Using the New Products Margin to Predict the Industry-Level Impact of Trade Reform

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Kehoe and Ruhl (2013) show that products that are traded very little or not at all account disproportionately for aggregate changes in bilateral trade following trade liberalization or rapid growth experiences, but not over the business cycle.

Hypothesis: Industries with more trade due to these little-traded and non-traded products should experience more growth following trade liberalization.

Product: A 5-digit SITC, rev. 2 code. There are 1,836 products.

Industry: A 3-digit ISIC code. There are 38 industries. (We are only interested in industries that produce goods in merchandise trade — agriculture, mining and extraction, and manufacturing.)

We map products into industries using concordance developed by Muendler (2009).

Notice that each industry, on average, consists of 48.3 products.

ISIC code	industry name
111	Agriculture and livestock production
113	Hunting, trapping and game propagation
121	Forestry
122	Logging
130	Fishing
210	Coal mining
220	Crude petroleum and natural gas production
230	Metal ore mining
290	Other mining
311–312	Food manufacturing
313	Beverage industries
314	Tobacco manufactures
321	Manufacture of textiles
322	Manufacture of wearing apparel, except footwear
323	Manufacture of leather and products of leather, leather substitutes and fur
324	Manufacture of footwear
331	Manufacture of wood and wood and cork products, except furniture
332	Manufacture of furniture and fixtures, except primarily of metal
341	Manufacture of paper and paper products

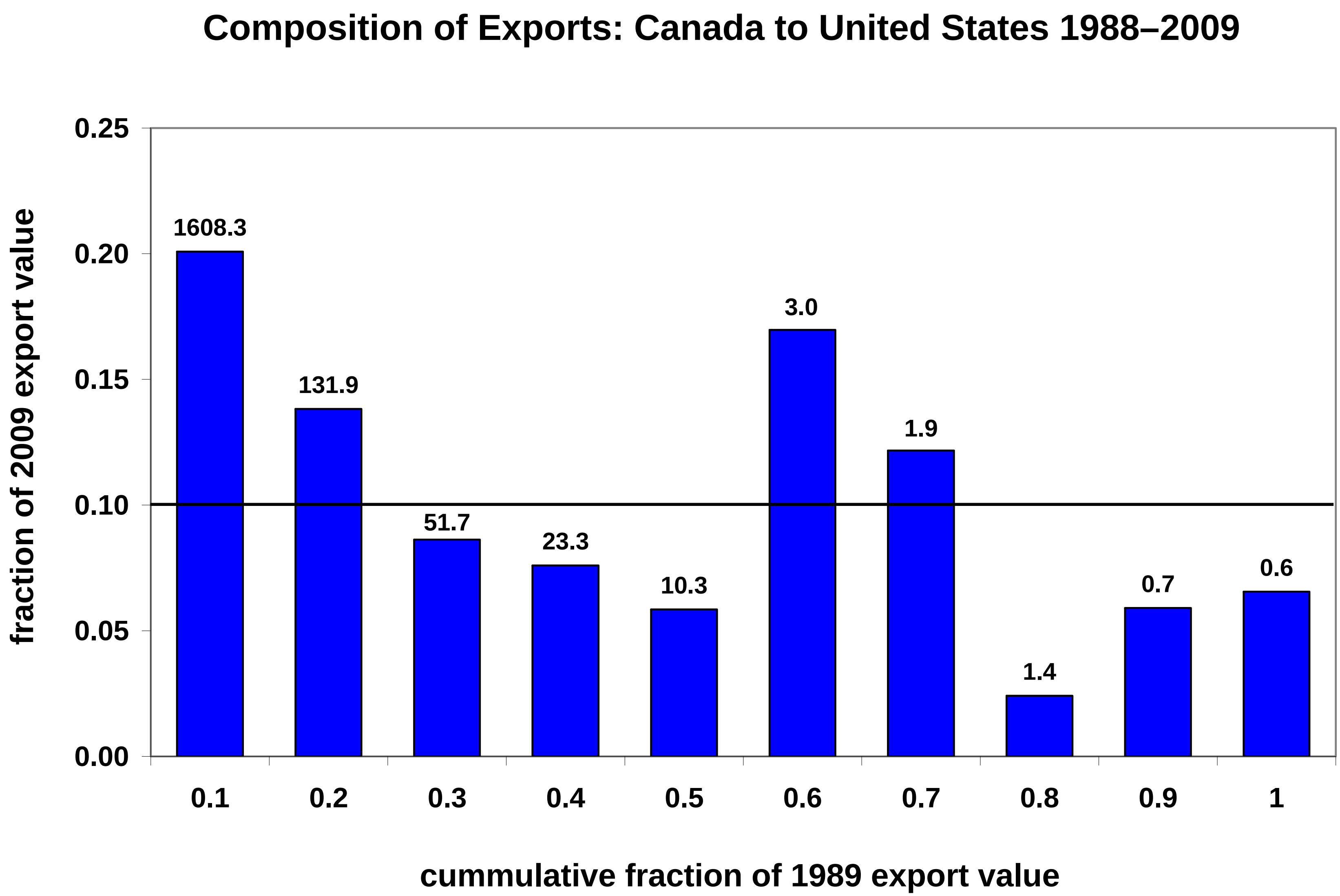
342	Printing, publishing and allied industries
351	Manufacture of industrial chemicals
352	Manufacture of other chemical products
353	Petroleum refineries
354	Manufacture of miscellaneous products of petroleum and coal
355	Manufacture of rubber products
356	Manufacture of plastic products not elsewhere classified
361	Manufacture of pottery, china and earthenware
362	Manufacture of glass and glass products
369	Manufacture of other non-metallic mineral products
371	Iron and steel basic industries
372	Non-ferrous metal basic industries
381	Manufacture of fabricated metal products
382	Manufacture of machinery except electrical
383	Manufacture of electrical machinery apparatus, appliances and supplies
384	Manufacture of transport equipment
385	Manufacture of professional and scientific equipment
390	Other manufacturing industries

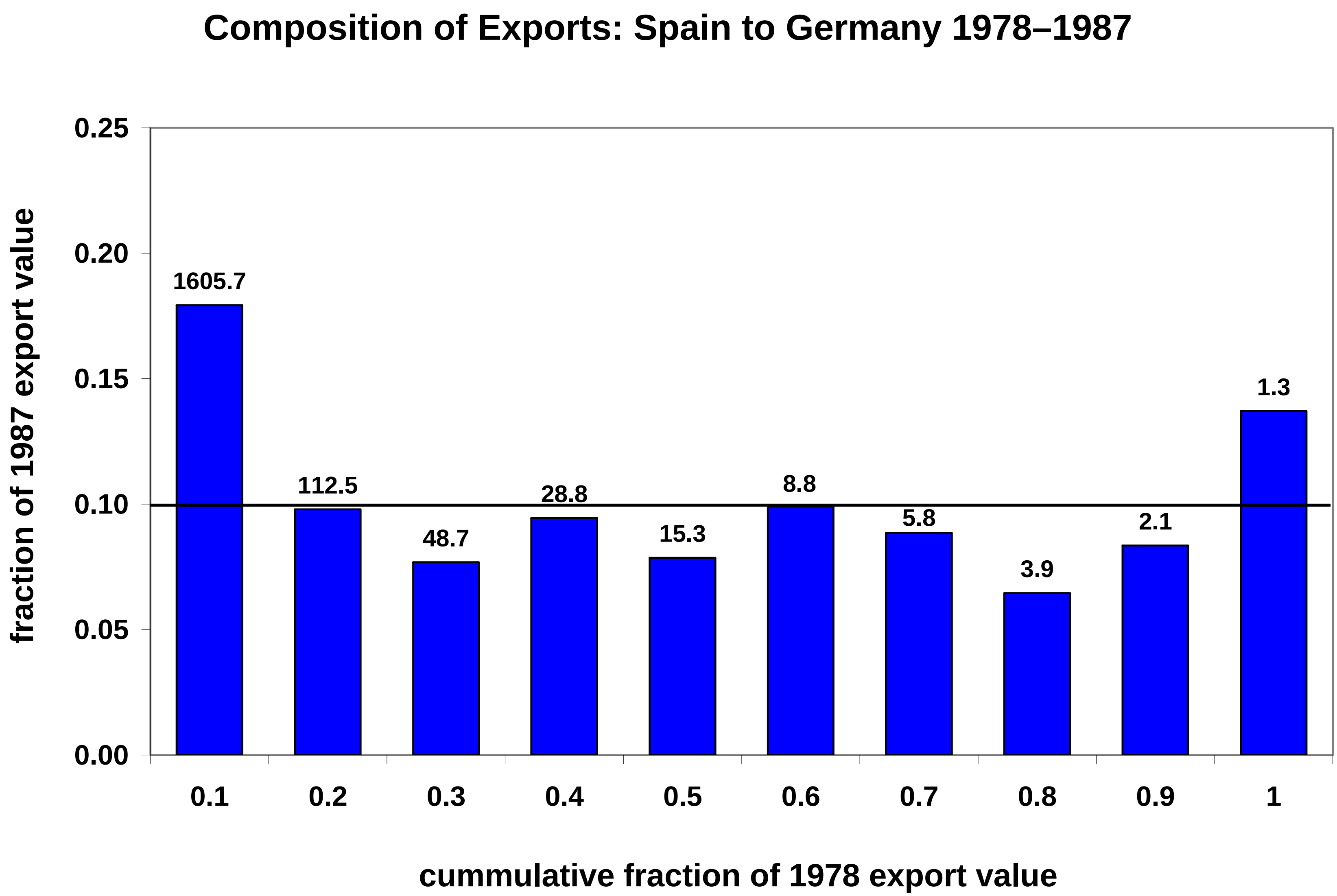
The New Product, or Extensive, Margin

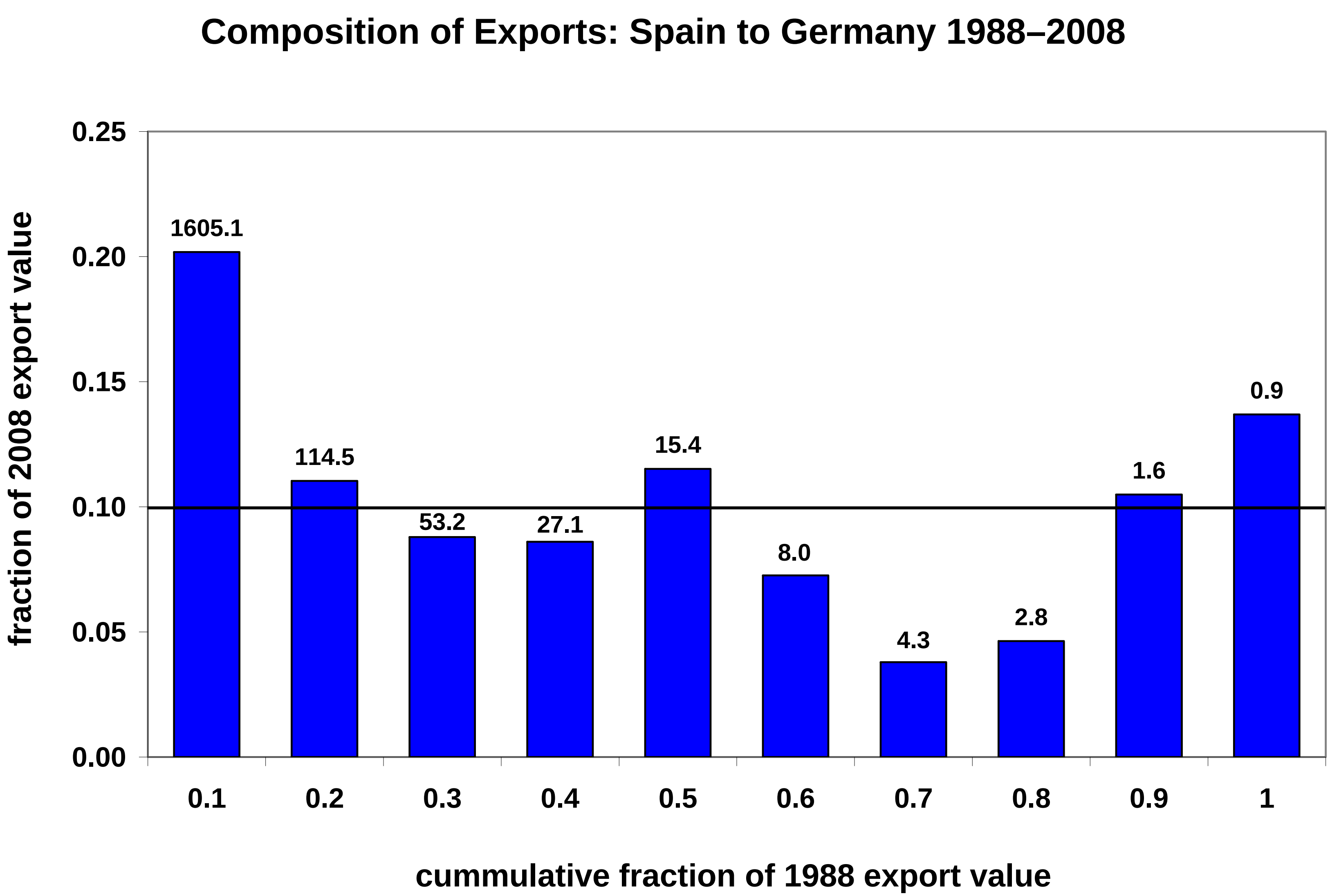
We sort each of the 1,836 products by average amount of trade over the first three years of our period

We then place each product into bins sequentially until each bin accounts for 10 percent of total trade in the base period.

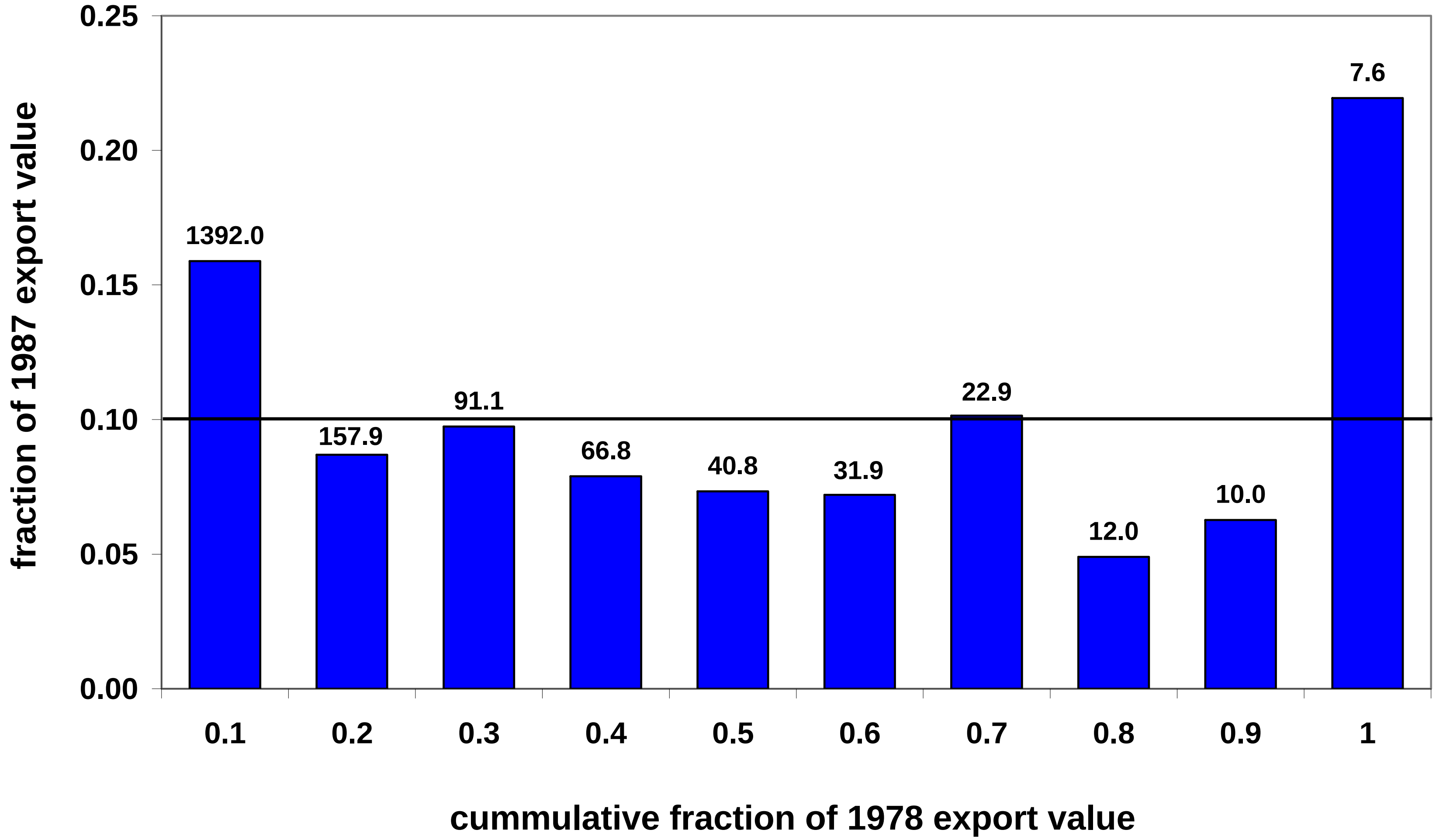
We define Least Traded Products (LTP) to be the products in the final 10 percent bin, the products with the least amount of trade over the first three years.

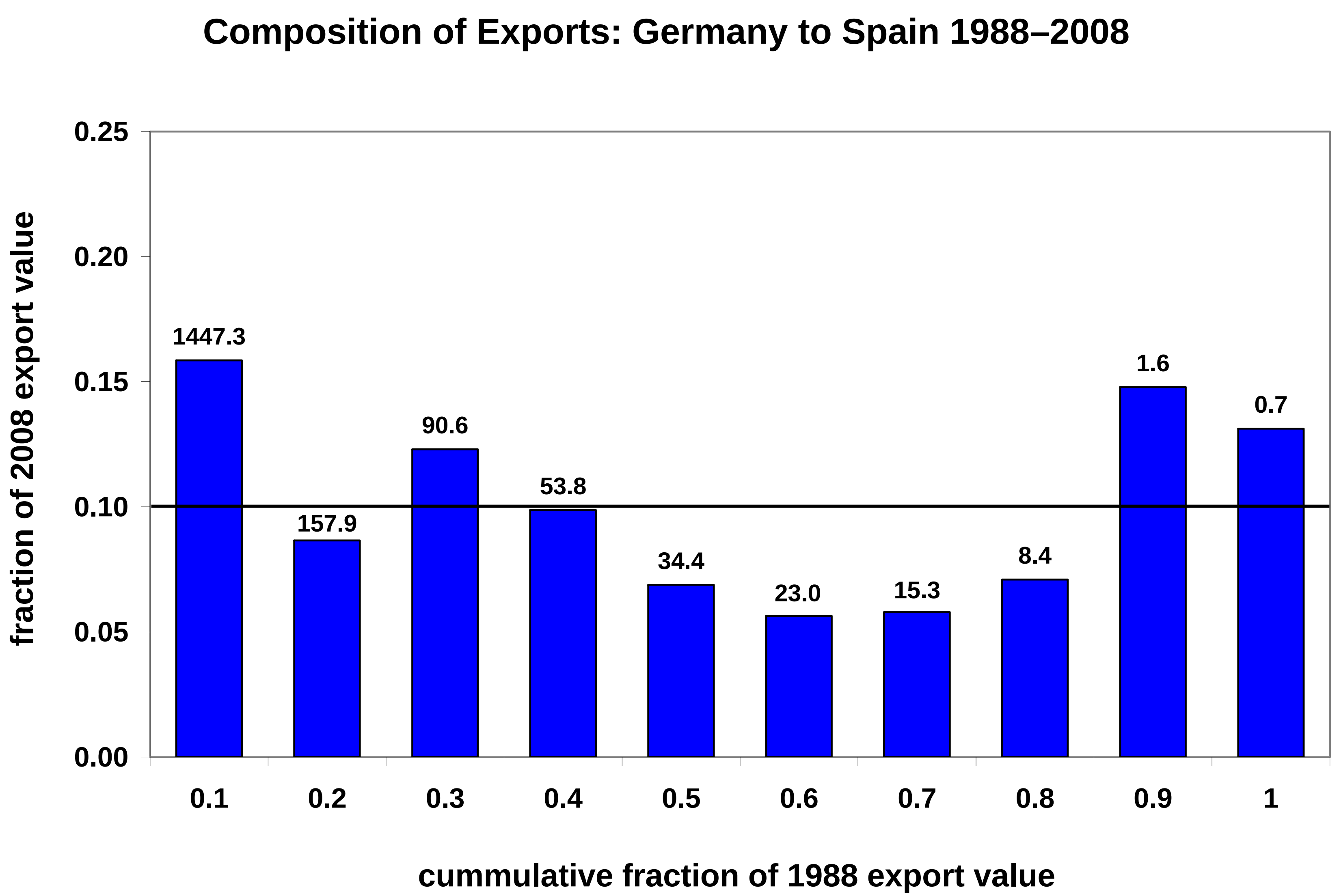

Composition of Exports: Canada to United States 1988–2009
fraction of 2009 export value
0.25
0.20
0.15
0.10
0.05
0.00
1608.3
131.9
51.7
23.3
10.3
3.0
1.9
1.4
0.7
0.6
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
cummulative fraction of 1989 export value


Composition of Exports: Spain to Germany 1978–1987
fraction of 1987 export value
0.25
0.20
0.15
0.10
0.05
0.00
1605.7
112.5
48.7
28.8
15.3
8.8
5.8
3.9
2.1
1.3
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
cummulative fraction of 1978 export value


Composition of Exports: Spain to Germany 1988–2008
0.25
0.20
0.15
0.10
0.05
0.00
fraction of 2008 export value
1605.1
114.5
53.2
27.1
15.4
8.0
4.3
2.8
1.6
0.9
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
cummulative fraction of 1988 export value

Composition of Exports: Germany to Spain 1978–1987




Composition of Exports: Germany to Spain 1988–2008
fraction of 2008 export value
0.25
0.20
0.15
0.10
0.05
0.00
1447.3
157.9
90.6
53.8
34.4
23.0
15.3
8.4
1.6
0.7
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
cummulative fraction of 1988 export value

Comparison to other extensive margins

Most of the literature uses a fixed cutoff when deciding whether a product is part of the extensive margin, Feenstra (1994) uses a value of \$0, and Evenett and Venables (2002) use \$50,000.

In contrast, our measure varies by country pairs. The cutoff for Ecuador-Peru differs from the cutoff for U.S.-Canada.

We keep our set of extensive margin products fixed, as opposed to focusing on movement into and out of the extensive margin.

Predicting changes in trade by industry

Compute the fraction of trade in each industry accounted for by LTP s_j in the base period t_0. Predict

$$z_j = \alpha + \beta s_j$$

$$z_j = \frac{X_{jit}^k / GDP_{it}}{X_{jit_0}^k / GDP_{it_0}} - 1$$

and X_{jit}^k are exports of industry j from country i to country k in year t.

We use experience from previous trade reforms (in this case NAFTA) to estimate α and β. Our hypothesis is that $\beta > 0$.

Least Traded Products predictions compared to those of Yaylaci-Shikher (forthcoming)

industry	Korea to United States			United States to Korea		
	Yaylaci-Shikher predictions	LTP predictions	2005 fraction LTP	Yaylaci-Shikher predictions	LTP predictions	2005 fraction LTP
Chemicals	28.2	54.00	0.36	30.3	20.70	0.16
Electrical mach.	15.5	−0.44	0.02	41.0	−3.02	0.04
Food	70.1	86.03	0.56	422.3	26.63	0.19
Other machinery	8.9	9.17	0.08	31.9	6.86	0.09
Medical	9.9	74.82	0.49	45.0	−1.05	0.05
Metals	9.3	17.18	0.13	17.0	28.61	0.20
Nonmetals	20.5	39.59	0.27	38.7	80.00	0.46
Other	11.8	50.80	0.34	28.5	40.47	0.26
Paper	1.4	105.24	0.68	5.5	6.86	0.09
Petroleum	2.2	15.57	0.12	7.2	−5.00	0.03
Metal products	14.2	62.01	0.41	33.8	20.70	0.16
Rubber	19.8	10.77	0.09	48.0	22.68	0.17
Textile	56.3	58.81	0.39	63.5	117.56	0.65
Transport. equip.	23.3	−2.04	0.01	33.9	−5.00	0.03
Wood	7.9	29.99	0.21	21.1	38.49	0.25
Chemicals	28.2	54.00	0.36	30.3	20.70	0.16
KS-LTP weighted correlation			**0.43**			**0.19**

Kehoe (2005) showed that several of the leading models built to predict the industry level effects of NAFTA performed poorly

We confirm this finding for Brown-Deardorff-Stern (BDS), Cox-Harris, and Sobarzo models over the 1989-2009 period.

Focus on the BDS model since it has bilateral trade predictions for all importer-exporter pairs between Canada, Mexico, and the U.S.

Methodology for evaluating the NAFTA models

We compute the weighted correlation coefficient between the model predictions and the results from the data

We also compute the weighted regression coefficients *a* and *b* from

$$\min_{a,b} \sum_{j=1}^{23} \omega_j \left(a + b z_j^{model} - z_j^{data} \right)^2$$

Here *a* indicates how well the models did in matching average change ($a = 0$ is ideal) and *b* indicates how well the models did in matching the signs and magnitudes of the changes ($b = 1$ is ideal)

Changes in Canada-U.S. trade relative to exporter's GDP (percent)

	Canada to U.S.			U.S. to Canada		
industry	**1989–2009 data**	**BDS model**	**1989 fraction LTP**	**1989–2009 data**	**BDS model**	**1989 fraction LTP**
Agriculture	12.5	3.4	0.26	−6.4	5.1	0.19
Mining and quarrying	237.6	0.4	0.05	51.3	1.0	0.16
Food	101.2	8.9	0.24	124.1	12.7	0.25
Textiles	42.4	15.3	0.77	−35.9	44.0	0.52
Clothing	50.2	45.3	0.59	−3.0	56.7	1.00
Leather products	−67.7	11.3	1.00	−64.0	7.9	0.61
Footwear	−49.9	28.3	1.00	−67.2	45.7	0.34
Wood products	−54.5	0.1	0.01	−30.6	6.7	0.07
Furniture and fixtures	−46.6	12.5	0.00	22.5	35.6	0.00
Paper products	−65.9	−1.8	0.04	13.7	18.9	0.15
Printing and publishing	0.7	−1.6	0.12	−19.6	3.9	0.05
Rubber products	45.8	9.5	0.10	30.2	19.1	0.05
Chemicals	99.6	−3.1	0.38	50.2	21.8	0.24
Petroleum products	−79.8	0.5	0.07	−43.1	0.8	0.13
Glass products	−45.7	30.4	0.40	−20.0	4.4	0.23
Nonmetal mineral products	−0.4	1.2	0.38	−1.9	11.9	0.59
Iron and steel	−12.7	12.9	0.36	53.5	11.6	0.28

Nonferrous metals	−20.9	18.5	0.07	−20.8	−6.7	0.11
Metal products	17.7	15.2	0.20	−5.3	18.2	0.16
Nonelectrical machinery	−8.4	3.3	0.21	−38.9	9.9	0.08
Electrical machinery	−16.4	14.5	0.15	−42.6	14.9	0.05
Transportation equipment	−44.3	10.7	0.01	−37.8	−4.6	0.01
Misc. manufactures	56.1	−2.1	0.45	−19.2	11.5	0.15
weighted corr. with data		−0.28	0.30		0.39	0.54
regression coeff. $a \setminus \alpha$		21.82	−20.42		−26.62	−34.54
regression coeff. $b \setminus \beta$		−3.33	185.24		1.34	175.84
BDS-LTP weighted corr.			−0.11			0.70

Results for the BDS model: the BDS model fared poorly in predicting industry level changes in bilateral trade

exporter	importer	correlation	*a*	*b*
Canada	Mexico	−0.10	645.29	−7.94
Canada	United States	−0.28	21.82	−3.33
Mexico	Canada	0.06	135.79	0.16
Mexico	United States	−0.13	66.64	−0.11
United States	Canada	0.39	−26.62	1.34
United States	Mexico	−0.06	88.47	−0.24
weighted average		−0.00	19.83	−0.94
pooled regression		0.06	10.54	0.17

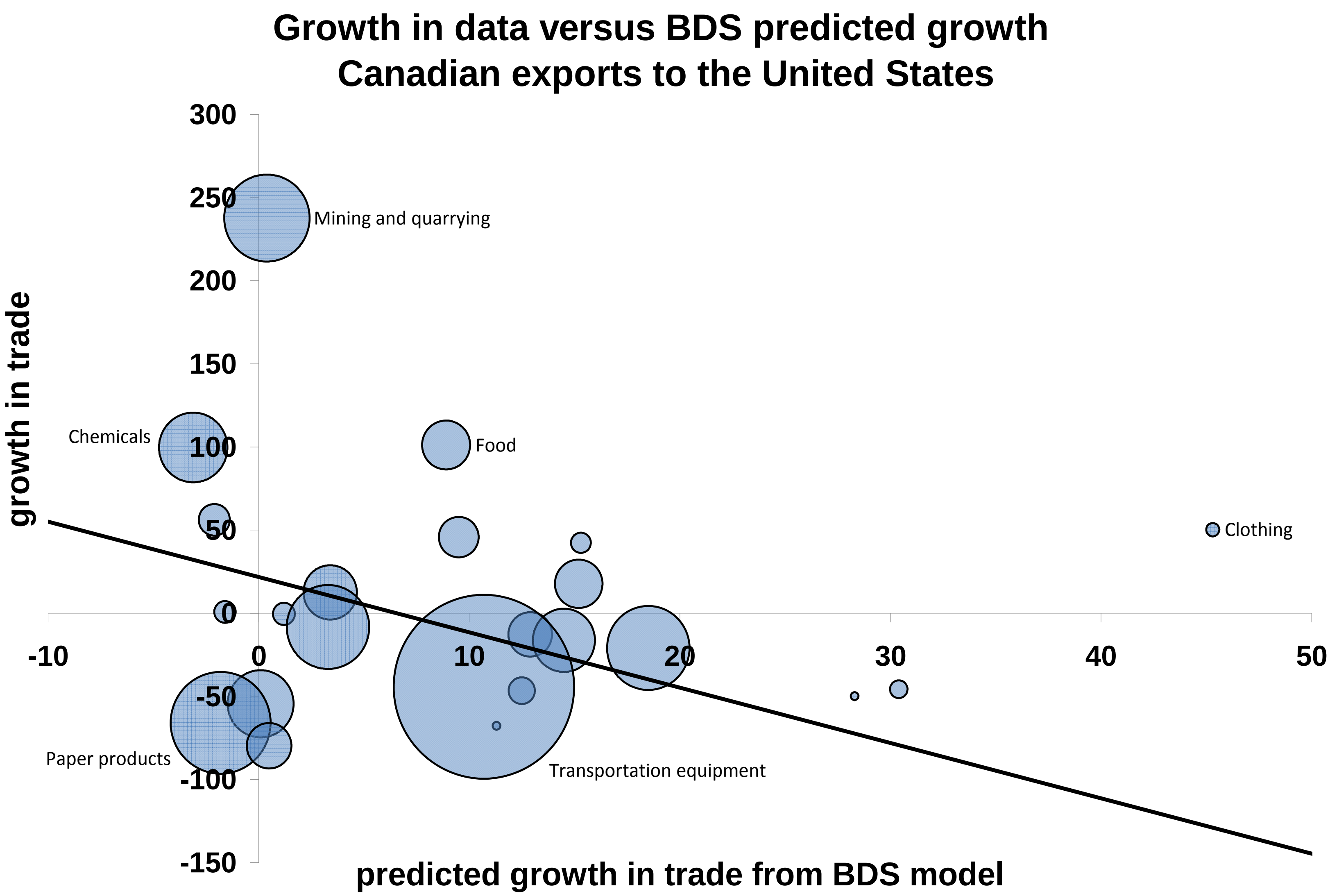
Correlation is the weighted correlation of predictions with the data.

Results for the LTP exercise: the LTP exercise fares much better in predicting industry level changes in bilateral trade

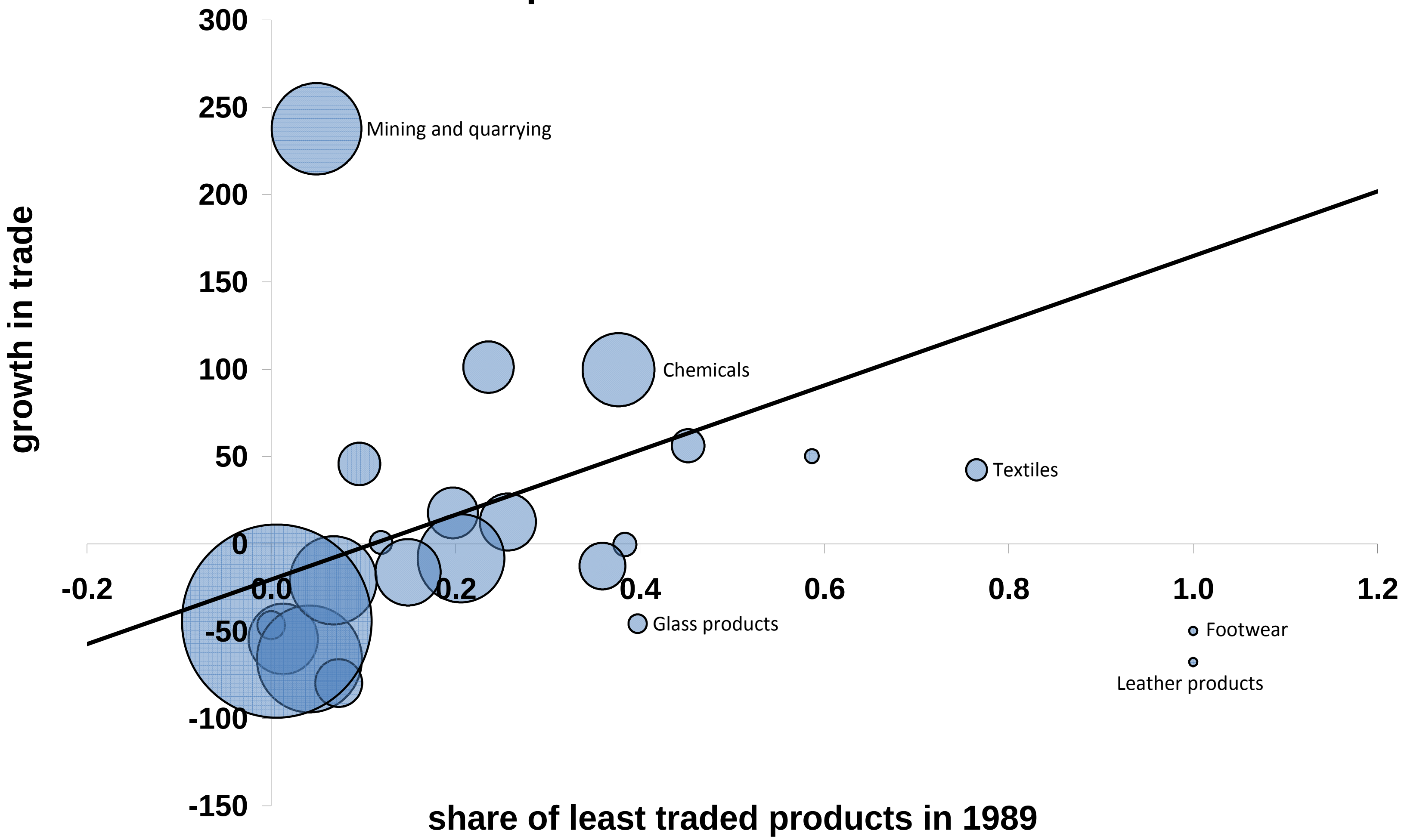
exporter	**importer**	**correlation**	$\boldsymbol{\alpha}$	$\boldsymbol{\beta}$
Canada	Mexico	0.55	254.23	4468.37
Canada	United States	0.30	−20.42	185.24
Mexico	Canada	0.33	115.16	286.39
Mexico	United States	0.19	51.52	77.54
United States	Canada	0.54	−34.54	175.84
United States	Mexico	0.47	62.31	265.44
weighted average		0.39	−5.74	87.29
pooled regression		0.24	−5.30	181.18

Comparison of the BDS results and LTP exercise results: LTP exercise performs better the BDS model for every country pair.

exporter	importer	BDS correlation	LTP correlation
Canada	Mexico	−0.10	0.55
Canada	United States	−0.28	0.30
Mexico	Canada	0.06	0.33
Mexico	United States	−0.13	0.19
United States	Canada	0.39	0.54
United States	Mexico	−0.06	0.47
weighted average		−0.00	0.39
pooled regression		0.06	0.24


Growth in data versus BDS predicted growth
Canadian exports to the United States
growth in trade
predicted growth in trade from BDS model
300
250
200
150
100
50
0
-50
-100
-150
-10
0
10
20
30
40
50
Mining and quarrying
Chemicals
Food
Clothing
Paper products
Transportation equipment

Growth in data versus share of LTP by industry
Canadian exports to the United States



Our exercise shows that looking at the share of least traded products in an industry is a useful predictor of which industries will experience the most growth following trade liberalization.

Major downside to our method: As of now it is atheoretical.

It is our hope that our results will spur the development of models able to account for the importance of the new product margin in trade.

Robustness:

The α and β computed from our industry-level regressions tell us how much LTP and non-LTP products grew on average

We compare these industry-based estimates to the average growth rates computed directly from the product data.

The industry level growth rates will not account for products with zero trade in 1989, while the product level growth rates will. If the estimated growth rates are similar, it indicates the important products are the ones with small, but positive trade.

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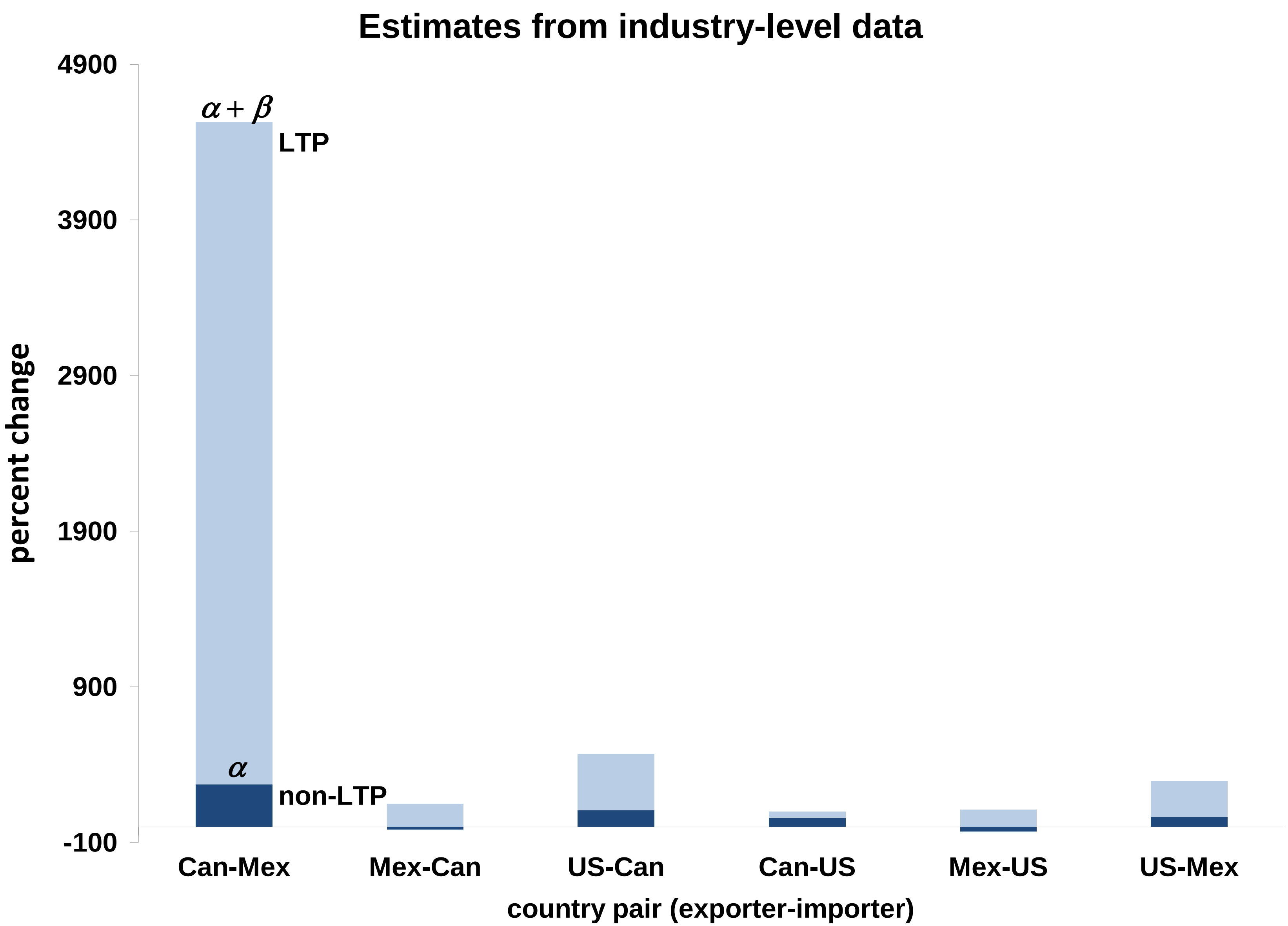
We find a weighted correlation of 0.97 for α and 0.91 for β

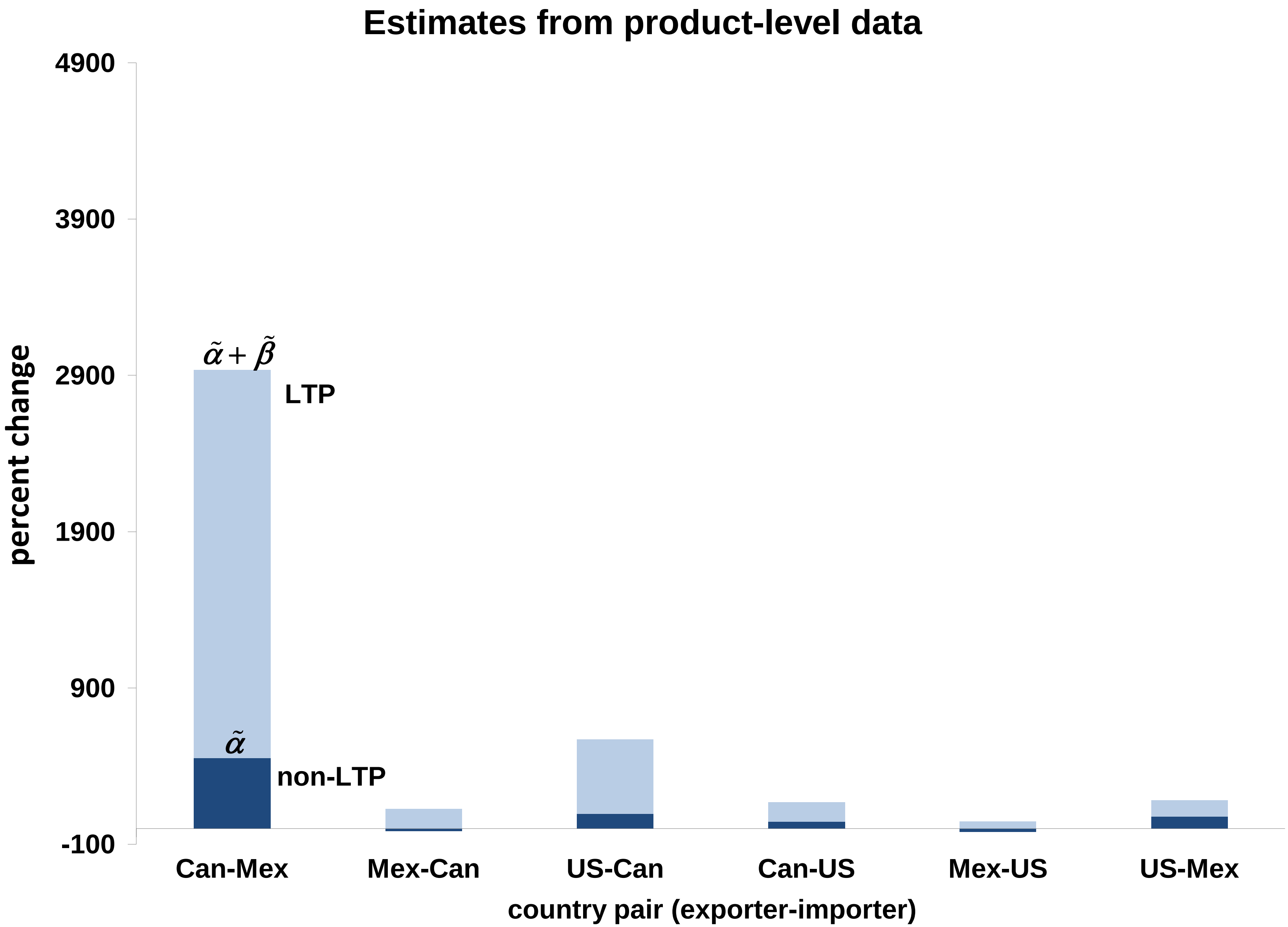
Changes in North American trade relative to exporter's GDP: Estimates from industry data versus estimates from product data

			industry data		product data	
exporter	**importer**	**period**	α	β	$\tilde{\alpha}$	$\tilde{\beta}$
Canada	Mexico	89–09	273.01	4253.33	452.67	2483.99
Canada	United States	89–09	−16.89	149.92	−14.57	126.73
Mexico	Canada	89–09	107.47	363.23	96.13	476.67
Mexico	United States	89–09	54.92	43.54	46.89	123.86
United States	Canada	89–09	−28.22	112.55	−21.61	46.48
United States	Mexico	89–09	65.96	228.93	78.46	103.92
weighted correlation $\alpha,\tilde{\alpha}$			0.97			
weighted correlation $\beta,\tilde{\beta}$				0.91		

C. Arkolakis (2010), "Market Penetration Costs and the New Consumers Margin in International Trade."



Estimates from industry-level data
4900
3900
2900
1900
900
-100
percent change
α + β
LTP
α
non-LTP
Can-Mex
Mex-Can
US-Can
Can-US
Mex-US
US-Mex
country pair (exporter-importer)



Estimates from product-level data
4900
3900
2900
1900
900
-100
percent change
$\tilde{\alpha}+\tilde{\beta}$
LTP
$\tilde{\alpha}$
non-LTP
Can-Mex
Mex-Can
US-Can
Can-US
Mex-US
US-Mex
country pair (exporter-importer)

Robustness

We also find that our results hold when changing our end dates. For example if we use 1988(when available)–2007 to avoid the great recession.

We also find that, for goods for which we have both price and quantity data, after deflating by the exporter's PPI — most changes in value are driven by changes in quantity.

Our exercise similarly performs well when compared to alternative models used to predict the effects of NAFTA, for example Cox-Harris for Mexico and Sobarzo for Canada.

Changes in North American trade deflated by Exporter's PPI: Growth due to quantities versus change due to prices

		average share of total growth	
exporter	**importer**	**P**	**Q**
Canada	Mexico	2.3	97.7
Canada	United States	-2.5	102.5
Mexico	Canada	31.7	68.3
Mexico	United States	24.9	75.1
United States	Canada	-8.9	108.9
United States	Mexico	5.3	94.7
weighted average		-0.2	100.2
pooled		0.8	99.2

Changes in Mexican trade relative to Mexican GDP in the Sobarzo Model (Percent)

sector	Exports to North America			Imports from North America		
	1989–2009 data	Sobarzo growth rate	1989 fraction least traded	1989–2009 data	Sobarzo growth rate	1989 fraction least traded
Agriculture	-15.3	-11.1	0.07	3.2	3.4	0.10
Beverages	161.8	5.2	0.01	85.2	-1.8	0.32
Chemicals	34.1	-4.4	0.60	104.2	-2.7	0.23
Electrical Machinery	54.7	1.0	0.02	6.6	9.6	0.01
Food	100.8	-6.9	0.41	46.7	-5.0	0.15
Iron and Steel	19.6	-4.9	0.37	23.1	17.7	0.24
Leather	-64.6	12.4	0.53	2.5	-0.4	0.67
Metal Products	86.2	-4.4	0.30	24.8	9.5	0.14
Mining	27.7	-17.0	0.01	15.0	13.2	0.17
Nonelectrical Machinery	166.5	-7.4	0.12	38.3	20.7	0.09
Nonferrous Metals	36.8	-9.8	0.13	37.1	9.8	0.10
Nonmetallic Min. Prod.	-16.0	-6.2	0.26	5.3	10.9	0.49
Other Manufactures	88.4	-4.5	0.23	26.1	4.2	0.16
Paper	-35.9	-7.9	0.30	-4.1	-4.7	0.07
Petroleum	-98.0	-19.5	0.12	-81.6	-6.8	0.06
Rubber	158.9	12.8	0.43	78.3	-0.1	0.06
Textiles	69.5	1.9	0.76	48.3	-1.2	0.44
Tobacco	-61.3	2.8	1.00	333.0	-11.6	1.00
Transportation Equip.	126.1	-5.0	0.02	26.7	11.2	0.02
Wearing Apparel	197.2	30.0	0.23	-17.2	4.5	0.20
Wood	30.8	-8.5	0.04	-34.0	11.7	0.05
weighted correlation with data		0.43	0.02		-0.12	0.47
regression coefficient $a \backslash \alpha$		62.91	81.13		30.91	9.61
regression coefficient $b \backslash \beta$		7.92	3.06		-0.49	175.76

Changes in Canadian trade relative to Canadian GDP in the Cox-Harris Model (Percent)

sector	Exports to World			Imports from World		
	1989–2009 data	C-H growth rate	1989 fraction least traded	1989–2009 data	C-H growth rate	1989 fraction least traded
Agriculture	39.1	-4.1	0.13	13.4	7.2	0.18
Chem. & Misc. Man.	70.9	28.1	0.34	59.1	10.4	0.20
Fishing	-30.9	-5.4	0.05	32.9	9.5	0.22
Food, Bev., and Tobacco	95.5	18.6	0.22	86.6	3.8	0.19
Forestry	-24.8	-11.5	0.15	4.5	7.1	0.24
Machinery and Appl.	11.7	57.1	0.19	-6.6	13.3	0.06
Mining	117.0	-7.0	0.03	103.0	4.0	0.06
Nonmetallic Minerals	20.9	31.8	0.64	3.4	7.3	0.32
Refineries	-67.8	-2.7	0.06	-71.9	1.5	0.03
Rubber and Plastics	107.3	24.5	0.22	56.0	13.8	0.07
Steel and Metal Products	6.6	19.5	0.15	33.2	10.0	0.17
Textiles and Leather	18.4	108.8	0.86	-1.9	18.2	0.33
Transportation Equip.	-37.5	3.5	0.01	-19.7	3.0	0.01
Wood and Paper	-58.5	7.3	0.02	12.8	7.2	0.09
weighted correlation with data		0.06	0.40		0.04	0.48
regression coefficient $a \backslash \alpha$		2.00	-13.73		9.77	-7.55
regression coefficient $b \backslash \beta$		0.16	199.46		0.30	199.46