U.S.-Canada Trade and U.S. State-Level Production and Employment: 2008

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Abstract

Using a computable general equilibrium (CGE) model belonging to the class of multi-region CGE models commonly used to estimate the economy-wide and the sector-specific impacts of trade policy changes, we update our previous estimates of the impacts on U.S. and state output of U.S.-Canada trade. We find that trade with Canada in 2008 continues to provide tangible and important economy-wide employment and income benefits to the United States and to every U.S. state. Total trade with Canada – of goods and services, and exports as well as imports – generated U.S. output worth $470 billion in 2008, or 3.3 percent of GDP. That output supports U.S. employment. We estimate that 8 million net U.S. jobs, or 4.4 percent of total U.S. employment in 2008, depend on trade with Canada. Every U.S. state registered net positive job gains from trade with Canada.

Introduction

As we enter 2010 the American economy continues to be mired in a deep recession with high unemployment, and the public remains suspicious of the benefits of trade.[1] Policy makers struggle to explain the benefits of trade to their constituents. While it is not difficult to "sell" the benefits of exports and related jobs to a skeptical public, less widely embraced are the benefits of imports, or of trade generally.

[1] A February 2009 Gallup Poll found that 47 percent of the more than 1,000 Americans asked thought that foreign trade was more of a threat to the economy from imports compared to 44 percent who saw it as more of an opportunity for economic growth through increased U.S. exports. Jeffrey M. Jones, "Americans More Negative Than Positive About Foreign Trade," Gallup, February 18, 2009, http://www.gallup.com/poll/115240/americans-negative-positive-foreign-trade.aspx.

But our research has consistently shown that millions of U.S. jobs depend on trade – exports *and* imports -- with Canada (Francois and Baughman 2004; Baughman and Francois 2006). We found that in 2001, cross-border trade (exports *and* imports) in goods alone supported 5.2 million U.S. jobs. An update and expansion of that research found that in 2005, the net job impact of cross border trade in goods *and services* supported 7.1 million U.S. jobs.

Given the ongoing interest in U.S. policy makers in further stimulating job growth in the United States and avoiding unintended job loss consequences,[2] we update our earlier research quantifying U.S. employment related to trade with Canada and break down the job estimates by state. We begin with an overview of the U.S. Canada trade from 2000-2008, and then present our estimates of the number of U.S. jobs that depended on trade with Canada in 2008. We conclude with an assessment of what our results mean for U.S. trade policy. Appendix A details our methodology and Appendix B presents trade and trade cost elasticities.

The U.S.-Canada Trading Relationship

As we noted in our earlier research, the United States and Canada have enjoyed a long history of close trade relations due to geographic proximity, trade promotion agreements like the U.S.-Canada Free Trade Agreement and the North American Free Trade Agreement, and the resulting close integration of our economies. In 2008, Canada continued to be the United States' leading export market for goods, and the second largest export market for services (see Table 1). Canada is the second largest source of imports of goods into the United States (after China), and the fourth largest source of services imports.

Table 1: Leading U.S. Trading Partners, 2008
(billions of US dollars)

Goods Exports (*Rank*)	$1,169.8	Goods Imports (*Rank*)	$2,090.5
Canada (1st)	**222.4**	China (1st)	337.5

[2] On February 11, 2010, Senators Max Baucus and Charles Grassley introduced the lastest Congressional initiative to stimulate U.S. job growth, the "Hiring Incentives to Restore Employment (HIRE) Act," http://finance.senate.gov/sitepages/leg/LEG%202010/021010%20HIREACT%20draft.pdf

Mexico (2nd)	131.5	**Canada (2nd)**	**334.8**
China (3rd)	67.2	Mexico (3rd)	216.3
Japan (4th)	61.4	Japan (4th)	139.1
United Kingdom (5th)	49.1	Germany (5th)	95.8
Services Exports (*Rank*)	$525.8	Services Imports (*Rank*)	$364.4
United Kingdom (1st)	62.5	United Kingdom (1st)	43.5
Canada (2nd)	**46.8**	Germany (2nd)	26.4
Japan (3rd)	41.2	Japan (3rd)	24.5
Germany (4th)	28.2	**Canada (4th)**	**24.4**
Mexico (5th)	24.0	Bermuda (5th)	17.1
China (9th)	15.9	China (12th)	9.8

Source: U.S. Department of Commerce, Bureau of Economic Analysis

U.S. exports to and imports from Canada have both been growing over the last five years (see Table 2). Since 2004, Canada accounts for on average nearly 23 percent of U.S. goods exports, and 17 percent of its goods imports. The contribution of fuel imports to the growing deficit with Canada has escalated over the last five years. By 2008, fuel imports accounted for nearly the entire trade deficit. Canada ranks as the leading goods export destination for 34 U.S. states, and as the second largest export destination for another 11 states.

Table 2: U.S. Goods Trade with Canada, 2004-2008
(billions of US dollars and percent)

	Exports	Imports	Balance
2004	$190.0	$260.4	-$70.4
2005	212.2	295.1	-82.9
2006	231.0	307.1	-76.1
2007	250.0	320.8	-70.8
2008	261.9	342.9	-81.0
Average Share of Total 2004-2008	22.5%	16.8%	9.6%

Source: U.S. Department of Commerce, Bureau of Economic Analysis

While Canada enjoys a goods trade surplus with the United States, the United States holds a growing services trade surplus with Canada (Table 3). While U.S. services imports from Canada have been increasing modestly – on average 4.7 percent per year, U.S. services exports to Canada have been growing much more rapidly, on average 11.7 percent a year. Consequently, the 2004 U.S. services trade surplus had more than doubled by 2008. Canada has represented on average nearly 9 percent of total U.S. services exports since 2004, and 7 percent of U.S. services imports.

Table 3: U.S. Services Trade with Canada, 2004-2008
(billions of US dollars and percent)

	Exports	Imports	Balance
2004	$29.8	$21.0	$8.9
2005	32.9	22.3	10.6
2006	38.0	23.9	14.1
2007	43.2	25.2	18.0
2008	46.4	25.1	21.3
Average Share of Total 2004-2008	8.5%	6.8%	14.6%

Source: U.S. Department of Commerce, Bureau of Economic Analysis

Overall, total trade with Canada – imports and exports of both goods and services – has been increasing at an average annual rate of 7.8 percent. It represents a stable to growing share of the U.S. economy. While total U.S. trade with all countries accounted for about 30 percent of U.S. GDP in 2008, Canada contributed more than 15 percent of that.

Table 4: Total* Goods and Services Trade, 2004-2008
(billions of US dollars and percent)

	Total Goods	Total Services	Total Trade	Share of GDP
2004	$450.4	$50.8	$501.1	4.2%
2005	507.3	55.3	562.5	4.5
2006	538.1	62.0	600.0	4.5
2007	570.7	68.4	639.1	4.5

2008	604.8	71.5	676.3	4.7

*Exports plus imports
Source: U.S. Department of Commerce, Bureau of Economic Analysis

At the sectoral goods level, most of what the United States trades with Canada is raw materials, components, machinery and other inputs to manufacturing production and farming (see Table 5). As such, the economies of the two countries are intertwined, with parts and components crossing borders and finding their way into finished products– finished products that are also traded across borders in addition to being sold domestically. It is fair to say that imports from Canada contain much U.S. content. Motor vehicle parts made in the United States are shipped to Canada where they are assembled into cars that are shipped back to the United States. U.S. wheat and corn are used in Canada to make food products, many of which are shipped back to the United States.

U.S. goods trade with Canada frequently occurs between companies related to U.S. companies. In 2008, 47 percent of U.S. imports from Canada came from companies located in Canada that are related to U.S. companies.[3] This compares to just 27 percent for imports from China. U.S. exports to Canada also take place heavily through related parties: 41 percent of U.S. exports to Canada take place with Canadian companies related to the U.S. exporter.

Energy products figure heavily in U.S. goods imports from Canada. Indeed, as noted above, they account for most of the growth in the U.S. goods trade deficit with Canada in recent years. Canada is the largest supplier of crude petroleum to the United States, more than double the dollar value of crude petroleum imports from Saudi Arabia in 2008.

Trade in travel-related services is heavily tilted towards U.S. exports; Canada holds an advantage in freight exports and port services (see Tables 5 and 5a). The United States maintains a trade surplus in virtually all other types of services, except business, professional and technical services. Within that category, the United States in 2008 registered a surplus in trade

[3] Foreign Trade Division, U.S. Census Bureau, Washington, DC, http://sasweb.ssd.census.gov/relatedparty/.

with Canada in construction, architectural and engineering services; industrial engineering; installation, maintenance and repair of equipment; and legal services. Canada held a surplus in trade with the United States in computer and information services; management, consulting and public relations services; and research, development and testing services.

Table 5: Leading Sectors in U.S. Trade with Canada, 2004-2008
(billions of US dollars)

	2004	2005	2006	2007	2008
Goods Exports					
Vehicles (HS 87)	$37.4	$40.9	$43.9	$47.1	$42.0
Non-electrical machinery (HS 84)	27.5	30.9	33.0	33.7	34.3
Mineral fuels (HS 27)	5.4	8.1	8.4	9.9	15.9
Electrical machinery (HS 85)	12.7	13.9	14.3	14.4	14.6
Plastics (HS 39)	8.2	9.4	10.2	10.3	10.9
Precision instruments (HS 90)	5.1	5.3	5.8	5.9	6.1
Iron and steel (HS 73)	3.6	4.3	5.0	5.1	6.3
Paper and paperboard (HS 48)	4.0	4.3	4.8	5.0	5.2
Aircraft (HS 88)	1.8	2.4	2.5	3.8	3.9
Goods Imports					
Mineral fuels (HS 27)	48.8	65.4	72.9	78.2	111.3
Crude petroleum	*18.9*	*24.1*	*32.9*	*37.9*	*62.4*
Other petroleum oils	*6.3*	*8.5*	*9.4*	*11.1*	*13.2*
Natural gas	*21.4*	*29.2*	*26.8*	*25.2*	*30.2*
Electricity	*1.3*	*2.4*	*2.5*	*2.7*	*3.6*
*Other**	*0.9*	*1.2*	*1.3*	*1.3*	*1.9*
Vehicles (HS 87)	59.2	61.7	61.3	60.4	47.5
Non-electrical machinery (HS 85)	18.0	19.7	20.1	22.0	21.6
Plastics (HS 39)	9.1	10.5	11.1	10.7	10.7
Electrical machinery (HS 85)	9.5	10.8	10.7	10.5	10.0
Paper and paperboard (HS 48)	9.9	10.4	10.4	9.7	9.6
Alum. and alum. products (HS 76)	5.9	6.9	9.3	9.3	9.1
Wood and wood products (HS 44)	14.2	14.2	12.6	9.8	6.8
Iron and steel (HS 72)	3.4	3.8	4.2	4.4	6.3
Aircraft (HS 88)	5.3	6.0	5.1	6.4	5.8

Services Exports					
Travel and passenger fares	10.5	11.7	13.4	16.6	18.7
Other transportation	2.7	3.0	3.1	3.4	3.7
Royalties and license fees	3.9	4.7	6.1	5.9	5.9
Other private services	12.4	13.3	14.9	16.9	17.5
Services Imports					
Travel and passenger fares	7.7	7.5	7.8	7.8	7.3
Other transportation	4.0	4.4	4.7	4.9	5.0
Royalties and license fees	0.8	0.8	0.7	0.8	0.7
Other private services	7.9	9.1	10.2	11.1	11.4

* Nuclear fuels, fuel oil, coal, liquefied natural gas, and other energy products.
Source: Bureau of Census, Bureau of Economic Analysis.

Table 5a: Detailed Snapshot of U.S. Services Trade with Canada, 2008
(billions of US dollars)

	Exports	Imports	Balance
Travel and passenger fares	$18.8	$7.3	$11.5
Other transportation (freight, port services)	3.7	5.0	-1.3
Royalties and license fees	5.9	0.7	5.2
Industrial processes	*2.0*	*0.4*	*1.6*
Books, records, tapes	*0.2*	*	*
Franchise fees	*0.8*	*	*0.8*
Trademarks	*0.9*	*0.1*	*0.8*
General use computer software	*2.1*	*0.1*	*1.9*
Other	*0.2*	*	*0.1*
Other private services	17.5	11.4	6.1
Education	*0.9*	*0.2*	*0.7*
Financial services	*3.8*	*0.9*	*2.9*
Insurance	*2.4*	*0.8*	*1.6*
Telecommunications	*0.7*	*0.4*	*0.3*
Business, professional and tech.	*8.0*	*8.8*	*-0.8*
Film & TV tape rentals	*1.3*	*0.1*	*1.2*

* Less than $500 million
Source: Bureau of Census, Bureau of Economic Analysis.

The U.S.-Canada Economic Relationship: What It Meant for U.S. Output and Jobs in 2008

Our previous research demonstrated that the U.S.-Canada trade relationship equated to millions of dollars of U.S. output and millions of jobs. This is output and these are jobs that would not exist but for trade with Canada. Moreover, they measure the net impact of the trading relationship on U.S. output and jobs, and they capture all the direct and indirect jobs related to trade with Canada.

This paper shows that the trading relationship has grown since we last measured its impact on output and jobs in 2005. As the two economies have grown even more interrelated, and output and jobs have moved to meet the needs of an even deeper cross-border relationship, we update in this paper our examination of the output and employment impacts of the bilateral trading relationship for 2008. We use the same methodology we followed in our earlier research: a computable general equilibrium (CGE) model that examines the direct and indirect impacts of trade on the U.S. economy. Appendix A details our methodology.

We modeled the same counterfactual as our previous research: what is the impact on U.S. output and employment of a cessation of trade with Canada? If there were no trade with Canada, what would the United States produce, and what it would import and from whom, and what would it export and to whom? The changes in U.S. output and employment provide us with a measure of the opposite: the output and employment that exists at current wage and productivity levels only because we trade with Canada. We break our national estimates down by state using state industry-specific "gross state output" employment data.

Results: Impact of U.S.-Canada Trade on U.S. Output

The impact of U.S.-Canada trade on U.S. national and state output continues to be significant. U.S. national output in 2008 related to trade with Canada totaled more than $470 billion (see Table 6), more than 3 percent of total U.S. GDP. Most of that boost in income was felt by U.S. services sectors – not just those sending exports to Canada but also services sectors related to the manufacture or farming of goods that are export to Canada or imported from Canada. This includes, for example, $41 billion in finance and insurance sector output, and $55 billion in wholesale/retail trade sector

output. Notably, U.S. manufacturing output experienced a net gain from trade with Canada measuring nearly $30 billion in 2008. The trade relationship is also important for the energy sector (defined to include oil and gas extraction, petrochemical production, and utilities). These sectors contributed roughly $14.4 billion to U.S. GDP because of trade with Canada.

Table 6: U.S. National Output Related to Trade with Canada, 2008
(billions of U.S. dollars)

Total	$470.3	
Primary Sectors (agriculture, forestry, fishing, mining)	3.1	
Oil and gas extraction		*1.2*
Construction	13.1	
Manufacturing	27.6	
Petroleum and coal products		*1.8*
Services	426.5	
Transportation and warehousing		*13.4*
Utilities		*11.4*
Wholesale and retail trade		*54.8*
Finance and insurance		*40.7*
Information		*20.2*
Professional and technical		*35.6*
Management		*23.1*
Rental, leasing and real estate		*68.2*
Accommodation and food		*18.5*
Other consumer and public services		*140.6*

Source: Authors' estimates.

Every U.S. state benefited from trade with Canada in 2008. Table 7 shows that state output related to this trade ranged from $871 million in Vermont to $62 billion in California. In general, between 3 and 4 percent of state national income depended on trade with Canada.

Table 7: State Output Related to Trade with Canada, 2008
(millions of U.S. dollars)

	Value of Output	Share of Total Output in State	State Share of Total Output Related to Trade		Value of Output	Share of Total Output in State	State Share of Total Output Related to Trade
Alabama	$5,480	3.2%	1.2%	Montana	1,169	3.3%	0.2%
Alaska	1,273	2.7	0.3	Nebraska	2,663	3.2	0.6
Arizona	8,490	3.4	1.8	Nevada	4,675	3.6	1.0
Arkansas	3,092	3.1	0.7	New Hampshire	2,063	3.4	0.4
California	62,442	3.4	13.3	New Jersey	16,345	3.4	3.5
Colorado	8,238	3.3	1.8	New Mexico	2,419	3.0	0.5
Connecticut	7,363	3.4	1.6	New York	40,558	3.5	8.6
Delaware	2,183	3.5	0.5	North Carolina	12,995	3.2	2.8
D.C.	3,685	3.8	0.8	North Dakota	944	3.0	0.2
Florida	26,257	3.5	5.6	Ohio	15,385	3.3	3.3
Georgia	13,394	3.4	2.8	Oklahoma	4,372	3.0	0.9
Hawaii	2,377	3.7	0.5	Oregon	5,202	3.2	1.1
Idaho	1,713	3.2	0.4	Pennsylvania	18,473	3.3	3.9
Illinois	21,170	3.3	4.5	Rhode Island	1,659	3.5	0.4
Indiana	7,925	3.1	1.7	South Carolina	5,201	3.3	1.1
Iowa	4,158	3.1	0.9	South Dakota	1,189	3.2	0.3
Kansas	3,894	3.2	0.8	Tennessee	8,338	3.3	1.8
Kentucky	4,979	3.2	1.1	Texas	36,549	3.0	7.8
Louisiana	6,148	2.8	1.3	Utah	3,602	3.3	0.8
Maine	1,705	3.4	0.4	Vermont	871	3.4	0.2
Maryland	9,688	3.5	2.1	Virginia	13,707	3.5	2.9
Massachusetts	12,620	3.5	2.7	Washington	10,884	3.4	2.3
Michigan	12,636	3.3	2.7	West Virginia	1,972	3.2	0.4
Minnesota	8,688	3.3	1.8	Wisconsin	7,699	3.2	1.6
Mississippi	2,948	3.2	0.6	Wyoming	896	2.5	0.2
Missouri	7,897	3.3	1.7	U.S. Total	470,272	3.3	100.0

Source: Authors' estimates

Results: Impact of U.S.-Canada Trade on U.S. Jobs

All of this additional output related to U.S.-Canada trade means jobs as well. In 2008, we estimate that more than 8 million U.S. jobs depended on trade with Canada (see Table 8). As with output, most of those jobs are in

services sectors; nearly half a million were in manufacturing. Many of them pay average hourly wages in excess of the national average. Again, these are jobs directly and indirectly associated with cross-border trade: jobs that would not exist but for that trade.

Table 8: U.S. National Employment Related to Trade with Canada, 2008

	Employment	Hourly Wages
Total	8,027,826	$18.08*
Primary Sectors (agriculture, forestry, fishing, mining)	56,764	22.50**
Oil and gas extraction	*6,597*	*27.28*
Construction	307,014	21.87
Manufacturing	452,123	17.74
Petroleum and coal products	*6,073*	*27.46*
Services	7,211,925	n.a.
Transportation and warehousing	*284,881*	*18.41*
Utilities	*36,060*	*28.84*
Wholesale and retail trade	*1,184,428*	*14.90*
Finance and insurance	*370,512*	*21.54*
Information	*212,044*	*24.77*
Professional and technical	*439,404*	*27.83*
Management	*462,372*	*22.05*
Rental, leasing and real estate	*297,858*	*16.38*
Accommodation and food	*650,542*	*10.23*
Other consumer and public services	*3,273,824*	*n.a.*

* Private, non-agricultural hourly rate

** Mining and logging only.

Sources: Employment, authors' estimates; Hourly wages, U.S. Bureau of Labor Statistics, Current Employment Statistics, "Employment, Hours, and Earnings – National." Hourly wages are for non-supervisory (services) and production (goods), full- and part-time workers.

Table 9 shows that every state enjoys a net positive employment impact from national trade with Canada. These jobs include those directly

involved in exports to or imports from Canada, as well as supporting jobs in states with little or no direct trade with Canada.

Table 9: State Employment Related to Trade with Canada, 2008

	Number of Jobs	Share of Total Jobs in State	State Share of Total Jobs Related to Trade		Number of Jobs	Share of Total Jobs in State	State Share of Total Jobs Related to Trade
Alabama	115,355	4.4%	1.4%	Montana	28,156	4.3%	0.4%
Alaska	20,385	4.5	0.3	Nebraska	54,967	4.4	0.7
Arizona	149,996	4.4	1.9	Nevada	73,524	4.5	0.9
Arkansas	68,845	4.3	0.9	New Hampshire	37,706	4.4	0.5
California	931,890	4.4	11.6	New Jersey	234,094	4.5	2.9
Colorado	143,807	4.4	1.8	New Mexico	49,374	4.4	0.6
Connecticut	100,146	4.5	1.3	New York	517,028	4.6	6.4
Delaware	24,705	4.5	0.3	North Carolina	244,555	4.4	3.1
D.C.	39,066	4.8	0.5	North Dakota	21,404	4.3	0.3
Florida	465,072	4.5	5.8	Ohio	301,072	4.4	3.8
Georgia	249,155	4.5	3.1	Oklahoma	93,499	4.2	1.2
Hawaii	40,465	4.6	0.5	Oregon	100,893	4.3	1.3
Idaho	39,893	4.3	0.5	Pennsylvania	330,610	4.5	4.1
Illinois	339,905	4.4	4.2	Rhode Island	27,648	4.6	0.3
Indiana	162,286	4.4	2.0	South Carolina	114,088	4.5	1.4
Iowa	87,123	4.3	1.1	South Dakota	24,604	4.4	0.3
Kansas	80,405	4.4	1.0	Tennessee	163,780	4.4	2.0
Kentucky	105,722	4.3	1.3	Texas	624,986	4.3	7.8
Louisiana	112,666	4.4	1.4	Utah	74,467	4.4	0.9
Maine	37,230	4.5	0.5	Vermont	19,306	4.4	0.2
Maryland	156,426	4.5	2.0	Virginia	218,425	4.5	2.7
Massachusetts	190,915	4.5	2.4	Washington	173,978	4.4	2.2
Michigan	237,082	4.4	3.0	West Virginia	40,887	4.4	0.5
Minnesota	157,228	4.4	2.0	Wisconsin	156,452	4.4	2.0
Mississippi	67,692	4.4	0.8	Wyoming	16,821	4.2	0.2
Missouri	162,045	4.4	2.0	U.S. Total	8,027,826	4.4	100.0

Source: Authors' estimates

Services Output and Employment

Our earlier research explains why so much of this trade-related output and jobs are in services sectors, an explanation that bears repeating here. We again note four reasons. First, trade with Canada includes services trade. We capture direct linkages between exports to Canada and services production in the United States. But as noted above, goods trade with Canada is much larger than services trade, so the concentration of benefits on services sectors seems unusual until one notes that, second, manufacturing in the United States is actually quite services-intensive (Francois and Woerz 2007). Thus, a boost to manufacturing activity from exports to Canada has important implications for demand for intermediate services. Third, the U.S. economy is largely services-based. In 2008, services (including construction) accounted for 84 percent of non-farm private employment and 80 percent of private gross domestic product. A boost in economic activity measured by trade with Canada therefore means a general increase in economic activity, particularly services activity. Finally, because we are looking at general equilibrium effects, our estimates include income linkages to services demand. This means that higher incomes lead to more demand for (and jobs linked to) consumer services. This last effect is missing from analyses that just focus on production-based input-output linkages.

Impact on Changes in Trade Volumes and Costs

It is useful to know what our results suggest the impacts on employment and output would be from small changes in trade and trade costs (known as "elasticities"). The answers are provided in Table 10. A 1 percent increase in the volume (measured in quantity or in real dollars) of U.S.-Canada trade (defined as total goods *and* services exports *and* imports) would trigger a 0.057 percent increase in U.S. employment and a 0.043 percent increase in U.S. output.[4] (Similarly, a 1 percent *decline* in U.S.-Canada trade would result in a 0.057 percent *drop* in related employment and a 0.043 percent decline in output.)

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[4] It would not be appropriate to apply these elasticities to some measure of trade other than *total* trade between the United States and Canada: for example, goods exports alone in order to estimate the employment associated with an increase or decrease in goods exports.

Table 10 shows that the potential impact of a change in the cost of U.S.-Canada trade is potentially significant. For example, a 10 percent increase in trade costs (i.e., a 10 percent increase in the cost of delivering goods across the border measured as a share of the value of the goods traded) would cut U.S. employment by roughly 1.47 percent and U.S. output by 1.1 percent. Appendix B details these elasticity estimates by state.

Table 10: The Marginal Impact of Changes in Trade Volumes and Costs
(percent)

	Change in Total Employment	Change in Total Gross National Product
1% increase in trade volumes	0.057	0.043
1% increase in cost of trade	-0.147	-0.110

Source: Authors' estimates

Conclusion

Trade with Canada continues to provide the United States with substantial, quantifiable and real benefits. It boosts U.S. output and, consequently, U.S. employment. The jobs related to trade with Canada are spread across the United States, and concentrated in high-wage services sectors. Policy initiatives that expand trade with Canada would have positive impacts on U.S. output and employment. By the same token, initiatives that raise barriers to trade or increase the costs of trade with Canada would have a negative impact on the U.S. economy and employment.

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Appendix A: Methodology

As with our previous research, we applied a computable multi-sector model of the U.S. economy to estimate the impacts on the United States of total trade with Canada. We used the most recent version of a computable general equilibrium (CGE) model known as the "Global Trade Analysis Project" (GTAP), updated to reflect the state of the U.S., Canadian and world economies in 2008. We mapped these data to Bureau of Economic Analysis (U.S. Department of Commerce) data for national and state employment and output (Gross Domestic Product) by sectors, as detailed in the main body of the report. Apart from database updates, the methodology follows closely that of our earlier estimates, so that our estimates here are consistent with our earlier findings (see Baughman and Francois 2006).

The CGE model is a static multi-regional, multi-sector computable general equilibrium model. On the production side, capital stocks are fixed at a national level. Firms are competitive, and employ capital and labor to produce goods and services subject to constant returns to scale.[5] Products from different regions are assumed to be imperfect substitutes in accordance with the so-called "Armington" assumption. Trade, demand and production elasticities are taken from the GTAP 7 database.

Because we are interested in estimates close, in concept, to the older generation of input-output calculations and net labor embodied in trade, we work with a version of the GTAP model with standard assumptions about resources and technology. In other words, the counterfactual represents an effort to link trade to labor market patterns, given the structure of the U.S. economy in 2008. This approach will miss important dynamic effects, so that our estimates here may understate overall labor market impacts. For example, the productivity benefits of trade with Canada are reinforced by investment that itself is a response, at the margin, to these productivity effects. This means that the underlying capital stock in the U.S. is also supported, in part, by the benefits of foreign trade. Including these effects would likely magnify the effects identified here, reinforcing the static

[5] Compared to dynamic CGE models and models with alternative market structures, the present assumption of constant returns to scale with a fixed capital stock is closest in approach to older studies based on pure input-output modeling of trade and employment linkages. In the present context, it can be viewed as generating a lower-bound estimate of effects relative to alternative CGE modeling structures.

estimates we report. We have not focused on these additional mechanisms because we view them as removed from our core question, which is linking current jobs to current trade given current economic structures (including the U.S. capital stock in 2008).

Experiment

We seek to estimate the impact of trade on the U.S. and state economies given the actual U.S. wage structures prevailing in 2008. For a given level of wages, the ability of the firms producing a good or service in the United States to supply jobs to workers at those wages depends on the productivity of U.S. workers. Labor productivity, in turn, hinges on the general level of productivity of the U.S. economy as a whole, which is a function of underlying technology in 2008 as well as the effect of trade on overall productivity of the U.S. economy. Our goal here is to estimate this overall effect, and translate it directly into the number of jobs made possible by these productivity effects. In other words, given U.S. productivity in 2008 and the resulting prevailing wage structure of the labor force in that year, how many total jobs in the U.S. economy and in each state's economy were linked either directly or indirectly to trade? As such, we employ a labor market closure (equilibrium conditions) where we fix wages at prevailing levels, and force employment levels to adjust. This provides a direct estimate of the jobs supported, at current wage levels, by the current level of trade.

The experiment consists of imposing changes in U.S. trade, in this instance effectively eliminating U.S. exports and imports with Canada by imposing prohibitive trade costs and tracing changes at the border as they work through the U.S. economy. The results tell us how much U.S. and state output and employment would decline were the United States to cease exporting and importing goods and services with Canada. These results thus also measure the reverse scenario: how much 2008 levels of trade in goods and services contributed to U.S. and state output and employment.

It is important to stress that, in the absence of trade with Canada, there would likely be diversion of trade to other countries. In other words, if we did not allow trade with other countries to adjust, we would overstate the impact of Canadian trade on the U.S. economy. For this reason we work with a multi-region model that allows for diversion of U.S.-Canada trade to

third countries. As such, our estimates take into account the impact of trade diversion involving third countries.

Appendix B: Marginal Impacts by of Trade on State Jobs and Output Elasticities Analysis

This Appendix details by state our estimates of the marginal impacts on trade and of trade costs on state-level output (Gross State Product, GSP) and employment. These impacts, technically termed an "elasticity," measure the percentage change in output (or employment) associated with a 1 percent change in trade, and the percentage change in output (or employment) resulting from a 1 percent change in trade costs.

Table B-1 shows that a 1 percent *increase* in U.S. trade with Canada (measured as exports plus imports of goods and services) results in, for example, a 0.042 percent *increase* in California's output and a 0.058 percent increase in employment in California. Equally, it means that a 10 percent *decline* in trade with Canada results in a 0.42 percent decline in state output and a 0.58 percent *decline* in state employment.

Table B-1: Employment and GDP Elasticities: 1 Percent Change in Trade Volumes with Canada

	Jobs Impact	Output Impact
United States	**0.057**	**0.043**
Alabama	0.057	0.042
Alaska	0.058	0.034
Arizona	0.057	0.044
Arkansas	0.056	0.041
California	0.058	0.043
Colorado	0.057	0.043
Connecticut	0.058	0.044
Delaware	0.059	0.045
District of Columbia	0.062	0.048
Florida	0.058	0.045
Georgia	0.058	0.043
Hawaii	0.060	0.048
Idaho	0.055	0.042
Illinois	0.058	0.043
Indiana	0.057	0.040
Iowa	0.057	0.040
Kansas	0.057	0.041
Kentucky	0.056	0.041
Louisiana	0.057	0.036

Maine	0.058	0.044
Maryland	0.059	0.045
Massachusetts	0.059	0.044
Michigan	0.057	0.043
Minnesota	0.057	0.043
Mississippi	0.057	0.041
Missouri	0.057	0.043
Montana	0.056	0.042
Nebraska	0.057	0.041
Nevada	0.058	0.046
New Hampshire	0.058	0.044
New Jersey	0.059	0.044
New Mexico	0.058	0.039
New York	0.060	0.045
North Carolina	0.058	0.042
North Dakota	0.056	0.039
Ohio	0.057	0.042
Oklahoma	0.055	0.038
Oregon	0.056	0.042
Pennsylvania	0.058	0.043
Rhode Island	0.060	0.045
South Carolina	0.058	0.043
South Dakota	0.057	0.041
Tennessee	0.057	0.043
Texas	0.056	0.038
Utah	0.057	0.042
Vermont	0.058	0.044
Virginia	0.058	0.044
Washington	0.058	0.043
West Virginia	0.057	0.041
Wisconsin	0.057	0.041
Wyoming	0.054	0.032

Source: Authors' estimates

Table B-1 reports the state-level changes in output and employment resulting from a 1 percent increase in the cost of trade with Canada (measured as a percent of the value of goods and services sold across the border). It shows that a 1 percent *increase* in the total cost of U.S. trade with Canada *reduces* Illinois' output by 0.111 percent and the state's employment by -0.148 percent. Alternatively, a 10 percent *reduction* in national costs of trading with Canada *increases* Arizona's output by 1.13 percent and its employment by 1.47 percent.

Table B-1: Employment and GDP Elasticities: 1 Percent Change in Cost of Trade with Canada

	Jobs Impact	Output Impact
United States	**-0.147**	**-0.110**
Alabama	-0.146	-0.107
Alaska	-0.150	-0.090
Arizona	-0.147	-0.113
Arkansas	-0.146	-0.104
California	-0.148	-0.112
Colorado	-0.146	-0.110
Connecticut	-0.149	-0.113
Delaware	-0.150	-0.117
District of Columbia	-0.159	-0.125
Florida	-0.148	-0.116
Georgia	-0.149	-0.112
Hawaii	-0.154	-0.122
Idaho	-0.143	-0.108
Illinois	-0.148	-0.111
Indiana	-0.145	-0.103
Iowa	-0.145	-0.102
Kansas	-0.147	-0.105
Kentucky	-0.144	-0.106
Louisiana	-0.147	-0.093
Maine	-0.150	-0.113
Maryland	-0.150	-0.117
Massachusetts	-0.150	-0.115
Michigan	-0.146	-0.109
Minnesota	-0.148	-0.110
Mississippi	-0.149	-0.106
Missouri	-0.147	-0.110
Montana	-0.145	-0.108
Nebraska	-0.148	-0.106
Nevada	-0.149	-0.117
New Hampshire	-0.147	-0.114
New Jersey	-0.150	-0.114
New Mexico	-0.148	-0.101
New York	-0.152	-0.117
North Carolina	-0.149	-0.108
North Dakota	-0.144	-0.101
Ohio	-0.147	-0.108
Oklahoma	-0.142	-0.100
Oregon	-0.145	-0.107
Pennsylvania	-0.149	-0.111
Rhode Island	-0.153	-0.116

South Carolina	-0.149	-0.110
South Dakota	-0.146	-0.107
Tennessee	-0.148	-0.109
Texas	-0.144	-0.100
Utah	-0.148	-0.109
Vermont	-0.148	-0.113
Virginia	-0.149	-0.114
Washington	-0.148	-0.112
West Virginia	-0.147	-0.106
Wisconsin	-0.146	-0.106
Wyoming	-0.139	-0.086

Source: Authors' estimates