THE DEPENDENCE OF U.S. EMPLOYMENT ON CANADA, 2013

by

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December 3, 2014

Summary

Canada is biggest market for U.S. exports and the second biggest source of U.S. imports, behind China. It is also a significant foreign supplier of direct investment to the U.S. In this report we quantify the role of Canada in supporting jobs in the U.S. through trade and investment.

To calculate the dependence of U.S. employment on trade with Canada, we use an economic model to look at how employment in the U.S. would be affected by a cessation of Canada/U.S. trade. In this way we find that Canada/U.S. trade:

- *supports 8.27 million jobs in the U.S.* This is about 4.54 per cent of U.S. jobs.

- *has a net positive effect on GDP of 6.5 per cent* resulting from a positive effect on output in 437 industries and a negative effect in 96 industries. The most obvious U.S. beneficiaries are industries with a heavy reliance on exports to Canada. However many other industries benefit from the availability of imported inputs from Canada. The only U.S. industries that lose from Canada/U.S. trade are those that face strong competition from Canadian imports. But of course this import competition has beneficial effects in keeping prices down in the U.S. for business inputs and for consumer goods.

- *generates 24 per cent of U.S. exports.* This is more than Canada's direct share (18 per cent) in U.S. exports. For many industries, exports to Canada provide the economies of scale in exporting that are necessary to sustain U.S. competitiveness in other export markets.

- *has a positive effect on employment in every state and the District of Columbia and every Congressional district.* Because of links between states, even states that have little direct connection with Canada/U.S. trade are beneficiaries.

To calculate the dependence of U.S. employment on Canadian direct investment we use statistics from the Bureau of Economic Analysis on U.S. employment in Canadian-majority-owned affiliates operating in the U.S. We find that Canadian direct investment:

- *supports 0.57 million employees in the U.S.* This is about 0.45 per cent of employee jobs in the U.S.

- *provides more than 1 per cent of U.S. employee jobs in Manufacturing, Information, Finance & insurance and Real estate and rental & leasing.*

- *provides jobs in every state and the district of Columbia.* In Alaska, Kansas, Minnesota, Nevada, New Hampshire, South Dakota and Wisconsin Canadian-majority-owned affiliates provide more than 0.8 per cent of employee jobs.

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1. Introduction

Canada is of major economic importance to the U.S. both as a trade partner and as a direct investor in the U.S. In this report we quantify the economic contribution of Canada to the U.S. by estimating how many jobs in the U.S. depend on trade with Canada and on Canadian-owned businesses in the U.S.

To provide our trade estimate we conducted a simulation with a general equilibrium model. This shows the effects on U.S. macro variables including employment and on U.S. industries, states and Congressional districts of an elimination of both U.S. exports to Canada and U.S. imports from Canada.

Our main macro results for cessation of Canada/U.S. trade are in Table 1.1. This table shows reductions in U.S. GDP and employment of 6.47 per cent and 4.54 per cent, equivalent to a loss in GDP of about $1,085 billion and a loss of 8.27 million jobs.

Table 1.1 Macro effects on the U.S. of ceasing trade with Canada (%)

GDP	-6.47
Employment	-4.54

Two previous studies using a similar methodology to that adopted here obtained similar results. Baughman and Francois (2010) found that 4.4 per cent of U.S. jobs in 2008 depended on trade with Canada while Dixon *et al.* (2012) estimated the dependence in 2010 at 4.5 per cent of U.S. jobs. That is, these studies found that U.S. employment would be reduced by 4.4 and 4.5 per cent if trade with Canada ceased. The two studies translated these percentage estimates into jobs losses of 8.03 and 7.88 million.[1] Our new estimate for 2013 is 8.27 million jobs (4.54 per cent of the 182.28 million jobs in the U.S. in 2013).

On U.S. GDP, Baughman and Francois estimated that the reduction associated with cessation of Canada/U.S. trade would be 3.3 per cent whereas Dixon *et al.* (2012) estimated the loss at 5.84 per cent. As pointed out by Dixon *et al.*, the Baughman and Francois estimated loss is too low: it appears to take into account only the direct contribution to GDP of the lost jobs. The Dixon *et al.* estimate for 2010 of a 5.84 per cent loss in GDP and our current estimate for 2013 of a 6.47 per cent loss take account not only of the direct loss but also the loss in U.S. efficiency associated with the substitution in the U.S. market of less suitable U.S. and third-country products for Canadian products.[2]

To provide our estimate of U.S. employment dependence on Canadian businesses, we accessed data from the Bureau of Economic Analysis (BEA) on numbers of employees in Canadian-majority-owned businesses in the U.S. These data imply for 2013 that Canadian businesses in the U.S. provided jobs for about 571 thousand U.S. residents.

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[1] The number of jobs in the U.S. in 2008 was higher than in 2010.
[2] This point is developed further in the Appendix.

The rest of this report is organized as follows. In section 2 we explain our methodology for the trade-cessation estimates and provide additional macroeconomic results. In sections 3, 4 and 5 we look at industry, state and Congressional district results for the effects of trade cessation. Section 6 discusses employment dependence in the U.S. on Canadian businesses operating in the U.S. Estimates are presented at the macro, sectoral and state levels. Concluding remarks are in section 7.

2. Employment dependence in the U.S. on trade with Canada: methodology and macroeconomic results

2.1 The USAGE model

Our trade-cessation simulations were conducted with the USAGE model of the U.S. USAGE is a 533-industry/commodity dynamic computable general equilibrium (CGE) model of the U.S. developed at the Centre of Policy Studies, Victoria University in collaboration with the U.S. International Trade Commission.[3] The theoretical structure of USAGE is similar to that of Australia's MONASH model, Dixon and Rimmer (2002). USAGE has been applied by the U.S. International Trade Commission and the U.S. Departments of Commerce, Agriculture, Homeland Security, Energy and Transportation in studies concerned with trade, biofuels, immigration, the Obama stimulus package, the President's National Export Initiative, greenhouse policy, economic aspects of security threats and highway infrastructure.

The standard version of USAGE relies on a database for 2005. For the present study we updated key aspects of the database to 2013. The update covered: macro aggregates; U.S. imports from Canada and U.S. exports to Canada disaggregated to the 533 commodity level; and jobs by industry, state and congressional district.

2.2 Assumptions underlying the USAGE simulation and further macro results

We simulated the effects of cessation of Canada/U.S. trade under the assumption that there would be no effect on real wage rates in the U.S. The same assumption was made by Baughman & Francois and Dixon *et al.* (2012). The idea is to find out how many jobs in the U.S. at current wage rates depend on Canada/U.S. trade. If there were a cessation of Canada/U.S. trade, then U.S. wages would eventually fall allowing U.S. employment to return to normal levels. So in this sense, U.S. employment in the long run does not depend on Canada/U.S. trade. However, maintenance of employment at current real wage rates *does* depend on Canada/U.S. trade. It is this dependence that we measure by calculating the number of jobs that would be lost if Canada/U.S. trade ceased and U.S. wages did not fall.

In our simulations we assume that cessation of Canada/U.S. trade does not affect the U.S. balance of trade. Put another way, we assume that there would be no change in U.S. reliance on foreign borrowing. As shown in Table 2.1, both U.S. exports and imports would contract sharply. The trade balance would be maintained via adjustment of the U.S. exchange rate. U.S. exports to Canada and imports from Canada in 2013 were both about $400 billion. Thus cancellation of this trade without a change in the U.S. trade deficit would require balanced changes in U.S. imports from and exports to the rest of the world. Cessation of Canada/U.S. trade would raise costs in the U.S., and with no change in the real wage rates

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[3] For USAGE applications by the U.S. International Trade Commission see USITC (2004, 2007, 2009, 2011, 2013).

Table 2.1 Further macro effects on the U.S. of ceasing trade with Canada (%)

Private consumption	-5.38
Public consumption	-5.38
Investment	-5.38
Exports	-24.28
Imports	-14.79
GDP	-6.47
Employment	-4.54
Capital stock	0.00

devaluation of the U.S. currency would be required for maintenance of the U.S. trade balance.[4]

In percentage terms the contraction in total U.S. exports would exceed that in total U.S. imports because the value of U.S. imports exceeds that of U.S. exports. Although Canada accounts for only 18 per cent of U.S. exports, the elimination of these exports leads to a contraction in total U.S. exports of more than 18 per cent (24.28 per cent). What our model is reflecting is that with the elimination of Canada as a partner, trade becomes a less efficient way for the U.S. economy to satisfy the requirements of its citizens. Without the ability to import from Canada, there is a reduction in the value to the U.S. of earning foreign currency by selling exports in other countries.

With cessation of Canada/U.S. trade and no change in the trade balance, our model implies that changes in real GDP must be accommodated by reductions in absorption. We see this in Table 2.1 where private consumption, public consumption and investment all fall by 5.38 per cent. That they fall by the same percentage reflects an assumption built into the simulation: cessation of Canada/U.S. trade does not affect the broad composition of U.S. absorption (or gross national expenditure, GNE). That the percentage reduction in absorption (5.38) is less than the percentage reduction in GDP (6.47) arises from two factors. First, in nominal terms (current dollars), GNE for the U.S. is greater than GDP. With the balance of trade fixed, the change in nominal GNE must be the same as the change in nominal GDP, implying a smaller percentage decline in nominal GNE than in nominal GDP. This nominal effect is reinforced in real terms by the second factor, a terms-of-trade improvement. With a reduction in its exports, not only to Canada but to the rest of the world, the U.S. gets minor compensation via increases of the prices of its exports on world markets (a terms-of-trade improvement). This allows GNE in real terms to increase relative to GDP in real terms.

The final macro assumption underlying our simulation is that cessation of Canada/U.S. trade does not affect the total quantity of capital stock in the U.S. This is a short-run assumption, consistent with our assumption that wages do not change, also a short-run assumption.

3. U.S. industry dependence on Canada/U.S. trade

Table 3.1 shows effects of cessation of Canada/U.S. trade on U.S. outputs of 533 commodities. For 437 commodities the effect is negative while for 96 commodities the effect is positive or zero.

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[4] With consumer prices treated as the numeraire (unaffected by cessation of trade) U.S. devaluation of about 8 per cent is required.

A priori we would expect cessation of Canada/U.S. trade to be particularly bad for output of U.S. commodities that are heavily exported to Canada. On the other hand we would expect the output of commodities that are heavily exported to countries other than Canada to be stimulated by cessation of Canada/U.S. trade. This is because output of these commodities would benefit from the movement in the U.S. exchange rate: as mentioned earlier cessation would cause devaluation of the U.S. dollar.[5] Commodities that face considerable competition in the U.S. market from Canadian imports would also benefit from cessation.

We tested these expectations by running a regression of the form

$$y(i) = \alpha_0 + \alpha_1 * SC_{imp}(i) + \alpha_2 * SC_{exp}(i) + \alpha_3 * SNC_{exp}(i), \quad \text{for } i = 1, 533 \qquad (3.1)$$

where

y(i) is the USAGE result in Table 3.1 for the percentage effect of Canada/U.S. trade cessation on U.S. output of commodity i;

$SC_{imp}(i)$ is a measure of the competition faced by U.S. producers of commodity i from imports of Canadian commodity i;[6]

$SC_{exp}(i)$ is the share of U.S. output of commodity i that is exported to Canada;

$SNC_{exp}(i)$ is the share of U.S. output of commodity i that is exported to countries other than Canada; and

α_0 to α_3 are parameters to be estimated.

The resulting regression equation is:

$$y(i) = -4.54 + 34.85 * SC_{imp}(i) - 87.28 * SC_{exp}(i) + 16.92 * SNC_{exp}(i), \qquad R^2 = 0.66 \qquad (3.2)$$

As expected, outputs of commodities with high export shares to Canada are systematically reduced by cessation: the coefficient on SC_{exp} is negative. Outputs of commodities facing strong competition from Canadian imports are systematically increased by cessation: the coefficient on SC_{imp} is positive. Similarly, cessation has positive effects on the outputs of commodities that are significantly exported to countries other than Canada: : the coefficient on SNC_{exp} is positive.

By using Table 3.1, we can identify the attributes of each commodity that largely explain the output effect of cessation of Canada/U.S. trade.[7] At the winning end, commodities 119 (Ice), 162 (Reconstructed wood), 279 (Smelting copper), 281 (Primary non-ferrous metals nec), 177 (Pulp mills) and 34 (Crude oil) owe their positive output result in Table 3.1 predominantly to strong import competition from Canada (a high value for SCimp),

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[5] In view of this argument, how can the reduction in total exports (24.28 per cent) be more than 18 per cent (the share of Canada in U.S. exports)? Our modeling implies that elimination of exports to Canada damages the general export capability of industries with heavy reliance on Canada as a trade partner. Thus, not only are their exports to Canada eliminated but they also reduce their exports to other countries. For industries with low reliance on Canada but heavy reliance on exports to other countries, the devaluation effect is dominant allowing them to increase their exports.

[6] The measure we use is $SC_{imp}(i) = \sigma(i) * \left(\dfrac{C_{imp}(i)}{O(i) + M(i) - X(i)} \right) * \left(1 - SC_{exp}(i) \right)$

where $\sigma(i)$ is the elasticity of substitution in the U.S. between imported and domestically produced units of commodity i; $C_{imp}(i)$ is the basic value (landed duty paid) of U.S. imports of i from Canada; O(i) is U.S. output of i; M(i) is total U.S. imports of i; and X(i) is total U.S. exports of i.

[7] Technically we do this by computing the contributions of each of the variables on the RHS of (3.2) to the result on the LHS.

while commodities 321 (Oil & gas field machinery), 245 (Women's handbags) and 410 (Electro-medical appliances) owe their positive output results mainly to having high export shares in their sales, but not to Canada (a high value for SNCexp). At the losing end, commodities 257 (Earthenware), 267 (Asbestos), 342 (Fans), 398 (Travel trailers), 252 (Ceramic tiles) and 382 (Storage batteries) owe their negative output result in Table 3.1 predominantly to strong reliance on exports to Canada (a high value for SCexp).

The three variables, SC_{imp}, SC_{exp} and SNC_{exp}, explain about 66 per cent of the variance in the USAGE output results across commodities. This still leaves 34 per cent of the variance to be explained. Another way of looking at this is that we need to understand the gaps between the two lines in Figure 3.1. The smooth line shows the USAGE results for commodity outputs ranked from the worst affected at the left hand side to the most favorably affected at the right hand side. The jagged line shows fitted regression values from equation (3.2). The gaps reflect factors that USAGE knows about but the regression doesn't.

To illustrate the process of locating these factors, we examine a few of the large gaps in Figure 3.1, beginning with Vitreous china plumbing (commodity 255). The USAGE result (see Table 3.1) for this commodity is a contraction of 5.44 per cent. The fitted result is a contraction of 13.80 per cent, dominated by strong exports to Canada [$SC_{exp}(255)=0.1250$ compared with an average of 0.0344, last row of Table 3.1]. What does USAGE know that causes it to generate a more favorable result than the regression in (3.2)? Nearly all of U.S. production of Vitreous china plumbing is sold to the residential construction industries which produce commodities 41 to 44. Sales of these commodities depend on investment in Ownership of dwellings. While total investment falls by 5.38 per cent (Table 2.1), investment in Ownership of dwellings is only mildly reduced (a reduction of 1.6 per cent, not shown here). Ownership of dwellings (the provision of shelter) has little connection to trade with Canada. The relative impacts on investment across industries of trade cessation with Canada are recognized by USAGE, but not by the regression.

Next we look at Wood products nec (commodity 161). The regression strongly overestimates the USAGE result for output (+6.29 compared with -9.93 per cent). The positive regression estimate reflects strong competition from Canadian imports ($SC_{imp} = 0.3793$) and significant exports to countries other than Canada ($SNC_{exp} = 0.0926$). What is included in USAGE but is missed in the regression is the dependence of the U.S. Wood products nec industry on imported inputs of Sawmills from Canada. Because of the need to replace these inputs by higher cost inputs from other sources, the Wood products nec industry suffers a significant cost hike. In these circumstances its reliance on exports to countries outside Canada is a negative rather than positive factor. While Wood products nec competes in the U.S. market with imports from Canada giving it a high value (0.3793) for SC_{imp}, it also faces significant competition from Chinese imports. The cost increase suffered by the U.S. producers of Wood products nec causes a loss of competitiveness against Chinese imports, an effect captured by USAGE but not by the regression.

The final product that we will consider here is Logging (commodity 149). From the point of view of the regression equation, the characteristics of Logging are close to average [$SC_{imp}(149) = 0.0739$ compared with an average of 0.0375, $SC_{exp}(149) = 0.0390$ compared with an average of 0.0344 and $SNC_{exp}(149) = 0.1421$ compared with an average of 0.1505]. Consequently the regression gives Logging a close to average result [-3.00 per cent compared with an average of -3.69 per cent]. The relevant factor missed out by the regression is the heavy dependence of the U.S. Logging industry on sales to the U.S. Sawmills industry. As can be seen from Table 3.1, cessation of trade with Canada causes a 10.4 per cent increase in

Table 3.1. Commodity output effects (%) of Canada/U.S. trade cessation: USAGE & fitted results, and explanatory variables[*]

Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}	Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}
1 Dairyfarmprd	-2.82	-4.29	0.0118	0.0020	0.0005	35 NaturalGas	2.10	-0.69	0.1106	0.0000	0.0000
2 PoultryEggs	-1.48	-4.49	0.0050	0.0040	0.0136	36 crushedstone	0.75	-4.28	0.0208	0.0079	0.0136
3 BeefCattle	1.42	-2.87	0.0459	0.0005	0.0069	37 SandGravel	0.71	-4.27	0.0064	0.0058	0.0333
4 Hogs	9.55	-0.46	0.1139	0.0001	0.0073	38 ClayCeramic	-2.00	-1.73	0.0292	0.0630	0.4310
5 Livestckmisc	1.81	1.44	0.1182	0.0259	0.2440	39 Nonmetminsrv	2.26	0.84	0.1611	0.0298	0.1399
6 Cotton	6.78	8.64	0.0000	0.0027	0.7929	40 Chemfertiliz	-1.39	-4.92	0.0245	0.0182	0.0209
7 Wheat	6.13	11.05	0.0369	0.0004	0.8476	41 Nresident1	-1.88	-4.54	0.0000	0.0000	0.0000
8 Rice	3.84	8.04	0.0462	0.0016	0.6567	42 Nresid2to4	-1.44	-4.54	0.0000	0.0000	0.0000
9 Corn	-0.62	-2.65	0.0103	0.0046	0.1144	43 AddAlter	-1.61	-4.54	0.0000	0.0000	0.0000
10 OthFeedCrop	2.75	1.19	0.0550	0.0032	0.2421	44 GardHighrise	-1.68	-4.54	0.0000	0.0000	0.0000
11 Grassseeds	-0.13	-0.64	0.0744	0.0223	0.1928	45 HighwysBrid	11.91	-4.54	0.0000	0.0000	0.0000
12 Tobacco	7.95	-4.54	0.0000	0.0000	0.0000	46 Farmresident	-1.72	-4.54	0.0000	0.0000	0.0000
13 Fruits	-6.83	-6.70	0.0269	0.0782	0.2202	47 PetNgDrill	0.86	-4.54	0.0000	0.0000	0.0000
14 Treenuts	-0.15	0.24	0.0001	0.0238	0.4052	48 PetNgExplor	1.14	-4.54	0.0000	0.0000	0.0000
15 Vegetables	-8.22	-8.43	0.1104	0.1111	0.1158	49 AccStrucSMD	-6.60	-4.54	0.0000	0.0000	0.0000
16 SugarCane	0.27	-4.56	0.0000	0.0002	0.0002	50 IndComBuild	-8.12	-4.54	0.0000	0.0000	0.0000
17 SugarBeets	-2.77	-4.69	0.0000	0.0019	0.0010	51 OthrConstruc	-4.82	-4.54	0.0000	0.0000	0.0000
18 Cropsmisc	-5.39	-7.58	0.0079	0.0642	0.1350	52 MRresident	-1.26	-4.54	0.0000	0.0000	0.0002
19 SwitchGrass	-9.89	-4.54	0.0000	0.0000	0.0000	53 MRstreets	-6.54	-4.54	0.0000	0.0000	0.0000
20 Cropresidue	-4.35	-4.54	0.0000	0.0000	0.0000	54 MRpetngwell	6.88	-4.54	0.0000	0.0000	0.0000
21 CellMaterial	-5.05	-4.54	0.0000	0.0000	0.0000	55 OthMRconst	-4.59	-4.53	0.0000	0.0000	0.0006
22 OrgByProds	-4.92	-4.54	0.0000	0.0000	0.0000	56 GuidedMiss	-6.08	-4.22	0.0001	0.0001	0.0190
23 Soybeans	3.74	5.33	0.0323	0.0062	0.5489	57 Ammunition	-4.19	-3.56	0.0000	0.0048	0.0827
24 OthOilseeds	-5.19	-4.57	0.1232	0.1247	0.3880	58 Tanks	-1.44	-1.65	0.0072	0.0065	0.1897
25 Greennursery	-1.43	-2.91	0.0734	0.0198	0.0477	59 SmallArms	-0.55	-2.25	0.0189	0.0139	0.1684
26 Forestryprds	4.26	-3.84	0.0121	0.0008	0.0208	60 SmArmsAmmu	2.02	1.11	0.0300	0.0388	0.4722
27 ComFishing	5.85	0.09	-0.0216	0.1221	0.9482	61 Ordnance	3.01	0.55	0.0000	0.0077	0.3409
28 AgForFshserv	-0.77	-4.49	0.0001	0.0001	0.0037	62 BeefPack	-0.30	0.13	0.0889	0.0059	0.1233
29 Lndscaphort	-2.74	-4.54	0.0000	0.0000	0.0000	63 OthMeatPack	-2.88	0.40	0.0916	0.0140	0.1756
30 Ironmetlores	-7.49	-5.43	0.0608	0.1210	0.4464	64 Sausages	-7.08	-4.78	0.0011	0.0085	0.0277
31 Copperore	8.92	-4.68	0.0000	0.0372	0.1836	65 Pltryslaught	-1.23	-3.62	0.0016	0.0087	0.0962
32 Nonferrores	-14.31	-8.31	0.0101	0.1685	0.6257	66 Butter	-3.95	-4.38	0.0045	0.0034	0.0177
33 Coal	-4.39	-5.22	0.0046	0.0216	0.0619	67 Cheese	-3.97	-4.24	0.0040	0.0040	0.0301
34 CrudeOil	11.98	1.58	0.3529	0.0712	0.0024	68 DairyCE	-0.03	-2.63	0.0464	0.0195	0.1182

Table 3.1 continues …

Table 3.1 continued

Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}	Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}
69 DairyDry	1.45	-1.53	0.0030	0.0061	0.2036	103 Sweeteners	-3.31	-4.54	0.0000	0.0000	0.0000
70 ConcMilkProt	-0.69	-2.85	0.0025	0.0516	0.3608	104 Chocolate	-4.76	-1.55	0.4774	0.2237	0.3476
71 Icecream	-0.04	-3.78	0.0113	0.0026	0.0352	105 NutsSeeds	-4.62	-4.04	0.0283	0.0994	0.4844
72 Fluidmilk	-4.35	-4.56	0.0011	0.0014	0.0042	106 Candy	-0.23	1.19	0.1928	0.0179	0.0342
73 TunaOil	-10.08	-3.93	0.0175	0.0000	0.0000	107 Maltbevrage	-2.33	-3.77	0.0232	0.0057	0.0269
74 TunaWat	-8.71	-4.39	0.0015	0.0052	0.0331	108 Malt	0.29	-1.07	0.0886	0.0068	0.0579
75 CanFishnec	-14.51	-5.99	0.1349	0.2073	0.7064	109 WinesSpirit	0.84	-4.10	0.0093	0.0157	0.0881
76 Canndspecial	-3.99	-4.02	0.0476	0.0179	0.0257	110 Distliqour	0.95	0.44	0.1140	0.0120	0.1214
77 Cannedfruit	-3.44	-4.26	0.0486	0.0324	0.0836	111 Softdrinks	-5.46	-4.36	0.0123	0.0046	0.0094
78 Dehydfruit	1.53	-1.48	0.0370	0.0365	0.2928	112 Flavorsyrups	9.90	5.27	0.2440	0.0121	0.1397
79 Pickles_dres	-5.52	-5.36	0.0269	0.0424	0.1149	113 Cottnsdmills	1.72	-3.23	0.0000	0.0007	0.0814
80 PreparedFish	-6.77	-4.53	0.0000	0.0004	0.0025	114 Soybeanmills	-1.44	-1.53	0.0077	0.0539	0.4406
81 Frozenfruit	-2.47	1.18	0.2300	0.0622	0.1851	115 Vegetmills	-0.98	6.00	0.3672	0.1122	0.4460
82 Froznspecial	-3.88	-4.54	0.0000	0.0000	0.0000	116 FatsOilsnonv	1.35	1.58	0.0428	0.0254	0.4048
83 Flour	-3.44	-3.52	0.0124	0.0071	0.0713	117 Coffee	-6.96	-5.86	0.0027	0.0195	0.0169
84 Cereal	-6.45	-3.68	0.1752	0.0723	0.0633	118 EdblfatsOils	1.33	3.91	0.2325	0.0145	0.0951
85 Prepdough	-2.43	-0.61	0.1446	0.0175	0.0249	119 Ice	42.58	20.12	0.6273	0.0159	0.2478
86 DogCatfood	-5.78	-4.89	0.0655	0.0556	0.1314	120 Noodles	-4.22	-5.36	0.0512	0.0359	0.0313
87 Prepfeeds	0.13	-2.83	0.0216	0.0099	0.1081	121 Potatochips	-3.42	-4.18	0.0071	0.0039	0.0270
88 Ricemill	0.75	0.52	0.0025	0.0394	0.4973	122 Foodprepnec	-1.83	-2.68	0.0741	0.0293	0.1084
89 HFCS	-2.08	-3.97	0.0067	0.0012	0.0258	123 Cigarettes	1.59	-1.43	0.0120	0.0009	0.1640
90 Glucose	-5.55	-8.41	0.0136	0.0793	0.1523	124 Cigars	-13.30	-13.85	0.0001	0.1161	0.0486
91 Dextrose	-0.98	-4.37	0.0049	0.0000	0.0000	125 tobaccoSnuff	-26.62	-20.63	0.0001	0.2474	0.3256
92 Dextrin	-12.67	-14.46	0.0034	0.2486	0.6897	126 TobStmRedry	13.01	2.91	0.0154	0.0030	0.4242
93 Starch	-5.68	-6.23	0.0067	0.1278	0.5459	127 Broadfabric	-1.69	-2.56	0.0299	0.0143	0.1292
94 ModStarch	-8.79	-10.13	0.0013	0.1835	0.6137	128 Narrowfabric	4.78	3.74	0.0288	0.0735	0.8095
95 WetMillingne	3.06	12.54	0.4494	0.0039	0.1040	129 YarnFinish	-2.12	-3.08	0.0277	0.0214	0.1393
96 Bread	-3.50	-2.36	0.0826	0.0103	0.0120	130 Threadmills	1.51	-0.32	0.0165	0.0146	0.2909
97 Cookies	-3.75	-4.54	0.0000	0.0000	0.0000	131 CarpetsRugs	-8.48	-6.99	0.0198	0.0462	0.0534
98 Froznbakery	-4.23	-4.54	0.0000	0.0000	0.0000	132 Coatdfabric	-1.26	1.43	0.1295	0.0310	0.2464
99 RawSugar	0.63	-2.62	0.0001	0.0033	0.1305	133 TirecordFab	-6.29	-4.12	0.1216	0.0632	0.1004
100 RefCaneSugar	-5.26	-4.54	0.0000	0.0000	0.0000	134 CordageTwine	-1.77	-3.42	0.0326	0.0245	0.1256
101 RefBeetSugar	-2.40	-3.33	0.0348	0.0000	0.0000	135 Nonwovenfab	-4.13	-2.56	0.0316	0.0552	0.3369
102 RefinedSugar	-4.46	-4.60	0.0000	0.0104	0.0502	136 Textilegoods	-3.69	-3.50	0.0235	0.0283	0.1594

Table 3.1 continued

Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}	Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}
137 Womenhosiery	-5.91	-4.73	0.0097	0.0291	0.1194	171 OfFurnXwood	-7.80	-4.16	0.0489	0.0228	0.0392
138 Hosierynec	-3.73	-3.21	0.0165	0.0214	0.1550	172 PubBldFurnit	-14.56	-9.31	0.0887	0.1214	0.1614
139 Knitfabric	4.93	2.02	0.0607	0.0233	0.3829	173 Woodfixture	-7.51	-4.54	0.0000	0.0000	0.0000
140 Apparel	-2.38	-2.79	0.0186	0.0241	0.1897	174 FixturExwood	-7.04	-4.15	0.0737	0.0418	0.0868
141 Curtains	-5.72	-7.14	0.0090	0.0377	0.0222	175 DraphardBlnd	-2.47	-4.17	0.0114	0.0019	0.0088
142 Housefurnish	-6.46	-6.00	0.0045	0.0248	0.0330	176 Furnfixnec	-1.52	-0.12	0.1438	0.0100	0.0167
143 Textilebags	0.54	-2.06	0.0462	0.0060	0.0824	177 Pulpmills	17.38	18.17	0.4352	0.0204	0.5515
144 Canvasprods	-2.15	-3.89	0.0234	0.0098	0.0410	178 Envelopes	-7.62	-5.60	0.0116	0.0222	0.0278
145 Pleating	0.55	-1.93	0.0041	0.0031	0.1622	179 SanitPapProd	-9.08	-6.27	0.0393	0.0442	0.0448
146 AutoAppTrim	-4.97	-4.78	0.0000	0.0034	0.0038	180 PaperCoat	-5.01	-4.18	0.0074	0.0207	0.1126
147 Embroideries	-4.16	-4.54	0.0000	0.0000	0.0000	181 BagsExtext	-5.14	-2.84	0.0745	0.0197	0.0489
148 Fabtxtprods	-15.02	-10.87	0.0194	0.1491	0.3553	182 Cardboard	-6.52	-5.22	0.0453	0.0634	0.1935
149 Logging	6.17	-3.00	0.0729	0.0390	0.1421	183 Stationery	-5.12	-5.36	0.0107	0.0255	0.0611
150 Sawmills	10.40	4.82	0.2886	0.0281	0.1041	184 PapProdsnec	-4.87	-2.84	0.0581	0.0058	0.0114
151 Hrdwdfloor	-5.01	-3.62	0.0040	0.0012	0.0526	185 Papermills	2.62	6.49	0.3532	0.0400	0.1313
152 Sawmillprod	-1.43	3.93	0.4360	0.1287	0.2663	186 Boxes	-5.23	-4.00	0.0280	0.0121	0.0369
153 Millwork	-5.09	-2.02	0.1073	0.0192	0.0272	187 Newspapers	-5.52	-4.63	0.0026	0.0033	0.0063
154 kitchencab	0.30	-1.24	0.1061	0.0053	0.0038	188 Periodicals	-9.29	-7.50	0.0156	0.0473	0.0374
155 VeneerPlywd	-4.45	-4.71	0.0404	0.0402	0.1140	189 BookPublish	-7.49	-5.66	0.0192	0.0369	0.0850
156 Structwood	-5.14	-5.05	0.0026	0.0084	0.0082	190 Bookprint	-7.19	-4.47	0.0000	0.0001	0.0050
157 PrefabBlding	-4.33	-3.49	0.0273	0.0019	0.0155	191 MiscPublish	-5.29	-4.32	0.0144	0.0050	0.0096
158 Mobilehomes	-2.56	-4.63	0.0000	0.0016	0.0030	192 CommercPrnt	-5.09	-3.95	0.0222	0.0100	0.0408
159 Woodpreserv	-1.87	-2.73	0.0506	0.0017	0.0117	193 BusinessForm	-4.88	-3.73	0.0232	0.0006	0.0034
160 PalletsSkids	-5.41	-1.80	0.0861	0.0062	0.0167	194 Blankbooks	-4.52	-4.83	0.0177	0.0139	0.0184
161 Woodprodnec	-9.93	6.49	0.3793	0.0430	0.0926	195 Greetingcard	-8.18	-5.67	0.0328	0.0327	0.0341
162 Reconstwood	21.47	12.39	0.5442	0.0303	0.0361	196 Bookbinding	-6.59	-4.54	0.0000	0.0000	0.0000
163 Containernec	-7.83	-4.70	0.0036	0.0109	0.0397	197 Typesetting	-5.02	-4.54	0.0000	0.0000	0.0000
164 HldfurnrUnup	-2.98	-2.80	0.1225	0.0449	0.0820	198 Platemaking	-4.51	-4.26	0.0001	0.0005	0.0192
165 Hhldfurnnec	-5.54	-3.98	0.0249	0.0319	0.1462	199 IndustChem	-3.10	0.03	0.0447	0.0696	0.5369
166 TVcabinets	-10.25	-4.24	0.0060	0.0001	0.0064	200 CornEthanol	-5.47	-4.52	0.0000	0.0001	0.0019
167 HldfurnUp	-4.45	-5.16	0.0386	0.0260	0.0184	201 DDGS	0.84	-4.54	0.0000	0.0000	0.0000
168 Metalhldfurn	-1.58	-4.82	0.0182	0.0151	0.0242	202 CellEthanol	-5.72	-4.54	0.0000	0.0000	0.0000
169 Mattresses	-4.38	-4.38	0.0133	0.0060	0.0135	203 AltEthanol	-5.72	-4.54	0.0000	0.0000	0.0000
170 WoodOffFurn	-3.54	1.41	0.1615	0.0006	0.0223	205 OthEthanol	0.00	-4.54	0.0000	0.0000	0.0000

Table 3.1 continued

Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}	Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}
206 Ethanol	-5.72	-4.54	0.0000	0.0000	0.0000	240 BootCutStock	5.12	6.43	0.0033	0.0322	0.8078
207 MotorFuels	-5.84	-4.54	0.0000	0.0000	0.0000	241 ShoesExrub	-1.94	-0.23	0.0005	0.0961	0.7497
208 NitPhosFert	2.75	0.43	0.0597	0.0409	0.3821	242 Slippers	-0.81	-1.26	0.0015	0.0253	0.3216
209 Pesticidnec	-3.72	-5.55	0.0066	0.0794	0.3365	243 Leathrgloves	-17.54	-15.73	0.0006	0.2213	0.4790
210 GumWoodchm	-3.33	-3.50	0.0072	0.0603	0.3579	244 Luggage	-1.96	-3.54	0.0143	0.0747	0.4152
211 Adhesives	-7.80	-5.34	0.0075	0.0394	0.1404	245 WmnsHandbag	12.10	6.20	0.0005	0.0231	0.7536
212 Explosives	0.16	-2.09	0.0752	0.0405	0.1993	246 PerLeathrGds	1.34	-3.91	0.0075	0.0284	0.1683
213 PrintingInk	-6.76	-3.78	0.0145	0.0252	0.1455	247 LeathrGdsnec	2.95	3.71	0.0043	0.0654	0.8164
214 CarbonBlack	-13.99	-8.64	0.0399	0.0985	0.1837	248 Glass	-7.02	-6.55	0.0324	0.0722	0.1868
215 Chemicalsnec	-5.46	-3.94	0.0113	0.0656	0.3503	249 Glasscontain	-2.76	-5.18	0.0368	0.0264	0.0228
216 Plastics	-8.22	-4.39	0.0505	0.1089	0.4670	250 Cement	1.17	-3.96	0.0356	0.0085	0.0049
217 SyntheticRub	-4.54	-1.88	0.0490	0.0776	0.4569	251 BrickClyTile	-4.10	-4.79	0.0109	0.0093	0.0111
218 CellMmdeFibr	-2.12	0.02	0.0004	0.0558	0.5569	252 CeramicTile	-17.90	-20.60	0.0007	0.2373	0.2735
219 MmadeFibOth	-4.74	-4.08	0.0179	0.0344	0.1679	253 ClayRefract	-6.01	-4.65	0.0137	0.0347	0.1441
220 Drugs	0.25	-1.84	0.0226	0.0119	0.1747	254 StrClyPrdnec	-1.47	-4.38	0.0024	0.0083	0.0471
221 Soap	-10.68	-7.68	0.0160	0.0599	0.0904	255 VitChinaPlmb	-5.44	-13.80	0.0041	0.1250	0.0889
222 Polishes	-6.26	-4.39	0.0032	0.0126	0.0677	256 VitChinaTble	-5.39	-7.87	0.0001	0.0476	0.0484
223 SurfActAgent	-6.29	-3.37	0.0469	0.0671	0.3186	257 Earthenware	-32.92	-34.63	0.0001	0.3608	0.0828
224 ToiletPrep	-5.87	-3.23	0.0570	0.0547	0.2428	258 PorclainElec	-6.15	-6.10	0.0017	0.0469	0.1463
225 Paints	-8.35	-6.22	0.0315	0.0488	0.0879	259 PottryPrdnec	-15.41	-11.28	0.0069	0.1956	0.5965
226 Gasoline	-5.29	-2.03	0.0437	0.0045	0.0813	260 ConcrtBrick	-1.79	-3.52	0.0375	0.0056	0.0120
227 Diesel	-5.29	-3.12	0.0409	0.0000	0.0000	261 ConcrtPrdnec	1.39	-3.93	0.0319	0.0072	0.0073
228 OthPetFuels	-10.29	-2.90	0.0469	0.1060	0.5477	262 Readymix	-0.03	-4.54	0.0000	0.0000	0.0000
229 LubricatOils	-4.51	-4.68	0.0000	0.0035	0.0100	263 Lime	-3.65	-5.30	0.0202	0.0172	0.0021
230 PetClPrdnec	-9.90	-6.55	0.0006	0.1343	0.5730	264 GypsumPrd	-3.94	-4.67	0.0500	0.0253	0.0199
231 AsphaltPav	4.08	-4.09	0.0233	0.0058	0.0086	265 CutStone	-7.13	-4.00	0.0379	0.0165	0.0390
232 AsphaltFelts	-4.45	-9.06	0.0138	0.0640	0.0346	266 AbrasivePrd	-4.11	-4.27	0.0448	0.0353	0.1059
233 Tires	-7.43	-5.54	0.0899	0.0795	0.1658	267 AsbestosPrd	-32.27	-52.00	-0.0743	0.6847	0.8796
234 RubPlFootwr	-3.29	1.54	0.0002	0.1014	0.8823	268 MineralsGrnd	-2.90	-5.04	0.0193	0.0295	0.0831
235 FabRubPrdnec	-3.84	-3.83	0.0603	0.0395	0.1218	269 MineralWool	-4.68	-6.32	0.0816	0.0699	0.0875
236 MiscPlPrdnec	-5.24	-4.28	0.0211	0.0252	0.1023	270 NonClayRefrc	-6.77	-6.10	0.0507	0.0655	0.1416
237 RubPlHose	-6.59	-3.57	0.1241	0.0886	0.2588	271 NonmtMinPrd	1.24	2.52	0.1407	0.0219	0.2407
238 Gaskets	-3.40	-3.42	0.1735	0.1017	0.2339	272 BlastFurnace	-4.58	-4.91	0.0832	0.0526	0.0784
239 LeatherTan	5.07	0.54	0.0009	0.0047	0.3228	273 ElectMetPrds	-6.76	-6.32	0.0204	0.0394	0.0563

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Table 3.1 continued

Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}	Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}
274 SteelWire	-6.27	-7.94	0.1141	0.1382	0.2771	308 PlatingPolsh	-1.27	-4.54	0.0000	0.0000	0.0000
275 IronSteel	-4.21	-4.04	0.0029	0.0008	0.0278	309 Coating	-2.82	-4.54	0.0000	0.0000	0.0000
276 IronStlForg	-5.34	-4.54	0.0000	0.0000	0.0001	310 MisFabWirPrd	-3.37	-4.35	0.0188	0.0118	0.0336
277 MetalHeatTr	-3.57	-4.54	0.0000	0.0000	0.0000	311 SteelSpring	-3.12	-4.60	0.2051	0.1272	0.2301
278 PrimMetPrd	-0.39	-0.93	0.0457	0.0202	0.2233	312 PipeValves	-3.29	-5.06	0.0355	0.0479	0.1436
279 SmeltCopper	19.12	10.45	0.3982	0.0159	0.1481	313 MtlFoilLeaf	-4.19	-3.80	0.0199	0.0107	0.0582
280 PrimAluminum	10.21	14.04	0.5919	0.0448	0.1103	314 FabMtlPrdnec	-6.43	-5.86	0.0202	0.0773	0.2795
281 PrimNfMetnec	18.41	12.56	0.3528	0.0093	0.3322	315 Turbines	6.17	5.42	0.0036	0.0614	0.8981
282 ExtrudCopper	-2.95	-4.44	0.0350	0.0258	0.0668	316 IntCombusEng	-8.84	-6.90	0.0163	0.0913	0.2985
283 AluminumRoll	-8.11	-5.95	0.0772	0.0724	0.1313	317 FarmMachin	-7.75	-7.95	0.0447	0.0983	0.2140
284 NferRollnec	8.90	9.30	0.1200	0.0257	0.7040	318 GardenEquip	-6.04	-5.48	0.0208	0.0551	0.1856
285 NfWireDraw	0.30	0.18	0.1335	0.0560	0.2931	319 ConstMachin	-5.45	-5.71	0.0137	0.0638	0.2319
286 AluminCast	-5.92	-4.20	0.0026	0.0005	0.0176	320 MiningMachin	-6.78	-6.91	0.0459	0.1347	0.4599
287 NfForging	-1.67	-4.54	0.0000	0.0000	0.0000	321 OilGsFldMach	13.00	7.44	0.0066	0.0154	0.7737
288 MetalCans	-4.79	-4.32	0.0176	0.0059	0.0072	322 Elevators	-9.22	-6.78	0.0576	0.0637	0.0775
289 MetalBarrels	-8.18	-6.08	0.0621	0.0838	0.2136	323 Conveyors	-6.04	-5.51	0.0016	0.0244	0.0653
290 EnamSanWare	-1.14	-4.13	0.0265	0.0135	0.0394	324 Hoists	-6.66	-5.84	0.0159	0.0320	0.0556
291 PlumbFixFit	-3.63	-4.89	0.0023	0.0082	0.0171	325 IndTrukTrac	-8.56	-5.50	0.0739	0.1273	0.4477
292 HeatingEquip	-8.59	-6.58	0.0434	0.0570	0.0838	326 MachToolCut	2.31	-1.56	0.0397	0.0522	0.3639
293 FabStrMetal	-2.06	-4.06	0.0174	0.0038	0.0122	327 MachToolForm	2.02	1.76	0.1830	0.0983	0.5023
294 MetalDoors	-5.01	-4.94	0.0208	0.0176	0.0245	328 SpecialDies	-1.86	-2.62	0.1171	0.0506	0.1335
295 FabPlateWork	-2.18	-3.18	0.0464	0.0255	0.1164	329 PdrivnHandTl	-5.35	-4.23	0.0036	0.0481	0.2592
296 SheetMtlWork	-5.13	-4.54	0.0032	0.0022	0.0049	330 Rolmilmach	5.02	2.09	0.1887	0.0254	0.1346
297 ArchMtlWork	-3.68	-4.49	0.0127	0.0081	0.0188	331 ElecGasWeld	-1.65	-1.76	0.0381	0.0693	0.4435
298 PrefabMtlBld	-6.87	-5.39	0.0128	0.0242	0.0484	332 IndPatterns	-4.87	-5.17	0.0200	0.0184	0.0166
299 MiscStMtlWrk	-2.92	-3.26	0.0721	0.0296	0.0802	333 MtlWorkMach	-5.84	-4.54	0.0000	0.0000	0.0000
300 ScrewMach	-4.50	-5.44	0.0290	0.0373	0.0796	334 FoodPrdMach	-6.35	-5.22	0.0292	0.0748	0.2856
301 AutoStamp	-7.77	-5.78	0.0191	0.0248	0.0153	335 TextMach	3.69	-0.07	0.0137	0.0269	0.3750
302 Crowns	-6.80	-6.87	0.0935	0.0873	0.1202	336 WoodwrkMach	-7.56	-5.85	0.0677	0.1022	0.3100
303 MtlStampnec	-4.11	-4.39	0.0043	0.0001	0.0006	337 PaperIndMach	-1.71	-2.65	0.0715	0.0453	0.1986
304 Cutlery	-3.27	-7.33	0.0163	0.0830	0.2298	338 PrintMach	-2.40	-1.51	0.0265	0.0371	0.3162
305 Handtools	-7.05	-5.48	0.0051	0.0342	0.1107	339 SpecIndMach	0.98	0.78	0.0471	0.0236	0.3395
306 Handsaws	-2.47	-4.44	0.0400	0.0430	0.1455	340 PumpsCompres	-4.59	-4.51	0.0245	0.0886	0.4089
307 Hardwarenec	-7.52	-6.50	0.0324	0.0575	0.1142	341 Ballbearings	-4.34	-4.80	0.1032	0.0823	0.1966

Table 3.1 continued

Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}	Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}
342 Fans	-22.23	-15.95	0.0225	0.1937	0.2786	376 RecordTapes	-7.66	-6.33	0.0896	0.1292	0.3763
343 MecPwrTEqup	-7.29	-8.73	0.0478	0.1046	0.1938	377 Telephones	3.99	1.73	0.0520	0.0245	0.3899
344 Furnaces	2.64	0.86	0.0132	0.0294	0.4436	378 CommunEquip	-0.76	-1.95	0.0174	0.0195	0.2180
345 IndMachEquip	-2.69	-1.16	0.0237	0.1259	0.8011	379 ElectronTube	-0.91	-0.97	0.0016	0.0050	0.2336
346 PackagMach	-6.80	-4.99	0.0193	0.0510	0.1971	380 Semiconduct	2.77	0.08	0.0131	0.0120	0.3079
347 Carburetors	-7.41	-4.54	0.0000	0.0000	0.0000	381 OthElectronC	0.38	-3.11	0.0277	0.0124	0.0916
348 FluidPwEquip	-7.43	-6.83	0.0262	0.0582	0.1112	382 StoragBatt	-14.83	-14.27	0.0393	0.1588	0.1633
349 Scales	-6.68	-5.20	0.0081	0.0496	0.2005	383 Primarybatt	-10.22	-6.63	0.0122	0.0831	0.2803
350 IndMachnec	-3.69	-3.95	0.0138	0.0179	0.0994	384 ElecteqICE	-11.80	-12.34	0.0158	0.1351	0.2035
351 Calculatmach	-6.63	-3.69	0.0166	0.0177	0.1072	385 Recordmedia	1.00	-0.52	0.0015	0.0156	0.3151
352 Computers	-6.51	-4.96	0.0013	0.1201	0.5920	386 ElectMachnec	9.99	7.77	-0.0623	0.0455	1.0908
353 ComPerEquip	-3.53	-3.28	0.0169	0.0088	0.0857	387 TruckBusBdy	-7.54	-4.72	0.0575	0.0255	0.0028
354 OffMachnec	-5.67	-2.53	0.0295	0.0142	0.1315	388 Trucktrailer	-13.70	-8.60	0.0590	0.0776	0.0392
355 VendingMach	-8.13	-4.88	0.0183	0.0422	0.1603	389 Motorvehicle	-4.96	0.05	0.2723	0.0708	0.0759
356 ComLaundEq	-12.30	-8.62	0.0031	0.0682	0.1044	390 MotvehParts	-13.82	-11.71	0.1555	0.1980	0.2773
357 RefrigHtEq	-9.45	-6.78	0.0133	0.0583	0.1413	391 Aircraft	1.16	1.42	0.0328	0.0072	0.3219
358 MeasurPump	-9.75	-5.79	0.0029	0.0474	0.1650	392 AircrftEngin	-1.50	-2.80	0.0336	0.0426	0.2536
359 ServIndMach	-5.59	-3.31	0.0279	0.0075	0.0538	393 AircrftEquip	3.77	0.15	0.0164	0.0148	0.3196
360 PowerTrnsfrm	1.11	-0.12	0.1061	0.0237	0.1648	394 Shipbuild	-7.29	-4.41	0.0005	0.0035	0.0248
361 Switchboard	-2.08	-3.40	0.0131	0.0210	0.1493	395 Boatbuild	-7.26	-1.82	0.0990	0.0176	0.0477
362 Motors	-2.07	-2.91	0.0462	0.0528	0.2736	396 RailroadEq	-3.72	-2.97	0.0813	0.0362	0.1121
363 Relays	-4.27	-5.42	0.0356	0.0710	0.2409	397 Motorcycles	-4.24	-3.05	0.0073	0.0687	0.4277
364 Carbonprods	-1.66	-3.66	0.0254	0.0460	0.2371	398 TravelTraler	-18.73	-9.38	0.0688	0.0923	0.0483
365 ElectIndApp	-4.80	-4.30	0.0021	0.0056	0.0391	399 Motorhomes	-11.56	-4.54	0.0000	0.0000	0.0000
366 Hldcookequip	-7.82	-9.18	0.0785	0.1032	0.0964	400 TrnsprtEqnec	-8.14	-3.02	0.1389	0.0545	0.0848
367 Hldrefrig	-10.90	-11.14	0.0163	0.1084	0.1355	401 NavigEquip	-5.81	-4.68	0.0046	0.0177	0.0735
368 Hldlaundry	-9.24	-7.46	0.0444	0.0873	0.1862	402 LabApparat	-4.01	-3.75	0.0225	0.0001	0.0011
369 ElecHousware	-0.25	-3.61	0.0230	0.0383	0.2054	403 MechMeasur	-8.34	-7.52	0.0207	0.0939	0.2659
370 HldVacuumCl	-0.42	-2.33	0.0548	0.0488	0.2700	404 Environcontr	-3.77	-4.23	0.0251	0.0182	0.0605
371 HldApplianec	-9.93	-9.95	0.0458	0.1242	0.2268	405 MedicInst	2.30	0.63	0.0089	0.0335	0.4602
372 ElecLampbulb	-6.33	-7.14	0.0294	0.0694	0.1440	406 SurgiclAppl	0.21	-1.57	0.0064	0.0307	0.3212
373 LightingFixt	-6.37	-6.61	0.0237	0.0570	0.1234	407 DentalEquip	-6.25	-4.12	0.0088	0.0766	0.4021
374 Wiringdevice	0.19	-0.63	0.0128	0.0965	0.7026	408 Watches	-7.88	-3.35	0.0009	0.0668	0.4131
375 HldAudioVid	-10.57	-8.17	0.0012	0.1784	0.7035	409 XrayAppar	3.42	2.87	0.0030	0.0427	0.6524

Table 3.1 continued

Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}	Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}
410 ElctroMedApp	11.15	7.95	0.0018	0.0380	0.9302	444 CblePyTVserv	-5.10	-4.54	0.0000	0.0000	0.0000
411 LabInstrum	6.51	4.08	0.0269	0.0317	0.6182	445 RadioTVbroad	-8.31	-4.54	0.0000	0.0000	0.0000
412 InstrumElec	1.60	0.60	0.0092	0.0329	0.4546	446 Electricserv	-5.21	-3.91	0.0311	0.0052	0.0000
413 Ophthalmic	-3.52	-2.26	0.0017	0.0630	0.4564	447 NatgasTransp	-12.90	-4.54	0.0000	0.0000	0.0000
414 PhotoEquip	-2.99	-2.87	0.0387	0.0350	0.1992	448 NatgasDistrb	-4.47	-4.47	0.0000	0.0032	0.0211
415 Jewelry	0.48	4.55	0.0028	0.0369	0.7224	449 Watersupply	-1.83	-4.53	0.0000	0.0007	0.0047
416 JewelMater	2.52	5.94	0.0013	0.0128	0.6830	450 Sanitaryserv	-5.03	-4.54	0.0000	0.0001	0.0004
417 Silverware	-7.67	-6.04	0.0108	0.0495	0.1445	451 WholesleTrde	-6.38	-4.51	0.0000	0.0013	0.0087
418 CostumJewel	-4.96	-4.08	0.0071	0.0309	0.1725	452 RetailTrade	-7.22	-4.54	0.0000	0.0000	0.0001
419 Musicalinstr	-4.48	-2.64	0.0295	0.0226	0.1678	453 Banking	-4.73	-4.23	0.0004	0.0130	0.0846
420 Games	-12.13	-7.82	0.0059	0.0688	0.1491	454 Creditagency	-4.30	-4.50	0.0000	0.0020	0.0131
421 Dolls	-8.51	-4.47	0.0003	0.0141	0.0767	455 SecCombroker	-4.67	-4.35	0.0000	0.0085	0.0554
422 SportGdsnec	-7.80	-4.43	0.0286	0.0514	0.2128	456 InsurnceCarr	-2.40	-3.07	0.0385	0.0056	0.0367
423 Pens	-5.91	-5.62	0.0082	0.0390	0.1206	457 InsurnceBrok	-2.30	-4.51	0.0000	0.0014	0.0088
424 PencilsArt	-7.02	-5.68	0.0221	0.0302	0.0433	458 OwnoccDwell	4.13	-4.54	0.0000	0.0000	0.0000
425 MarkingDevic	-6.96	-5.98	0.0020	0.0214	0.0211	459 RestateAgent	-3.96	-4.50	0.0000	0.0019	0.0123
426 Carbonpaper	-8.49	-8.05	0.0094	0.0759	0.1650	460 Hotels	-3.40	-4.54	0.0000	0.0003	0.0018
427 Fasteners	-3.69	-3.97	0.0118	0.0451	0.2424	461 Othlodging	-2.93	-4.54	0.0000	0.0000	0.0000
428 Brooms	-6.38	-5.96	0.0323	0.0448	0.0806	462 Laundry	-5.77	-4.54	0.0000	0.0000	0.0000
429 HrdsurFlrCov	-2.44	-4.54	0.1310	0.0558	0.0185	463 Funeralserv	-6.03	-4.54	0.0000	0.0000	0.0000
430 Burialcasket	-5.85	-4.54	0.0000	0.0000	0.0000	464 PortraitStud	-5.47	-4.54	0.0000	0.0000	0.0000
431 SignsAdvert	-8.78	-4.97	0.0159	0.0130	0.0090	465 ElectRepair	-4.94	-4.53	0.0000	0.0005	0.0032
432 ManuIndnec	-8.86	-6.46	0.0135	0.0493	0.1133	466 WatchRepair	-5.88	-4.51	0.0000	0.0012	0.0080
433 Railroadserv	-5.97	-4.42	0.0015	0.0029	0.0188	467 Beautyshops	-5.96	-4.54	0.0000	0.0000	0.0000
434 PassengTrans	-4.46	-4.53	0.0000	0.0004	0.0024	468 MiscRepair	-3.93	-4.12	0.0002	0.0179	0.1167
435 TruckingServ	-6.67	-4.38	0.0034	0.0021	0.0140	469 ServtoDwell	-4.13	-4.53	0.0000	0.0004	0.0023
436 WarehseStore	-5.35	-4.28	0.0000	0.0114	0.0745	470 PersonnelSup	-4.71	-4.47	0.0020	0.0002	0.0015
437 WaterTransLR	-7.77	-4.54	0.0000	0.0000	0.0000	471 ComputerServ	-4.94	-4.44	0.0011	0.0027	0.0175
438 WaterTransCD	-9.57	-4.54	0.0000	0.0000	0.0000	472 DetectiveSer	-4.93	-4.51	0.0000	0.0012	0.0080
439 AirTrans	-5.48	-4.54	0.0000	0.0000	0.0000	473 MiscEqRent	-4.61	-4.42	0.0000	0.0052	0.0337
440 PipelinExng	-5.75	-4.29	0.0000	0.0110	0.0720	474 ComPhoto	-5.34	-4.53	0.0003	0.0005	0.0029
441 FreightForw	-3.82	-3.48	0.0000	0.0459	0.2993	475 OthBusServ	-5.07	-4.54	0.0001	0.0002	0.0010
442 ArrangPTrans	-4.41	-4.26	0.0000	0.0122	0.0797	476 ManageServ	-3.61	-3.97	0.0084	0.0122	0.0799
443 TelephonCom	-5.44	-4.53	0.0000	0.0019	0.0107	477 ResearchDev	-4.97	-4.35	0.0032	0.0036	0.0235

Table 3.1 continued

Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}	Commodity	USAGE	Fitted	SC_{imp}	SC_{exp}	SNC_{exp}
478 Advertising	-4.96	-4.21	0.0146	0.0026	0.0027	507 JobTraining	-5.14	-4.54	0.0000	0.0000	0.0000
479 Legalserv	-4.22	-4.32	0.0033	0.0045	0.0296	508 ChildDaycare	-5.35	-4.54	0.0000	0.0000	0.0000
480 EngineerSer	-3.37	-4.01	0.0121	0.0101	0.0591	509 ResidCare	-5.71	-4.54	0.0000	0.0000	0.0000
481 AccountServ	-4.67	-4.45	0.0019	0.0012	0.0078	510 SocialSernec	-5.87	-4.54	0.0000	0.0000	0.0000
482 EatDrinkPlce	-5.43	-4.54	0.0000	0.0002	0.0015	511 PostalServ	-5.24	-4.53	0.0000	0.0007	0.0046
483 AutoRental	-5.50	-4.54	0.0000	0.0000	0.0001	512 OthFedGvEnt	-4.83	-4.54	0.0000	0.0000	0.0000
484 AutoRepair	-5.84	-4.54	0.0000	0.0000	0.0002	513 OthSLGentpr	-1.61	-4.54	0.0000	0.0000	0.0000
485 AutoPark	-4.36	-4.54	0.0000	0.0000	0.0000	517 GenGovInd	-5.54	-4.54	0.0000	0.0000	0.0000
486 Theatres	-0.05	-2.85	0.1529	0.0521	0.0542	518 Hhldind	-5.46	-4.54	0.0000	0.0000	0.0000
487 VideoTpeRent	-5.04	-4.54	0.0000	0.0002	0.0015	519 FGCEnatdef	-5.38	-4.54	0.0000	0.0000	0.0000
488 TheatPrducer	-5.26	-4.45	0.0015	0.0018	0.0119	520 FGCEnondef	-5.38	-4.54	0.0000	0.0000	0.0000
489 BowlingCentr	-4.74	-4.54	0.0000	0.0000	0.0000	521 SLCEpubSch	-5.38	-4.54	0.0000	0.0000	0.0000
490 ProSportClub	-5.56	-4.54	0.0000	0.0001	0.0009	522 SLCEpubHied	-5.38	-4.54	0.0000	0.0000	0.0000
491 Racing	-4.45	-4.54	0.0000	0.0000	0.0000	523 SLCEothedLib	-5.38	-4.54	0.0000	0.0000	0.0000
492 MembSprtClub	-5.31	-4.54	0.0000	0.0000	0.0000	524 SLCEhealth	-5.38	-4.54	0.0000	0.0000	0.0000
493 OthAmuseServ	-4.53	-4.56	0.0000	0.0002	0.0001	525 SLCEwelfare	-5.38	-4.54	0.0000	0.0000	0.0000
494 DoctorsDent	-5.29	-4.54	0.0000	0.0000	0.0000	526 SLCEsanitat	-5.38	-4.54	0.0000	0.0000	0.0000
495 Hospitals	-5.42	-4.54	0.0000	0.0000	0.0001	527 SLCEpolice	-5.38	-4.54	0.0000	0.0000	0.0000
496 NursingFacil	-5.51	-4.54	0.0000	0.0000	0.0000	528 SLCEfire	-5.38	-4.54	0.0000	0.0000	0.0000
497 HomeHealth	-5.69	-4.54	0.0000	0.0000	0.0000	529 SLCEcorrect	-5.38	-4.54	0.0000	0.0000	0.0000
498 VetServ	-4.83	-4.54	0.0000	0.0000	0.0000	530 SLCEhighway	-5.38	-4.54	0.0000	0.0000	0.0000
499 OthMedServ	-5.25	-4.54	0.0000	0.0000	0.0000	531 SLCEnatural	-5.38	-4.54	0.0000	0.0000	0.0000
500 Schools	-5.04	-4.54	0.0000	0.0000	0.0000	532 SLCEother	-5.38	-4.54	0.0000	0.0000	0.0000
501 CollegeUni	-4.71	-4.51	0.0003	0.0007	0.0046	533 Holiday	-6.23	-2.37	0.0624	0.0000	0.0000
502 Libraryetc	-2.70	-4.29	0.0071	0.0004	0.0027	535 ExpTour	-0.01	-1.47	0.0000	0.1329	0.8671
503 BusinAssoc	-4.92	-4.54	0.0000	0.0000	0.0000	536 ExpEdu	-0.73	-1.47	0.0000	0.1329	0.8671
504 LaborOrgan	-5.07	-4.51	0.0000	0.0013	0.0086	538 WatInternat	-14.60	-4.54	0.0000	0.0000	0.0000
505 ReligiousOrg	-5.09	-4.54	0.0000	0.0000	0.0000	539 AirInternat	-4.74	-0.55	0.1146	0.0000	0.0000
506 OthmemOrg	-5.37	-4.54	0.0000	0.0000	0.0000						
						Averages	**-3.69**	**-3.69**	**0.0375**	**0.0344**	**0.1505**

* Commodities in USAGE are numbered from 1 to 539. This table lists 533 commodities. The other six USAGE commodities are artificial, such as domestic production of noncomparable imports.

Figure 3.1. Commodity output effects (%) of Canada/U.S. trade cessation: USAGE & fitted results from equation (3.2)
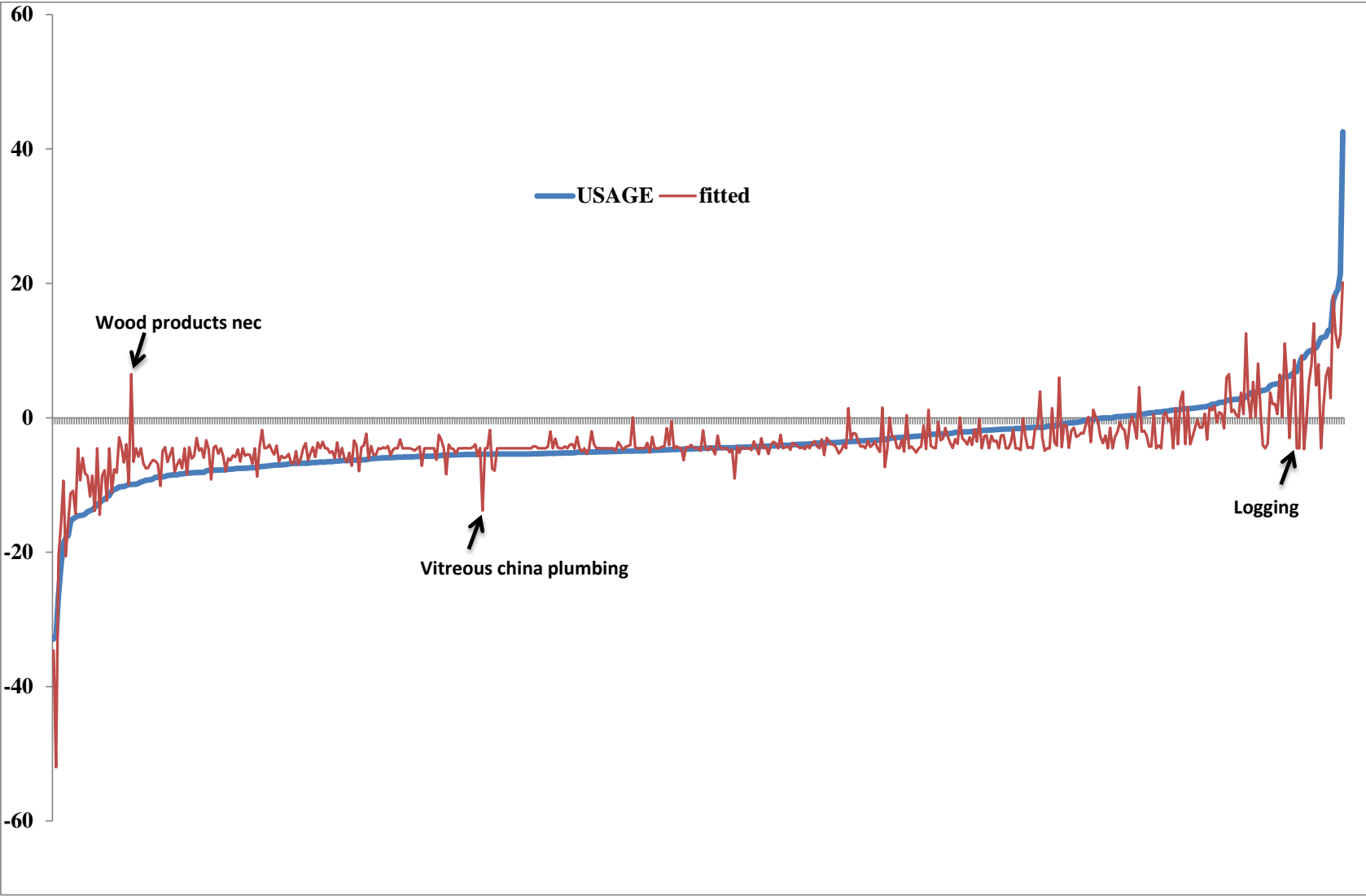
the output of Sawmills (commodity 150). Despite the reduction in U.S. output of Wood products nec discussed in the previous paragraph, output of Sawmills expands, replacing imports from Canada. This allows the U.S. output of logging to also expand.

The process of comparing USAGE and fitted results for individual commodities can encompass any commodity of interest to a policy maker or analyst, and additional variables can be included on the right hand side of the explanatory regression equation. On the basis of the analysis of Figure 3.1 conducted in this section, we can see that candidates for inclusion in the regression are: the share of production costs of the U.S. product accounted for by inputs from Canada; the share of non-Canadian imports in the U.S. market; and the connection of a commodity with investment activities across industries with different exposures to trade with Canada.

4. State dependence on Canada/U.S. trade

The first two columns of Table 4.1 show the employment losses (numbers of jobs and percentage) by state that would occur with cessation of Canada/U.S. trade.[8] These state effects were calculated by applying the USAGE regional extension to the results generated at the national level and described in previous sections. The theory of the regional extension is set out in Dixon *et al.* (2007). In distributing results from the national level to the states, the regional extension takes account of three factors. The most important is the industrial composition of activity in each state. If employment in a state is heavily concentrated in industries that are relatively harmed by the national shock under consideration (in this case a cessation of Canada/U.S. trade) then the regional extension will generate relatively large negative results for that state. The second factor is interstate trade. If a state relies heavily on exports to states that are strongly negatively impacted by the shock under consideration, then on this account the regional extension will generate negative effects for that state. Finally, the regional extension encompasses local multiplier effects. If traded-goods industries[9] in a state are relatively badly affected by the first two factors, then in the regional extension, nontraded-goods industries (e.g. Retail trade) will also be relatively badly affected.

The most striking feature of the employment results in Table 4.1 is that every state loses jobs from cessation of Canada/U.S. trade. These losses range from 1.95 per cent in Oklahoma to 6.30 per cent in South Carolina. A state need have no direct connection with Canada/U.S. trade to experience significant job losses. This is because the states of the U.S. are closely linked by interstate trade and movements of labor and capital. Thus, negative effects for one state flow on to negative effects for other states.

What explains the differences in employment effects between states? The most obvious explanation is the first factor taken into account in the regional extension: differences between states in their mix of industries. To test the importance of this factor, we regress the percentage employment results in Table 4.1 against a national index worked out for state r as:

$$\text{NationalIndex}(r) = \Sigma_j \, \text{Sh}(j,r) \times \text{emp}(j) \qquad\qquad (4.1)$$

where
   Sh(j,r) is the share of employment in state r accounted for by production of good j; and
   emp(j) is the percentage change in national employment in the production of j.

Table 4.1 Employment effects by state of Canada/U.S. trade cessation: USAGE results and explanatory variables

		Millions of jobs	% effect on employment	National index	Port index	Tourism index
		(1)	(2)	(3)	(4)	(5)
1	Alabama	-0.1021	-4.0147	-4.58	0.18	0.19
2	Alaska	-0.0183	-3.9723	-4.22	0.23	0.97
3	Arizona	-0.1311	-3.8664	-4.44	0.26	1.38
4	Arkansas	-0.0644	-4.0806	-4.61	0.17	0.14
5	California	-1.1286	-5.2618	-4.51	3.06	1.59
6	Colorado	-0.1310	-3.9071	-4.30	0.21	0.67
7	Connecticut	-0.0913	-4.0872	-4.49	0.23	0.35
8	Delaware	-0.0248	-4.5603	-4.50	1.84	0.38
9	Florida	-0.5887	-5.5767	-4.73	1.64	4.28
10	Georgia	-0.3122	-5.6725	-4.76	1.58	0.48
11	Hawaii	-0.0416	-4.7497	-4.97	1.55	18.60
12	Idaho	-0.0305	-3.3810	-4.33	0.18	0.41
13	Illinois	-0.3198	-4.2595	-4.72	0.23	0.49
14	Indiana	-0.1743	-4.7334	-4.91	0.18	0.25
15	Iowa	-0.0956	-4.7358	-4.84	0.18	0.21
16	Kansas	-0.0657	-3.5234	-4.16	0.18	0.20
17	Kentucky	-0.1027	-4.2531	-4.79	0.18	0.21
18	Louisiana	-0.0906	-3.4427	-3.94	0.72	0.45
19	Maine	-0.0307	-3.8232	-4.45	0.21	0.89
20	Maryland	-0.1968	-5.6634	-4.87	0.80	0.29
21	Massachusetts	-0.1923	-4.4494	-4.64	0.38	1.02
22	Michigan	-0.2332	-4.3933	-5.03	0.20	0.29
23	Minnesota	-0.1534	-4.3193	-4.68	0.20	0.37
24	Mississippi	-0.0633	-4.1253	-4.49	0.35	0.14
25	Missouri	-0.1553	-4.3375	-4.74	0.19	0.25
26	Montana	-0.0257	-4.0249	-4.47	0.19	0.53
27	Nebraska	-0.0551	-4.3785	-4.56	0.18	0.22
28	Nevada	-0.0727	-4.6603	-4.46	0.46	4.54
29	New Hampshire	-0.0343	-4.1011	-4.58	0.21	0.47
30	New Jersey	-0.2571	-5.0379	-4.70	0.24	0.39
31	New Mexico	-0.0389	-3.6062	-4.22	0.17	0.33
32	New York	-0.6416	-5.5523	-4.81	1.81	1.74
33	North Carolina	-0.2321	-4.2577	-4.59	0.29	0.35
34	North Dakota	-0.0264	-4.5518	-4.71	0.18	0.38
35	Ohio	-0.2891	-4.3386	-4.79	0.19	0.27
36	Oklahoma	-0.0440	-1.9532	-3.25	0.16	0.15
37	Oregon	-0.0934	-4.1214	-4.38	0.81	0.54
38	Pennsylvania	-0.3261	-4.4537	-4.62	0.38	0.46
39	Rhode Island	-0.0270	-4.5159	-4.72	0.21	0.48
40	South Carolina	-0.1574	-6.2984	-4.68	3.63	0.60
41	South Dakota	-0.0256	-4.4552	-4.70	0.19	0.31
42	Tennessee	-0.1639	-4.4169	-4.79	0.20	0.33
43	Texas	-0.4201	-2.7094	-3.60	0.66	0.55
44	Utah	-0.0770	-4.4187	-4.57	0.20	0.65
45	Vermont	-0.0166	-3.9035	-4.50	0.22	1.06
46	Virginia	-0.2725	-5.5621	-4.76	1.63	0.28
47	Washington	-0.2093	-5.2518	-4.42	3.38	0.68
48	West Virginia	-0.0363	-3.9692	-4.20	0.17	0.18
49	Wisconsin	-0.1369	-3.8776	-4.69	0.19	0.34
50	Wyoming	-0.0122	-3.0805	-3.70	0.19	0.71
51	District of Columbia	-0.0435	-5.1479	-5.04	0.38	4.19
	Total or average	-8.2731	-4.54	-4.54	1.00	1.00

The National index, shown in the third column of Table 4.1, gives the effect on employment in each state under the assumption that the national result for each industry applies in each state, that is the percentage change in employment in industry j in state r is emp(j) for all states r.

The outcome of the regression with the National index is:

$$Emp\_S(r) = 3.384 + 1.706*NationalIndex(r), \quad r \in REG \qquad R\text{-squared} = 0.57 \qquad (4.2)$$

where

Emp_S(r) is the percentage change in employment in state r [column (2) of Table 4.1]; and REG is the set of 50 states and the District of Columbia.

In (4.2), the coefficient on NationalIndex(r) has the expected sign. Its magnitude (1.706) is also plausible. It indicates multiplier effects. If state r has a mix of industries that give it an initial 1 per cent employment loss relative to the national percentage loss, then r's eventual employment loss is 1.706 per cent relative to the national percentage loss. This multiplier effect arises because the sourcing of inputs (especially service inputs) by industries in state r is skewed towards suppliers in state r. However, NationalIndex(r) explains only 57 per cent of the variance across the states in the USAGE employment results. As illustrated in Figure 4.1, there must be other factors contributing to the state employment effects.

On studying Figure 4.1, we see that regression equation (4.2) strongly over-predicts the USAGE employment results for South Carolina, Washington, Florida, Georgia, New York and California. A factor that these six states have in common is major ports. In our USAGE simulation, a state is harmed by having a major port via the general trade-contracting effects of the cessation of Canada/U.S. trade. The idea that ports are the missing factor in the NationalIndex explanation of the USAGE state employment results is strengthened by (4.2)'s under-prediction of employment results for Idaho, Tennessee, Michigan, Vermont, Kentucky, Arkansas and Wisconsin. These states have no major ports. On this basis we decided to add a port index to our regression explanation of the USAGE results. The index we chose was a ratio of two shares: the state's share of U.S. trade going through its ports and the state's share of national employment. The values of this index are in the fourth column of Table 4.1. With the Port index included, our regression equation becomes:

$$Emp\_S(r) = 3.119 + 1.579*NationalIndex(r) - 0.498*PortIndex(r), \quad r \in REG \qquad (4.3)$$

$$R\text{-squared} = 0.86$$

The Port index enters the regression with the expected sign and raises R-squared to 0.86. Nevertheless, as can be seen from Figure 4.2, our explanation of the state employment results is still incomplete. For example, regression equation (4.3) strongly under-predicts the USAGE employment result for Hawaii.

A key feature of the Hawaiian economy is over representation of international tourism. In the USAGE simulation, cessation of Canada/U.S. trade is good for international tourism to the U.S. This is because devaluation makes U.S. vacations cheaper for foreigners. This favorable effect for tourist destinations such as Hawaii is taken into account in USAGE but is not fully recognized in regression equation (4.3). In USAGE there is no direct employment in the tourism industries. These industries simply supply a package of hotel, entertainment, restaurant and travel services. Consequently, favorable movements in the output of the tourism industries enter the national index in only a muted way through their effects on employment in hotels, etc. The regression (but not USAGE) fails to recognize that states in which hotels, etc. are used mainly in international tourism activities benefit in the

Figure 4.1. Employment effects of cessation of Canada/U.S. trade explained by a one-variable regression: equation (4.2)
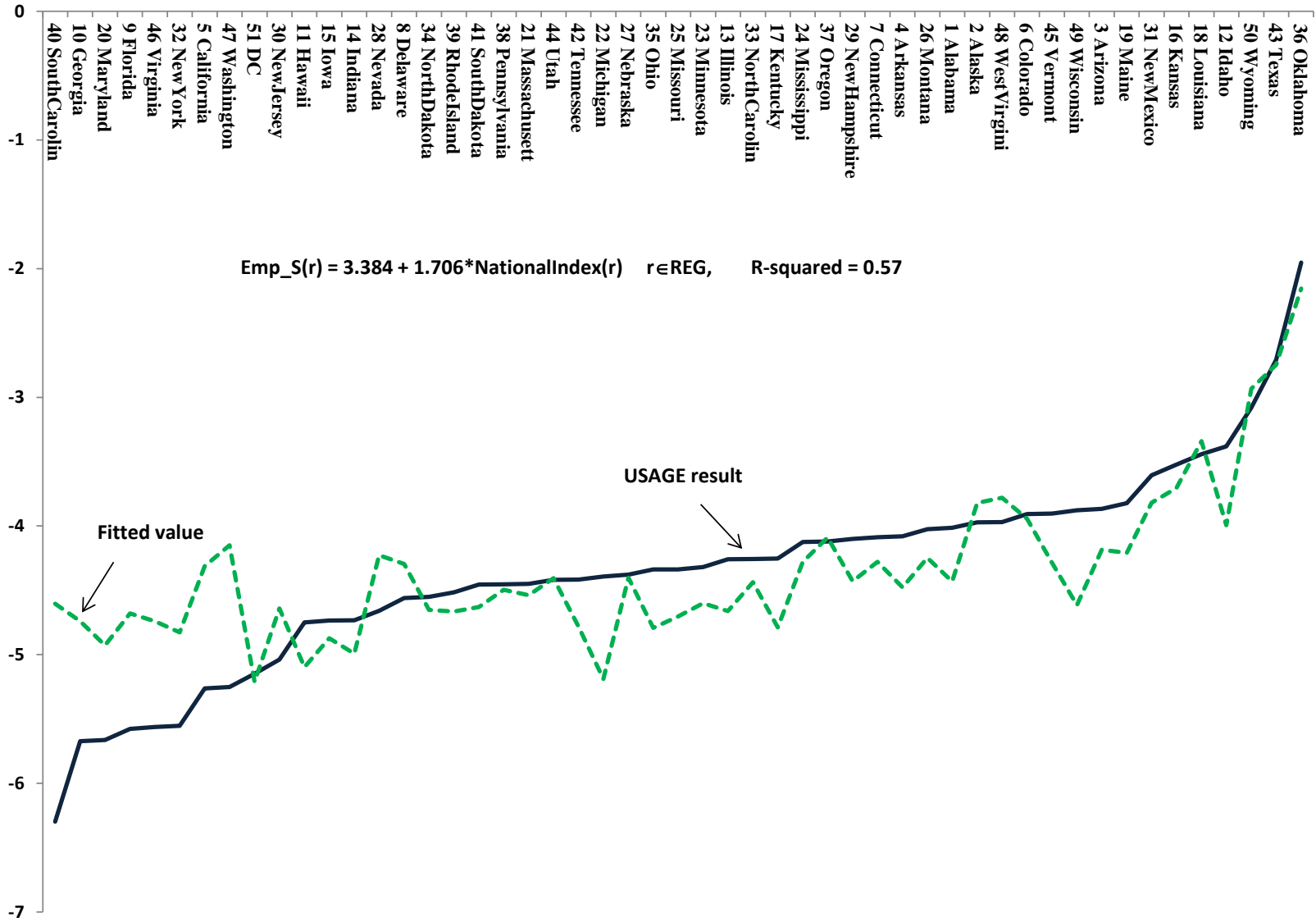
Emp_S(r) = 3.384 + 1.706*NationalIndex(r)   r∈REG,   R-squared = 0.57

Fitted value

USAGE result

Figure 4.2. Employment effects of cessation of Canada/U.S. trade explained by a two-variable regression: equation (4.3)
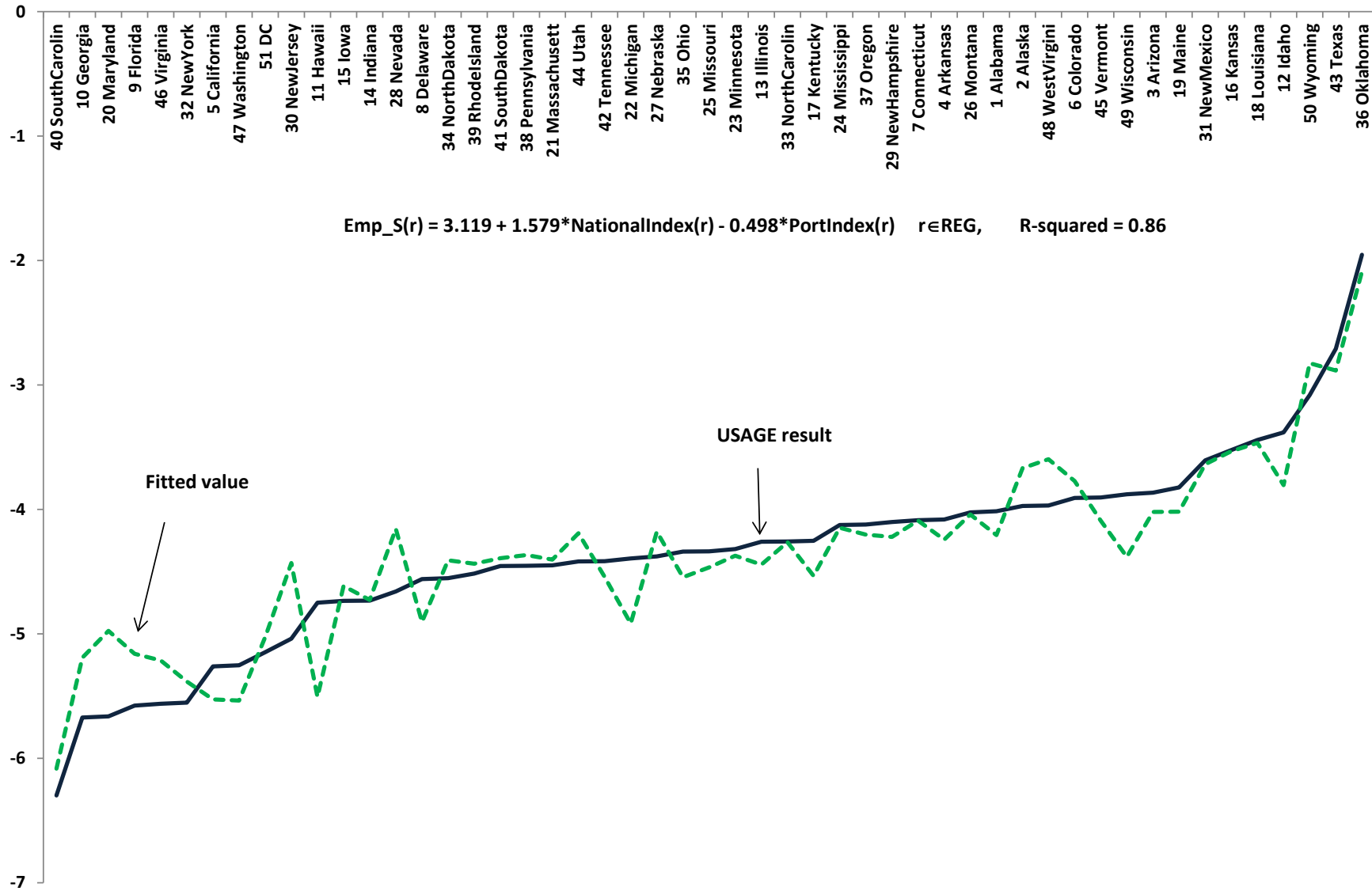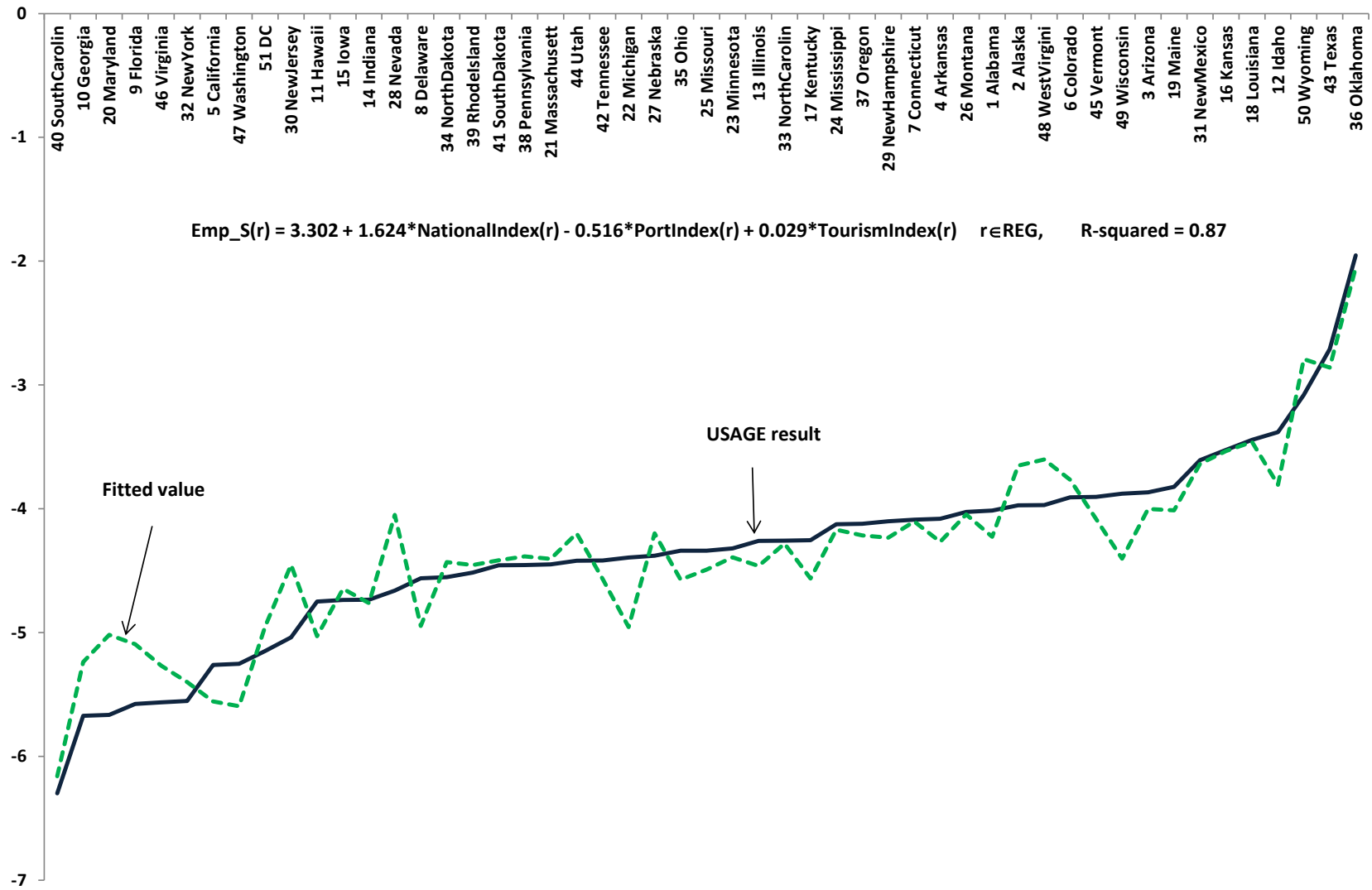
$$\text{Emp\_S}(r) = 3.119 + 1.579*\text{NationalIndex}(r) - 0.498*\text{PortIndex}(r) \quad r \in REG, \quad R\text{-squared} = 0.86$$

USAGE result

Fitted value

Figure 4.3. Employment effects of cessation of Canada/U.S. trade explained by a three-variable regression: equation (4.4)

$Emp\_S(r) = 3.302 + 1.624*NationalIndex(r) - 0.516*PortIndex(r) + 0.029*TourismIndex(r) \quad r \in REG, \quad$ R-squared = 0.87

USAGE result

Fitted value

USAGE simulation relative to regions in which hotels, etc. are used mainly for other purposes.

Thus we decided to add a tourism index to our regression equation. This is calculated for state r as the ratio of r's share in international tourism activities to r's share in national employment. The values of this index are in the fifth column of Table 4.1. With the inclusion of the Tourism index, the regression equation becomes:

$$Emp\_S(r) = 3.302 + 1.634*NationalIndex(r) - 0.516*PortIndex(r) + 0.029*TourismIndex(r)$$

$$r \in REG, \text{ R-squared} = 0.87 \quad (4.4)$$

The Tourism index slightly improves the overall fit of the regression equation and moves the fitted value for Hawaii close to the USAGE result (compare Figures 4.2 and 4.3).

At this stage, the gaps between the fitted values and the USAGE results are quite small, see Figure 4.3. Thus we judge that (4.4) is an adequate explanation of the USAGE results.

5. Congressional District dependence on Canada/U.S. trade

Table 5.1 shows effects of cessation of U.S. trade with Canada on the employment of residents in each of the 436 Congressional districts. The districts are identified by their representative in 2013 and their state and number. For example, BonnerAL1 is the first Congressional district in Alabama and was represented in 2013 by Jo Bonner.

Job losses are shown in column (1) in terms of millions while column (2) shows percentage losses. The percentages in column (2) were calculated under the assumption that the percentage reduction in jobs for residents in district r who work in industry j is the same as the percentage reduction in jobs for residents in the state to which r belongs who work in industry j, giving

$$empCD(r) = \sum_j SCD(j,r)*Emp\_IS(j,S(r)) \quad , r = 1, 2, \ldots, 436 \quad (5.1)$$

where

empCD(r) is the percentage change in employment of residents in Congressional district r;

SCD(j,r) is the share of jobs of residents in Congressional district r accounted for by industry j; and

Emp_IS(j,S(r)) is the percentage change in employment in industry j in the state to which Congressional district r belongs. These state results were generated in the calculations described in Section 4.

Implementation of (5.1) required us to make estimates of the job shares, SCD(j,r). The main source for these estimates was county data for about 400 industries from the 2010 Census.[10] Most Congressional districts are an aggregation of counties. For these districts we derived jobs data by addition. However in some western states, counties are large and encompass several Congressional districts. For these Congressional districts we estimated job shares

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[10] See http://www2.census.gov/econ2010/CBP_CSV/ .

Table 5.1 Employment effects by Congressional district of Canada/U.S. trade cessation: USAGE results

	Millions of jobs	% effect on jobs	% Mix effect		Millions of jobs	% effect on jobs	% Mix effect
	(1)	(2)	(3)		(1)	(2)	(3)
Alabama	**-0.1021**	**-4.0147**		29 CookCA8	-0.0153	-5.8960	-0.6342
1 BonnerAL1	-0.0115	-3.6058	0.4090	30 McNerneyCA9	-0.0171	-5.6941	-0.4324
2 RobyAL2	-0.0191	-4.4330	-0.4183	31 DenhamCA10	-0.0168	-5.6869	-0.4251
3 RogersAL3	-0.0144	-4.1785	-0.1638	32 MillerGeoCA11	-0.0297	-5.5289	-0.2672
4 AderholtAL4	-0.0117	-3.6127	0.4020	33 PelosiCA12	-0.0399	-5.3129	-0.0511
5 BrooksAL5	-0.0163	-4.3128	-0.2980	34 LeeCA13	-0.0312	-5.5269	-0.2651
6 BachusAL6	-0.0166	-3.8334	0.1813	35 SpeierCA14	-0.0342	-5.2402	0.0215
7 SewellAL7	-0.0124	-3.9819	0.0328	36 SwalwellCA15	-0.0307	-5.3194	-0.0577
Alaska	**-0.0183**	**-3.9723**		37 CostaCA16	-0.0142	-5.1925	0.0693
8 YoungAK1	-0.0183	-3.9723	0.0000	38 HondaCA17	-0.0274	-4.8006	0.4612
Arizona	**-0.1311**	**-3.8664**		39 EshooCA18	-0.0288	-4.7087	0.5531
9 KirkptrickAZ1	-0.0128	-4.1687	-0.3023	40 LofgrenCA19	-0.0246	-4.8614	0.4003
10 BarberAZ2	-0.0162	-4.0704	-0.2039	41 FarrCA20	-0.0173	-5.2649	-0.0031
11 GrijalvaAZ3	-0.0134	-3.7556	0.1108	42 ValadaoCA21	-0.0110	-3.4087	1.8531
12 GosarAZ4	-0.0125	-4.1382	-0.2718	43 NunesCA22	-0.0175	-5.3759	-0.1141
13 SalmonAZ5	-0.0149	-3.7142	0.1522	44 McCarthyCA23	-0.0156	-4.6394	0.6224
14 SchweikertAZ6	-0.0161	-3.6332	0.2332	45 CappsCA24	-0.0166	-4.9930	0.2688
15 PastorAZ7	-0.0130	-3.7852	0.0812	46 McKeonCA25	-0.0244	-5.3146	-0.0528
16 FranksAZ8	-0.0162	-3.9442	-0.0778	47 BrownleyCA26	-0.0171	-4.7353	0.5264
17 SinemaAZ9	-0.0161	-3.7372	0.1292	48 ChuCA27	-0.0269	-5.3360	-0.0742
Arkansas	**-0.0644**	**-4.0806**		49 SchiffCA28	-0.0267	-5.3128	-0.0510
18 CrawfordAR1	-0.0146	-4.1774	-0.0968	50 CardenasCA29	-0.0199	-5.2760	-0.0142
19 GriffinAR2	-0.0214	-4.3391	-0.2585	51 ShermanCA30	-0.0266	-5.3240	-0.0623
20 WomackAR3	-0.0149	-3.9649	0.1156	52 MillerGaryCA31	-0.0171	-5.8389	-0.5771
21 CottonAR4	-0.0135	-3.7519	0.3287	53 NapolitanoCA32	-0.0227	-5.2585	0.0032
California	**-1.1286**	**-5.2618**		54 WaxmanCA33	-0.0281	-5.1875	0.0743
22 LaMalfaCA1	-0.0149	-5.4430	-0.1813	55 BecerraCA34	-0.0211	-5.2912	-0.0294
23 HuffmanCA2	-0.0301	-5.3402	-0.0784	56 NgrtMcLeodCA35	-0.0171	-5.6782	-0.4164
24 GaramendiCA3	-0.0171	-5.4658	-0.2040	57 RuizCA36	-0.0096	-5.4523	-0.1906
25 McClintockCA4	-0.0168	-5.2584	0.0034	58 BassCA37	-0.0247	-5.3212	-0.0595
26 ThompsonCA5	-0.0286	-5.2669	-0.0051	59 SanchezLdaCA38	-0.0236	-5.3616	-0.0998
27 MatsuiCA6	-0.0162	-5.3878	-0.1260	60 RoyceCA39	-0.0267	-5.3944	-0.1326
28 BeraCA7	-0.0173	-5.3377	-0.0759	61 RoybAllardCA40	-0.0187	-5.2013	0.0605

Table 5.1 continues …

Table 5.1 continued

	Millions of jobs	% effect on jobs	% Mix effect		Millions of jobs	% effect on jobs	% Mix effect
	(1)	(2)	(3)		(1)	(2)	(3)
62 TakanoCA41	-0.0113	-5.5016	-0.2398	91 CrenshawFL4	-0.0265	-5.7043	-0.1275
63 CalvertCA42	-0.0127	-5.3608	-0.0990	92 BrownFL5	-0.0195	-5.5712	0.0055
64 WatersCA43	-0.0222	-5.3909	-0.1291	93 DeSantisFL6	-0.0185	-5.6149	-0.0381
65 HahnCA44	-0.0186	-5.3431	-0.0813	94 MicaFL7	-0.0202	-5.3939	0.1828
66 CampbellCA45	-0.0267	-5.2993	-0.0375	95 PoseyFL8	-0.0191	-5.3208	0.2559
67 SanchezLtaCA46	-0.0207	-5.4184	-0.1566	96 GraysonFL9	-0.0185	-5.7005	-0.1238
68 LowenthalCA47	-0.0253	-5.3280	-0.0662	97 WebsterFL10	-0.0198	-5.4712	0.1056
69 RohrbacherCA48	-0.0265	-5.3119	-0.0501	98 NugentFL11	-0.0153	-5.7907	-0.2140
70 IssaCA49	-0.0161	-5.1758	0.0860	99 BilirakisFL12	-0.0186	-5.4880	0.0887
71 HunterCA50	-0.0153	-5.2567	0.0051	100 YoungFL13	-0.0193	-5.2422	0.3345
72 VargasCA51	-0.0148	-5.3510	-0.0892	101 CastorFL14	-0.0271	-5.5778	-0.0010
73 PetersCA52	-0.0189	-5.2646	-0.0028	102 RossFL15	-0.0263	-5.6231	-0.0464
74 DavisCA53	-0.0197	-5.4067	-0.1449	103 BuchananFL16	-0.0179	-5.5188	0.0579
Colorado	**-0.1310**	**-3.9071**		104 RooneyFL17	-0.0169	-5.3893	0.1874
75 DeGetteCO1	-0.0213	-3.8548	0.0523	105 MurphyFL18	-0.0195	-5.5183	0.0585
76 PolisCO2	-0.0191	-3.9744	-0.0673	106 RadelFL19	-0.0166	-5.5340	0.0427
77 TiptonCO3	-0.0157	-3.6616	0.2455	107 HastingsFL20	-0.0235	-5.6961	-0.1194
78 GardnerCO4	-0.0160	-3.3613	0.5459	108 DeutchFL21	-0.0246	-5.6565	-0.0798
79 LambornCO5	-0.0192	-4.4582	-0.5511	109 FrankelFL22	-0.0254	-5.5633	0.0134
80 CoffmanCO6	-0.0191	-3.8198	0.0873	110 WasSchultzFL23	-0.0264	-5.5965	-0.0197
81 PerlmutterCO7	-0.0207	-4.2497	-0.3426	111 WilsonFL24	-0.0245	-5.7754	-0.1987
Connecticut	**-0.0913**	**-4.0872**		112 DiazBalartFL25	-0.0262	-5.6071	-0.0304
82 LarsonCT1	-0.0184	-4.0723	0.0149	113 GarciaFL26	-0.0268	-5.7519	-0.1752
83 CourtneyCT2	-0.0179	-4.2462	-0.1590	114 RosLehtineFL27	-0.0264	-5.8280	-0.2512
84 DeLauroCT3	-0.0193	-4.1886	-0.1014	**Georgia**	**-0.3122**	**-5.6725**	
85 HimesCT4	-0.0184	-3.9315	0.1557	115 KingstonGA1	-0.0231	-5.5956	0.0769
86 EstyCT5	-0.0172	-4.0071	0.0801	116 BishopGA2	-0.0190	-5.5014	0.1711
Delaware	**-0.0248**	**-4.5603**		117 WestmorelaGA3	-0.0219	-5.8664	-0.1939
87 CarneyDE1	-0.0248	-4.5603	0.0000	118 JohnsonGA4	-0.0235	-5.8430	-0.1705
Florida	**-0.5887**	**-5.5767**		119 LewisGA5	-0.0246	-5.7483	-0.0757
88 MillerFL1	-0.0221	-5.2786	0.2981	120 PriceGA6	-0.0255	-5.5202	0.1524
89 SouthrlandFL2	-0.0242	-5.6193	-0.0426	121 WoodallGA7	-0.0227	-5.6689	0.0036
90 YohoFL3	-0.0190	-5.5745	0.0022	122 ScottAusGA8	-0.0216	-5.5151	0.1575

Table 5.1 continued

	Millions of jobs	% effect on jobs	% Mix effect		Millions of jobs	% effect on jobs	% Mix effect
	(1)	(2)	(3)		(1)	(2)	(3)
123 CollinsGA9	-0.0189	-5.5466	0.1260	152 WalorskiIN2	-0.0200	-4.9190	-0.1856
124 BrounGA10	-0.0207	-5.5357	0.1368	153 StutzmanIN3	-0.0183	-4.6695	0.0639
125 GingreyGA11	-0.0241	-5.5968	0.0757	154 RokitaIN4	-0.0184	-4.9310	-0.1976
126 BarrowGA12	-0.0203	-5.6394	0.0331	155 BrooksIN5	-0.0219	-4.6645	0.0689
127 ScottDavidGA13	-0.0257	-5.9953	-0.3228	156 MesserIN6	-0.0189	-5.1163	-0.3830
128 GravesGA14	-0.0206	-5.8167	-0.1441	157 CarsonIN7	-0.0198	-4.5986	0.1347
Hawaii	**-0.0416**	**-4.7497**		158 BucshonIN8	-0.0187	-4.3018	0.4315
129 HanabusaHI1	-0.0236	-4.8120	-0.0623	159 YoungIN9	-0.0210	-4.8019	-0.0685
130 GabbardHI2	-0.0180	-4.6706	0.0791	**Iowa**	**-0.0956**	**-4.7358**	
Idaho	**-0.0305**	**-3.3810**		160 BraleyIA1	-0.0225	-4.6626	0.0731
131 LabradorID1	-0.0146	-3.2958	0.0853	161 LoebsackIA2	-0.0218	-4.7591	-0.0233
132 SimpsonID2	-0.0160	-3.4625	-0.0815	162 LathamIA3	-0.0268	-4.6831	0.0526
Illinois	**-0.3198**	**-4.2595**		163 KingIA4	-0.0245	-4.8441	-0.1084
133 RushIL1	-0.0187	-4.6382	-0.3788	**Kansas**	**-0.0657**	**-3.5234**	
134 KellyIL2	-0.0181	-4.5649	-0.3054	164 HuelskampKS1	-0.0149	-3.2662	0.2571
135 LipinskiIL3	-0.0201	-4.4582	-0.1987	165 JenkinsKS2	-0.0181	-3.7977	-0.2744
136 GutierrezIL4	-0.0174	-4.3365	-0.0770	166 YoderKS3	-0.0193	-4.0612	-0.5379
137 QuigleyIL5	-0.0247	-4.3378	-0.0784	167 PompeoKS4	-0.0134	-2.9353	0.5880
138 RoskamIL6	-0.0199	-4.1617	0.0978	**Kentucky**	**-0.1027**	**-4.2531**	
139 DavisDannyIL7	-0.0190	-4.4476	-0.1881	168 WhitfieldKY1	-0.0155	-4.1707	0.0825
140 DuckworthIL8	-0.0197	-4.2167	0.0427	169 GuthrieKY2	-0.0157	-4.0124	0.2407
141 SchakowskyIL9	-0.0203	-4.4167	-0.1572	170 YarmuthKY3	-0.0195	-4.4875	-0.2343
142 SchneiderIL10	-0.0148	-3.7709	0.4886	171 MassieKY4	-0.0186	-4.2014	0.0517
143 FosterIL11	-0.0199	-4.3124	-0.0529	172 RogersKY5	-0.0135	-4.2336	0.0195
144 EnyartIL12	-0.0147	-4.4168	-0.1573	173 BarrKY6	-0.0199	-4.3671	-0.1140
145 DavisRodIL13	-0.0153	-4.3343	-0.0749	**Louisiana**	**-0.0906**	**-3.4427**	
146 HultgrenIL14	-0.0199	-4.2724	-0.0129	174 ScaliseLA1	-0.0175	-3.6898	-0.2471
147 ShimkusIL15	-0.0125	-3.3123	0.9472	175 RichmondLA2	-0.0170	-4.0336	-0.5909
148 KinzingerIL16	-0.0146	-4.1262	0.1332	176 BoustanyLA3	-0.0116	-2.5939	0.8488
149 BustosIL17	-0.0136	-4.2236	0.0359	177 FlemingLA4	-0.0120	-2.8245	0.6182
150 SchockIL18	-0.0165	-4.1908	0.0686	178 AlexanderLA5	-0.0133	-3.3658	0.0769
Indiana	**-0.1743**	**-4.7334**		179 CassidyLA6	-0.0192	-4.0935	-0.6508
151 ViscloskyIN1	-0.0173	-4.6872	0.0461				

Table 5.1 continued

	Millions of jobs	% effect on jobs	% Mix effect		Millions of jobs	% effect on jobs	% Mix effect
	(1)	(2)	(3)		(1)	(2)	(3)
Maine	**-0.0307**	**-3.8232**		209 BentivolioMI11	-0.0248	-4.4579	-0.0646
180 PingreeME1	-0.0169	-3.8995	-0.0763	210 DingellMI12	-0.0206	-4.6561	-0.2628
181 MichaudME2	-0.0138	-3.7337	0.0894	211 ConyersMI13	-0.0160	-4.7428	-0.3495
Maryland	**-0.1968**	**-5.6634**		212 PetersMI14	-0.0178	-4.6071	-0.2139
182 HarrisMD1	-0.0229	-5.4563	0.2071	**Minnesota**	**-0.1534**	**-4.3193**	
183 RupprsbrgrMD2	-0.0251	-5.7083	-0.0449	213 WalzMN1	-0.0173	-4.3439	-0.0246
184 SarbanesMD3	-0.0248	-5.6946	-0.0312	214 KlineMN2	-0.0205	-4.2687	0.0506
185 EdwardsMD4	-0.0253	-5.8072	-0.1438	215 PaulsenMN3	-0.0206	-4.0439	0.2754
186 HoyerMD5	-0.0261	-5.7858	-0.1224	216 McCollumMN4	-0.0200	-4.3502	-0.0309
187 DelaneyMD6	-0.0242	-5.5675	0.0959	217 EllisonMN5	-0.0208	-4.2850	0.0343
188 CummingsMD7	-0.0220	-5.7426	-0.0792	218 BachmannMN6	-0.0191	-4.3791	-0.0598
189 VanHollenMD8	-0.0263	-5.5519	0.1115	219 PetersonMN7	-0.0173	-4.3305	-0.0112
Massachusett	**-0.1923**	**-4.4494**		220 NolanMN8	-0.0179	-4.6494	-0.3301
190 NealMA1	-0.0199	-4.6818	-0.2324	**Mississippi**	**-0.0633**	**-4.1253**	
191 McGovernMA2	-0.0192	-4.4958	-0.0464	221 NunneleeMS1	-0.0150	-4.0711	0.0542
192 TsongasMA3	-0.0186	-4.2836	0.1658	222 ThompsonMS2	-0.0156	-4.1785	-0.0532
193 Kennedy3MA4	-0.0202	-4.2575	0.1919	223 HarperMS3	-0.0155	-3.8473	0.2780
194 MarkeyMA5	-0.0225	-4.3766	0.0728	224 PalazzoMS4	-0.0173	-4.4119	-0.2866
195 TierneyMA6	-0.0226	-4.4122	0.0372	**Missouri**	**-0.1553**	**-4.3375**	
196 CapuanoMA7	-0.0239	-4.5789	-0.1295	225 ClayMO1	-0.0303	-4.5365	-0.1991
197 LynchMA8	-0.0255	-4.4927	-0.0433	226 WagnerMO2	-0.0291	-4.1454	0.1921
198 KeatingMA9	-0.0200	-4.4690	-0.0196	227 LuetkemyerMO3	-0.0176	-4.3911	-0.0537
Michigan	**-0.2332**	**-4.3933**		228 HartzlerMO4	-0.0164	-4.4843	-0.1469
199 BenishekMI1	-0.0128	-3.9639	0.4294	229 CleaverMO5	-0.0164	-4.2054	0.1321
200 HuizengaMI2	-0.0147	-4.1208	0.2724	230 GravesMO6	-0.0175	-4.3740	-0.0366
201 AmashMI3	-0.0153	-4.2130	0.1803	231 LongMO7	-0.0147	-4.2364	0.1011
202 CampMI4	-0.0140	-4.3819	0.0114	232 SmithMO8	-0.0133	-4.3340	0.0035
203 KildeeMI5	-0.0135	-4.4494	-0.0561	**Montana**	**-0.0257**	**-4.0248**	
204 UptonMI6	-0.0132	-4.2099	0.1834	233 DainesMT1	-0.0257	-4.0248	0.0000
205 WalbergMI7	-0.0147	-4.4911	-0.0978	**Nebraska**	**-0.0551**	**-4.3785**	
206 RogersMI8	-0.0171	-4.4192	-0.0259	234 FortnberryNE1	-0.0192	-4.5014	-0.1229
207 LevinMI9	-0.0213	-4.3410	0.0523	235 TerryNE2	-0.0205	-4.3778	0.0007
208 MillerMI10	-0.0176	-4.3359	0.0574	236 SmithNE3	-0.0154	-4.2353	0.1432

Table 5.1 continued

	Millions of jobs	% effect on jobs	% Mix effect		Millions of jobs	% effect on jobs	% Mix effect
	(1)	(2)	(3)		(1)	(2)	(3)
Nevada	**-0.0727**	**-4.6603**		265 JeffriesNY8	-0.0237	-5.7809	-0.2286
237 TitusNV1	-0.0137	-4.6179	0.0423	266 ClarkeNY9	-0.0256	-5.7337	-0.1814
238 AmodeiNV2	-0.0230	-4.6251	0.0352	267 NadlerNY10	-0.0347	-5.1767	0.3756
239 HeckNV3	-0.0181	-4.6652	-0.0050	268 GrimmNY11	-0.0265	-5.7036	-0.1513
240 HorsfordNV4	-0.0179	-4.7345	-0.0742	269 MaloneyClnNY12	-0.0436	-5.1601	0.3922
NewHampshire	**-0.0343**	**-4.1011**		270 RangelNY13	-0.0250	-5.3110	0.2414
241 SheaPorterNH1	-0.0176	-4.1329	-0.0319	271 CrowleyNY14	-0.0237	-5.9241	-0.3717
242 KusterNH2	-0.0167	-4.0680	0.0331	272 SerranoNY15	-0.0170	-5.9870	-0.4347
NewJersey	**-0.2571**	**-5.0379**		273 EngelNY16	-0.0188	-5.5959	-0.0436
243 AndrewsNJ1	-0.0206	-5.1336	-0.0956	274 LoweyNY17	-0.0191	-5.1670	0.3854
244 LoBiondoNJ2	-0.0196	-5.2847	-0.2467	275 MaloneySeaNY18	-0.0200	-5.3639	0.1885
245 RunyanNJ3	-0.0230	-5.3511	-0.3131	276 GibsonNY19	-0.0184	-5.6451	-0.0928
246 SmithNJ4	-0.0214	-5.1303	-0.0924	277 TonkoNY20	-0.0238	-5.5838	-0.0314
247 GarrettNJ5	-0.0215	-5.0502	-0.0123	278 OwensNY21	-0.0172	-5.6876	-0.1352
248 PalloneNJ6	-0.0210	-5.0455	-0.0075	279 HannaNY22	-0.0195	-6.1664	-0.6141
249 LanceNJ7	-0.0222	-4.6831	0.3548	280 ReedNY23	-0.0165	-5.1963	0.3561
250 SiresNJ8	-0.0236	-4.8799	0.1580	281 MaffeiNY24	-0.0181	-5.5181	0.0342
251 PascrellNJ9	-0.0198	-5.1404	-0.1025	282 SlaughterNY25	-0.0165	-5.5333	0.0191
252 PayneNJ10	-0.0204	-5.1543	-0.1163	283 HigginsNY26	-0.0252	-5.5314	0.0209
253 FrelinghuyNJ11	-0.0223	-4.8536	0.1844	284 CollinsNY27	-0.0255	-5.6802	-0.1278
254 HoltNJ12	-0.0218	-4.8866	0.1514	**NorthCarolina**	**-0.2321**	**-4.2577**	
NewMexico	**-0.0389**	**-3.6061**		285 ButterfielNC1	-0.0147	-4.0121	0.2456
255 LujanGrishNM1	-0.0139	-3.7816	-0.1754	286 EllmersNC2	-0.0179	-4.5329	-0.2752
256 PearceNM2	-0.0120	-3.2445	0.3616	287 JonesNC3	-0.0200	-4.6318	-0.3741
257 LujanNM3	-0.0129	-3.8112	-0.2051	288 PriceNC4	-0.0193	-4.4210	-0.1633
NewYork	**-0.6416**	**-5.5523**		289 FoxxNC5	-0.0159	-4.1518	0.1059
258 BishopNY1	-0.0271	-5.5904	-0.0380	290 CobleNC6	-0.0174	-3.8921	0.3656
259 KingNY2	-0.0282	-5.5570	-0.0047	291 McIntyreNC7	-0.0176	-4.3985	-0.1408
260 IsraelNY3	-0.0257	-5.4055	0.1468	292 HudsonNC8	-0.0169	-4.3800	-0.1223
261 McCarthyNY4	-0.0277	-5.6183	-0.0660	293 PittengerNC9	-0.0211	-4.1082	0.1495
262 MeeksNY5	-0.0250	-5.9112	-0.3588	294 McHenryNC10	-0.0170	-4.2715	-0.0138
263 MengNY6	-0.0234	-5.8368	-0.2845	295 MeadowsNC11	-0.0172	-4.3126	-0.0549
264 VelazquezNY7	-0.0262	-5.4103	0.1420	296 WattNC12	-0.0177	-4.3214	-0.0637

Table 5.1 continued

	Millions of jobs	% effect on jobs	% Mix effect		Millions of jobs	% effect on jobs	% Mix effect
	(1)	(2)	(3)		(1)	(2)	(3)
297 HoldingNC13	-0.0195	-3.9958	0.2619	**Pennsylvania**	**-0.3261**	**-4.4537**	
NorthDakota	**-0.0264**	**-4.5518**		325 BradyPA1	-0.0203	-4.6331	-0.1794
298 CramerND1	-0.0264	-4.5518	0.0000	326 FattahPA2	-0.0204	-4.6617	-0.2080
Ohio	**-0.2891**	**-4.3386**		327 KellyPA3	-0.0155	-4.2719	0.1818
299 ChabotOH1	-0.0173	-4.4246	-0.0860	328 PerryPA4	-0.0201	-4.6495	-0.1958
300 WenstrupOH2	-0.0170	-4.3764	-0.0378	329 ThompsonPA5	-0.0151	-4.0835	0.3701
301 BeattyOH3	-0.0180	-4.3677	-0.0291	330 GerlachPA6	-0.0189	-4.2917	0.1620
302 JordanOH4	-0.0171	-4.5849	-0.2464	331 MeehanPA7	-0.0169	-4.2835	0.1701
303 LattaOH5	-0.0175	-4.4756	-0.1370	332 FtzpatrickPA8	-0.0186	-4.3883	0.0654
304 JohnsonOH6	-0.0151	-4.2467	0.0919	333 ShusterPA9	-0.0160	-4.4567	-0.0030
305 GibbsOH7	-0.0147	-3.9369	0.4016	334 MarinoPA10	-0.0161	-4.2941	0.1596
306 BoehnerOH8	-0.0174	-4.3738	-0.0352	335 BarlettaPA11	-0.0201	-4.6251	-0.1714
307 KapturOH9	-0.0180	-4.5906	-0.2520	336 RothfusPA12	-0.0165	-4.5367	-0.0830
308 TurnerOH10	-0.0191	-4.5927	-0.2542	337 SchwartzPA13	-0.0259	-4.3217	0.1320
309 FudgeOH11	-0.0272	-4.4503	-0.1118	338 DoylePA14	-0.0163	-4.7786	-0.3249
310 TiberiOH12	-0.0189	-4.1480	0.1906	339 DentPA15	-0.0175	-4.6080	-0.1543
311 RyanOH13	-0.0162	-4.2127	0.1259	340 PittsPA16	-0.0161	-4.3733	0.0804
312 JoyceOH14	-0.0188	-4.2123	0.1263	341 CartwrightPA17	-0.0180	-4.4627	-0.0090
313 StiversOH15	-0.0178	-4.3759	-0.0374	342 MurphyPA18	-0.0176	-4.4657	-0.0120
314 RenacciOH16	-0.0190	-4.0549	0.2837	**RhodeIsland**	**-0.0270**	**-4.5159**	
Oklahoma	**-0.0440**	**-1.9531**		343 CicillineRI1	-0.0130	-4.4053	0.1105
315 BridnstineOK1	-0.0069	-1.5677	0.3854	344 LangevinRI2	-0.0139	-4.6246	-0.1088
316 MullinOK2	-0.0093	-2.7180	-0.7649	**SouthCarolina**	**-0.1574**	**-6.2984**	
317 LucasOK3	-0.0071	-1.5537	0.3994	345 SanfordSC1	-0.0239	-6.0863	0.2121
318 ColeOK4	-0.0124	-2.5545	-0.6013	346 WilsonSC2	-0.0271	-6.1833	0.1150
319 LankfordOK5	-0.0084	-1.5749	0.3783	347 DuncanSC3	-0.0193	-6.2081	0.0903
Oregon	**-0.0934**	**-4.1214**		348 GowdySC4	-0.0233	-6.4692	-0.1708
320 BonamiciOR1	-0.0168	-3.7778	0.3436	349 MulvaneySC5	-0.0237	-6.6092	-0.3108
321 WaldenOR2	-0.0166	-3.9681	0.1533	350 ClyburnSC6	-0.0206	-6.1955	0.1029
322 BlumenauerOR3	-0.0243	-4.5207	-0.3993	351 RiceSC7	-0.0196	-6.3732	-0.0748
323 DeFazioOR4	-0.0164	-4.0619	0.0596	**SouthDakota**	**-0.0256**	**-4.4552**	
324 SchraderOR5	-0.0193	-4.1800	-0.0585	352 NoemSD1	-0.0256	-4.4552	0.0000

Table 5.1 continued

	Millions of jobs	% effect on jobs	% Mix effect		Millions of jobs	% effect on jobs	% Mix effect
	(1)	(2)	(3)		(1)	(2)	(3)
Tennessee	**-0.1639**	**-4.4169**		384 GallegoTX23	-0.0099	-2.5474	0.1620
353 RoeTN1	-0.0155	-4.2191	0.1978	385 MarchantTX24	-0.0132	-2.1504	0.5590
354 DuncanTN2	-0.0184	-4.4622	-0.0453	386 WilliamsTX25	-0.0136	-3.2667	-0.5573
355 FleischmanTN3	-0.0160	-4.2812	0.1357	387 BurgessTX26	-0.0126	-3.2117	-0.5023
356 DesJarlaisTN4	-0.0188	-4.4084	0.0085	388 FarentholdTX27	-0.0133	-3.3466	-0.6372
357 CooperTN5	-0.0222	-4.4531	-0.0362	389 CuellarTX28	-0.0095	-2.6065	0.1030
358 BlackTN6	-0.0181	-4.5648	-0.1479	390 GreenGeneTX29	-0.0080	-1.6479	1.0616
359 BlackburnTN7	-0.0166	-4.3232	0.0937	391 JohnsonEdTX30	-0.0136	-2.8010	-0.0916
360 FincherTN8	-0.0186	-4.3833	0.0336	392 CarterTX31	-0.0133	-3.9379	-1.2285
361 CohenTN9	-0.0196	-4.6089	-0.1920	393 SessionsTX32	-0.0227	-3.3965	-0.6871
Texas	**-0.4201**	**-2.7094**		394 VeaseyTX33	-0.0211	-3.0241	-0.3146
362 GohmertTX1	-0.0092	-2.5895	0.1199	395 VelaTX34	-0.0086	-3.4253	-0.7158
363 PoeTX2	-0.0075	-1.0844	1.6251	396 DoggettTX35	-0.0077	-2.4716	0.2379
364 JohnsonSamTX3	-0.0098	-2.4148	0.2947	397 StockmanTX36	-0.0174	-3.5305	-0.8211
365 HallTX4	-0.0127	-3.4905	-0.7811	**Utah**	**-0.0770**	**-4.4187**	
366 HensarlingTX5	-0.0157	-2.9876	-0.2782	398 BishopUT1	-0.0212	-4.4703	-0.0516
367 BartonTX6	-0.0117	-3.1115	-0.4020	399 StewartUT2	-0.0187	-4.4002	0.0185
368 CulbersonTX7	-0.0156	-2.7757	-0.0663	400 ChaffetzUT3	-0.0171	-4.3710	0.0477
369 BradyTX8	-0.0067	-1.6394	1.0700	401 MathesonUT4	-0.0201	-4.4232	-0.0045
370 GreenAlTX9	-0.0051	-0.8474	1.8620	**Vermont**	**-0.0166**	**-3.9035**	
371 McCaulTX10	-0.0099	-3.1206	-0.4112	402 WelchVT1	-0.0166	-3.9035	0.0000
372 ConawayTX11	-0.0114	-2.8199	-0.1105	**Virginia**	**-0.2725**	**-5.5621**	
373 GrangerTX12	-0.0075	-1.6629	1.0466	403 WittmanVA1	-0.0259	-5.5488	0.0133
374 ThornberryTX13	-0.0117	-2.9978	-0.2884	404 RigellVA2	-0.0261	-5.8560	-0.2939
375 WeberTX14	-0.0097	-2.7665	-0.0571	405 ScottVA3	-0.0221	-5.6739	-0.1118
376 HinojosaTX15	-0.0118	-3.5337	-0.8243	406 ForbesVA4	-0.0222	-5.4417	0.1205
377 ORourkeTX16	-0.0112	-3.9493	-1.2398	407 HurtVA5	-0.0189	-5.3829	0.1792
378 FloresTX17	-0.0145	-4.1322	-1.4228	408 GoodlatteVA6	-0.0207	-5.4788	0.0834
379 JacksonLeeTX18	-0.0104	-1.8577	0.8517	409 CantorVA7	-0.0265	-5.5191	0.0430
380 NeugebauerTX19	-0.0107	-3.2208	-0.5114	410 MoranVA8	-0.0345	-5.5604	0.0018
381 CastroTX20	-0.0061	-1.5473	1.1621	411 GriffithVA9	-0.0188	-5.4106	0.1515
382 SmithTX21	-0.0121	-3.6414	-0.9320	412 WolfVA10	-0.0277	-5.5975	-0.0354
383 OlsonTX22	-0.0146	-3.5472	-0.8378	413 ConnollyVA11	-0.0290	-5.6243	-0.0622

Table 5.1 continued

	Millions of jobs	% effect on jobs	% Mix effect
	(1)	(2)	(3)
Washington	**-0.2093**	**-5.2518**	
414 DelBeneWA1	-0.0208	-4.9584	0.2934
415 LarsenWA2	-0.0188	-4.9677	0.2841
416 HerBeutlerWA3	-0.0183	-5.4217	-0.1699
417 HastingsWA4	-0.0187	-5.0729	0.1788
418 McMorRdgrsWA5	-0.0191	-5.0405	0.2113
419 KilmerWA6	-0.0226	-5.5574	-0.3056
420 McDermottWA7	-0.0234	-5.2593	-0.0076
421 ReichertWA8	-0.0212	-5.2214	0.0304
422 SmithWA9	-0.0213	-5.2455	0.0062
423 HeckWA10	-0.0250	-5.7241	-0.4723
WestVirginia	**-0.0363**	**-3.9692**	
424 McKinleyWV1	-0.0131	-4.2149	-0.2457
425 CapitoWV2	-0.0125	-3.5336	0.4357
426 RahallWV3	-0.0108	-4.2784	-0.3092
Wisconsin	**-0.1369**	**-3.8776**	
427 RyanWI1	-0.0176	-4.0627	-0.1851
428 PocanWI2	-0.0200	-3.8441	0.0335
429 KindWI3	-0.0172	-3.9554	-0.0778
430 MooreWI4	-0.0169	-4.0772	-0.1996
431 SensnbrnnrWI5	-0.0178	-3.7781	0.0995
432 PetriWI6	-0.0159	-3.8169	0.0607
433 DuffyWI7	-0.0156	-3.7919	0.0857
434 RibbleWI8	-0.0160	-3.7119	0.1657
Wyoming	**-0.0122**	**-3.0805**	
435 LummisWY1	-0.0122	-3.0805	0.0000
DC	**-0.0435**	**-5.1479**	
436 NortonDC1	-0.0435	-5.1479	0.0000
U.S.	**-8.27**	**-4.54**	**0.0**

using county data with its detailed industry coverage supplemented by Congressional district data available in the Census for 13 broad industries.[11]

Under equation (5.1), differences between the outcomes for Congressional districts within the same state are explained entirely by differences between the districts in the industrial composition of the employment of their residents. For example, BonnerAL1 does better than Alabama (job loss of 3.6058 per cent compared with the statewide loss of 4.0147 per cent) because AL1 residents rely for their jobs on a mix of industries that are less damaged than the state average. Detailed investigation of our calculations reveals that Pulp mills (producer of commodity 177, an industry that does well from cessation of trade with Canada, see Table 3.1) is overrepresented in AL1 jobs relative to Alabama jobs. Similarly, AL1 benefits from over representation of Industrial chemicals (commodity 199), Crude petroleum (commodity 34) and Sawmills (commodity 150). AL1 residents also benefit relative to Alabama as a whole from under representation in their employment of industries with strongly negative results from trade cessation. Examples include Motor vehicles parts (commodity 390) and Electrical equipment for internal combustion engines (commodity 384).

More generally, the total employment result for district r differs from that of its state according to the mix effect calculated as:

$$\text{Mix}(r) = \sum_j \big[\text{SCD}(j,r) - \text{Sh}(j,S(r))\big] * \big[\text{Emp\_IS}(j,S(r)) - \text{Emp\_S}(S(r))\big] \text{ , } r = 1, 2, .., 436 \text{ (5.2)}$$

where Mix(r) is the difference between Congressional district r's result for jobs and the state result. As can be seen from (5.2), Mix(r) will be positive if r has relatively high shares of its employment in industries in which the damage to employment is relatively light or if r has relatively low shares of its employment in industries in which the damage to employment is relatively heavy. The values for Mix(r) are given in column (3) of Table (5.1).

On average the absolute value of Mix(r) is 0.2080 implying that the average gap between the percentage loss of jobs for a Congressional district and the percentage loss of jobs for its state is 0.2080 percentage points. With the average loss of jobs across all Congressional districts being 4.54 per cent, we see that for most Congressional districts the percentage loss of jobs is close to that of the state to which it belongs. However, there are exceptions. For example, Oil producing congressional districts in Texas (TX2, TX8, TX9, TX12, TX18, TX20 and TX29) do considerably better than the rest of Texas. Consequently these Congressional districts have strong positive Mix effects. By contrast, most other Congressional districts in Texas have negative Mix effects.

All of the Congressional districts have a population of about 700,000. Consequently, at first glance, the extent of variation across the results in column (1) of Table 5.1 is surprising. Consider for example Congressional districts NY12 and NY13 (entries 269 and 270 in Table 5.1). For NY12, the percentage reduction of 5.1601

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[11] The 13 industry coverage for Congressional districts is in http://www2.census.gov/acs2011_1yr/CD113/ . For Congressional districts that are contained within a county but are only part of it, we converted the 13 industries into the USAGE 500-plus industries by assuming that the detailed industry breakdown within each of the 13 industries is the same as that in the county to which the Congressional district belongs. For a Congressional district that lies across county borders, we allocated the 13 industry data for the Congressional district to the relevant counties taking account of the location of cities and rural areas. Then we split the allocated 13 industry data for each of the relevant counties to the 500 level as above. Finally, we combined the 500 level data from the relevant counties to form the 500 industry breakdown for the cross-county Congressional district.

translates into 43,600 job losses. For NY13, a larger percentage reduction, 5.3110, translates into only 25,000 job losses. Although their populations are broadly equal, there is considerable variation across Congressional districts in the number of jobs held by their residents. The residents of NY12 hold 850,000 jobs whereas the residents of NY13 hold only 470,000 jobs. These differences reflect unemployment rates (7 per cent in NY12 and 15 per cent in NY13) and demographic factors (a lower percentage of people under 16 in NY12 relative to NY13). Overall, variation across Congressional districts in the number of jobs contributes about 50 per cent of the variance of the Congressional district results in column (1). The other 50 per cent reflects the variation across Congressional districts in the percentage job losses shown in column (2).

6. U.S. employment in U.S. affiliates of Canadian companies

Trade is not the only way in which Canada supports jobs in the U.S. As can be seen from BEA statistics reproduced in Tables 6.1 and 6.2, 571 thousand U.S. residents are employees in Canada's majority-owned U.S. affiliates. This represents 0.45 per cent of total employee jobs in the U.S. [12]

Jobs in Canada's majority-owned affiliates in the U.S. are concentrated in Manufacturing, Information, and Finance & insurance. In each of these sectors Canada's majority-owned affiliates provide between 1.45 and 1.64 per cent of U.S. employment.

At the state level, Table 6.2 shows that the state with the least dependence on Canadian affiliates to provide employment is Hawaii. For this state, the Canadian-affiliate share in employment is 0.11 per cent. At the other end of the spectrum is Maine where Canadian affiliates account for 1.41 per cent. Other states that have significant dependence on Canadian affiliates for employment (more than 0.8 per cent) are Alaska, Kansas, Minnesota, Nevada, New Hampshire, South Dakota and Wisconsin.

7. Concluding remarks

In 2013 Canada was the biggest market for U.S. exports and the second biggest source of U.S. imports, behind China. Trade with Canada has a profound effect on the U.S. economy. Our simulation with the USAGE model suggests that about 8.27 million jobs in the U.S. depend on Canada/U.S. trade.

Over 80 per cent of U.S. industries would suffer output loss if Canada/U.S. trade ceased. Output loss is easy to explain for industries that have a heavy dependence on exports to Canada. For other industries, output losses would reflect increases in the cost of their inputs caused by the unavailability of imports from Canada. Industries with little or no direct connection with Canada would suffer from the overall contraction in the U.S. economy. The main group of industries that would gain from cessation of Canada/U.S. trade are those that have little dependence on imports from Canada, export little to Canada and face significant import competition from Canadian products in the U.S. market. Another group of winning industries are those that are trade-exposed but do not have direct connection with Canada. These industries would gain from devaluation.

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[12] In the summary we mentioned that employment in the U.S. was 182. 28 million jobs in 2013. Table 6.1 shows a total of 125.98 million jobs in the U.S. This latter number refers to employees, it excludes self-employment jobs.

Table 6.1. Employees by sector in 2013: millions of jobs (and percentages of affiliates in sectoral employment)

	Total U.S. employees[a]	Employees in foreign affiliates[b]		Employees in Canadian affiliates[c]	
Manufacturing	11.75	2.16	(18.39%)	0.19	(1.59%)
Wholesale trade	5.55	0.57	(10.30%)	0.03	(0.56%)
Retail trade	13.08	0.51	(3.89%)	0.04	(0.32%)
Information	2.54	0.25	(9.82%)	0.04	(1.64%)
Finance and insurance	5.72	0.43	(7.45%)	0.08	(1.45%)
Real estate and rental and leasing	1.89	0.04	(2.20%)	0.02	(1.10%)
Professional, scientific, and technical services	7.81	0.30	(3.86%)	0.04	(0.53%)
Other	77.66	1.60	(2.06%)	0.12	(0.16%)
Total or average	125.98	5.86	(4.65%)	0.57	(0.45%)

[a] Source: NIPA Table 6.5d available from the Bureau of Economic Analysis (BEA) website at http://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1#reqid=9&step=1&isuri=1 , downloaded on October 21, 2014.

[b] Source: Data in Table II.F3 on employees by sector in foreign-owned affiliates in the U.S. available for 2011 on the BEA website at http://www.bea.gov/international/fdius2011_preliminary.htm , downloaded on October 21, 2014. This data was updated to 2013 by scaling all numbers in proportion to the average growth (across all industries) between 2011 and 2013 in Total U.S. employees.

[c] Source: Data in Table II.F3 on employees by sector in Canadian-owned affiliates in the U.S. available for 2011 on the EA website at http://www.bea.gov/international/fdius2011_preliminary.htm , downloaded on October 21, 2014.. This data was updated to 2013 by scaling all numbers in proportion to the average growth (across all industries) between 2011 and 2013 in Total U.S. employees.

With the number of losing industries far outweighing the number of winning industries, it is not surprising that our simulation shows that every state and the District of Columbia would lose from a cessation of Canada/U.S. trade. Job losses would exceed 5 per cent in California, Florida, Georgia, Maryland, New Jersey, New York, South Carolina, Virginia, Washington and District of Columbia. Even among the 436 Congressional districts, we found no example of a winner from cessation of Canada/U.S. trade.

While less important than trade, Canadian direct investment is also a significant source of jobs in the U.S., particularly in Manufacturing, Information and Finance & insurance. Altogether, about 571 thousand U.S. residents are employees in Canadian-majority-owned affiliates operating in the U.S. This is about 0.45 per cent of U.S. employees. At the state level, dependence on Canadian-majority-owned affiliates varies between 0.11 per cent in Hawaii and 1.41 per cent in Maine.

Appendix: With cessation of Canada/U.S. trade, why is the percentage reduction in U.S. real GDP significantly larger than the percentage fall in U.S. employment?

Table 1.1 shows reductions in U.S. real GDP and employment of 6.47 per cent and 4.54 per cent. In CGE models such as USAGE, GDP effects can be explained by what is often referred to as the Solow equation:

$$y = S_\ell * \ell + S_k * k + a \tag{A1}$$

Table 6.2. Employees by state in 2013: millions of jobs and percentages of affiliates in state employment

		Total U.S. employees[d]	Employees in foreign affiliates[a]		Employees in Canadian affiliates[b]	
1	Alabama	1.81	0.090	4.983%	0.0091	0.503%
2	Alaska	0.34	0.015	4.307%	0.0030	0.878%
3	Arizona	2.03	0.083	4.092%	0.0157	0.770%
4	Arkansas	1.05	0.039	3.661%	0.0022	0.208%
5	California	14.40	0.613	4.257%	0.0375	0.260%
6	Colorado	2.26	0.087	3.829%	0.0102	0.453%
7	Connecticut	1.66	0.107	6.407%	0.0051	0.308%
8	Delaware	0.40	0.031	7.675%	0.0018	0.440%
9	Florida	6.43	0.248	3.853%	0.0315	0.490%
10	Georgia	3.61	0.202	5.576%	0.0184	0.509%
11	Hawaii	0.65	0.028	4.238%	0.0007	0.112%
12	Idaho	0.53	0.014	2.616%	0.0023	0.432%
13	Illinois	5.67	0.279	4.917%	0.0245	0.433%
14	Indiana	2.61	0.151	5.768%	0.0155	0.592%
15	Iowa	1.34	0.051	3.822%	0.0044	0.328%
16	Kansas	1.34	0.061	4.524%	0.0184	1.371%
17	Kentucky	1.71	0.096	5.604%	0.0099	0.580%
18	Louisiana	2.00	0.060	2.987%	0.0053	0.266%
19	Maine	0.56	0.032	5.696%	0.0078	1.408%
20	Maryland	2.45	0.110	4.467%	0.0087	0.353%
21	Massachusetts	3.26	0.196	6.009%	0.0187	0.573%
22	Michigan	4.12	0.184	4.475%	0.0258	0.626%
23	Minnesota	2.45	0.098	3.982%	0.0208	0.848%
24	Mississippi	1.11	0.028	2.557%	0.0026	0.235%
25	Missouri	2.58	0.092	3.552%	0.0085	0.328%
26	Montana	0.40	0.006	1.593%	0.0009	0.236%
27	Nebraska	0.87	0.026	3.039%	0.0023	0.264%
28	Nevada	0.82	0.040	4.877%	0.0101	1.229%
29	New Hampshire	0.56	0.041	7.348%	0.0047	0.844%
30	New Jersey	3.79	0.237	6.272%	0.0172	0.455%
31	New Mexico	0.76	0.017	2.246%	0.0039	0.506%
32	New York	8.54	0.426	4.995%	0.0393	0.460%
33	North Carolina	3.60	0.208	5.768%	0.0154	0.426%
34	North Dakota	0.33	0.014	4.240%	0.0021	0.631%
35	Ohio	5.03	0.229	4.545%	0.0196	0.390%
36	Oklahoma	1.63	0.042	2.585%	0.0067	0.410%
37	Oregon	1.53	0.048	3.115%	0.0047	0.306%
38	Pennsylvania	5.18	0.278	5.363%	0.0205	0.395%
39	Rhode Island	0.45	0.027	6.154%	0.0006	0.141%
40	South Carolina	1.71	0.119	6.948%	0.0079	0.465%
41	South Dakota	0.34	0.009	2.516%	0.0030	0.884%
42	Tennessee	2.42	0.129	5.313%	0.0064	0.263%
43	Texas	9.78	0.478	4.888%	0.0396	0.405%
44	Utah	1.02	0.034	3.297%	0.0019	0.184%
45	Vermont	0.29	0.012	4.205%	0.0023	0.788%
46	Virginia	3.66	0.162	4.434%	0.0083	0.226%
47	Washington	2.75	0.100	3.653%	0.0140	0.509%

Table 6.2 continues …

Table 6.2 continued

		Total U.S. employees	Employees in foreign affiliates[a]		Employees in Canadian affiliates[b]	
48	West Virginia	0.71	0.027	3.776%	0.0041	0.574%
49	Wisconsin	2.40	0.089	3.721%	0.0211	0.879%
50	Wyoming	0.26	0.009	3.419%	0.0009	0.368%
51	Dist. of Columbia	0.73	0.022	3.049%	0.0014	0.185%
		125.98	5.860	4.651%	0.5714[c]	0.454%

[a] Source: Data on employees by state and sector in foreign-owned affiliates in the U.S. is in Table II.F7, available for 2011 on the BEA website at http://www.bea.gov/international/fdius2011_preliminary.htm , downloaded on October 21, 2014. This data was updated to 2013 by scaling all numbers in proportion to the average growth across all industries between 2011 and 2013 in Total U.S. employees.

[b] Source: Table II.F 8. Employment of Affiliates, State by Country of UBO, available for 2011 on the BEA website at http://www.bea.gov/international/fdius2011_preliminary.htm , downloaded on October 21, 2014. This data was updated to 2013 by scaling all numbers in proportion to the average growth across all industries between 2011 and 2013 in Total U.S. employees.

[c] Includes a small number of U.S. employees in affiliates in U.S. areas other than the states and DC.

[d] Derived from the BEA's jobs data in SA25N available at http://bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=4#reqid=70&step=1&isuri=1. We assumed that the ratio of employees to jobs was the same across all states.

where

y, ℓ, k and a are the percentage changes in GDP, employment, capital and efficiency (total-factor productivity); and

S_ℓ and S_k are the shares of labor and capital in GDP, 0.75 and 0.25.

In our simulation capital is held fixed (k=0). Thus the Solow equation implies that the cessation of Canada/U.S. trade causes an efficiency loss for the U.S. of 3.07 per cent:

$$a = -6.47 + 0.75*4.54 = -3.07 \quad . \tag{A2}$$

Figure A1 explains this efficiency loss. In the initial situation for 2013, the quantity of U.S. imports from Canada is 0.026 and the price is 1. The quantity units are fractions of GDP: in 2013 U.S. imports from Canada were worth about 2.6 per cent of GDP and with the price set at 1, the value rectangle in Figure A1 shows the value of imports from Canada as a fraction of U.S. GDP. In our simulation, elimination of imports from Canada required the U.S. to impose tariffs with an average value of about 400 per cent, raising the landed-duty-paid price in the U.S. from 1 to 5. With a linear demand curve this would suggest an efficiency loss, measured by the area of the consumer surplus triangle, of about 5.2 per cent of GDP [= 0.5*(4*0.026)*100]. The simulated efficiency loss in USAGE is not this large because the demand curve is convex from above, not linear. As a percent of GDP, the lost area under the demand curve turns out to be 3.07: the scooping out effect of the non-linear demand curve reduces the consumer surplus area from a half base times height to 0.295 base times height [3.07 = 0.295*(4*0.026)*100].

What about exports? Does the U.S. suffer a further efficiency loss from elimination of exports to Canada. Perhaps counter-intuitively, the answer to this question is no. Efficiency is measured by the ability of an economy to turn any given level of capital and labor into goods and services. This ability is adversely affected by taxes and tariffs which cause the economy to use a wrong-mix of inputs. But it is not affected by

Figure A1. U.S. demand curve for imports from Canada
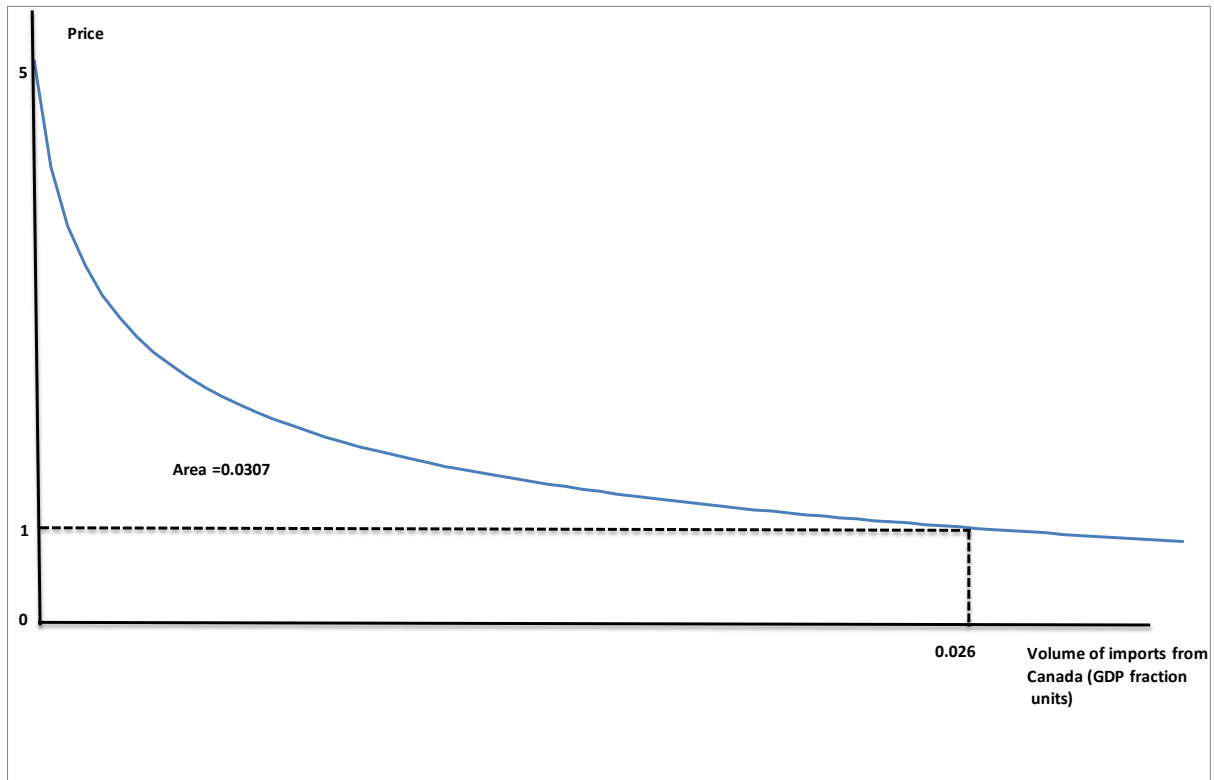
loss of export markets. Such losses may affect the terms of trade and thereby effect the ability to consume, but they do not lead to distorted input choices and consequently they do not lead to efficiency losses.

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