

APPRECIATE THE APPRECIATION: IMPORTED INPUTS AND CONCERN OVER DUTCH DISEASE*

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SUMMARY

If anything is to blame for a higher dollar having negative effects on the Central Canadian manufacturing sector, you are not likely to find it in any “Dutch Disease” supposedly caused by Alberta’s oil sands. Contrary to popular belief, the higher value of the Canadian dollar may even help Central Canadian manufacturers grow stronger, cut costs, and create jobs.

The idea that a booming, commodity-driven dollar is hurting Canadian goods exports, afflicting the country with so-called Dutch Disease, may be popular among certain politicians, including federal Opposition leader Thomas Mulcair and former Premier of Ontario Dalton McGuinty, but is not supported by the facts. It turns out that the simple economic theory these politicians have in mind is incomplete.

A more thorough, data-driven look at the nation’s manufacturing sector reveals that Canadian businesses rely very heavily on imported materials and equipment as inputs in the manufacturing process. Canadian industry overall has one of the highest import ratios for such intermediate goods in the OECD, roughly twice as high as that of the U.S., the European Union and Japan. Compared to all other sectors, manufacturers are the heaviest users of imported materials and equipment, with more than 40 per cent of their inputs coming from other countries.

A higher dollar may make it more expensive for foreign buyers to purchase Canadian manufactured goods, but that effect appears to be more than offset by the savings that Canadian producers enjoy with a higher dollar that makes possible cheaper imported-inputs and lower cost of production, which have a lowering effect on prices. The net result is that Canadian manufacturers actually get more benefit from a higher dollar, and the regions that get the biggest boost from it are the Central Canadian provinces of Ontario and Quebec.

Policy-makers looking to aid the Canadian economy as a whole, and the manufacturing sector in particular, should stop worrying about Dutch Disease and, rather, welcome a higher Canadian dollar. But more than that, they should design policies that are better tailored for an economy that relies so heavily on imported intermediate inputs. Policy efforts would be far better put to eliminating tariffs and other trade barriers that make imported inputs more expensive, and thus hamper Canadian competitiveness. Policies should also focus on improving productivity, by inviting foreign investment, rather than subtly discouraging it through vehicles such as the Investment Canada Act. And certainly, anything that forces businesses to “buy local,” as Ontario’s Green Energy Act requires, will only stand in the way of Canadian businesses taking advantage of our higher dollar by importing lower-cost inputs from abroad. If policy-makers want to help Canadian factories, they shouldn’t complain about Alberta but instead focus on improving their domestic economic policies instead.

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DE L'IMPORTATION DES INTRANTS ET DU MAL HOLLANDAIS*

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RÉSUMÉ

S'il faut chercher le coupable des effets négatifs de la hausse du dollar sur le secteur manufacturier du centre du Canada, il est peu probable qu'on le trouve dans le « mal hollandais », prétendument causé par les sables bitumineux de l'Alberta. Contrairement à la croyance populaire, la valeur élevée du dollar canadien serait même de nature à renforcer les manufacturiers canadiens, à réduire leurs coûts et à créer des emplois.

L'idée qu'un dollar canadien en forte hausse, dopé par le prix des matières de base, nuit aux exportations canadiennes et inflige au pays le soi-disant « mal hollandais » peut plaire à certains politiciens, notamment le leader de l'opposition fédérale Thomas Mulcair et l'ancien premier ministre de l'Ontario Dalton McGuinty, mais rien dans les faits ne corrobore cette vision des choses. En fait, la théorie économique simple que ces politiciens ont à l'esprit est incomplète.

Un regard plus approfondi, fondé sur des données probantes dans le secteur de la fabrication au pays révèle que les entreprises canadiennes s'appuient très largement sur des biens et de l'équipement importés comme intrants dans les processus de fabrication. Dans l'ensemble, le taux d'importation de ces biens intermédiaires dans l'industrie canadienne est l'un des plus élevés des pays de l'OCDE, soit près du double de celui des États-Unis, de l'Union européenne et du Japon. Comparativement à tous les autres secteurs, les entreprises du secteur de la fabrication représentent les plus importants utilisateurs de biens et d'équipement importés, et plus de 40 % de leurs intrants proviennent d'autres pays.

Il se peut que la hausse du dollar fasse grimper le prix des biens fabriqués au Canada pour les acheteurs internationaux, mais cette situation semble plus que compensée par les économies que réalisent les producteurs canadiens quand la valeur élevée du dollar leur permet d'importer des intrants meilleur marché et de réduire les coûts de production, ce qui a pour effet d'abaisser les prix. En somme, les fabricants canadiens tirent un avantage net de la valeur élevée du dollar et les régions qui en profitent le plus sont les provinces du centre du Canada, l'Ontario et le Québec.

Les décideurs qui souhaitent venir en aide à l'ensemble de l'économie canadienne et au secteur manufacturier en particulier devraient cesser de se soucier du mal hollandais et accueillir la hausse du dollar comme un bienfait. Mais plus encore, ils devraient concevoir des politiques mieux adaptées à une économie qui s'appuie si lourdement sur les intrants intermédiaires importés. Il serait beaucoup plus profitable d'axer les efforts sur l'élimination des barrières tarifaires et douanières qui augmentent le prix des produits qui entrent dans le processus de fabrication et qui nuisent ainsi à la compétitivité du Canada. Les politiques devraient aussi mettre l'accent sur l'amélioration de la productivité et pour ce faire, stimuler l'investissement étranger plutôt que de l'affaiblir subtilement par des véhicules tels que la Loi sur Investissement Canada. Et il ne fait aucun doute que toute mesure qui force les entreprises à acheter « localement », par exemple la Loi sur l'énergie verte de l'Ontario, nuit à la capacité des entreprises canadiennes de tirer le meilleur parti possible d'un dollar dont le cours est élevé dans l'importation à meilleur prix des intrants. Si les décideurs souhaitent aider les usines canadiennes, ils devraient cesser de blâmer l'Alberta et améliorer plutôt leurs politiques économiques nationales.

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INTRODUCTION

The subject of currency appreciation and its effect on manufacturing productivity, output, and employment has become an increasingly important topic for Canadian governments and policy-makers. It is often claimed that an appreciation of the Canadian dollar — driven perhaps by a booming commodity sector — will reduce manufacturing activity through lower demand for Canadian exports. This phenomenon is referred to as “Dutch Disease.”¹ For Dutch Disease to exist, two conditions must be satisfied: (1) commodity price increases lead to the appreciation of the currencies of commodity-exporting countries; and (2) an appreciating currency negatively affects domestic manufacturers. In this paper, we make no attempt to investigate the first condition, and focus all attention on the second condition. We will show that a currency appreciation does not necessarily harm manufacturers — and, in certain situations, may even benefit them. By extension, we also show that Ontario and Quebec — the two provinces widely believed to be harmed by a higher dollar — stand to fare relatively better from a higher dollar than the rest of Canada.

The basic logic behind the claims that a higher dollar harms manufacturers is simple, though incomplete. It is of course true that foreign buyers require Canadian dollars to purchase exported Canadian manufactured products. So, as the dollar’s value increases, the effective cost to purchase manufactured goods increases. This story, however, neglects an important aspect of today’s increasingly interconnected global marketplace. Not only are final products traded, but so are many intermediate inputs, such as materials, computers, or anything else used by Canadian businesses.² Recognizing that supply chains are now global can change how one views the effect of a rising dollar. An appreciating currency decreases the cost of imported inputs and, if imported inputs are used in large-enough volumes relative to other inputs, this lowers overall production costs and, consequently, prices. With lower prices comes higher sales volumes, and with that comes higher output and employment. While the benefits of imported, lower-cost intermediate inputs are well recognized in the academic literature, they have received little attention in the current policy debate on Dutch Disease; we hope to shed light on this issue.

Using high-quality data from the OECD, we estimate the importance of imported inputs for various Canadian industries and provinces. We find that Canadian businesses import a substantially larger fraction of their intermediate inputs than do firms in most other countries, even within particular industries. The volume of imported intermediate inputs is also large relative to other types of inputs. Canadian manufacturers, for example, import over 40 per cent of all intermediate inputs used in production, which is equivalent in value to one quarter of total output. For comparison, total labour compensation is equivalent to only 18 per cent of output. We highlight the significance of these results with a model of Canada’s economy. This model is deliberately simplified to illustrate as cleanly and clearly as possible how an appreciating currency can lower the cost of imported inputs and, consequently, benefit manufacturers. We find the benefits of cheaper access to imported inputs is so large that this effect can potentially offset the negative effect of a higher dollar on manufacturing exports.

¹ We will abstract from other mechanisms through which a booming commodity sector affects manufacturing activity. For example, increased demand for workers and other resources by commodity producers will increase wages and prices for other inputs. These higher input prices will increase costs for manufacturers and cause a relative decline in this sector.

² The increasing importance of cross-border sourcing of inputs has been widely documented. For an excellent analysis of this phenomenon, see David Hummels, Jun Ishii, and Kei-Mu Yi, “The Nature and Growth of Vertical Specialization in World Trade,” *Journal of International Economics* 54(1) (2001): 75-96.

We explore a number of scenarios and find that under some reasonable assumptions, a higher dollar can actually lead manufacturing output to *increase*. This occurs since, under all scenarios, manufacturing revenue will decline from a higher dollar, but the severity of the decline will depend on the sensitivity of exports to exchange rates; we ground our model in recent estimates of this sensitivity. When the export response to exchange rates is sufficiently small, the revenue decline is *smaller* than the price decline (from cheaper inputs) and, therefore, the quantity of output increases as the dollar rises. Using the simulated output changes by sector, we derive a back-of-the-envelope estimate of the aggregate effect on the GDP of each province. We find that, contrary to popular belief, Ontario and Quebec fare relatively better than the rest of Canada in the face of an appreciating Canadian currency. Given the model's simplicity, however, we do not wish to claim too much. Our main goal, and our ultimate conclusion based on this analysis, is that it is not clear (and perhaps even unlikely) that a higher dollar is damaging to Canadian manufacturing and, by extension, to Ontario and Quebec. Claims made by politicians and commentators regarding the negative effects of a higher dollar amount to claims about the value of this elasticity, for which a precise and indisputable estimate does not exist. While more research is clearly necessary, public commentators should simply refrain from making claims without evidence — it lowers their credibility and the quality of discourse in Canada.

In the next section, we will review the public debate over Dutch Disease in Canada and examine some recent research on this issue. We will cover public commentary, policy-related research, and academic research papers. The specific contribution of our paper will be made clear. We provide detailed accounting of the importance of imported intermediate inputs in Canada relative to other countries and for various industries. We use these data in developing a simple model of Canada's economy that incorporates imported inputs. We then use the model to simulate the effect of a currency appreciation on economic activities across sectors and provinces. Based on these results, we propose a number of policy recommendations.

BACKGROUND

Before proceeding further, a brief history of events and a summary of the existing research in this area is in order. Research related to Dutch Disease varies from those who presume it exists and investigate possible remedies³ to those that investigate whether Dutch Disease indeed exists or not. Our review of the literature will focus on the latter research. We will examine both public commentary and academic research. There is also concern that the rate of the resource industry's expansion will further deepen the regional economic disparities in Canada.⁴ We will not address these concerns directly, instead focusing on the effect of an appreciating currency regardless of its underlying cause.

³ For example, see: Max W. Corden, "The Dutch Disease in Australia: Policy Options for a Three-Speed Economy" (working paper 5/12, Melbourne Institute, 2012).

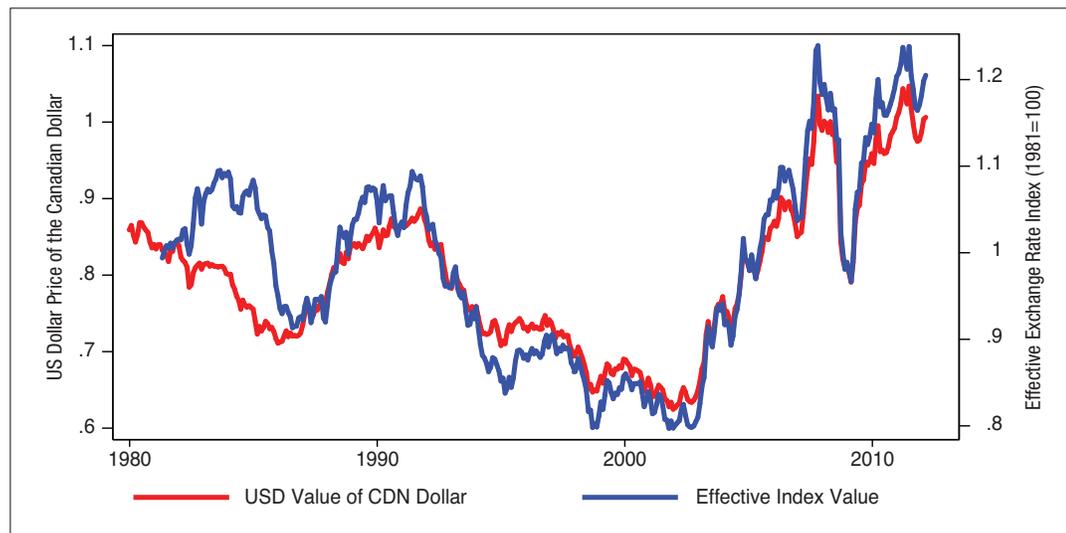
⁴ Nathan Lemphers and Dan Woynilowicz, "In the Shadow of the Boom: How Oilsands Development is Reshaping Canada's Economy," The Pembina Institute (2012).

Concerns over Dutch Disease in Canada

The spark for this entire debate has been the steady increase in the value of the Canadian dollar since 2002. We illustrate this dramatic rise in Figure 1, which plots the value of the Canadian dollar relative to the American dollar, and relative to a broad basket of currencies belonging to Canada's trading partners. Following a decline from 1990 to 2002 the dollar dramatically rose nearly 50 per cent between 2002 and 2011. While the dollar experienced a sharp dip during the recent recession, it has since appreciated back around parity with the U.S. dollar. Much of this appreciation may be due to the increasing global price of Canada's principal commodity exports. Since agricultural and fishing, forestry, and energy-related products account for over one-third of Canada's exports,⁵ increases in the price of these commodities increases the demand for Canadian currency and, therefore, its value.

That being said, careful analysis yields conflicting conclusions. Some researchers find energy prices account for much of Canada's exchange-rate fluctuations.⁶ Other researchers, such as Ferraro, Rogoff and Rossi,⁷ use different techniques and find the energy-price and exchange-rate relationship to be only a short-term phenomenon. Whatever the true relationship, the popular perception is that commodity price increases raise the value of the dollar and this subsequently harms Canadian manufacturers.

FIGURE 1: VALUE OF THE CANADIAN DOLLAR OVER TIME



Note: This plots two measures of the value of the Canadian dollar over time: (1) The amount of U.S. dollars needed to purchase one Canadian dollar; and (2) the inverse of Canada's effective exchange rate. The effective exchange rate is the trade-weighted average of Canada's exchange rate with all its trading partners. Since 2002, there has been a large and rapid appreciation of the Canadian dollar.

⁵ Statistics Canada, CANSIM, table 228-0043.

⁶ Michel Beine, Charles Bos and Serge Coulombe, "Does the Canadian Economy Suffer from Dutch Disease?" *Resource and Energy Economics* 34(4) (2012): 468-492.

⁷ Ferraro, Domenico, Kenneth Rogoff and Barbara Rossi. "Can Oil Prices Forecast Exchange Rates?" National Bureau of Economic Research, Working Paper 17998, 2012.

Statements along this line have most recently, and most visibly, been made by Thomas Mulcair (Leader of Canada's Official Opposition) and by Dalton McGuinty (when he was Premier of Ontario).⁸ Connecting the booming commodity sector (concentrated mainly in Canada's western provinces) to the rise in the Canadian dollar, the Opposition leader and Ontario's then Premier both claimed this would negatively affect manufacturing activity (concentrated mainly in the central provinces of Quebec and Ontario). While it is obviously true that the decline in manufacturing output and employment is correlated with dollar appreciation, it is questionable to conclude from this data alone that any causal relationship exists. One cannot say the higher dollar *caused* a decline in Canadian manufacturing merely because the two developments coincide.

Following the renewed interest among the Canadian public, some commentators have gained headlines by claiming this relationship is indeed causal. The quality and quantity of the evidence presented to support these claims is, unfortunately, limited. For instance, Andrew Jackson, Senior Policy Advisor with the Broadbent Institute and a Professor at York University, has publicly claimed that free trade has not increased productivity in Canada and that increased production of natural resources lowers overall productivity.⁹ His evidence: (1) productivity has declined since Canada's free-trade deal with the United States and (2) the natural-resource share of total exports has increased over the same period. This type of *cum hoc ergo propter hoc* fallacy is very common and confuses cause with correlation.¹⁰ Private-sector economists also make questionable public pronouncements without adequate (or any) evidence to support their claims. In a recent *Globe and Mail* piece, Eric Lascelles, Chief Economist of RBC Global Asset Management, claims that "almost three-quarters of the gap [between U.S. and Canadian productivity] is due to the soaring loonie, which is out of control."¹¹ Some, such as United Steelworkers' economist Erin Weir, even suggest that the Bank of Canada should broaden its mandate to protect Canadian exports from the negative effects of a strong dollar.¹² He claims businesses do not benefit from a higher dollar on the input side of their operations but are squeezed on the export side; a point we will take direct issue with.

Not all public commentary, however, has viewed a higher dollar negatively and there are some who are skeptical of the Dutch Disease diagnosis for Canada. In a recent *Financial Post* comment piece, Jack Mintz, Director of the University of Calgary's School of Public Policy, points out that the decline in Ontario's manufacturing sector is mirrored by very similar declines in Ohio and Michigan.¹³ In fact, he points out, "manufacturing in Ontario, industrial states, and the United States in general has been on a steady decline for 35 years." This declining trend has weathered the booms and busts of the resource sector during the '70s and '80s. Similarly, in a recent Macdonald-Laurier Institute commentary, Robert Murphy and Brian Crowley argue that despite the existence of the Dutch Disease mechanism, other provinces stand to benefit from the thriving petroleum industry.¹⁴ An expanding resource sector results in increased demand for Canadian manufactured goods, potentially offsetting any losses from

⁸ See, for example: Gloria Galloway, "Mulcair digs in for long debate on 'Dutch Disease'," *Globe and Mail*, May 18, 2012; and Karen Howlett, "McGuinty rebuffs Redford's oil-sands plea," *Globe and Mail*, February 27, 2012.

⁹ Andrew Jackson, "Tarnished anniversary: Why the free-trade deal didn't deliver," *Globe and Mail*, October 5, 2012.

¹⁰ For serious, objective research identifying the effect of free trade on Canada's productivity, see: Daniel Trefler, "The Long and Short of the Canada-U.S. Free Trade Agreement," *The American Economic Review* 94(4) (2004): 870-895.

¹¹ Eric Lascelles, "Shrugging off Canada's Competitiveness Shortfall," *Globe and Mail*, May 18, 2012.

¹² Erin Weir, "It's time to broaden Bank of Canada's mandate," *Globe and Mail*, August 21, 2012.

¹³ Jack Mintz, "No Dutch Disease Here," *National Post*, March 2, 2012.

lower foreign demand due to a higher currency. Skepticism exists even among Canada's leading policy-makers. In a recent speech in Calgary, Bank of Canada Governor Mark Carney stated that Canada's economy is too diverse to be plagued by such a phenomenon.¹⁵

In the context of this ongoing debate, we will present another side to the Dutch Disease story and highlight a typically ignored positive benefit of Canada's higher dollar: cheaper access to imported inputs. We will illustrate the causal relationships clearly and estimate the potential benefits of imported inputs with the aid of a simple model that is consistent with general features of the Canadian economy. We side strongly with those who are skeptical of Dutch Disease in Canada.

The Existing Academic Research

There have been various studies looking at the effect of currency fluctuations on manufacturing and exporter performance. Given the breadth of this literature, we do not review it here.¹⁶ It is clear, however, that previous research has not quantified the potential benefits of a higher dollar in terms of cheaper access to import inputs.

We are not the first, of course, to study imported inputs. Linda Goldberg and Jose Campa,¹⁷ for instance, document the importance of imported intermediate inputs for determining the effect of exchange-rate fluctuations on consumer prices. As explained above, a higher dollar decreases the cost of imported inputs used by domestic producers, who then lower their output prices. These researchers find this channel is the most important factor behind the exchange rate's effect on overall consumer prices. They also document the extent of imported inputs for a broad set of industries for a number of countries, though not for Canada. We derive similar estimates for the Canadian economy, disaggregating our results by province and industry, where possible. We find not only, as they do, that domestic prices fall following an appreciation of the dollar, but that manufacturing output may (potentially) rise as well.

Mary Amiti and Jozef Konings¹⁸ investigate a similar gain from lower tariffs on imported intermediate inputs for Indonesian manufacturing firms. They find that for a 10-percentage-point reduction of intermediate input tariffs, productivity increases by 12 per cent for firms that import inputs. Pinelopi Goldberg and co-authors¹⁹ find similar gains from imported inputs for Indian firms. In particular, they find significant gains from access to new input varieties rather than just cheaper access to existing varieties used by firms. In the Canadian context, Alla

¹⁴ Murphy, Robert and Brian Lee Crowley. "No Dutch Treat: Oil and Gas Wealth Benefits All of Canada." Macdonald-Laurier Institute, 2012.

¹⁵ Mark Carney, "Dutch Disease," speech to the Spruce Meadows Round Table (Calgary, Alberta), September 7, 2012. Full text available at <http://www.bankofcanada.ca/2012/09/speeches/dutch-disease>.

¹⁶ For interested readers, see: Baldwin and Krugman (1989), Jorion (1991), Bodnar and Gentry (1993), Clarida (1997), Campa and Goldberg (1997, 1999), Nucci et al. (2001), Griffin and Stulz (2001), and Greenaway et al. (2007), among many others.

¹⁷ Linda Goldberg and Jose Manuel Campa, "The Sensitivity of the CPI to Exchange Rates: Distribution Margins, Imported Inputs, and Trade Exposure," *The Review of Economics and Statistics* 92(2) (2010): 392-407.

¹⁸ Mary Amiti and Jozef Konings, "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia," *American Economic Review* 97(5) (2007): 1611-1638.

¹⁹ Pinelopi Goldberg, Amit Khandelwal, Nina Pavcnik and Petia Topalova, "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India," *Quarterly Journal of Economics* 125(4) (2010): 1727-1767.

Lileeva and Daniel Trefler²⁰ find that reductions in tariffs on inputs used by Canadian firms purchased from the United States, due to the Canada-U.S. Free Trade Agreement, resulted in higher manufacturing productivity (though smaller than the gains for developing countries cited above). Many other studies link substantial gains from trade liberalization to access to foreign inputs by domestic firms.²¹ We will abstract from a number of additional benefits of increased access to imported inputs, ranging from increased demand for skilled labour,²² technology transfer,²³ and increased firm investment.²⁴ We depart from these studies to show another benefit of imported-input use: reducing (and potentially eliminating) the symptoms of Dutch Disease.

THE IMPORTANCE OF IMPORTED INPUTS FOR CANADA

The lack of attention paid to imported inputs in the current debate may be due to a lack of information on their importance to Canadian firms. Linda Goldberg and Jose Campa, in another paper,²⁵ document the importance of imported intermediate inputs for many countries, but not for Canada. We follow their approach and provide these important estimates for the Canadian economy. Specifically, we provide estimates of the share of total inputs that are imported, separately by sector. The OECD Database for Structural Analysis (STAN) is our main source of data. It covers 33 OECD countries and 15 non-member countries. For Canada, the data cover the years 1995, 2000, and 2005.

Estimating the imported-input use by sector is not trivial. The OECD infers an industry's imported-input use from data on individual goods (such as wood) used by each industry and the aggregate (national) import share for those goods. That is, sector-specific information on actual imports are not known but are instead inferred good-specific imports that are known. While this is a limitation of the data, a direct measure of imported materials by sector is not available.²⁶ Mathematically, industry-*i*'s total imports of intermediate inputs (denoted, m_i) is inferred from data on the whole economy's imports of a given good-*g* (m_g), total domestic use of good-*g* as inputs ($\sum_{i=1}^N x_{ig}$), and industry-*i*'s own purchases of good-*g* using the following equation:

$$m_i = \sum_{g=1}^G \left(\frac{x_{ig} m_g}{\sum_{i=1}^N x_{ig}} \right)$$

We rely on this estimation method in all that follows.

²⁰ Alla Lileeva and Daniel Trefler, "Improved Access to Foreign Markets Raises Plant-level Productivity ... For Some Plants," *Quarterly Journal of Economics* 125(3) (2010): 1051-1099.

²¹ For more, see Kugler and Verhoogen (2009); Kandilov and Leblebicioglu (2011); Nataraj (2011); Topalova and Khandelwal (2011); Bilgin et al. (2012); Crino (2012); or Halpern, Koren, and Szeidl (2012).

²² Rosario Crino, "Imported Inputs and Skill Upgrading," *Labour Economics*, forthcoming. Available online August 20, 2012.

²³ Huseyin Bilgin, Marco Lau and Gokhan Karabulut, "Technology Transfer and Enterprise Performance: A Firm-Level Analysis in China," *Journal of Business Economics and Management* 13(3) (2012): 489-498.

²⁴ Ivan Kandilov and Asli Leblebicioglu, "Trade Liberalization and Investment: Firm-Level Evidence from Mexico," *World Bank Economic Review* 26(2) (2011): 320-349.

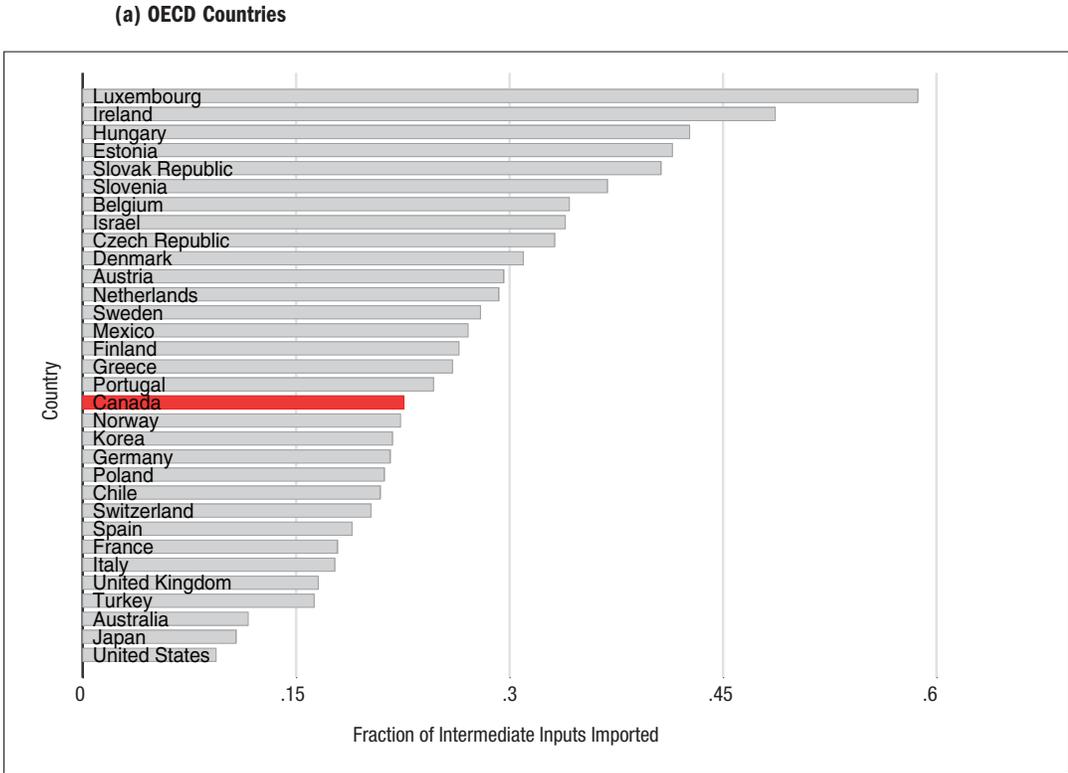
²⁵ Linda Goldberg and Jose Manuel Campa, "The Sensitivity of the CPI to Exchange Rates: Distribution Margins, Imported Inputs, and Trade Exposure" (2010).

²⁶ For a detailed discussion of this issue, and a more direct measure for the United States, see: Robert Feenstra and J. Bradford Jensen, "Evaluating Estimates of Materials Offshoring from US Manufacturing," *Economics Letters* 117 (2012): 170-173.

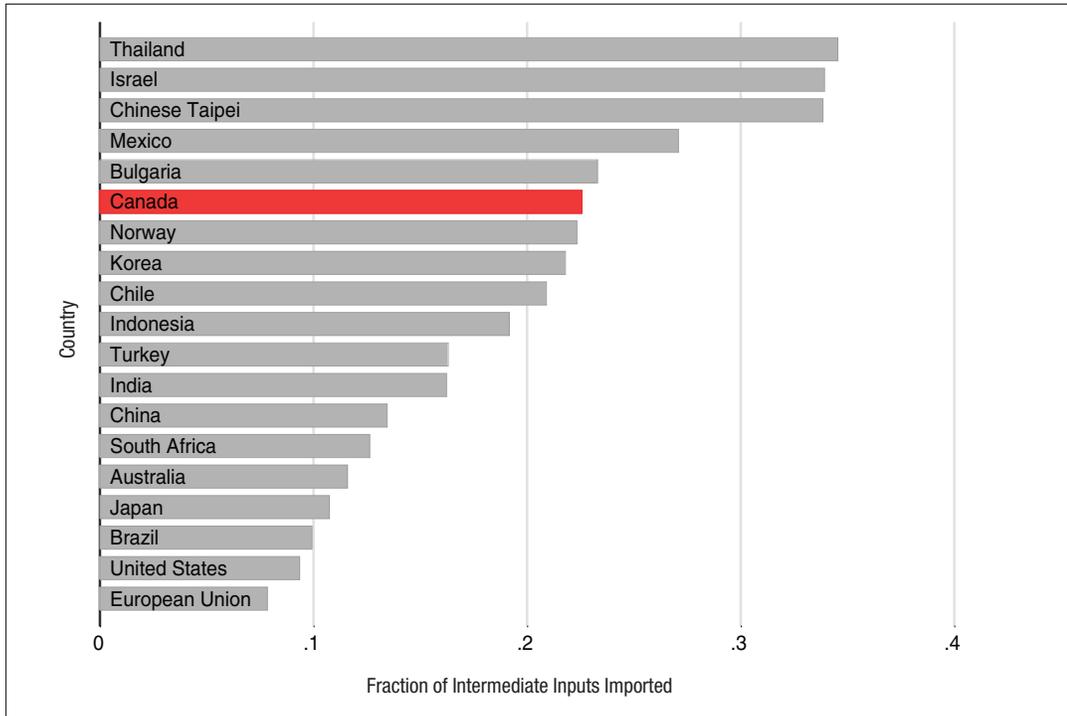
Using the OECD STAN database, we plot the fraction of intermediate inputs that are imported for a large set of countries in Figure 2a. This does not cover all countries, just the ones for which OECD data are readily available. At first glance, it may seem that Canada is an entirely typical country, right in the middle, with an intermediate import ratio of approximately 23 per cent. However, the European Union countries are typically small and have nearly free trade across borders, and when they are aggregated in Figure 2b, Canada is revealed to have one of the highest fractions of imported intermediate goods. Our import ratio for intermediate goods is more than twice as much as that of the European Union (eight per cent) and the United States (10 per cent), almost twice as high as that of Japan (12 per cent), and larger than other economies such as Brazil, Australia, China, or India. The Canadian economy imports a higher-than-average proportion of its intermediate goods.

Further disaggregating the import ratio to the industry level reveals even more about the Canadian economy. Canada’s manufacturing industry, for example, has the highest imported-input ratio, with over 40 per cent of its inputs being imported. This is followed by the mining, oil and gas extraction industry, which imports a little over 30 per cent of its inputs, and the accommodation and food services sector, which imports roughly 20 per cent of inputs. We plot all industries in Figure 3a. These three industries feature imported-input ratios that are significantly greater than the average of 12 per cent. At the other end of the spectrum, the construction industry, health and social services sector, utilities sector, and finance, insurance, leasing and real estate industry all import less than five per cent of their inputs.

FIGURE 2: FRACTION OF TOTAL INTERMEDIATE INPUTS IMPORTED, BY COUNTRY (MID-2000S)



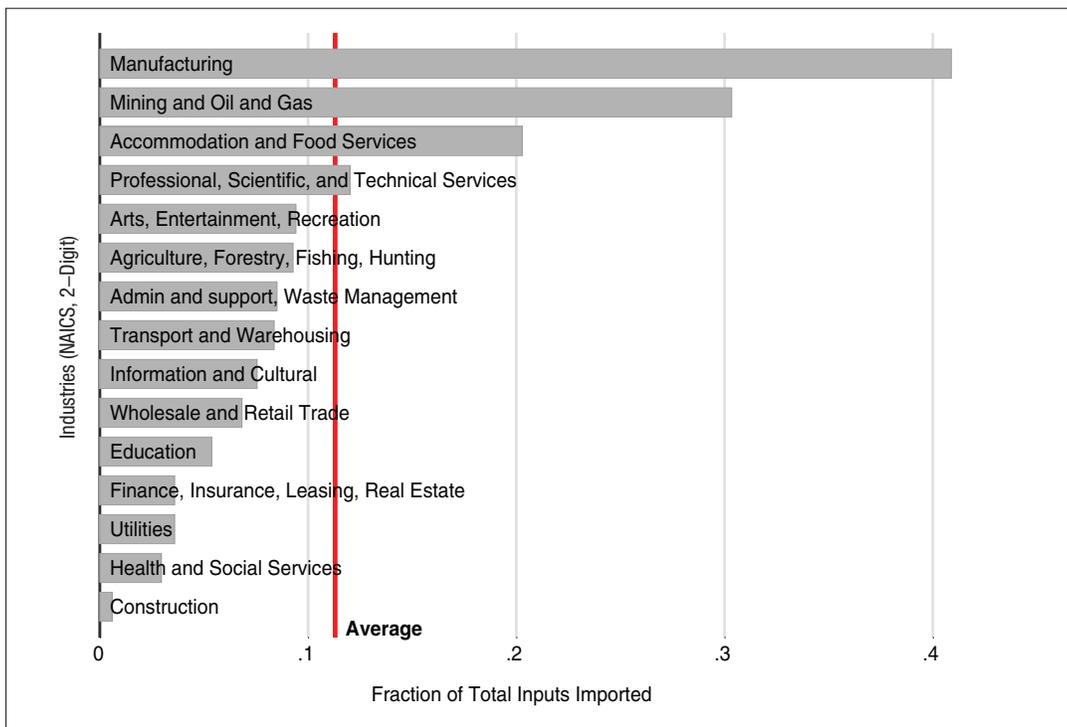
(b) All Countries in STAN Database (EU Aggregated)



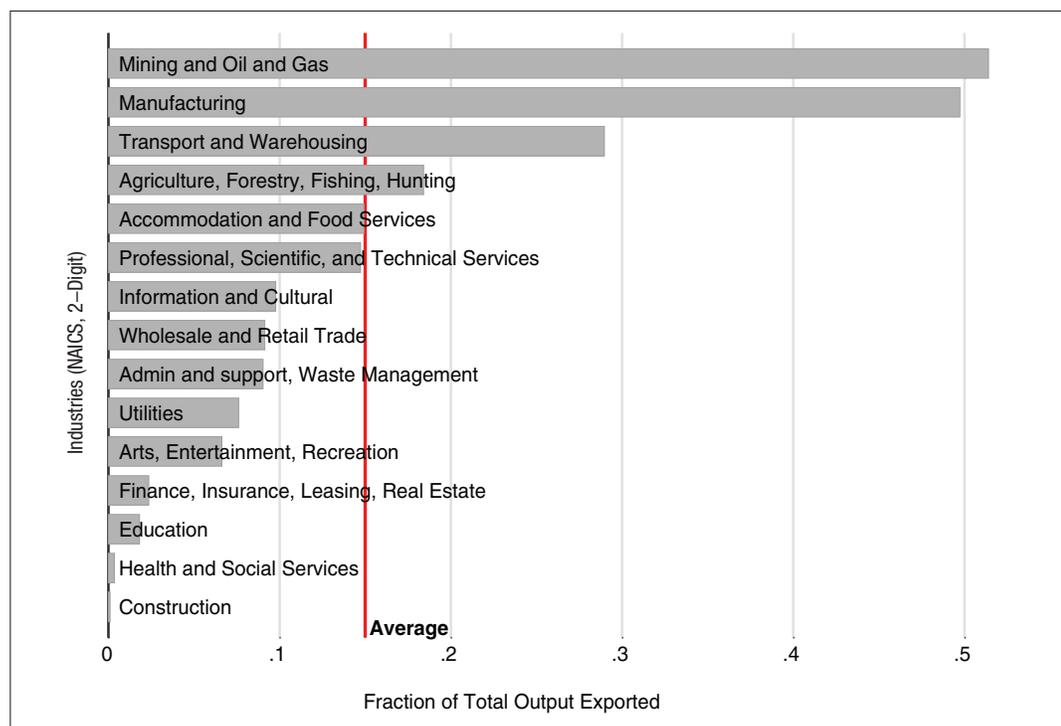
Source: Authors' calculations from the OECD STAN Database.

FIGURE 3: IMPORTANCE OF IMPORTED INPUTS AND EXPORTED OUTPUT, BY INDUSTRY (2005)

(a) Imported-Input Share of Total Inputs



(b) Export Share of Total Output



Note: NAICS 81 and 91 are excluded. The simple average across industries is marked in red.

To put these figures in perspective, we contrast the imported-input shares with the share of each sector's output that is exported. Mining, oil and gas extraction, for example, exports the highest share of its total output, 53 per cent, whereas the manufacturing sector exports approximately 49 per cent of its total output. We plot the export shares for all industries in Figure 3b. Even though these industries export a large portion of their output, they are also heavy importers of intermediate goods. If some industries feel the pinch of the higher dollar through decreases in exports, they also stand to benefit from the higher dollar through decreases in the costs of imported intermediate goods. Transport and warehousing and agriculture, forestry, fishing and hunting are the only two other industry groups that export a higher-than-average portion of their output. However, these two industry groups import only a modest portion of their inputs: eight per cent and seven per cent, respectively. These are two channels through which exchange rates affect industry output, and the effect seems to vary by industry.

THE EFFECT OF CURRENCY APPRECIATION ON THREE BROAD SECTORS

To quantify the effect of exchange-rate changes on output, we developed a simple model of Canada's economy that corresponds to an aggregation of all industries into three broad sectors: primary, manufacturing, and services. We treat the rest of the world as exogenous and set the various parameters of the model to reflect data on the Canadian economy (more detail on this to follow). Using this model, we perform various counterfactuals to examine the effect of (exogenous) exchange-rate changes on (1) the output prices of each sector, (2) the total revenue of each sector, and (3) the real (quantity of) output produced by each sector.

We focus on this simplified model since we are not interested in producing a precise estimate of the effect of exchange-rate changes on Canadian economic activity. Such an estimate would require a much more complex model, such as the Terms of Trade Economic Model developed and maintained by the Bank of Canada. Instead, we wish to illustrate the quantitative importance of imported intermediate inputs, as intuitively and clearly as possible, to advance the quality and direction of current policy debates. In our simplified model, we also abstract from any link between commodity prices and exchange rates. As stated earlier, our focus is on the effect of currency changes on manufacturing output. If there is no link here, then Dutch Disease cannot be a concern regardless of whether commodity price increases contribute to currency appreciation.

The model's basic structure is straightforward. In each of the three sectors, firms use intermediate inputs from both domestic and foreign sources. Revenue is earned through sales of final output to domestic consumers for final consumption; to other domestic producers for use as intermediate inputs; and to customers abroad (exports). The exchange rate influences the price for imported intermediates and the level of total exports. We adopt a simple view of consumers and presume they allocate total income in fixed proportions between the three sectors, since our goal is to present the simplest possible model to highlight the potential importance of imported intermediate inputs.

A higher currency value will have two main effects in our model: (1) it will decrease the effective price of any imported inputs, which lowers production costs and prices; and (2) it will decrease total exports, as it becomes more expensive for customers abroad to purchase Canadian goods. Which effect ends up dominating will depend on how sensitive foreign customers are to the exchange rate. If export volumes decline significantly in response to an appreciating Canadian dollar, then the second effect will dominate the first. The overall effect of an appreciating currency would, therefore, be negative. On the other hand, if export volumes are not so sensitive, then the first effect will dominate, and the overall effect would be positive.

Finally, we explicitly incorporate input-output links between sectors, as they are an important source of additional gains. To see this, consider a sector that spends 10 per cent of its revenue on imported inputs. Abstracting from input-output linkages will mean that a 10-per-cent increase in the currency's value will decrease costs by one per cent. When input-output linkages are considered, the one-per-cent initial cost reduction is *compounded* by firms that purchase this sector's output for use as their own intermediate inputs. To be clear, production costs decline due to the lower cost of imported inputs *as well as the lower costs of inputs from domestic sources that also benefited from cheaper imported inputs*. This can be viewed as a multiplier effect that magnifies the initial cost-reducing effect of the higher dollar. Using the OECD data, we find manufacturers use 56 per cent of inputs from other manufacturers, half of which are imported. Primary sector firms get 30 per cent of their inputs from manufacturers, 36 per cent of which are imported. Finally, service sector firms get 27 per cent of their inputs from the manufacturers, 33 per cent of which are imported. The primary sector gets 40 per cent of its inputs from the service sector and 30 per cent from other primary firms. We highlight the important features of the data in Table 1 and use the reported values to calibrate the model, to which we now turn.

The Main Structure of the Model

The economy is composed of three sectors: primary, p ; manufacturing, m ; and services, s . A representative firm in each sector- i uses labour (L_i), capital (K_i) and intermediate inputs (X_{ij} denotes domestic inputs from sector- j and M_i imported inputs) using the constant returns to scale technology

$$(1) \quad Y_i = A_i K_i^{\alpha_{ik}} L_i^{\alpha_{il}} X_{ip}^{\alpha_{ip}} X_{im}^{\alpha_{im}} X_{is}^{\alpha_{is}} M_i^{\alpha_{iM}} \quad \forall_i \in \{p, m, s\}$$

where α 's denote input shares, which are sector-specific and sum to one within each sector, and A_i is sector- i 's total factor productivity (a measure of how much output is produced for a given bundle of inputs).

Producers sell their output in a perfectly competitive market, which implies the price charged will equal marginal production costs. Inputs are also purchased in a perfectly competitive market. To purchase intermediate inputs from abroad (M_i), firms must first exchange domestic currency for foreign currency. So, the effective price of imported inputs is given by $P_M = P_M^f e$, where P_M^f is the price charged by foreign producers, denominated in their own currency, and e is the exchange rate or the *inverse* of the Canadian currency value. We will treat the Canadian economy as sufficiently small relative to foreign markets so that P_M^f is constant and not affected by any changes in the model.

Labour is inelastically supplied, with total supply normalized to one, and is this economy's numeraire good, which implies $w = 1$. This means that all variables in the economy, such as prices and revenue, are expressed relative to total labour compensation. Finally, credit markets will be global in nature and capital is perfectly mobile, which allows us to treat the cost of capital (denoted r) as fixed.

The Exchange Rate's Effect on Prices

With a perfectly competitive market structure, the price each sector charges for its output will equal marginal costs of production,

$$(2) \quad P_i = \frac{1}{A_i} \left(\frac{r}{\alpha_{ik}}\right)^{\alpha_{ik}} \left(\frac{w}{\alpha_{il}}\right)^{\alpha_{il}} \left(\frac{P_p}{\alpha_{ip}}\right)^{\alpha_{ip}} \left(\frac{P_m}{\alpha_{im}}\right)^{\alpha_{im}} \left(\frac{P_s}{\alpha_{is}}\right)^{\alpha_{is}} \left(\frac{P_M}{\alpha_{iM}}\right)^{\alpha_{iM}} \quad \forall_i \in \{p, m, s\}$$

This equation says that the output price a given industry charges will decrease with that industry's productivity and increase with the prices of various inputs. Wages and the interest rate are the prices of the primary inputs labour and capital, respectively. The price charged by other sectors for their output that are used as inputs are given by P_p (for primary), P_m (for manufacturing), and P_s (for services). The price charged by foreign producers for their output is given by P_M . Any decrease in these inputs prices will decrease the price charged by sector- i and the strength of this pass-through is governed by the importance of the given inputs in production (that is, by the input shares, α).

To see the effect of changes in the exchange rate on prices in each sector, take the ratio of equation (2) after an exchange rate change with its original value to yield

$$(3) \quad \hat{P}_i = \hat{P}_p^{\alpha_{ip}} \hat{P}_m^{\alpha_{im}} \hat{P}_s^{\alpha_{is}} \hat{P}_M^{\alpha_{iM}} \quad \forall_i \in \{p, m, s\}$$

where hats denote gross percentage changes. Notice that all terms that do not change with time (wages, interest rates, productivity, and some of the input share terms) are cancelled. This means price changes in each sector are only a function of price changes in all other sectors and the change in the price of imported intermediates. When the exchange rate changes (\hat{e}), the price of imported intermediate inputs will change (denoted by the \hat{P}_M), since the price charged by the foreign producer is fixed. For example, if the dollar rises by 20 per cent, from parity to \$1.20 USD/CDN, the price of imported intermediates will change by $\hat{P}_M = \hat{e} = 1/1.2$. So, with \hat{P}_M replaced by \hat{e} , we now have a system of three equations and three unknowns as a function of the change in the price of imported intermediate inputs due to exchange rate changes. One may be concerned that the above specifications assume perfectly competitive firms but equation (3) and the results that follow will still hold even if firms earn profits so long as their markup is a fixed percentage of revenue.

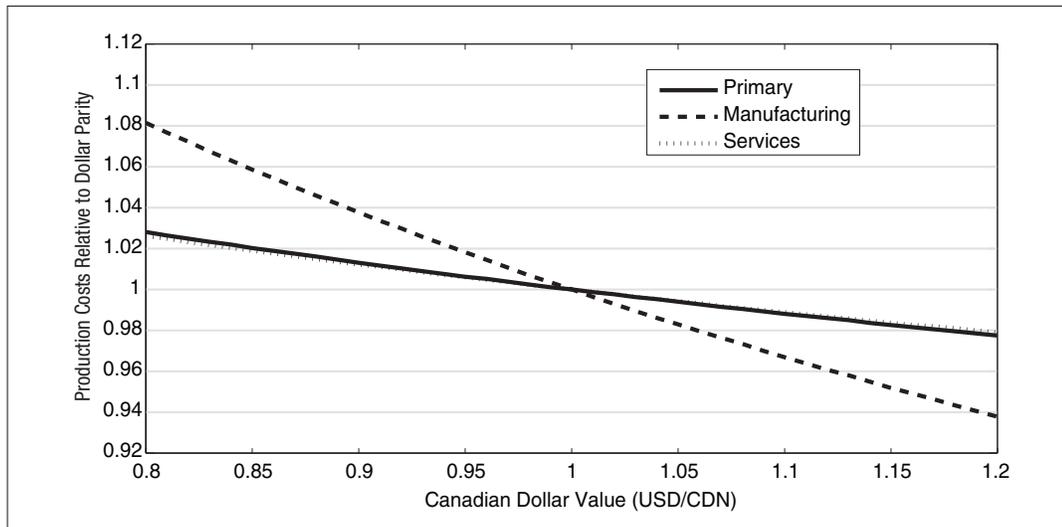
This is a simple means of simulating and illustrating the effect of exchange-rate changes through to output prices of three broad industries in Canada. The simplicity is achieved since price changes of each sector are a function of exchange-rate changes only, and we do not need values for wages, interest rates, or sectoral productivity. This eases the data requirements and allows our results to be valid under a variety of general models. We only require data on the input shares by sector, which we base on data outlined in the previous section. We report the values for each of the input shares (α) in Table 1. Using these values, we simulated a variety of exchange-rate changes and report the effect on each sector's price in Figure 4.

TABLE 1: INPUT SHARES BY SECTOR

	Domestic Inputs			Foreign Inputs α_{iM}
	Primary α_{ip}	Manufacturing α_{im}	Services α_{is}	
Primary	0.10	0.07	0.15	0.07
Manufacturing	0.11	0.20	0.15	0.25
Services	0.01	0.07	0.26	0.06

Note: This reports the various input shares for each broad sector in Canada. Values are estimated from the OECD STAN dataset as the ratio of spending on each type of input to each sector's output.

FIGURE 4: SIMULATED CHANGE IN OUTPUT PRICES, FOR VARIOUS EXCHANGE RATES



Note: Reports the relative output price for each of the three sectors over various exchange rates. All values are reported relative to Dollar parity between Canada and the United States.

If the dollar appreciates by 20 per cent, the price of manufactured goods declines by more than six per cent (regardless of whether the dollar's value appreciates from \$0.75 to \$0.90 against the U.S. dollar, or from \$1.00 to \$1.20). The price of output from the other two sectors falls by only two per cent. This follows from the heavy reliance of manufactured goods on imported intermediate inputs. The reverse is a similar, but opposite, effect. If the dollar declines to \$0.80, from parity (\$1.00), prices for manufactured goods will rise by eight per cent, while the prices of the other sectors rise by less than three per cent. Note that these price changes result *only* from the use of imported intermediate inputs that become cheaper as the dollar value rises. If this channel is ignored, as it is with most investigations into the effect of exchange-rate changes on manufacturing activity, there would be *no change* in prices of any of the sectors in response to a change in the dollar.

Determining the effect of these price changes on overall output requires that additional structure be placed on the model. We turn to this issue next. Intuitively, though, note that there are two opposing forces that determine the effect of exchange-rate changes on a sector's quantity of output: (1) lower prices from a higher dollar will increase sales (including exports); and (2) a higher dollar will decrease export demand for the sector's output. We know the strength of the first channel, but must turn to a more detailed model to investigate them both together. We explore a variety of scenarios, disciplined by various empirical estimates of the strength of the second channel.

The Exchange Rate's Effect on Revenue

Total revenue of each sector is derived from domestic consumers that directly consume the final output (D_i), intermediate input spending by other sectors ($\alpha_{pi} P_p Y_p + \alpha_{mi} P_m Y_m + \alpha_{si} P_s Y_s$), and foreign demand (E_i). Combined, we express total revenue of sector- i as²⁷

$$(4) \quad P_i Y_i = D_i + \alpha_{pi} P_p Y_p + \alpha_{mi} P_m Y_m + \alpha_{si} P_s Y_s + E_i \quad \forall_i \in \{p, m, s\}$$

With aggregate labour supply fixed and wages equal to 1 (see our earlier discussion) we can replace domestic demand ($D_i = d_i wL$) with the fraction of consumer expenditure allocated to sector- i (d_i). We assume consumers in Canada spend two-thirds of income on domestic producers, split 0.05, 0.2, and 0.75 between primary, manufacturing, and service sectors respectively. That is, $d_p = 0.03$, $d_m = 0.13$, and $d_s = 0.5$. We set exports to match the export share of each sector's overall revenue found in the OECD data. As before, we have a system of three equations (one for each sector) and three unknowns (the revenue for each sector). The effect of exchange-rate changes on a sector's total revenue will operate through total export demand (E_i). A higher dollar value will (potentially) decrease total revenue.²⁸

The sensitivity of export flows to the exchange rate is an empirical question where existing research can shed light; we rely on these existing estimates. Mariana Colacelli,²⁹ for instance, finds in a recent working paper that a 10-per-cent appreciation of a typical high-income country's currency will lower exports by 1.3%. If we followed this estimate, we would adjust E_i such that $\frac{\partial E_i}{\partial e} = -0.13$. Unfortunately, there is a large variance in the estimated elasticity across studies. Seven studies conducted between 1951 and 1985 for Canada are reviewed by Hooper and Marquez.³⁰ The elasticities in these studies range within $[-1.37, 0.80]$,³¹ which imply that a 10-per-cent appreciation could lead export volumes to decline by 13.7 per cent or to increase by eight per cent; this is an unfortunately larger variance in potential outcomes. While the most recent, and sophisticated, estimate of Colacelli³² suggests -0.13 is an appropriate elasticity, we will present results from the model with an elasticity of 0.00, -0.25, -0.50, -0.75, and -1.00. Using these elasticity estimates, we determine each sector's revenue for the alternative values of the exchange rate by varying the level of exports and re-solving

²⁷ As before, one may be concerned that this assumes a zero markup by producers. This may be a particular concern for the primary sector, as producers there may earn rents. For a constant markup of price over marginal costs for primary producers (denoted $m > 1$), assuming all rents were rebated lump-sum to households, D_i would equal $d_i = (wL + (1 - m^{-1})P_v Y_v)$. So, equation (4) would become $P_i Y_i = d_i + (\alpha_{pi} m^{-1} + d_i(1 - m^{-1})) P_v Y_v + \alpha_{mi} P_m Y_m + \alpha_{si} P_s Y_s + E_i$. To set the value of m , operating profit margins for the primary sector reported in Statistics Canada's Quarterly Financial Statements for Enterprises (Catalogue 61-008-XWE) was 9% in the 4th quarter of 2011, suggesting $m = 1.09$. All results are robust to various assumptions of the magnitude of m . Results from these exercises are available upon request.

²⁸ Value-added and total revenue are proportional in this framework. We therefore focus our attention and results on revenue changes. Also, there is no notion of a "firm" in this model. So, we cannot make a statement about how a sector's revenue change will affect the number or scale of firms.

²⁹ Mariana Colacelli, "Export Responses to Real Exchange Rate Fluctuations: Development Status and Exported Good Effects," working paper, Barnard College, Columbia University, 2008.

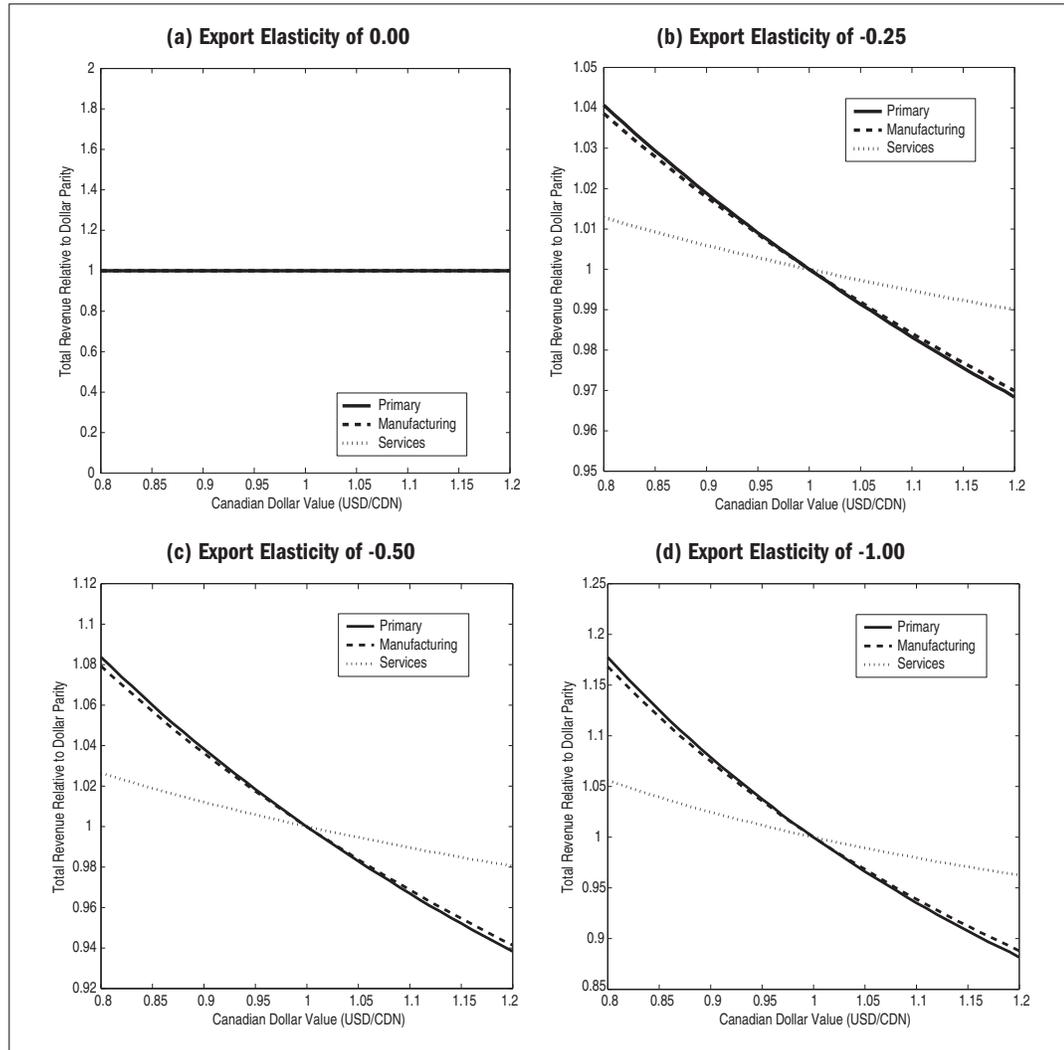
³⁰ Peter Hooper and Jaime Marquez, "Exchange Rates, Prices, and External Adjustment in the United States and Japan," International Finance Discussion Paper No. 456, Board of Governors of the Federal Reserve System, 1993.

³¹ The mean across the studies is 0.46, with one finding zero and another finding *positive* 0.80.

³² Mariana Colacelli, "Export Responses to Real Exchange Rate Fluctuations: Development Status and Exported Good Effects," 2008.

equation (4), holding all other parameters fixed. We do not simulate the positive elasticity case since, if it were true, a higher dollar would both *increase export revenue* and *decrease prices*. This would be an unambiguously positive outcome for the firms involved and our purpose is to determine under what conditions a rising dollar will increase the quantity of output even *if export revenues decline*.

FIGURE 5: SIMULATED REVENUE CHANGES FOR VARIOUS EXPORT ELASTICITIES



Our simulated revenue responses are reported in Figure 5 and in Table 2. We find that a higher dollar lowers each sector's revenue, since exports decline. In manufacturing, revenue declines by three per cent following a 20 per cent appreciation of the dollar when the elasticity of exports is -0.25. Revenue declines by nearly 13 per cent when the elasticity is set at -1.0. For perspective, 13 per cent of manufacturing output (assuming constant labour productivity) is associated with nearly 200,000 workers.³³ Without recognizing that imported intermediate inputs become cheaper following a dollar appreciation, one would conclude the revenue change equals the output change. In this case, a significant appreciation of Canada's currency could have potentially large negative effects on manufacturing output and employment. That being said, taking account of changing output prices can dramatically alter this conclusion.

³³ Source: Canadian Industry Statistics, Industry Canada. Total employment in NAICS 31-33 was 1,480,010 in 2010.

TABLE 2: EFFECT OF A 20% DOLLAR APPRECIATION

Sector	% Change		
	Price	Revenue	Output
Exchange Rate Elasticity of Exports = 0.00			
Primary	-2.29	0.00	2.24
Manufacturing	-6.62	0.00	6.21
Services	-2.14	0.00	2.09
Exchange Rate Elasticity of Exports = 0.25			
Primary	-2.29	-3.26	-0.95
Manufacturing	-6.62	-3.09	3.31
Services	-2.14	-1.01	1.11
Exchange Rate Elasticity of Exports = 0.50			
Primary	-2.29	-6.59	-4.20
Manufacturing	-6.62	-6.22	0.37
Services	-2.14	-1.99	0.15
Exchange Rate Elasticity of Exports = 0.75			
Primary	-2.29	-9.97	-7.50
Manufacturing	-6.62	-9.40	-2.61
Services	-2.14	-2.94	-0.79
Exchange Rate Elasticity of Exports = 1.00			
Primary	-2.29	-13.41	-10.86
Manufacturing	-6.62	-12.62	-5.64
Services	-2.14	-3.87	-1.70

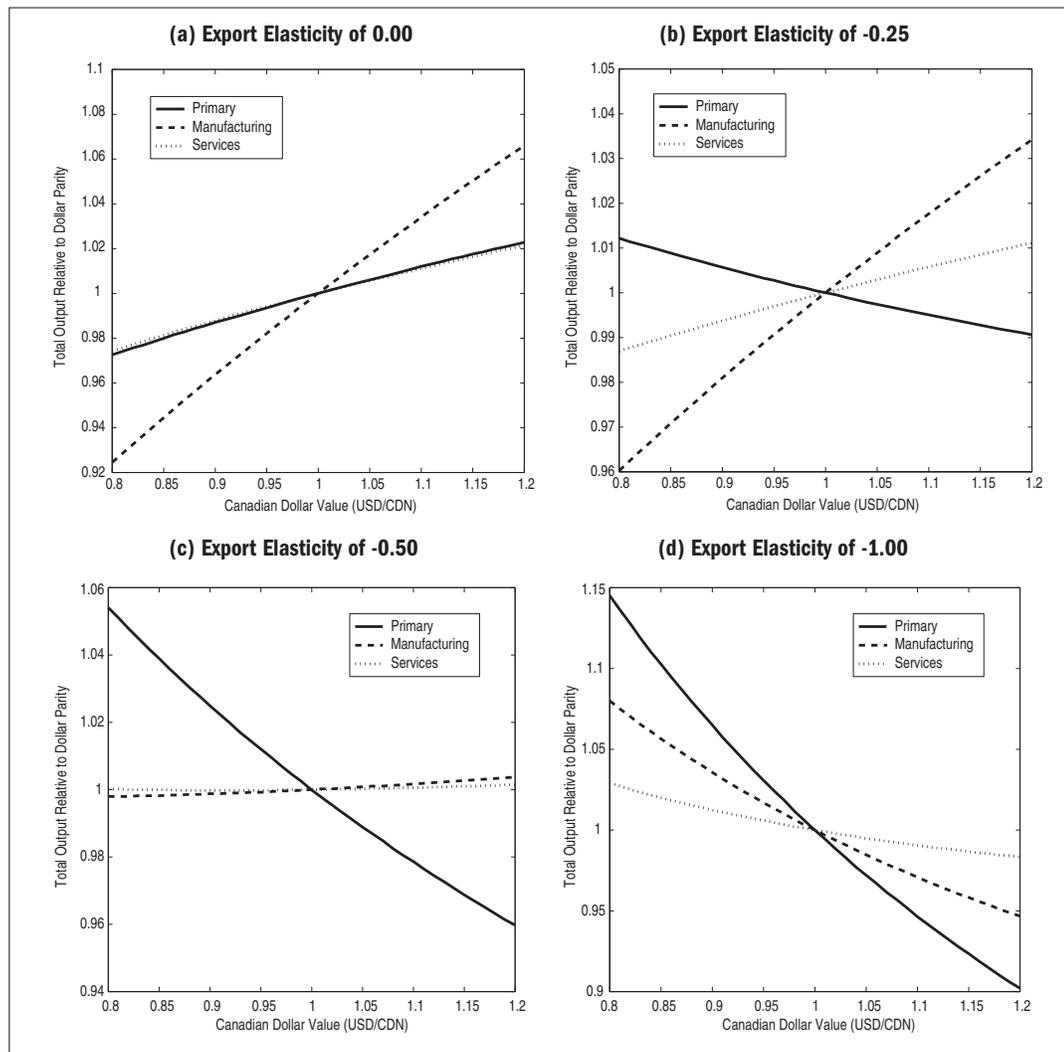
Note: Reports the simulated change in prices, revenue, and output for the three main sectors of the Canadian economy in response to a 20% appreciation of the dollar. Given the market structure and production technologies assumed, value-added is proportional to total revenue. So, percentage changes in revenue reported in Column 2 are also percentage changes in firm value-added. The equation governing the relationship between the columns is: $1 + \% \text{ change in output} = (1 + \% \text{ change in revenue}) \div (1 + \% \text{ change in price})$.

The Exchange Rate's Effect on the Quantity of Output

The change in a sector's real output (that is, the quantity of output) is given by the change in revenue *removing the effect of* the change in price. Price declines will lower revenue even if output (and, therefore, employment) is unchanged. For example, as we saw in Figure 4, manufactured-goods prices decline by more than six per cent following a 20-per-cent dollar appreciation. So, if revenues decline by 13 per cent, but output prices decline six per cent, then output (as a quantity) declines by only seven per cent. If revenues decline by six per cent (as they do in the case of an elasticity equal to -0.50), then the six-per-cent output-price reduction completely accounts for that change; output, in this case, is not affected by the dollar's appreciation. For a range of elasticities, we calculate the output (quantity) change and report the results in Figure 6 and in the last column of Table 2. When the elasticity is -0.25, the output actually *rises* by over three per cent, since the price decline is larger than the revenue reduction. For an elasticity of -1.0, output declines by only six per cent following a 20-per-cent appreciation — less than half the effect than if price reductions are ignored. By incorporating imported intermediate inputs, which become cheaper with a higher dollar, the effect of an appreciation is significantly mitigated.

The critical elasticity, where changes in the dollar can affect real output levels, is -0.5 . That is, unless total exports are *more sensitive to exchange rates than this (elasticity between -0.50 and -1.00 , for example)*, a rising dollar is not expected to lower the output of manufacturers in Canada. Since there is (some) empirical evidence that the sensitivity can exceed this level, we do not wish to conclude that Dutch Disease cannot exist in Canada. There is other evidence, though, suggesting the sensitivity is much smaller than this level. Colacelli³⁴ suggests it can be as low as -0.13 . If true, then a higher dollar can be expected to *increase* manufacturing output (and employment) in Canada even if revenue falls.

FIGURE 6: SIMULATED OUTPUT (QUANTITY) CHANGES FOR VARIOUS EXPORT ELASTICITIES



Note: This displays the quantity of output (revenue per unit price) for various degrees of export sensitivity to exchange-rate changes. For small elasticities, dollar appreciation results in greater price reductions than revenue reductions. This implies the quantity of output can actually increase from a higher-value dollar. For higher degrees of sensitivity, dollar appreciation results in greater revenue reductions than price reductions and output quantity declines. Whether Dutch Disease is a problem for Canadian manufacturing depends on the degree of export sensitivity to the exchange rate.

³⁴ Mariana Colacelli, "Export Responses to Real Exchange Rate Fluctuations: Development Status and Exported Good Effects," 2008.

The Effect of Currency Appreciation on Each Province

The Dutch Disease debate in Canada is often expressed in regional terms (west vs. east). To shed light on this aspect of the debate, we can provide a back-of-the-envelope estimate of the province-by-province effect based on the previous results for three broad sectors. Intuitively, if a province's economic activity is more heavily concentrated in manufacturing activities, then it is more likely to benefit from an appreciating currency since this sector imports a great deal of its inputs. A province that is concentrated in primary sector activities exports a lot, but imports fewer inputs, and so will likely be relatively harmed from a currency appreciation. We use the results calculated for three broad sectors in the previous section to extrapolate the effect on a province's overall GDP.

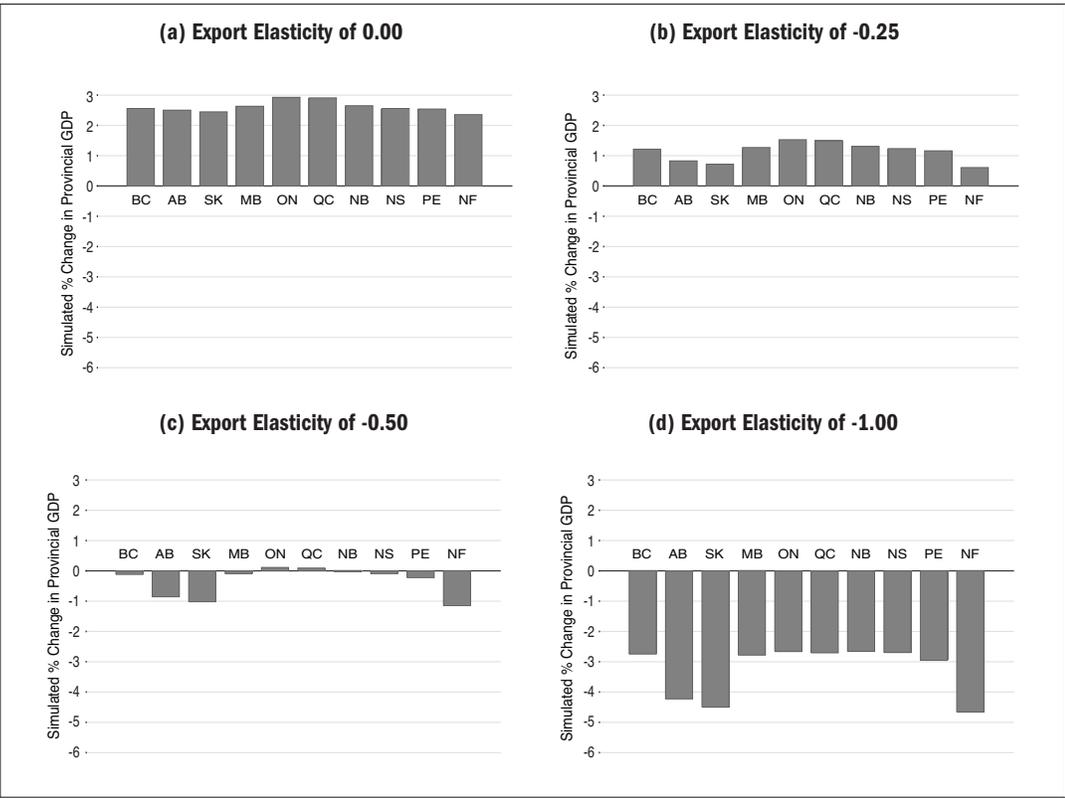
Specifically, we use data on the share of each province's GDP accounted for by each sector. With this, we assume each sector experiences the same gain or loss from appreciation as we simulated nationally in Section 4. We can then extrapolate each province- j 's GDP change based on

$$(5) \quad \% \Delta GDP_j = s_{jp} y_p + s_{jm} y_m + s_{js} y_s$$

where s_{jp} is primary sector share of GDP in province- j and y_p is the percentage change in output for the primary sector that we previously calculated (see column 3 of Table 2); the remaining variables (s_{jm} , y_m , s_{js} , y_s) are defined similarly. Data on provincial GDP by sector are readily available from Statistics Canada and we use that to calculate s_{jp} , s_{jm} , and s_{js} . In 2005, manufacturing activities accounted for one-fifth of GDP in Ontario and Quebec, while, at the other extreme, manufacturing constituted only five per cent of Newfoundland's GDP. In Alberta and Saskatchewan, manufacturing accounted for less than 10 per cent of the economy. Newfoundland and Saskatchewan each derived more than one-quarter of their GDP from the primary sector and Alberta was nearly as high. There is clearly much regional variation in the underlying structure of economic activity in Canada.

With these values, we solve equation (5) above for each province and report the results in Figure 7. Each figure corresponds to a different export elasticity, as before. If the export response to an appreciated currency is low (0.25), then each province stands to benefit. On average, provincial GDPs will increase by more than one per cent. Ontario and Quebec stand to gain the most (at 1.5 per cent) as they are more heavily engaged in manufacturing activities. Alberta, Saskatchewan, and Newfoundland gain 0.8 per cent, 0.7 per cent, and 0.6 per cent respectively. For higher elasticities, each province is more likely to experience GDP losses, but Ontario and Quebec are consistently better off than the rest of Canada.

FIGURE 7: THE EFFECT OF A 20-PER-CENT APPRECIATION ON EACH PROVINCE'S GDP



Note: Each graph plots, for a different exchange-rate elasticity of exports, the percentage change in provincial GDP due to a 20-per-cent appreciation of the dollar. We estimate this effect from the sectoral change in output (see Table 2) and each province's GDP in the three sectors. See text for details.

Before concluding, two important caveats are in order. First, this exercise does not provide a precise estimate of how a currency appreciation will affect each province's economy, but merely serves to broadly illustrate which provinces are more or less likely to be adversely affected. It is, at its core, a partial equilibrium estimate of the effect of currency appreciation across Canada. A more complex model that incorporates inter-provincial trade, factor mobility, and estimates of imported inputs by province and sector would be required for a more precise estimate. Second, these results abstract from the source of the appreciated currency. If Canada's dollar increases due to high commodity prices, then Alberta, Saskatchewan, and Newfoundland will gain on the one hand from these higher commodity prices, but will lose on the other hand from a higher dollar. Which effect will dominate is beyond the scope of this paper. Our results suggest that a higher dollar's *ceteris-paribus* effect will improve the relative economic state of Central Canada. Despite these limitations, we hope this exercise sheds light on the potential geographic distribution of costs and benefits from a higher dollar.

POLICY RECOMMENDATIONS

Based on these findings, a number of policy recommendations become apparent. First, and most importantly, the concern expressed by many public figures in Canada (notably Thomas Mulcair, during the summer of 2012) may not be well founded. It is not obvious that a higher dollar is detrimental to manufacturing activity in Canada. Our analysis finds that cheaper access to imported intermediates can nearly offset the negative effect from lower export demand. This conclusion is also conservative, as we do not incorporate the increased demand for manufactured goods that a booming commodity sector would create. In fact, recent research suggests that one-third of the additional inputs required by expanding oil sands production will originate from Canadian producers in other provinces — nearly 15 per cent in Ontario alone.³⁵ Our analysis abstracts from the productivity-enhancing effects of cheaper access to imported capital goods. This effect is well known, with approximately one quarter of international productivity differences coming from variation in relative equipment prices, half of which is due to trade barriers.³⁶ So, we would recommend all policy-makers temper their claims that Dutch Disease afflicts the Canadian economy.

Our analysis also suggests more concrete recommendations: Governments should adopt policies that facilitate easy access to intermediate inputs imported from abroad. This can be as easy as lowering tariffs on imported goods used by Canadian businesses. Tentative steps were made in this direction as part of the federal government's "Economic Action Plan." Specifically, the government has committed itself to eliminating tariffs on manufacturing inputs and machinery and equipment used for manufacturing. This is not an insignificant step, as it covers approximately \$7 billion of imports and saves businesses \$410 million a year, but much more can be done.³⁷ We recommend that tariffs on all imported inputs, not just machinery and equipment, be eliminated. We further recommend that this benefit be made available to all Canadian businesses not just manufacturers. With lower import costs, Canadian firms can become more integrated into global supply chains and enhance their vertical linkages with other businesses abroad. With greater imported input flows, the positive contribution of a higher dollar through cheaper imported intermediate inputs will grow. Increased input use from abroad can significantly help Canada adjust to its new high-dollar reality.

Beyond assisting Canadian businesses' access to imported inputs, governments can also relax local content requirements. A recent high-profile example of this type of regulation can be found in Ontario's Green Energy Act of 2009 and the FIT (Feed-in-Tariff) program it established. This legislation requires a large portion of equipment used to generate renewable energy be produced within Ontario.³⁸ These measures are so stringent, and so contrary to Canada's trade obligations, that they have sparked an international dispute within the WTO.³⁹

³⁵ Alan Arcand, Michael Burt and Todd Crawford, "Fuel for Thought: The Economic Benefits of Oil Sands Investment for Canada's Regions," The Conference Board of Canada, October 24, 2012.

³⁶ Jonathan Eaton and Samuel Kortum, "Trade in Capital Goods," *European Economic Review* 45(7) (2001): 1195-1235.

³⁷ Economic Action Plan Initiatives: <http://plandaction.gc.ca/en/initiative/tariff-relief-manufacturing-inputs-and-machinery-and-equipment>.

³⁸ For a listing of domestic content requirements, see the Ontario Power Authority's Feed-in-Tariff Program Interpretations of the Domestic Content Requirements, updated December 14, 2009, at: <http://fit.powerauthority.on.ca/table-final-interpretations>.

³⁹ For details, see WTO Dispute DS412. Japan is the complainant, with many third parties participating, including the United States, the European Union, Australia, Brazil, China, Mexico, and others.

Putting aside these trade issues, and any arguments for so-called “green jobs,” our analysis suggests that requirements that firms increase the use of domestically supplied inputs (when other more effective or efficient alternatives exist abroad) will serve to *increase* the potential for a higher dollar to negatively affect economic activity. Limiting the extent of imported inputs will limit the opportunity for firms to use a higher dollar to access cheaper inputs from abroad. This will short-circuit the cost- and price-reducing effect of a higher dollar. Without this offsetting mechanism, lower export demand from a higher dollar will potentially dominate, leading firms to scale back production and lay off workers. The politics of “buy local” should not be allowed to prevent Canadian firms from enjoying certain potential benefits of a higher dollar.

We end by noting that Dutch Disease may be a misplaced diagnosis of a significant and very legitimate observation that Canada’s manufacturing productivity is low relative to the United States. The data supporting this claim are clear: in constant and comparable dollars, Canada’s GDP per-hour-worked was just over \$46 in 2011, which is far below the U.S. level of over \$60.⁴⁰ If this gap with the United States were to close completely, the average Canadian worker would see his or her annual earnings increase by nearly \$24,000.⁴¹ Our productivity growth rates have also been consistently lower than the United States. To reverse this dangerous trend, legislative and regulatory attention should be redirected to other areas.

Some of these areas are well known to economic researchers and policy-makers. Most importantly for Canada, as a small and generally open economy, is the large increase in productivity from greater integration into the global economy. This goes beyond improved access to foreign inputs used by manufacturers discussed earlier, and to free trade in all areas of economic activity. The Canada-U.S. Free Trade Agreement and NAFTA have been clearly linked to increases in Canadian productivity.⁴² The government should continue to strive to remove all remaining barriers to international trade.

These lessons also apply to more than just imports and exports; increased openness to investment from abroad should also be a priority.⁴³ The Investment Canada Act allows the federal government to review any investment in excess of a certain (low) threshold (\$330 million in 2012) by a non-Canadian wishing to acquire control of a Canadian firm. Since its inception, the act has been used to review over 19,000 investment projects in Canada with a cumulative value of over \$1 trillion.⁴⁴ The review is not transparent, is based on vaguely defined criteria, and has few avenues for appeal. The government can also use the act for political purposes, such as when the act was used to block foreign buyers from taking over

⁴⁰ Source: OECD Country Statistical Profiles. Available online at <http://stats.oecd.org>.

⁴¹ This calculation is based on 1,700 hours of work for an average worker, per year.

⁴² See, for example: Daniel Treffer, “The Long and Short of the Canada-U.S. Free Trade Agreement” (2004); Alla Lileeva and Daniel Treffer, “Improved Access to Foreign Markets Raises Plant-level Productivity... For Some Plants” (2010); Loris Rubini, “Productivity During the Auto Pact and the Free Trade Agreement Between Canada and the United States,” Universidad Carlos III de Madrid, 2011; Marc Melitz and Daniel Treffer, “Gains from Trade when Firms Matter,” *Journal of Economic Perspectives* 26(2) (2012): 91-118.

⁴³ For an analysis of Canada’s restrictive foreign-investment policies and the potential productivity effect, see: Kristelle Audet and Robert Gagne, “Openness to Foreign Direct Investment and Productivity in Canada,” Center for Productivity and Prosperity publication, October 2010, http://cpp.hec.ca/cms/assets/documents/recherches_publicees/PP-2010-01_FDI_ANG.pdf.

⁴⁴ ICA’s Quarterly Statistics for 2012 – Quarter 2, Table 1 and Table 2. These statistics reflect operations under the Investment Canada Act and can be found online at: http://www.ic.gc.ca/eic/site/ica-lic.nsf/eng/h_lk00015.html.

MacDonald, Dettwiler and Associates and Potash Corporation, and in the delayed reviews of foreign bids for Progress Energy and Nexen. To improve access to capital, and ensure that Canadian firms are efficiently operated, our capital markets must become more open.

There are also domestic reforms that can serve to improve Canadian productivity. Related to our discussion of international trade, lowering barriers to inter-*provincial* trade can also have substantial productivity effects. Such barriers are not as obvious as tariffs or quotas across international borders but are no less real and no less costly. Some recent evidence suggests internal trade barriers between Canada's provinces lower national productivity and even increase income differences between provinces.⁴⁵ Education is also an obvious candidate where improvements might be possible, and there may be good reason to think that business education in particular can have a significant effect on productivity. Improvements in management knowledge and skill have been linked to productivity increases in the United States and in Canada.⁴⁶ Finally, innovation policy has also been cited as the reason for Canada's continued decline in global competitiveness. The OECD recently described Canada as a laggard in terms of research spending by business enterprises, at a rate of only 0.91 per cent of GDP, well below the typical OECD country's rate.⁴⁷ These reforms may or may not be the most pressing, but it is clear that Canadian policy-makers have many options to increase overall productivity.

CONCLUSION

Our analysis highlights the importance of recognizing that, in Canada, a large portion of intermediate inputs are imported. With a higher-value dollar, imported inputs become cheaper and production costs (and output prices) decline in response. This potentially offsets a large portion of the negative effect of currency appreciation from lower export demand. Depending on the sensitivity of export flows to the dollar, the positive contribution of cheaper intermediate inputs and lower prices may actually lead to an *increase* in manufacturing output and, therefore, employment. We find that within a reasonable range of export sensitivities, this is indeed a possibility.

⁴⁵ Trevor Tombe and Jennifer Winter, "Internal Trade and Aggregate Productivity," Laurier Centre for Economic Research and Policy Analysis Research Paper 2012-02, 2012.

⁴⁶ Michelle Alexopoulos and Trevor Tombe, "Management Matters," *Journal of Monetary Economics* 59(3) (2011): 269-285; and Michelle Alexopoulos and Trevor Tombe, "Managerial Knowledge and Canadian Productivity," working paper, University of Calgary, 2012.

⁴⁷ For a full report, see <http://www.oecd.org/sti/sti-outlook-2012-canada.pdf>.

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