), unskilled labor (1.03 percent), skilled labor (1.15 percent), and capital (1.06 percent). (Table **??**4).

.1 e) Welfare Decomposition

Table **??**5 presents the overall welfare decomposition from the CGE simulation. The welfare decomposition is essentially a consumer surplus concept, broken down by gains or losses to consumers from efficiency gains, factor endowments, technological improvements, terms of trade effects, and the savingsinvestment mechanism.

The model would suggest a global gain in net welfare of more than $71.7 billion dollars. As might be expected, the vast majority of welfare gains are experienced by the United States, which would see a $76.2 billion welfare gain ($73.8 billion of which comes from technological gains brought by improvements in U.S. logistics and transport methods).

In contrast, much of the rest of the world would be worse off after the improvements to U.S. logistics and transport. Large net welfare losses would be seen in the EU (-$3.0 billion), Canada and Mexico (-$573.5 million), Japan (-$751.4 million), and Australia (-$203.0 million). China and East Asia would be better off (by $385.5 million and $306.4 million, respectively).

A decomposition of welfare effects is presented in Table **??**5. Net effects are broken down by source, including allocative effects, technological effects, terms of trade effects, and changes to savings and investment.

Allocative efficiencies measure how existing, scarce resources can be stretched further to produce greater outputs. Again, the United States enjoys the greatest increase. Its improvements to technology allow it to change its allocation of existing resources to its own productive benefit, resulting in a $450.0 million welfare gain. Smaller such gains are seen in China ($321.4 million), East Asia ($161 million), and Canada and Mexico ($108.0 million).

Terms of trade gains describe improvements to trade competitiveness, or the ratio of export prices to import prices. If the prices of a country's exports relative to its imports increase, that country essentially receives more imports per unit of goods it exports. Trade is a more beneficial exchange if a country has a higher terms of trade.

Here, the model suggests that the United States would lose welfare (-$1.1 billion) by experiencing a worsening of its terms of trade. Canada and Mexico would see a welfare loss through a worsening terms of trade (measuring $504.9 million). Terms of trade gains would accrue to East Asia ($628.3 million), China ($639.1 million), and the EU ($189.0 million). Gains from greater savings and investment would accrue to the United States at the expense of every other region of the world. Here the U.S. would experience a welfare gain of $3.1 billion, while large welfare losses would accrue to the EU (-$792.2 million), Japan (-$418.6 million), China (-574.9 million), and East Asia (-$483.2).

V.

.2 Model Limitations and Future Research

This type of model attempts to measure multiregional and multi-sectoral changes produced by an exogeneous economic shock. The shock in this experiement has been a 10 percent increase in productivity in American logistics and trasnport sectors. Naturally, the largest impacts are felt by the United States and U.S. industrial sectors. But as in all CGE models, the effects ripple through all markets and all regions. These model results attempt to summarize the most interesting effects.

Such a model has limitations, however. First, the nature of the shock is a question. How could the United States achieve such productivity changes in its transport sector? Would the gains be so uniform across modes of transportation and across industries? Would the gains be uniform for the United States vis-à-vis all of its trading partners? Could such productivity changes be kept to U.S. logistic companies alone, or would all countries catch on?

These and other questions complicate the kind of shock that can be introduced to the model, and thus the corresponding results seen.

Second, as with all CGE models, some caution should be used in interpreting results. Less significance should be attached to the exact dollar magnitude of given results than with the direction of results (i.e. increases vs. decreases). With thousands of equations and thousands of supply and demand elasticities used, a CGE model offers an enormous opportunity for statistical error. So interpreting results as a ”forecast” would be misleading. Econometric methods exist for statisitcally significant forecasts, mist built on concepts of partial equilibrium. This model is one of static, general equilibrium.

A third issue is the very static nature of this CGE model. It is a counterfactual simultaneous equations model which introduces a one-time shock to an economic equilibrium, and then measures a new equilibrium. A more dynamic model would better capture effects over time, such as the changes to the accumulation of capital stock, investment flows, and economic growth over a longer period of time. For example, as the world sees greater efficiencies in production within the United States, might there be a long-term movement of Chinese, European, and other factories to the United States?

Likewise, capital investment by Americans themselves would be expected to alter production over time. The same would be true within the other regions of the model.

Each of these and other similar issues are worth considering. Each could be a new line of research, or at least a discussion for anyone using the present paper for policy decisions.

.3 VI.

.4 Conclusions

This paper essentially says global production and trade could be altered by the improvement of logistics and transport in the United States. In particular, the United States would stand to significantly benefit in GDP, trade, and consumer welfare should its transport and logistics sectors improve. The rest of the world would increase their use of U.S. transport services. As the U.S. economy would adjust to its own success, it must adjust to higher wages and competition. This paper suggests that improvemnts to and development of its logistics and trasnport sectors could be one part of that adjustment.

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