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United States Manufacturing Direct Investment and Trade: The Case of Canada and Mexico under NAFTA and Earlier Trade Liberalization Measures

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***A*bstract:** This paper examines the apparent impact of the formation of the North American Free Trade Agreement (NAFTA) and earlier relevant trade liberalization measures on U.S. manufacturing direct investment and trade vis-à-vis Canada and Mexico. Employing a maximum likelihood regression approach that focuses on the relationship between U.S. manufacturing direct investment in Canada and Mexico and its manufacturing trade with each of these countries, as well as the real GDP of each country, serving as a "gravity model" proxy variable, empirical results are presented for the period 1989-2013. The results suggest that the process of regional economic integration in North America, with its concomitant relaxation of trade barriers, has served to modify what one would otherwise expect on the basis of the conceptual frameworks and scenarios that have thus far been developed in the literature with regard to the relationship of foreign direct investment to international trade. With regard to the expected relevance of gravity-type influences on U.S. direct manufacturing investment in its two NAFTA partners, for Canada these influences appear to be confirmed, but not so for Mexico, owing to the close interconnection between U.S. manufacturing direct investment in Mexico and its Mexican manufacturing trade.

Keywords: Empirical studies of trade; Economic integration; International investment; Long term capital movements; Industry studies: manufacturing, general

JEL Classifications: F14, F15, F21, L60

This paper examines the apparent impact of the formation 20 years ago of the North American Free Trade Agreement (NAFTA), as well as earlier relevant trade liberalization measures, on U.S. manufacturing direct investment and trade vis-a-vis Canada and Mexico. Empirical results are presented for the period 1989-2013 (the period when comparable data could be examined) that were undertaken against the back-drop of conceptual and empirical work going back many decades with respect to the relationship between foreign direct investment and international trade, as well as possible scenarios for that relationship in the presence of regional economic integration.

1. NAFTA and Its Precursors: Emergence of Substantial Two-Way U.S. Regional Trade and Regional Direct Investment Expansion[1]

In many respects, NAFTA represented a broadening of the earlier (January 1, 1989) U.S.-Canada Free Trade Agreement, to include Mexico, with the NAFTA phased-in market opening measures applying principally to Mexico since the U.S.-Canada FTA was already in effect. Additionally, there had been liberalized trade in motor vehicles, parts and tires between Canada and the U.S. since 1965, the year that the U.S.-Canada Automotive Products Agreement went into force, and which saw the beginning of the integration of much of the North American automotive sector. Mexico had also undergone a period of trade liberalization and investment liberalization beginning in the mid-1980s and qualified for GATT membership in 1986, after which it lowered its maximum tariff rates as a condition of membership. While applied to all countries multilaterally, U.S. imports from Mexico and Canada had been stimulated by U.S. tariff treatment under HTS (Harmonized Tariff Schedule) provisions 9802.00.60 and 9802.00.80 and its antecedents dating back to 1930, that permitted the importation duty-free of the portion of a good produced abroad that represented U.S.-originated content, with duties assessed only on the value-added in these countries.

Against this backdrop, another significant trade development for Mexico was the introduction, starting in the 1960s, of its "maquiladora" program, which facilitated the establishment of export assembly plants in such labor intensive industries as auto parts and electronic goods. A majority of these plants have U.S. parent companies and are heavily concentrated along the U.S. border. After the introduction of NAFTA, North American "rules of origin" determined duty-free status for U.S. imports from Canada and Mexico (Villarreal, 2012). Today, much of the trade between the U.S. and Mexico reportedly represents vertical supply-chain relationships, especially along the U.S.-Mexico border, with intermediate goods produced in the U.S. returning to the U.S. in the form of finished products. Supply-chain relationships are also reportedly important in U.S.-Canada trade (Villarreal and Fergusson, 2013). While this phenomenon cannot be confirmed directly in this paper, U.S. official data for manufacturing exports and imports to and from Canada and Mexico indicate, for several categories, that a pronounced "two-way trade" pattern has developed, thus suggesting the existence of strong-supply-chain relationships between the U.S. and its NAFTA partners. This is evident for the year 2012 (see Tables 1a and 1b), and was already evident by 1997 (see Appendix II, Tables 1a and 1b). The data in both of these sets of tables were collected using the North American Industrial Classification System (or NAICS). As explained elsewhere in this paper, prior to 1997, U.S trade data were collected under the Standard Industrial Classification system (or SIC). However, even under this substantially different data collection method, indications of two-way trade with Mexico and Canada can be observed for the year 1989 (see Appendix II, Tables 2a and 2b).

As a consequence of NAFTA and these earlier liberalization measures, as well as such other factors as economic expansion in each participating country, bi-lateral trade and direct investment among the parties to the agreement has flourished. U.S. trade in manufactured goods with Mexico and Canada (a key element in the present study) expanded significantly: U.S. manufactured exports to Mexico grew by 325.5% from 1994 to 2012; U.S. exports of manufactures to Canada grew by 150.9% during the same period; U.S. imports of manufactured products from Mexico rose by 456.1% from 1994 to 2012, while U.S. imports of manufactures from Canada grew by 101.8%.

[1] For a comprehensive summary of NAFTA and its antecedents, see Villarreal and Fergusson, 2013.

Table 1a. Top 15 U.S. Imports from and Exports to Mexico in 2012
(NAICS Categories, Millions of U.S. Dollars)

AIC Number	U.S. Imports	NAIC Number	U.S. Exports
3361 Motor Vehicles	35,347	3241 Petroleum and Coal Products	20,755
3363 Motor Vehicle Parts	33,334	3363 Motor Vehicle Parts	19,577
3341 Computer Equipment	15,969	3341 Computer Equipment	14,457
3343 Audio and Video Equipment	14,242	3344 Semiconductors and Other Electronic Components	11,421
3342 Communications Equipment	13,820	3251 Basic Chemicals	10,119
3314 Nonferrous Metal (Except Aluminum) and Processing	10,865	3252 Resin, Synthetic Rubber & Artificial & Synthetic Fibers & Filament	7,741
3353 Electrical Equipment	8,793	3261 Plastics Products	5,654
3345 Navigational, Measuring, Electro medical and Control Instruments	6,749	3359 Electrical Equipment and Components, NESOI	5,458
3359 Electrical Equipment and Components, NESOI	5,108	3342 Communications Equipment	5,411
3391 Medical Equipment and Supplies	4,620	3339 Other General Purpose Machinery	5,096
3352 Household Appliances and Miscellaneous Machines, NESOI	4,579	3336 Engines, Turbines, and Power Transmission Equipment	4,906
3344 Semiconductors and Other Electronic Components	4,180	3329 Other Fabricated Metal Products	4,851
3339 Other General Purpose Machinery	3,752	3311 Iron and Steel and Ferroalloy	4,642
3336 Engines, Turbines, and Power Transmission Equipment	3,747	3353 Electrical Equipment	4,529
3152 Apparel	3,497	3361 Motor Vehicles	4,267
Subtotal	**168,602**	**Subtotal**	**128,885**
All Other	**54,040**	**All Other**	**66,151**

Data Source: U.S. International Trade Commission, Interactive Tariff and Trade Data Web.

The NAFTA accord also provided for "non-discriminatory (or "national") treatment" for foreign investment by each of the NAFTA parties with respect to one another, but with specific exceptions by sector, such as energy in Mexico (Villarreal and Fergusson, 2013). Not unexpectedly, the stock of U.S. direct investment in each partner country grew substantially during

the 1994-2012 period.[2] The stock of overall U.S direct investment in Canada and Mexico respectively grew by 374% and 495% from 1994 to 2012, while the stock of U.S. manufacturing direct investment grew by 122% in Canada and 254% in Mexico.

Table 1b. Top 15 U.S. Imports from and Exports to Canada in 2012
(NAICS Categories, Millions of U.S. Dollars)

NAIC Number	U.S. Imports	NAIC Number	U.S. Exports
3361 Motor Vehicles	46,499	3363 Motor Vehicle Parts	26,286
3241 Petroleum and Coal Products	18,782	3361 Motor Vehicles	24,826
3363 Motor Vehicle Parts	13,853	3331 Agriculture and Construction Machinery	13,109
3314 Nonferrous Metal (Except Aluminum) and Processing	9,713	3241 Petroleum and Coal Products	11,862
3364 Aerospace Products and Parts	7,862	3339 Other General Purpose Machinery	9,698
3251 Basic Chemicals	7,619	3341 Computer Equipment	8,522
3221 Pulp, Paper, and Paperboard Mill Products	7,046	3311 Iron and Steel and Ferroalloy	8,457
3311 Iron and Steel and Ferroalloy	5,955	3251 Basic Chemicals	7,996
3313 Alumina and Aluminum and Processing	5,671	3252 Resin, Synthetic Rubber & Artificial & Synthetic Fibers & Filament	6,891
3252 Resin, Synthetic Rubber, & Artificial & Synthetic Fibers & Filament	5,347	3345 Navigational, Measuring, Electromedical and Control Instruments	6,825
3253 Pesticides, Fertilizers and Other Agricultural Chemicals	5,270	3329 Other Fabricated Metal Products	6,216
3339 Other General Purpose Machinery	4,841	3261 Plastics Products	6,062
3261 Plastics Products	4,390	3364 Aerospace Products and Parts	5,289
3254 Pharmaceuticals and Medicines	4,295	3399 Miscellaneous Manufactured Commodities	5,120
3112 Grain and Oilseed Milling Products	4,036	3344 Semiconductors and Other Electronic Components	5,023
Subtotal	**151,179**	**Subtotal**	**152,183**
All Other	**63,866**	**All Other**	**108,183**

Data Source: U.S. International Trade Commission, Interactive Tariff and Trade Data Web.

2 The stock of U.S. direct investment data cited or used in this study have been drawn from the international data interactive web site of the U.S. Department of Commerce, Bureau of Economic Analysis (www.bea.gov).

2. Possible Impacts of the Process of Regional Economic Integration on Regional Foreign Direct Investment

The foreign direct investment literature seeks to identify the forces or incentives that enable foreign firms to overcome the inherent disadvantages/costs associated with operating in another political jurisdiction, often at a distance from the company's home country location and involving various cultural and linguistic barriers (Graham Krugman, 1995, Appendix B). Three major conceptual strands have been developed over the years: one based on the economics of industrial organization in the presence of imperfect competition (e.g., Caves, 1971,1982); an earlier, more traditional "cost of capital" paradigm (Mundell,1957); and, more recently, the so-called "gravity"-type models (e.g. Brainard, 1997, Kleinert and Toubal, 2010), which represent extensions to the process of direct investment of the gravity models that seek to explain international trade patterns (e.g., McCallum's seminal paper, 1995).

2.1 Conventional view of the impact of direct investment on trade

Interestingly, while these three approaches are very distinct in terms of their conceptual foundations, they tend to assume that direct investment is part of a process of firm-level horizontal integration which serves as a substitute for international trade, most notably in the presence of host-country trade restrictions.[3]

2.2 Implications of regional economic integration on the relationship of direct investment to trade

However, within the context of regional economic integration, entailing an elimination of tariff barriers and other forms of trade restrictions, the implications for trade and direct investment patterns among the cooperating parties are a priori ambiguous. One possible scenario is that trade among the participating countries would increase as the process of regional trade integration unfolds, while direct investment emanating from the partner countries would correspondingly decrease, as expected in the literature with respect to the substitutability of trade and investment. For example, to the extent that, prior to regional trade integration, a foreign owned "plant" in a host country had been intended by virtue of its scale to serve the internal market exclusively, such a market could now be served via exports from larger-scale plants located in other countries within the region. However, under another scenario, if the formation of the regional grouping makes it possible for host country plants to take advantage of cross-border scale economies in some sectors, the elimination of regional trade barriers could conceivably lead to further increases in inward direct investment targeted at the host country plants, and attendant increases in regional exports from those plants. This outcome, moreover, would be reinforced if the direct investments are part of a process of vertical integration which results in supply-chain exports from the host country plants back to the investing countries.

2.3 Regional Integration and Gravity Model Relevance

With regard to gravity model relevance within the context of regional integration, it would seem to be plausible to infer that the gravitational pull of such factors as adjoining member countries' market size would continue to exercise its potentially positive influence on direct investment, quite apart from the fact that the countries are undergoing a mutual reduction or elimination of trade barriers.

3 An explicit gravity-model rationale for the substitutability of FDI for exports (using market size as the proxy variable for gravitational pull) is provided by Buckley, Clegg, Forsans and Reilly (2007), p.275. Additionally, the possibility of vertical direct investment is addressed by some writers in the gravity direct investment literature (e.g. Kleinert and Toubal (2010)).

3. Regression Models and Results

3.1 Original model and results

Our regression approach attempts to grapple with the regional integration direct investment hypotheses and scenarios outlined above by specifying a possible relationship between U.S. manufacturing direct investment in each of its partner countries (serving as the dependent variable) and U.S. manufacturing trade with each country, as well as that country's market size (serving as independent variables). Owing to data availabilities, in what follows the analysis was conducted only at the level of total manufacturing direct investment and trade.

The most general regression model for possible testing would be as follows:

$$I_t = \alpha_1 + \beta_1 Y_t + \beta_2 X_t + \beta_3 M_t + \mu_t \qquad (1)$$

where:

I_t is the stock of annual U.S. manufacturing investment in either Canada or Mexico, expressed in U.S. dollars. (Appendix I, "The Official U.S. Manufacturing Foreign Direct Investment and International Trade Data," provides a rationale for the use of the stock of manufacturing direct investment as the dependent variable in this study.)

Y_t is either the index of Canadian or Mexican real GDP (2005=100), serving as a proxy for market size.

X_t is either the annual U.S. dollar value of U.S. manufactured exports to Canada or Mexico.

M_t is either the annual U.S. dollar value of U.S. manufactured imports from Canada or Mexico.

α_1 is a constant term; the coefficients β_1, β_2, and β_3, together with α_1 are to be estimated.

μ_t is an error term.

The above noted hypotheses and scenarios would lead to an expectation that coefficient β_1 would be positive and significant (reflecting the influence of gravitational forces in either Canada or Mexico on U.S. direct investment), coefficient β_2 would be negative and significant (reflecting the substitution of direct investment in either Canada or Mexico by exports to that market), and coefficient β_3 would be positive and significant (reflecting a further increase in direct investment in Canadian or Mexican plants for the purpose of increasing exports back to the United States).

For U.S. manufacturing direct investment in Canada, the maximum likelihood regression results for the relationships expressed in equation (1) for the period 1989-2013 are set forth in the following Table 2.[4]

[4] The official U.S. data sources are summarized in the appendix to this paper. The real GDP indexes were drawn from data downloaded from the online version of **International Financial Statistics** (International Monetary Fund).

Table 2. Canadian Maximum Likelihood Results: Original Hypotheses

		Estimates	Std Error	*t*	Approx Sig
Regression Coefficients	Canada Real GDP Index	1249.892	332.327	3.761	.001
	U.S. Mfg Imports from Canada	0.195	0.097	1.996	.060
	U.S. Mfg Exports to Canada	-0.221	0.103	-2.140	.046
Constant		-50429.313	17372.005	-2.903	.009

As can be seen in Table 2, and in accord with the traditional expectation in the direct investment literature noted earlier, the negative export regression coefficient (statistically significant at the .046 level) suggests that U.S manufactured exports to Canada served, in part, as a substitute for U.S. manufacturing direct investment in Canada during the period under review. However, the positive import regression coefficient (statistically significant at the .060 level) also suggests that U.S. manufacturing direct investment in Canada was attracted by the development of Canadian manufacturing that was destined to serve the U.S. market, either as exports of finished products or exports of intermediate goods as part of a supply-chain relationship. This regression outcome would seem to be in accord with one of the possible trade and indirect investment scenarios noted earlier that could arise as part of the regional integration process. Additionally, and in accord with gravity model expectations, the statistically significant (.001 level) and positive Canadian real GDP coefficient suggests that the pull of the size of the Canadian economy also exercised a strong influence on U.S. manufacturing direct investment in Canada.[5] A check for the presence of multi-collinearity among the explanatory variables suggests that this condition is not a serious problem. First, the standard errors of the parameter estimates are relatively low, thereby resulting in parameter estimates that are statistically significant at high levels of significance, unlike the relatively high standard errors that are associated with the presence of multi-collinearity. Second, computations from the correlation matrix for each explanatory variable of its "variance inflation factor" (or VIF) also suggest little indication of the presence of multi-collinearity. The VIF is a widely-used diagnostic test for multi-collinearity (Allison, 2012).[6]

For U.S. manufacturing direct investment in Mexico, the maximum likelihood regression results for the relationships expressed in equation (1) for the period 1989-2013 are set forth in Table 3 following.

[5] Not reported in Table 2 are the Canadian regression results when dummy variables are included to account for the switch from the SIC data collection system to the NAICS: after 1998 for U.S. manufacturing direct investment data and after 1996 for U.S. international manufacturing trade data. Their inclusion only served to reduce somewhat the significance of the basic explanatory factors (to .015 for Canadian real GDP, .088 for U.S. manufacturing imports from Canada, and .084 for U.S. manufacturing exports to Canada), while the regression coefficients of the dummy variables themselves had no significance at virtually any level.

[6] From the correlation matrix, the VIF is computed as $1/(1-R^2)$. In the present study for the Canadian regression, the VIF for Y and X is 1.70, for Y and M is 1.03, and for X and M is 1.57. The VIF has a lower bound of 1 but no upper bound. "Authorities differ on how high the VIF has to be to constitute a problem. Personally, I tend to be concerned when a VIF is greater than 2.50, which corresponds to an R^2 of .60 with the other variables." (Allison, 2012)

Table 3. Mexican Maximum Likelihood Results: Original Hypotheses

		Estimates	Std Error	*t*	Approx Sig
Regression	Mexico Real GDP Index	-3.103	126.112	-.025	.981
Coefficients	U.S. Mfg Exports to Mexico	.134	.053	2.521	.021
	U.S. Mfg Imports from Mexico	.021	.054	.395	.697
Constant		3934.757	7667.723	.513	.614

As can be seen, the expected levels of significance and/or the expected signs of the regression coefficients associated with the conceptual direct investment literature reviewed earlier are not upheld in the results summarized in Table 3. Specifically, the manufacturing export regression coefficient, while seemingly statistically significant, has the wrong (i.e. positive) sign; the manufacturing import coefficient is positive, as expected, but is not significant; and the Mexican real GDP coefficient is not statistically significant and has the wrong (i.e., negative) sign. Part of the problem with these results appears to revolve around the already-noted special relationship that apparently exists between U.S. manufacturing exports to and imports from Mexico in the form of a likely supply-chain relationship between the two countries. While the VIF between the manufacturing export and import variables calculated from Table 3's associated correlation matrix (2.34) does not necessarily suggest the presence of multicollinearity (Allison, 2012, see footnote 6), a further analysis of the relationship between the export and import variables in the form of a separate regression (not shown here) which omits the Mexican real GDP variable clearly suggests the presence of this condition: namely (a VIF of 38.71).

3.2 Reformulated models and results

These results prompted a reformulation of the maximum likelihood estimating model in equation (1) that substitutes total U.S. manufacturing trade with Mexico for separate export and import trade:

$$I_t = \alpha_1 + \alpha_2 Y_{mext} + \alpha_3 XM_t + \mu_t \qquad (2)$$

where:

I_t is the stock of annual U.S. manufacturing investment in Mexico, expressed in U.S. dollars.

Y_{mext} is the index of Mexican real GDP (2005=100).

XM_t is the annual U.S. dollar value of U.S. total manufactured trade with Mexico (exports plus imports of manufactured goods).

The regression results for Mexico for the period 1989-2013 are summarized in Table 4.

Table 4. Mexican Maximum Likelihood Results: Using Total U.S. Manufacturing Trade with Mexico and the Mexican Real GDP Index as Explanatory Variables

		Estimates	Std Error	*t*	Approx Sig
Regression	U.S. X + M	.029	.018	1.597	.126
Coefficients	Mexico Real GDP Index	210.695	118.997	1.771	.092
Constant		-7129.276	7194.557	-.991	.334

As can be seen in Table 4, both the total trade with Mexico and the Mexican real GDP index regression coefficients are positive but have relatively large standard errors and, consequently, are only marginally significant at the .126 and .092 levels respectively. Moreover, a strong presence of multi-collinearity between the total trade and real GDP regression coefficients is evident in the associated correlation matrix: namely, a computed VIF of 25.25.

On further inspection, this indication of multi-collinearity should not be surprising in light of the fact that Mexican overall trade and Mexican manufacturing trade have been highly important drivers of the Mexican economy during the period under review in this study. For example, according to World Bank data (2016), Mexican total merchandise trade expressed as a percentage of Mexican GDP (both valued in current U.S. dollars) stood at 50.6% in 2000, rose to 58.0% in 2010, and was in excess of 60.0% from 2011 to 2014. Moreover, Mexican manufacturing trade as a percentage of Mexican total merchandise trade in 2012 stood at 74.45% (down from 81.6% in 1997 but still a very high percentage). Additionally, in 1997, the U.S. share of total Mexican manufacturing trade was 74.25%, and by 2012 this share had essentially held constant at 74.60%.[7]

Thus, given that total U.S. manufacturing trade with Mexico has clearly been influencing the overall performance of the Mexican economy, it was decided to drop the Mexican real GDP index variable from equation (2) for estimating purposes. Table 5 summarizes the revised maximum likelihood regression results, which also include the trade and investment dummy variables as possible modifying variables.

Table 5. Mexican Maximum Likelihood Results: Using Total U.S. Manufacturing Trade with Mexico and the Trade and Dummy Variables as the Explanatory Variables

		Estimates	Std Error	*t*	Approx Sig
Regression	U.S. X + M	.053	.006	8.269	.000
Coefficients	Investment Dummy	1011.508	1484.823	.681	.504
	Trade Dummy	1359.793	1623.177	.838	.413
Constant		5438.811	947.850	5.738	.000

As can be seen, the total manufacturing trade regression coefficient is highly significant. Thus, we can conclude that U.S. direct manufacturing investment in Mexico has been driven by the need to support manufacturing trade between the two regional partners, likely in the form of strong supply-chain relationships. This outcome was not envisaged in the direct investment and trade hypotheses and scenarios reviewed earlier. We can also infer from these results, as well as the data cited above with regard to the close connection between U.S. manufacturing trade with Mexico and overall Mexican economic performance, that the size of the Mexican economy did not exercise a meaningful independent gravitational pull on U.S. manufacturing direct investment in Mexico.

[7] Percentages computed from U.S. and Mexican data appearing in the online U.S. SITC website and the World Trade Organization Statistical Program website. U.S. exports are reported on an FAS basis; U.S. imports are reported on a general customs value basis. WTO export data are reported on a "free on board" basis; WTO import data is reported on a c.i.f. basis.

4. Conclusion

The U.S. manufacturing trade and direct investment experience during both the NAFTA years and in the years leading up to NAFTA has provided a rich opportunity to probe deeply into the relationship of both its trade and its direct investment vis-à-vis its NAFTA partners. The results of this study, for both Canada and Mexico, suggest that the process of regional integration in North America, with its concomitant relaxation of trade barriers, has served to modify what one would otherwise expect within the conceptual frameworks and scenarios that have thus far been developed in the literature with regard to the relationship of foreign direct investment to international trade. With regard to the expected relevance of gravity-type influences on U.S direct manufacturing direct investment in its two NAFTA partners, for Canada these influences appear to be confirmed, but not so for Mexico, owing to the close and positive connection between U.S. manufacturing direct investment in Mexico and its manufacturing trade with Mexico.

Hopefully, these results will contribute to a furtherance of our understanding of the rationale for manufacturing direct investment among countries that have become closely linked through the process of regional economic integration.

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APPENDIX I

The Official U.S. Manufacturing Foreign Direct Investment and International Trade Data

This paper presents results based on official U.S. manufacturing direct investment and international trade data vis-à-vis Canada and Mexico for the period 1989 to 2013. While reasonably consistent manufacturing data on U.S. foreign direct investment is available on an annual basis going back to 1982, reported sectoral U.S manufacturing trade is available only from 1989 onward, thus constraining the period for comparative analysis. Moreover, as will be further explained below, the two sets of data were initially collected on the basis of the Standard Industrial Classification (SIC) system and later were switched to the North American Industrial Classification System (NAICS).

In the U.S. as well as in international statistical guidelines, the criterion used to define direct investment is ownership of at least 10 percent of the voting securities of an incorporated business enterprise or the equivalent interest of an unincorporated business enterprise (Barefoot and Ibarra-Caton, 2013). Statistical studies make a distinction between "the stock of direct investment" of one country in a host country (equivalent to the "U.S. direct investment position of the United States at historical cost," as officially reported in U.S. sources) and the "annual flow" of direct investment from year to year. The stock of direct investment in any given year is the sum of a country's past and current equity investments, intercompany debt investment (outstanding loans between U.S. parents and their affiliates on a net basis), and reinvested earnings (without current-cost adjustment). The year-to-year changes in these components are financial flows and are officially reported by the U.S. separately as "financial outflows without current cost adjustments." They account, in part, for the annual change in the reported investment stock positions, but must be supplemented by balance sheet valuation adjustments arising from exchange rate translation adjustments in the foreign-currency-denominated assets and liabilities of the foreign affiliates, capital gains and losses incurred by the affiliates (e.g. when assets are sold), as well as some "other" valuation adjustments. (Barefoot and Ibarra-Caton, 2013) Year-to-year capital outflow flow data,

i.e., the reported financial outflows figures, are used in a number of direct investment studies. However, these data tend to be highly volatile, and the data on U.S. capital outflows to Canada and Mexico are no exception. Some preliminary regressions using these capital outflows data yielded insignificant results. On the other hand, the investment stock figures would seem to be a stable measure of the extent of U.S. production presence in a given country over time, and it was thus decided to use the stock data in this study, as have other studies (e.g., Egger and Pfaffermayr, 2004).[8]

The U.S. Department of Commerce's Bureau of Economic Analysis maintains an official data base for both the stock of direct investment as well as the capital outflows on an annual basis for the years 1982 through 2012. However, the 1982–1998 figures were collected under the Standard Industrial Classification (SIC) system while the figures for 1999–2012 were collected using the North American Industrial Classification System (NAICS). Similarly, the official data for U.S. manufacturing trade were collected for the period 1989-1995 using the SIC system and for 1997-2012 using the NAICS. No trade data was reported at the sectoral level for 1996, presumably as part of the transition process to the NAICS system. Concordances of a complex nature have been developed to interface the two classification systems for more narrowly specified industrial sectors (e.g. chemicals, food, etc.), but these were not used in this paper since the analysis was confined to the total manufacturing sector only, thus achieving a degree of consistency overall that would not have been possible at narrower industrial levels. However, as explained in footnotes in the body of the report, dummy variables were employed in the regression process in order to try to account for any remaining data inconsistencies resulting from the switch in data collection systems. The results of the use of the dummy variables are specifically reported in footnotes in the body of this paper as well as toward the end of the body of the paper.

[8] However, the literature also points to alleged inherent statistical weakness when using stock of investment data in studies seeking to explain the foreign direct investment process (e.g., Buckley, Clegg, Forsans and Reilly, 2007).

APPENDIX II

Table 1a. Top 15 U.S. Imports from and Exports to Mexico in 1997
(NAICS Categories, Millions of U.S. Dollars)

NAIC Number	U.S. Imports	NAIC Number	U.S. Exports
3361 Motor Vehicles	12,095	3344 Semiconductors and Other Electronic Components	7,993
3363 Motor Vehicle Parts	10,284	3363 Motor Vehicle Parts	7,972
3343 Audio and Video Equipment	5,659	3341 Computer Equipment	2,960
3344 Semiconductors and other Electronic Components	5,207	3251 Basic Chemicals	2,445
3152 Apparel	4,835	3261 Plastics Products	2,362
3341 Computer Equipment	3,455	3353 Electrical Equipment	2,188
3353 Electrical Equipment	2,537	3339 Other General Purpose Machinery	2,020
3359 Electrical Equipment and Components, NESOI	2,166	3361 Motor Vehicles	1,991
3342 Communications Equipment	2,086	3252 Resin, Synthetic Rubber & Artificial & Synthetic Fibers & Filament	1,964
3345 Navigational, Measuring, Electromedical, and Control Instruments	1,846	3359 Electrical Equipment and Components, NESOI	1,911
3399 Miscellaneous Manufactured Commodities	1,418	3152 Apparel	1,752
3311 Iron and Steel and Ferroalloy	1,240	3241 Petroleum and Coal Products	1,549
3329 Other Fabricated Metal Products	1,230	3329 Other Fabricated Metal Products	1,526
3352 Household Appliances and Miscellaneous Machines, NESOI	1,193	3345 Navigational, Measuring, Electromedical and Control Instruments	1,371
3391 Medical Equipment and Supplies	836	3342 Communications Equipment	1,343
Subtotal	**56,087**	**Subtotal**	**41,348**
All Other	**14,790**	**All Other**	**23,151**

Source: U.S. International Trade Commission, Interactive Tariff and Trade Data Web.

APPENDIX II

Table 1b. Top 15 U.S. Imports from and Exports to Canada in 1997
(NAICS Categories, Millions of U.S. Dollars)

NAIC Number	U.S. Imports	NAIC Number	U.S. Exports
3361 Motor Vehicles	35,651	3363 Motor Vehicle Parts	21,013
3363 Motor Vehicle Parts	11,421	3361 Motor Vehicles	14,135
3221 Pulp, Paper and Paperboard Mill	9,001	3341 Computer Equipment	7,633
3211 Sawmill and Wood Products	7,197	3344 Semiconductors and Other Electronic Components	7,605
3344 Semiconductors and Other Electronic Components	5,684	3339 Other General Purpose Machinery	5,202
3314 Nonferrous Metal (except Aluminum) and Processing	4,664	3331 Agriculture and Construction Machinery	4,386
3364 Aerospace Products and Parts	3,685	3251 Basic Chemicals	3,804
3313 Aluminum and Aluminum and Processing	3,491	3336 Engines, Turbines and Power Transmission Equipment	3,777
3251 Basic Chemicals	2,917	3345 Navigational, Measuring, Electromedical and Control Instruments	3,650
3252 Resin, Synthetic Rubber & Artificial & Synthetic Fibers & filament	2,910	3252 Resin, Synthetic Rubber & Artificial & Synthetic Fibers & Filament	3,575
3241 Petroleum and Coal Products	2,606	3329 Other Fabricated Metal Products	2,845
3311 Iron and Steel and Ferroalloy	2,476	3364 Aerospace Products and Parts	2,759
3342 Communications Equipment	2,329	3311 Iron and Steel and Ferroalloy	2,648
3261 Plastics Products	2,096	3261 Plastics Products	2,370
3339 Other General Purpose Machinery	2,082	3342 Communications Equipment	2,324
Subtotal	**98,210**	**Subtotal**	**87,727**
All Other	**40,004**	**All Other**	**49,591**

Source: U.S. International Trade Commission, Interactive Tariff and Trade Data Web.

APPENDIX II

Table 2a. Top 15 U.S. Manufactured Imports from and Exports to Mexico in 1989
(SIC Categories, Millions of U.S. Dollars

SIC Number	U.S. Imports	SIC Number	U.S. Exports
3651 Radio & TV Receiving Sets; Phonographs; Recorders, NSPF; Microphones; Loudspeakers; Audio Amplifiers & Oth Audio Equip	1,849	3714 Motor Vehicle Parts and Accessories, NSPF	1,954
3714 Motor Vehicle Parts and Accessories, NSPF	1,518	3651 Radio & TV Receiving Sets; Phonographs; Recorders, NSPF; Microphones; Loudspeakers; Audio Amplifiers & Oth Audio Equip	625
3711 Motor Vehicles and Passenger Car Bodies	1,313	3694 Electrical Equipment for Internal Combustion Engines	555
3694 Electrical Equipment for Internal Combustion Engines	1,208	3679 Electronic Components, NSPF	547
2599 Furniture and Fixtures, NSPF	504	2821 Plastics Materials and Resins	534
3571 Electronic Computers	491	3571 Electronic Computers	502
3672 Printed Circuit Boards	461	2869 Industrial Organic Chemicals, NSPF	491
3339 Primary Nonferrous Metals, NSPF	453	2911 Petroleum Refinery Products	460
3679 Electronic Components, NSPF	425	3357 Nonferrous Metal Wire and Cable, Drawn and Insulated	424
3357 Nonferrous Metal Wire and Cable, Drawn and Insulated	414	3312 Blast Furnace, Steel Works, and Rolling Mill Products	418
2399 Fabricated Textile Products, NSPF	390	2011 Meat Products and Meat Packing Products, Except Poultry and Small Game Animals	401
3621 Electric Motors, Generators, Generator Sets, Rotating Converters, and Parts and Accessories, NSPF	311	3625 Relays and Industrial Controls	384
3674 Semiconductors and Related Devices, and Parts, NSPF	290	3674 Semiconductors and Related Devices, and Parts, NSPF	370
3643 Current-Carrying Wiring Devices	240	3089 Plastics Products, NSPF	325
3312 Blast Furnace, Steel Works, and Rolling Mill Products	233	3721 Aircraft	272
Subtotal	**10,099**	**Subtotal**	**8,263**
All Other	**9,335**	**All Other**	**13,284**

Source: U.S. International Trade Commission, Interactive Tariff and Trade Data Web.

APPENDIX II

Table 2b. Top 15 U.S. Imports from and Exports to Canada in 1989
(SIC Categories, Millions of U.S. Dollars)

SIC Number	U.S. Imports	SIC Number	U.S. Exports
3711 Motor Vehicles and Passenger Car Bodies	19,586	3711 Motor Vehicles and Passenger Car Bodies	8,467
3714 Motor Vehicle Parts and Accessories, NSPF	7,510	3714 Motor Vehicle Parts and Accessories, NSPF	6,793
2621 Paper Mill Products	5,892	3571 Electronic Computers	1,996
2421 Lumber and Other Sawmill and Planning Mill Products, Except Hardwood Dimension Stock and Flooring	2,877	3674 Semiconductors and Related Devices, and Parts, NSPF	1,959
2611 Pulp Mill Products	2,660	3465 Automotive Stampings	1,225
3339 Primary Nonferrous Metals, NSPF	2,112	3531 Construction Machinery, and Parts, NSPF	1,082
2911 Petroleum Refinery Products	1,696	3519 Internal Combustion Engines, NSPF	861
3334 Aluminum and Aluminum Alloys, Unwrought	1,656	3728 Aircraft Equipment, NSPF	782
3312 Blast Furnace, Steel Works, and Rolling Mill Products	1,468	3523 Farm Machinery and Equipment, and Parts, NSPF	742
3571 Electronic Computers	1,259	3724 Aircraft Engines and Engine Parts, NSPF	741
2599 Furniture and Fixtures, NSPF	1,113	2821 Plastics Materials and Resins	707
2819 Industrial Inorganic Chemicals, NSPF	1,052	2869 Industrial Organic Chemicals, NSPF	677
3674 Semiconductors and Related Devices, and Parts, NSPF	893	2819 Industrial Inorganic Chemicals, NSPF	640
3728 Aircraft Equipment, NSPF	816	3585 Refrigeration and Heating Equipment	633
3341 Secondary Smelting and Refining of Nonferrous Metals	731	3721 Aircraft	613
Subtotal	**51,323**	**Subtotal**	**27,920**
All Other	**23,224**	**All Other**	**25,796**

Source: U.S. International Trade Commission, Interactive Tariff and Trade Data Web.