



CANADA

SELECTED ISSUES

July 2018

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Approved By
**Western Hemisphere
Department**

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TAXING BUSINESS IN A CHANGING WORLD¹

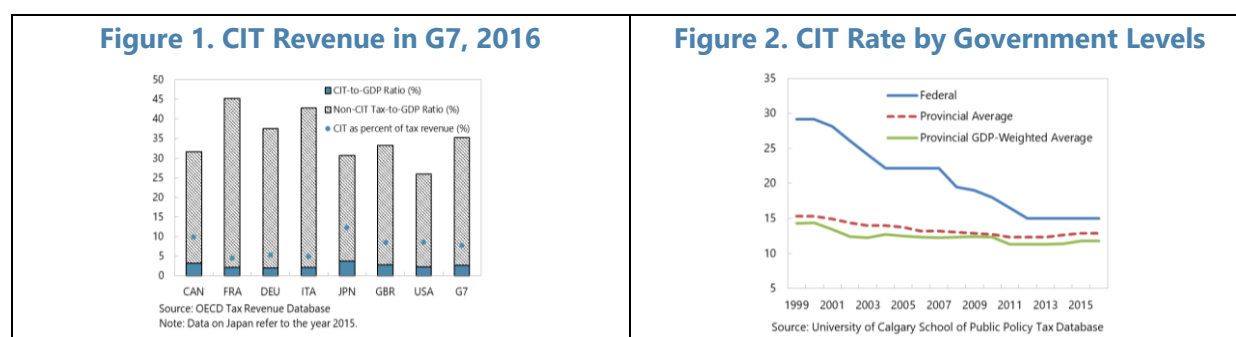
This paper reviews, and suggests possible improvements to, Canada's system of business taxation—focusing particularly on the implications of wider developments in the global tax environment. Section 1 provides an overview of current arrangements,² and identifies some sources of concern. Section 2 describes and considers the likely impact on Canada of recent developments in, and pressures on, the international tax order, including the landmark reform (known as the Tax Cuts and Jobs Act, TCJA) in the United States. Section 3 sets out some options for reform.

A. Taking Stock

This section reviews core features of the taxation of business income in Canada.

Revenue and Rates

1. Revenue from the corporate income tax (CIT) in Canada³ is relatively high. While fluctuating quite widely, revenue from the CIT (federal, provincial and in the territories) has consistently accounted for a larger share of GDP in Canada than in most other G7 countries (Figure 1). It generates around 10 percent of total tax revenue, also above the G7 average. For the provinces, their CIT accounts for about 15 percent of their total own-source revenue. Revenue from the CIT has held up despite a large reduction in the combined (federal plus provincial) average rate since 2000 (Figure 2). While the reasons for this robustness remain unclear, among the possible explanations is tax-induced migration from business operation as sole proprietor or in partnership to the corporate form,⁴ reflecting the substantial gaps between the top marginal rate of personal income taxation (PIT) and statutory rates of CIT⁵ (combined with provincial legal and regulatory changes that have allowed many regulated professionals to earn income through a corporate structure).



¹ Prepared by Michael Keen, Li Liu (both FAD); and Peter Harris (University of Cambridge).

² The paper does not address sector-specific issues, for example in relation to natural resources.

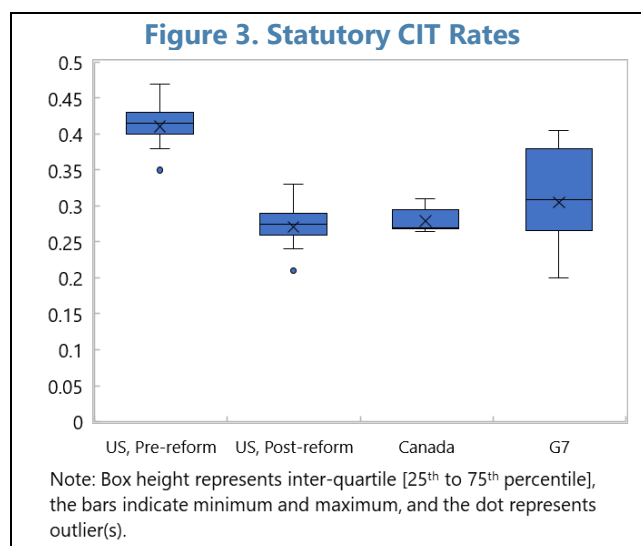
³ Figures for CIT revenue do not include receipts from resource royalties.

⁴ As suggested, for instance, Department of Finance (2017).

⁵ The gaps between the top PIT rate and the general (respectively, small business) CIT rate rose from about 3 percentage points in 2000 to 26 now (from 26 to 37 points).

2. At about 27 percent, the combined average rate of CIT (federal plus provincial) is towards the lower end of the G7 norm—but post-TCJA is now virtually the same as, rather than substantially below, the comparable average rate for the U.S.⁶ (Figure 3). Behind the averages,

however, variation in rates across the U.S. states is more marked than it is across the provinces, making the comparison of these averages especially misleading. Post-TCJA, the highest all-in rate in the U.S. is still 6.5 percentage points above the lowest rate in Canada, while the lowest U.S. rate (21 percent, in the six states that have no CIT⁷) is now 10 points below the highest in Canada. A full comparison also needs to consider taxes other than the CIT: four of the U.S. states without a CIT levy a gross receipts tax,⁸ for instance, while some provinces in Canada also levy a capital tax on financial institutions.⁹



‘Small’ Companies

3. Preferential rates of CIT are available to Canadian-Controlled Private Corporations (CCPCs).

The first CAN\$500,000 of profit is taxed at reduced rates of 10 percent at federal level (falling to 9 percent in 2019) and 0-7 percent at provincial level—implying a very large gap, of around 39 points, relative to the top rate of PIT.¹⁰ The benefit of the reduced rate is phased out at higher levels of taxable capital (between \$10-15 million at federal level).

4. The case for this favorable treatment is questionable. Experience¹¹ is that small companies as such are commonly not key drivers of growth and innovation, that the high effective marginal rates associated with withdrawal of the benefit of the reduced rate can discourage growth, and that reduced rates provide opportunities for the wealthy to avoid tax that are hard to deal with. The avoidance opportunities open to private corporations in Canada—which include, for instance, the advantage of generating passive income from lightly taxed income within the company rather than, say, from salary income—were recently the focus of a major and controversial consultation¹² and action announced in

⁶ The rates here are those generally applicable to domestic earnings of large corporations, and so do not reflect, for instance, the small business rate in Canada or the reduced FDII rate in the U.S. (both discussed later).

⁷ These are Wyoming, South Dakota, Washington State, Nevada, Ohio and Texas.

⁸ Washington State, Nevada, Ohio and Texas (ranging to a top rate of 1.5, 0.33, 0.26 and 2 percent respectively).

⁹ Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Prince Edward Island, and Saskatchewan, at rates of 4-6 percent.

¹⁰ Department of Finance (2017, p.12) increased by 1.5 points for the 2019 reduction in the federal rate.

¹¹ As reviewed, for instance, in International Tax Dialogue (2012). Chen and Mintz (2011) provide a powerful critique of the small business tax regime in Canada.

¹² Department of Finance (2017).

October 2017 and February 2018. They remain a source of considerable complexity, and the distortions and inequities associated with the small company tax rate are unlikely to have been reduced by its recent further reduction. In so far as smaller companies face particular difficulties accessing credit, this is best dealt with directly rather than by further distorting the tax system. And if the concern is to ease the distortions caused by the non-refundability of tax payments in the event of bankruptcy (which is more common for smaller firms), an alternative response is to provide a reduced rate up to some cumulative level of profits over time (though experience shows this can bring administrative difficulty). A stronger case can perhaps be made for supporting start-ups and young entrepreneurs, though this can be difficult to implement without creating its own avoidance opportunities.

The Tax Base

5. The central elements of the CIT base are closely aligned between federal and provincial¹³ governments. Provinces that have entered into a Tax Collection Agreement¹⁴ agree to adopt the federal base, with relatively minor differences, in return for collection of the tax virtually free of charge, by the Canada Revenue Agency (CRA). Features of the common base that are central to the issues addressed here are:

- **Depreciation allowances are likely somewhat accelerated relative to true economic depreciation.** Such acceleration is common international practice, and is explicit policy in relation to machinery and equipment used for manufacturing and processing, for instance, which is depreciated at 50 percent declining balance, compared, for example, to an estimated economic depreciation of 17 percent for industrial machinery.¹⁵
- **Interest is fully deductible, subject only to a thin capitalization rule on payments to related parties abroad.** Even that rule appears weak: interest payments to third parties on debt that is guaranteed by the parent company are excluded from its application and the rule does not cover the financing element of financing leases.
- **Only 50 percent of capital gains realized by corporations are included in the CIT base,** a feature returned to below.
- **Other than the reduced rate for small businesses, the capital gains exclusion and an R&D credit that is quite generous by international standards, corporate tax incentives appear to be modest.** They are mainly at provincial level,¹⁶ and of limited scope; they are not examined here.

¹³ Including throughout the paper, the territories.

¹⁴ Quebec administers its own CIT and personal income taxes; Alberta administers its CIT but participates in the federal-provincial collection scheme for the personal income tax.

¹⁵ Statistics Canada (2015), Table 11.

¹⁶ These usually take the form of investment tax credits that reduce provincial liability.

International Aspects of the CIT

6. **Canada operates a *de facto* territorial form of international taxation for active income**, with four key elements:

- ***Subject to Canada's Foreign Accrual Property Income (FAPI) rules,¹⁷ distributions from subsidiaries in jurisdictions with which Canada has a tax treaty or Tax Information Exchange Agreement (TIEA) are untaxed ('exempt surplus')***. Since Canada has treaties or TIEAs with 116 jurisdictions, this provides considerable scope for tax-free repatriation, routed to minimize withholding taxes. There is believed to be some stock of unrepatriated earnings accumulated abroad that would be liable to tax in Canada; it would be useful to quantify their scale, which appears to be unknown.¹⁸
- ***The FAPI rules bring certain types of passive income earned abroad immediately into tax in Canada***. The difference between the exempt surplus rules and the CFC rules is, respectively, full exemption irrespective of the level of foreign tax paid vs. full taxation on a current basis (with a credit-type mechanism for foreign taxes paid). This places extreme pressure on the definitional rules of the CFC regime.
- ***Canada has a full range of withholding taxes on outbound payments which are reduced, but often not eliminated under tax treaties***. Under the treaty with the U.S., interest and royalties on copyright, patents and software are not subject to withholding, while dividends (on shareholdings of more than 10 percent) are withheld at 5 percent.
- ***Canada has little in the way of rules that allocate interest and other expenses between domestic and foreign source income***, which risks excessive allocation of expenses to Canada.

Personal Income Tax—Key Features

7. **The progressivity of the PIT rate structure is marked by current international standards:** the top (federal plus provincial) marginal rate is in the order of 53-54 percent (in New Brunswick, Nova Scotia, Ontario, and Quebec) and sets in at a relatively modest level of income. Three specific features are particularly important for the taxation of business activity.

8. **The first key feature is the widespread availability of savings schemes that in effect exclude the normal return from tax,¹⁹** (Such schemes are less readily available to business owners, but individuals disposing of qualified small business shares have a lifetime capital gains exemption of

¹⁷ These are a form of what are referred to more generally as Controlled Foreign Corporation (CFC) rules.

¹⁸ Smart (2010, p.9) reports that as of 2009 around 7 percent of Canadian FDI was in non-treaty/TIEA jurisdictions.

¹⁹ Notably the Registered Pension Plan and Registered Retirement Savings Plan (under each of which contributions are deductible and withdrawals fully taxable), and Tax-free Savings Accounts (under which capital income is exempt).

around \$850,000 in 2018). The alternative to direct investment in business is thus in many cases a PIT-free return. Boadway (2017) reports that if full advantage were taken of the opportunities for PIT-free saving, about 70 percent of all capital income of Canadian taxpayers could be in some way excluded from tax. The system thus has important elements of expenditure tax treatment.

9. Second, the federal and provincial governments provide non-refundable²⁰ dividend tax credits that largely reflect a presumption that the underlying profits have been fully taxed at the domestic corporate tax rate. However, the availability and extent of this credit is based on notional, not actual, Canadian CIT paid, the most extreme example being that full credits are granted with respect to redistributed foreign dividends paid from exempt surplus. While the intention of the credit is to integrate corporate and personal level taxation, it is subject to some criticism in its current form:

- ***The rationale for giving the credit when no Canadian tax—and, especially, when little or no tax at all—has been paid is unclear.*** Reluctance to give credit for foreign taxes was a primary reason, for instance, why, given European Court of Justice decisions that not to do so in respect of other member states would be discriminatory, EU countries²¹ moved away from similar dividend tax credit systems.

In a small open economy, dividend tax credits may have limited impact on domestic investment, and may forego an efficient source of revenue.²² For an economy that is small in world capital markets, a reasonable benchmark assumption is that the after-corporate tax return on investments is fixed exogenously on those markets. Measures that reduce or offset taxes paid at corporate level then have no impact on the level of domestic investment. And to the extent that tax bears on the normal return to capital, the effect of the CIT is to reduce investment while leaving the after-tax return to capital unchanged: the real incidence of the tax then falls on immobile factors (whose productivity is reduced by the lower capital stock), not on shareholders. To the extent, on the other hand that the CIT bears on rents,²³ the credit merely dissipates tax revenue of a particularly efficient kind.

10. Third, only 50 percent of realized capital gains are included in the PIT base. This opens up large and potentially problematic wedges between the top rates of tax on returns received as ordinary income or as dividends and those received on the disposal of shares, creating tax mitigation opportunities (and distortions) by tax-favoring the retention of profits within the company.

²⁰ Excess credits (which may arise, for example, when the taxpayer has a low marginal tax rate or has expenses associated with dividends) may, however, be set against tax imposed on other income.

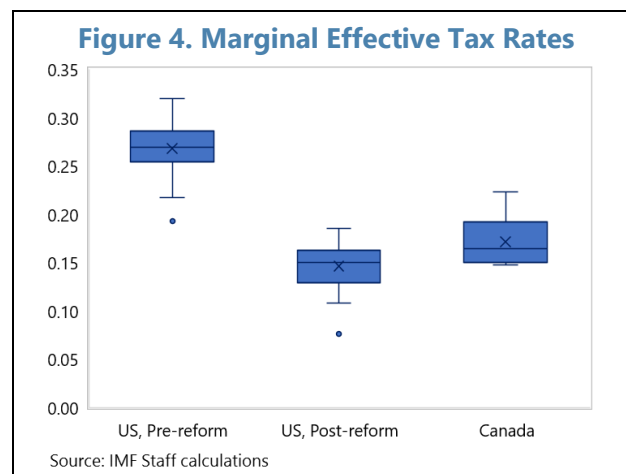
²¹ Harris (2010).

²² See Boadway and Bruce (1992), and on the possible welfare implications, Smart (2018).

²³ That is, on the amount by which the return that the company earns exceeds the minimum required by investors.

Distortions to Investment

- **Marginal effective tax rates (METRs)²⁴ have fallen substantially in the U.S., on average, to around the same level as those in Canada.** (Figure 4; see also Mintz (2018)).²⁵ This is so when the comparison takes account not only of CIT parameters but of unrecovered sales taxes on business purchases—which, given the prevalence of value added tax treatment under the Goods and Services Tax (GST) in Canada, is noticeably more prevalent in the U.S.



11. Care is needed, however, in drawing conclusions from comparisons of average METRs. All METR calculations need to be interpreted with great caution. Their sensitivity to a variety of underlying assumptions means that they should be interpreted as no more than indicative, with little significance attached to small differences. Beyond this, however, it should be stressed that:

- **Measures that stimulate investment in the U.S. do not necessarily reduce investment in Canada or elsewhere,** a point taken up below.
- **Investment decisions may also be independently affected by the statutory rate** since, all else equal, multinationals prefer to base their businesses in locations that will tax their profits least heavily. For example, two countries might both offer rent taxes (as discussed later) levied at different rates but both providing an METR²⁶ of zero: a multinational faced with the discrete choice of where to locate would then be expected to choose that with the lower tax rate.
- **Averages conceal significant variations not only across provinces and states, but across both assets and source of finance:** The METR on debt-financed investments in plant and machinery, for instance, is commonly negative, implying that at the margin (and all else equal) the tax system induces such investments to take place even though, in the absence of tax, they would be unprofitable. On the other hand, for equity-financed investments the METR is generally positive, ranging within Canada from 10 percent for plant and machinery to 40 percent for buildings. Taking account of the variation in statutory CIT rates across the provinces, the debt-financed METR for plant

²⁴ The METR is the wedge between the pre- and post-tax return on an underlying investment which just yields the investor their required post-tax return (expressed as a proportion of the former). Since input taxes create such a wedge just as do features of the CIT, they are appropriately included in its calculation.

²⁵ The calculations in Figure 4 apply statutory rates of sales taxation, and so will over-estimate their impact given the exemptions that in some cases apply to business purchases. (Those used to produce output subject to sales taxation, for instance, are in broad terms commonly exempt in the U.S.). The calculations also do not take into account, however, investment tax credits in Canada.

²⁶ Taking account only of CIT.

and machinery in Nova Scotia is -75 percent, whereas for retention-financed investment in buildings in Newfoundland and Labrador the METR is 31 percent. There is variation in the U.S. too, of course, including as a consequence of the 'FDII' provision touched on below (and not reflected in the calculations above). Dispersion in METRs signals distortions to the composition and financing of investment decisions that is a distinct source of efficiency loss in itself.

- **Any positive METR implies a tax disincentive to investment in real assets.**

Distortions to Financing

12. For larger corporations, there is likely a strong incentive to use debt finance. This is so in two respects:

- **As one means of profit shifting.**²⁷ With few effective limits on interest deduction, there is potential to use interest payments to reallocate taxable income from high rate jurisdictions to low, both internationally and within Canada.²⁸ The primary policy concern with such 'debt shifting' is that it erodes revenue.
- **As inherently tax-preferred to equity.** In many contexts—corporate groups that finance themselves in global markets, or whose shareholders are effectively tax exempt on their capital income (pension funds, and those saving in tax-advantaged forms, being prominent instances)—the deductibility of interest but not of the return to equity creates a distinct CIT advantage to debt finance. Apart from the distortion to firms' operations and governance mechanisms that this implies, the excess leverage induced by such 'debt bias' potentially amplifies risks to financial stability.

13. There appears to be no direct evidence for Canada, and the severity of these issues is unclear. The ratio of corporate debt to GDP in Canada has risen markedly since 2012, and is now at an all-time high; but it is broadly in line with international norms; and the ratio of corporate debt to equity and assets has not increased markedly.²⁹ A substantial body of evidence from other countries, however, does suggest that both debt shifting and debt bias can be substantial.³⁰

14. For high income owners of CCPCs, on the other hand, the primary distortion is likely to be towards retention finance, as a consequence of the very low CIT rate (making debt less attractive) and light taxation of capital gains (with significant taxation of dividends remaining, for higher rate payers, after the dividend tax credit).

²⁷ There are of course also others, such as the payment of management fees and royalties.

²⁸ The latter is relevant for firms that operate through separate but related entities in different provinces. See Mintz and Smart (2004).

²⁹ Statistics Canada CANSIM Table 378-0122; and IMF Financial Soundness Indicators, available at: <http://data.imf.org/?sk=51B096FA-2CD2-40C2-8D09-0699CC1764DA>

³⁰ See for instance Huizinga and others (2008) on debt-shifting and IMF (2016) on debt bias.

Federal-provincial Interactions

15. The prominence of the provinces in corporate taxation is very marked³¹—and, for some, a cause for concern. It runs counter to the standard prescription for tax design in federations that the central government have control over taxes levied on bases that are mobile within the union, capital being a prime example. (This does not, of course, prevent some degree of revenue sharing). The underlying concern is that decentralizing powers over mobile tax bases will lead to excessively intense tax competition. While that incentive for ‘horizontal’ tax competition between the provinces exists in Canada, equalization arrangements counter this and imply (for recipient provinces) an incentive to set tax rates higher than would otherwise be the case, since the contraction in the provincial tax base that raising their rate would otherwise induce will be offset to some degree by increased receipt of transfers.³² There is indeed some evidence that provincial CIT rates are so high as to cause significant efficiency losses, and in several provinces may even be above the level at which they maximize provincial revenue.³³ Some³⁴ have thus suggested some degree of transfer of powers in corporate taxation to the federal government that can take a more complete view of the national interest.

16. What is critical, however—especially in these times of considerable uncertainty—is close coordination between federal and provincial governments. The record in this area is evidently good, with quite limited cross-province variation in either rate or base. And the provinces did not increase their own tax rates to take up room vacated by federal rate cuts in the early 2000s. Such cooperation is likely to be critical in shaping a coherent response to the pressure emerging from developments in international taxation beyond Canada, to which we now turn.

B. Changing Times

17. Canada is deeply exposed to developments in the wider international tax system. As an active and respected participant in the discussions underway in global forums, Canada will play its part in shaping the direction that the international tax order takes. At the same time, however, it must fashion its own response in a way which recognizes that it is both a very open economy and a relatively small player in world capital markets, and so needs to adapt to pressures created by current and prospective developments elsewhere. This applies to both cooperative programs in which Canada participates and unilateral measures adopted by others.

³¹ Though not unique: corporate taxation is a cantonal matter in Switzerland, and in Germany the local *Gewerbesteuer* accounts for a larger share of all corporate tax than do the provincial CITs in Canada.

³² Smart (1998). Broadly speaking, while the mechanics of the equalization arrangements can be expected to affect the level of provincial taxes they would not in themselves be expected to affect the responsiveness of provincial taxes to, for instance, changes in the federal rate or competing rates in the U.S.

³³ Dahlby and Ergete (2018).

³⁴ Such as Boadway (2017).

18. Policy choices must recognize the current unprecedented fluidity and uncertainty in international tax matters, with even the basic elements of the system under challenge. Key contributing factors here are:

- **'BEPS' implementation:** Canada is a member of the OECD Inclusive Framework on BEPS (Base Erosion and Profit Shifting) and so is committed to implement the four minimum standards³⁵ that emerged among the outcomes of the G20-OECD BEPS project. This creates few issues in itself—Canada is committed to and in the process of fulfilling its obligations³⁶—but there are more general concerns as to whether the broader implementation process will, for example, result in more extensive cross-national tax disputes (IMF and OECD (2017)).
- **Digitalization:** There are strong differences of opinion as to whether current international tax norms deal appropriately with business practices that involve substantial activity with little if any physical presence and which exploit information acquired from users—or whether, on the other hand, these now call for some element of profit taxation in the 'market country' (that in which purchasers/users of the product are located). This latter view points to far-reaching changes in the century-old norms of international taxation. In its recent interim report, the OECD (2018) remained agnostic on the need for a new approach. The European Commission, in contrast, has proposed a turnover tax on selected services³⁷ as a temporary response while arguing for an expanded notion of permanent establishment as a longer-term solution;³⁸ this seems far, however, from having the necessary unanimous support among the member states. Responding to a request from the Canadian House of Commons Standing Committee on International Trade, the government has stressed its commitment to multilateral discussions on possible updates to international tax norms to reflect new digital business models.³⁹
- **Unilateral reforms elsewhere...** The global trend towards lower statutory rates of CIT continues. Belgium, for instance, has recently reduced its rate, while Australia and France have expressed the intention to reduce from 30 to 25 percent and from 33.33 to 25 percent respectively. It may be that as BEPS implementation succeeds in reducing the scope of tax avoidance, so pressures for governments to compete through rates and other devices increases (Keen, 2018). At the same time, significant structural measures to curb perceived avoidance have been taken unilaterally, such as the

³⁵ These relate to: harmful tax practices, treaty abuse, country-by-country reporting and dispute resolution mechanisms.

³⁶ The BEPS minimum standards are subject to peer review. So far Canada has been assessed as having no harmful tax regime, has the legal framework and exchange network in place for country-by-country reporting and its dispute resolution mechanisms have been reviewed. Canada awaits review of measures for preventing treaty abuse, but is a signatory to the Multilateral Instrument that will amend its tax treaties to incorporate the minimum standard in this respect.

³⁷ Some countries, including India and Italy, have already adopted measures of this sort.

³⁸ European Commission (2017).

³⁹ At <http://www.ourcommons.ca/DocumentViewer/en/42-1/CIIT/report-9/response-8512-421-379>

adoption of a diverted profits tax⁴⁰ by both the UK and Australia. And, related, a number of actions have as noted above been adopted and more proposed in relation to digitalization.

- **...especially the recent tax reform in the United States.** The TCJA is a major and in many respects novel reform with the potential to fundamentally reshape international tax norms. Proximity and a largely integrated North American market make it especially germane for Canada: more than half of all foreign direct investment in Canada, for instance, is U.S.-owned.

19. There is considerable uncertainty as to the impact of the TCJA, not only in Canada but more generally. Many of the international provisions (discussed below) remain to be fully described; their novelty and complexity are such that practitioners are still assessing their implications; several provisions are projected to change significantly over time; questions have been raised as to the consistency of some provisions with WTO rules, tax treaties, and the minimum standard on harmful tax practices of the G20-OECD project on Base Erosion and Profit Shifting; and some observers have stressed that the legislation lacked bipartisan support. The discussion here focuses on broad features of the TCJA, and is necessarily speculative.

20. The sharp reduction in the federal CIT rate in the U.S. substantially reduces Canada's relative appeal for mobile investments and increases its exposure to the shifting of profits to the U.S.... Including average state and provincial CIT rates, what was a substantial advantage for Canada in the difference in statutory CIT rates has now turned into broad equality (Figure 2).⁴¹ This matters for two reasons.⁴² The first is a potential impact on real investment: to the extent that companies (both Canadian and U.S.) serve effectively the same market wherever they locate, they have an incentive to locate wherever their profits will be more lightly taxed. The second is a potential impact on profit shifting, as companies have an incentive to take deductions—such as interest paid and purchases of goods and services—where statutory rates are high and take their receipts where taxes are low. Prior to the TCJA, this generally pointed to shifting profits out of the U.S. and into Canada—to the benefit of tax revenue in Canada. Now that incentive is weakened, and may be reversed. Provincial and state taxes begin to matter, in a way that simple averages may conceal. For instance, the gap in statutory rates between British Columbia and neighboring Washington state is 12 percentage points, and that between Manitoba and North Dakota is about 4 points.⁴³

21. ...while also, combined with the move to immediate expensing, substantially eroding the gap in METRs between the U.S. and Canada. As noted, while a reduction in METRs in the U.S. can be expected to increase investment there, that does not necessarily imply any effect on investment in

⁴⁰ These measures are largely targeted at avoidance of taxable presence such as a permanent establishment and so arguably are also related to issues of digitalization.

⁴¹ For CCPCs, the lower rate of CIT continues to confer significant advantage. (See, however, Boidman (2018) on the complexities that arise in comparing the treatment of reinvested business profits in the U.S. and for CCPCs).

⁴² There is of course also a substantial benefit to Canadian owners of U.S. corporations.

⁴³ It would of course be even more advantageous for US firms to shift profits to jurisdictions with lower tax rates than Canada, but there is evidence that physical presence in a country facilitates shifting profits there.

Canada, which depends most directly on METRs in Canada. Indeed, in the simple model upon which derivation of METRs commonly relies, with firms operating in competitive markets and unconstrained in their ability to raise capital, one might not expect the METR in the U.S. to affect investment in Canada at all. More realistically, however, if companies are constrained in the total amount of investment they can undertake, or can effectively serve and are able to derive some rent from the same market wherever they locate, then a reduction in the U.S. METR might indeed reduce investment in Canada.

22. While subject to many caveats, an empirical analysis summarized in Appendix 1 suggests that the reaction of U.S. multinationals to the reduction in the U.S. statutory rate and average METR could well include significant reductions in their real investment in, and profit shifting into, Canada. Using a short panel of aggregate data on foreign multinationals' assets held in Canada, in the preferred point estimates reported there:

- Real assets held in Canada by U.S. multinationals are projected to fall, in the long run, by 6 percent,
- Reduced profit shifting into Canada by U.S. multinationals is estimated to reduce the profits they report in Canada by around 15 percent, ...
- ...which together imply a reduction in the CIT paid by U.S. multinationals in Canada (currently about 15 percent of all CIT revenue) of close to one quarter.

23. These results need to be interpreted with great caution. Among the many caveats, for example, is that the sample does not contain any change in the U.S. rate, nor is it long enough to meaningfully capture rate changes in Canada. Nonetheless, the results are not out of line with the wider literature on these issues. For instance, Beer and others (2018), using firm-level data covering many other countries (but not Canada), suggests a loss of CIT revenue attributable to the TCJA, arising from reduction in both real investment and reported profits, of around 1.58 percent of total MNC tax revenue (with the highest percentile of 6 percent).

24. Investment and profit shifting responses can also be expected from non-U.S. businesses. Canadian companies exporting to the U.S. may now find it advantageous to produce there; and perhaps even to produce there for sale into Canada (especially given the FDII provision discussed below). They may also incline towards more equity- and less debt-financing of U.S. subsidiaries, shifting tax revenue from Canada to the US. These concerns have been highlighted by business⁴⁴ and some commentators.⁴⁵ They remain unquantified, but are evidently a significant cause for concern.

⁴⁴ Ernst and Young (2018) report that more than half of 165 surveyed executives thought it likely they would shift revenue or risk functions to the U.S. following TJCA, and nearly one-third expected to reduce investment in Canada.

⁴⁵ See for example Mintz (2018).

Box 1. Three Novel International Provisions of the TCJA 1/

Foreign Derived Intangible Income (FDII). Domestic corporations receive a 37.5 percent deduction from the corporate tax base for FDII, which is calculated as the income of the corporation in excess of 10 percent of qualified business asset investment multiplied by the share of foreign-derived income to total income (all calculated on a consolidated group basis). This effectively reduces the CIT rate for such income from 21 to 13.125 percent. Questions have been raised on the consistency of this provision with WTO rules and the BEPS minimum standard on harmful tax practices.⁴⁶

Global Intangible Low Taxed Income (GILTI). As an important qualification of the move to territoriality, the TCJA imposes a minimum tax on overseas income that is in excess of 10 percent of the return on tangible assets. Specifically, it taxes at the standard U.S. CIT rate, and on accrual, the income of U.S. CFC's earned in all foreign jurisdictions that exceeds 10 percent of qualified business asset investment (i.e., the depreciated value of tangible fixed assets of those controlled foreign corporations)—but with a deduction for 50 percent of that income. Credit is also given for 80 percent of the foreign tax paid on such income. The effect is to impose a minimum rate on GILTI income of 10.5 percent on such income (when no tax is paid abroad) with the U.S. liability wholly eliminated if the average foreign tax rate paid is at least 13.125 percent.

Base Erosion and Anti-Abuse Tax (BEAT). The TCJA applies a base erosion provision to large multinational companies⁴⁷ (annual gross receipts over US\$500 million in the preceding 3 years) that make certain cross-border payments to affiliates that exceed 3 percent of their total deductible expenses. The payments targeted are those (such as interest, royalties, and management fees) that are commonly associated with profit shifting, but the provision does not apply to items characterized as cost of goods sold. Specifically, the BEAT imposes a minimum tax that is a fixed percentage⁴⁸ of a concept of "modified" taxable income that adds back into income the deductions claimed for these categories of cross-border payments to affiliates. Questions have been raised as to the consistency of this provision with tax treaties.

1/ These descriptions are much simplified: for instance, the allocation of domestic expenses to foreign earnings can mean that U.S. tax is payable under GILTI even when the foreign tax rate exceeds 13.125 percent.

25. The international provisions of the TCJA, especially some of the more novel, may also come to have a substantial impact on Canada.⁴⁹ The move towards territoriality (qualified by the GILTI provisions) means that earnings repatriated to the U.S. will no longer be subject to taxation there (with credit for Canadian taxes paid). To the extent that earnings were indeed repatriated, this implies a reduction in the effective tax rate on, and so might encourage, such investments. Tending in the opposite direction, however, the U.S. change also suggests a removal of a lock in effect. Once the profits were derived in Canada there was an incentive to keep those profits under Canadian control. Now it is easier to withdraw profits from Canada, so reinvestment may be less. Experience with the movements to territoriality in the UK and Japan has been an increase in outward investment in lower tax countries:⁵⁰ But

⁴⁶ Academic views on this are divided: Kamin and others (2017) argue that the FDII regime "is likely an illegal export subsidy in violation of WTO agreements"; Sanchirico (2018) concludes that it is not clearly in breach.

⁴⁷ This includes both U.S. companies and foreign companies with income effectively connected with a U.S. trade or business but does not cover individuals, S-corporations, regulated investment companies or real estate investment trusts.

⁴⁸ The rate is set at 5 percent for 2018, 10 percent for 2019–2025, and 12.5 percent thereafter.

⁴⁹ These are not captured in the empirical results just reported.

⁵⁰ For example, investment in Europe by U.K. MNCs is estimated to have increased by 15.7 percent in countries with lower statutory CIT rates than the UK (Liu, 2018). And for Canada itself, Smart (2010) finds a significant increase in outward FDI from Canada associated with the expansion of the treaty/TIEA network and hence of exempt surplus treatment.

the effects at work in the present context seem likely to be relatively muted given the ease with which repatriation could be and in many cases was deferred. The transition tax that now brings unrepatriated earnings into tax (at reduced rates) in the U.S. over the next eight years is a one-off that seems unlikely to have significant impact even in the short term.⁵¹ The distinctive measures summarized in Box 1, however, may prove to have, to varying degrees substantive implications for Canada:

- ***FDII may amplify the tax advantage of serving Canada from the U.S.*** that is created by the reduction in the statutory rate: for producers able to achieve a return on tangible assets located in the U.S. over 10 percent, that part of the return is taxed at the still lower rate of 13.125 percent.⁵² Transactions costs are likely to limit the shifting of tangible assets back to the U.S. But for companies already producing for export in the U.S., the implied tax advantage of producing in the U.S. for export to Canada may already be in play for a range of companies. And the effect could be significant: had FDII been in effect in 2014, one estimate is that around 9 percent of all U.S. companies and 13 percent of multinationals would have been eligible for FDII, with a particularly heavy concentration in manufacturing.⁵³
- ***At the same time, however, FDII can also encourage the location of tangible assets outside the U.S.,*** so as to increase the return on tangible assets in the U.S. and thereby increase the likelihood of the reduced rate coming into play.
- ***GILTI creates an incentive to locate tangible assets outside the U.S., including in relatively high tax countries such as Canada.*** This is because doing so increases the 'deemed' tangible income outside the U.S., and so reduces the amount of GILTI subject to tax. (Hence, bearing in mind FDII too, the international provisions of the TCJA are sometimes caricatured as encouraging the location of intangible assets in the U.S., and the location of tangible assets outside).
- ***One wider effect of the GILTI provisions may be to induce changes in the business models of some low tax jurisdictions*** (since those low rates may no longer be so effective in attracting highly mobile income). If so, a consequent reduced exposure to profit shifting towards such jurisdictions will be an indirect source of benefit for Canada and other relatively high tax countries.
- ***The impact on Canada of the BEAT seems likely to be limited.*** Since the reversal of the differential in statutory rates for larger companies largely eliminates any incentive to shift profits directly from the U.S. to Canada, the BEAT may have little direct bite, though there may be an indirect effect for Canadian operations financing their U.S. operations through low tax jurisdictions.

⁵¹ Other than reducing (perhaps substantially) the cost of repatriation of existing profits from Canada: Canadian dividend withholding tax will now be the only barrier for repatriation of existing retained profits.

⁵² On marginal effective tax rates under FDII, see Chalk and others (2018) and Beer and others (2018).

⁵³ Dowd and Landefeld (2018).

26. The generous treatment of small businesses in Canada means that they may be less affected by the TCJA. For large corporations, several aspects of the reform tend to switch the balance of advantage away from Canada and towards the U.S. Even with the rate reduction and FDII for C-corporations, however, and the top federal marginal rate for eligible pass throughs in the U.S. of 29.6 percent,⁵⁴ the low CIT rates in Canada for small corporations combined with the dividend tax credit and 50 percent exclusion of capital gains will often preserve more favorable treatment in Canada.⁵⁵

27. The balance of risks to Canada from the TCJA (to investment, activity and tax revenue) is firmly to the downside and focused on larger corporations—but the extent of the risk remains very unclear. Practitioners are still grappling to understand provisions that are complex, still incompletely defined and whose continuation into the medium term is not universally regarded as assured.

C. Looking Forward

28. The Canadian tax system has considerable coherence, but the strategy it embodies is coming under increasing pressure. Key elements of that strategy include: what is by international standards heavy reliance on a sharply progressive PIT rate structure (with a weighted average top marginal rate of about 52 percent), and beginning at a relatively low level of income—around one-third of that in the U.S.); a significant degree of integration with the corporate tax (in a form that is now quite rare);⁵⁶ particularly favorable treatment of small businesses; consumption tax treatment for a broad range of savings; and relatively modest reliance on the GST as a source of revenue (accounting for about 23 percent of total taxation, compared with the OECD (unweighted) average of 33.3 percent). The most evident pressures for change come from the large differential between the top rate of PIT and the rate of CIT, averaging around 25 points (and around 39 points for small businesses): the highest in the G-7 countries and 9 points above the OECD average). Responses therefore need to consider coherence of the wider system. Reducing the overall rate of CIT, for instance, risks exacerbating the difficulty of distinguishing between income taxable immediately at high marginal rates (such as employment income) and income that may be sheltered behind the corporate tax rate, at least until distribution. More generally, as it becomes increasingly hard to sustain such high rates of tax on capital income, the wider question arises as to the sustainability of the current tax strategy.

29. There are some ways in which coherence could be improved, but the wider pressures at work mean the time is ripe for a fundamental and independent review of the Canadian tax system. Box 2, drawing on parts of the discussion above, sets out some changes that could enhance the effectiveness of the tax system within its own terms and without unduly prejudging possible wider

⁵⁴ This is achieved by granting businesses a deduction equal to 20 percent of their income, capped by reference to the greater of 50 percent of certain wages paid, or 25 percent of those wages plus 2.5 percent of certain depreciable tangible property held by the business. This will of course be increased by applicable state taxes.

⁵⁵ Except perhaps in the case of dividends paid to high income CCPC-owners.

⁵⁶ Australia and New Zealand are the two main examples of OECD countries that still generally attempt to tax distributed corporate profits at shareholder marginal rates.

reforms. More is needed, however, to address the systemic issues. There have been a number of reviews of key aspects of the Canadian tax system, including the 1997 Technical Committee on Business Taxation and the 2008 Godsoe Report on international taxation.⁵⁷ Given however the interlinkages between all parts of the tax system, and the substantial changes in the tax environment over recent decades, there is a strong case for a holistic and independent review—the first since the Carter Review of 1966.⁵⁸ This could provide an opportunity to reassess not only corporate taxation but the wide architecture of the system: whether there is a case, for instance, for a more schedular approach to the treatment of capital and labor income (as in many Nordic countries), for some shift in the balance from direct to indirect taxation, and for the allocation of taxing powers between provinces and federal governments. While these issues go far beyond the scope of the paper, the considerations raised above can help frame the closer analysis needed.

Box 2. Improving the Coherence of the Current System

- Excluding 50 percent of the capital gain on inter-corporate shareholdings sits uneasily with exemption of inter-corporate dividend payments, both being ways of transferring value along the corporate chain. This creates a prima facie case for exempting corporate gains on the disposal of shares while, consistent with the logic of imputation, fully taxing other gains.
- For the reasons in Section A, there is a strong case to reconsider the purpose and role of the small business rate.
- Rebalance the tax treatment between small business taxed to individuals on a transparent basis and small business taxed as a company. The current differential in the tax treatment of business profit retention is a substantial distortion. There might be consideration, for instance, of whether small companies could be taxed on a transparent basis or sole proprietorships and partnerships taxed like companies.
- Review dividend tax credit arrangements with a view to their restructuring and reduction, for reasons outlined in Section B. The treatment of distributions out of exempt surplus seems overly-generous and potentially distorting; at a minimum, consideration should be given to limiting it to distributions from subsidiaries in countries that have a full tax treaty with Canada (and not simply a TIEA). More fundamentally, however, it is not clear that these arrangements enhance either efficiency or fairness.
- Canada has an important role to play in in the international dialogue seeking a coordinated way forward to address the BEPS-identified risk of substantial market penetration without taxation. It will be important too to reflect on whether Canada might ultimately move towards greater taxation of profits in order to ensure that Canadian enterprises competing at home are not disadvantaged.

Navigating the International Tax Environment

⁵⁷ Department of Finance (1997, 2008 respectively). The Department also produces an annual report on tax expenditures. At provincial level, there has also been a recent review of the tax system in Quebec (Gouvernement du Québec, 2015).

⁵⁸ Ernst and Young (2018) find considerable business support for such a review.

30. The current unprecedented uncertainty in international tax matters argues for a cautious approach to CIT reform... Fragmentation of policy responses to the international tax consequences of digitalization for instance, risk undermining—to comparatively modest national gain—the progress that has been made under the BEPS project in strengthening tax cooperation. With the OECD aiming to arrive at consensus approach by 2020, or perhaps 2019, there is a strong case against immediate action.

31. ...including in any response to the U.S. tax reform. While the risks to Canada are clear, their extent will not become clear for some time: hasty action could overshoot the appropriate response. There are, nonetheless, some guidelines for navigating through a system in some flux in such a way as to improve efficiency and limit risks of profit shifting.

32. Since the most immediate risk is of enhanced profit shifting out of Canada, the adequacy of anti-base erosion protections merits close attention. Possibilities for consideration here include:

- **Extend thin capitalization rules to borrowing from unrelated parties**, and perhaps to domestic transactions too. Policing a distinction between related and third parties is inherently problematic, and deduction of internally generated group debt that is not reflected in group third party debt is a continuing problem. Moreover, substantive problems of debt shifting can arise domestically between the provinces, and debt bias concerns arise predominantly from borrowing outside the corporate group. Thin capitalization rules, nonetheless, are an inherently blunt instrument and do not address the fundamental problem of a fundamental tax distortion towards debt finance.
- **Consider similar anti-base erosion measures for other types of deductible payments that are subject to minimal or limited withholding tax.** This is particularly the case with rents and royalties, but service fees are another problematic area. An extreme response would consider the coordination of anti-base erosion measures for all types of relevant deductible payments.
- **Address the risk of inappropriate allocation of expenses to Canada.** Deduction against domestic income of expenses related to foreign source income is potentially a significant form of base erosion. This is especially so for interest expense incurred in deriving exempt foreign dividends. A lack of prescriptive allocation rules facilitates stuffing foreign low-tax subsidiaries with profits and loading Canadian parents with expenses. Addressing this may require more prescriptive rules in allocating expenses between domestic and foreign activities. In relation to foreign branches of Canadian companies, allowing the deduction of foreign losses effectively allows foreign expenses to reduce domestic source income; this merits reconsideration.

33. There are many instruments—perhaps some as yet unthought of—by which investment in Canada can be encouraged and profit shifting discouraged, each with strengths and costs. Now being a time in which countries are showing ingenuity in international tax policies, there may be scope for novel measures which, while consistent with international obligations, are tailored to Canada's particular circumstances. More obvious are responses through the statutory rate and/or the treatment of investment:

- **Reductions in the statutory rate are best targeted to discouraging profit shifting—but can be expensive** because they confer a windfall benefit to past investments. There may well be further pressures to reduce the rate for large businesses: one estimate is that the rate reduction in the U.S. may eventually spur reductions elsewhere in the order of 4 or so percentage points.⁵⁹ As discussed above, there is likely to be less pressure on the small business rate; indeed there remains a strong case for moderately increasing it. And it will be important too to preserve effective taxation of location-specific rents, most obviously in the natural resource sector.
- **Revenue concerns can be mitigated to some degree by phasing any necessary reduction in the rate.**, as has been the case in the past. Phasing brings its own distortions, creating incentives to bring investment forward (so as to take investment-related deductions when the tax rate is high and profits when it is low) and, by the same token, to exploit timing opportunities to bring expenses forward and shift profits into the future. It may also add complexity to the dividend tax credit during the transition period, though experience is that these difficulties have proved manageable. These are likely to be prices worth paying, however, to limit a loss of revenue that simply conveys a windfall benefit on companies' owners.
- **Close coordination between federal and provincial governments, which appears to be well-established, would be needed** to consider how best to share any reduction in the combined rates between the two levels of government. Given the narrowing of the rate differential between Canada and the U.S. and the absence of corporate taxes in some states, there may be increased pressure for rate harmonization across the provinces. It is of considerable benefit to Canada (in terms of consistency, predictability and mobility within Canada) that there is greater uniformity of rates and bases of taxation across provinces than there is, for instance, across U.S. States. However, increasing provincial uniformity is a continuing worthwhile goal.
- **Increased generosity of investment allowances is most directly targeted at supporting real investment.** Movement towards immediate expensing of a wide class of assets would directly follow developments in the U.S. This too can be expensive, though the issue here, while significant, is essentially one of timing: immediate expensing implies a narrower tax base than depreciation when the investment is undertaken, but—since in either event the asset is fully written off over time—a broader one later. Here too there would be a need for coordination with the provinces as the provinces would also suffer a front-loaded revenue loss to the extent their tax base reflects the federal corporate tax base.
- **More generous treatment of investment may need to be accompanied by tighter limits on interest deductibility to avoid exacerbating a marginal corporate tax subsidy to investment.** This would need to apply to all interest, not just borrowing from related parties—and it would also recoup some of the revenue loss from enhanced investment allowances.

⁵⁹ Beer, Klemm and Matheson (2018).

Structural Corporate Tax Reform

34. A central issue for any broad review of the tax system is the case for moving towards some form of rent taxation at corporate level. This would in principle eliminate any corporate level distortion to investment and remove the bias towards debt finance, resetting the corporate-level METRs for all investments to zero.

35. There are two leading candidate forms of corporate rent taxation, and experience, to varying degrees, with both:

- **Allowance for Corporate Equity (ACE)/Capital (ACC).** Under an ACE, interest deductibility is retained but a deduction is also allowed for a notional return on equity; under an ACC, a common notional rate is applied to debt as well as equity. No restriction is placed on the schedule of depreciation allowances. Potential concerns include biases that may arise from setting the notional rate inappropriately (though whether the potential cost exceeds those of the distortions under the current system is unclear), and the revenue loss from a narrowing of the corporate tax base (though this can be mitigated by, for instance, providing the equity deduction only for equity added after introduction of the tax). ACE-type schemes have been adopted in several countries. While these experiences⁶⁰ have pointed to the risk of creating new avoidance opportunities, that in Italy in particular is widely regarded as having been positive, especially in alleviating debt bias.
- **Cash flow taxation (CFT).** This means giving full expensing for all investment while (since that provides full allowance for the costs of investment) denying any deduction for interest (or of equity finance). Ensuring full neutrality requires that this be accompanied by full loss offset, or carrying forward of losses at interest. While there is quite wide experience with full expensing, particularly for smaller firms, there is almost no international experience of that accompanied by complete denial of interest deductions.⁶¹ In revenue terms, while full expensing reduces the present value of receipts (by bringing depreciation allowances forward, the extent to which this is offset by denying interest deductions will be context-specific.

36. Each form of rent tax has its merits and drawback, both in general and in the Canadian context.⁶² The ACE approach is better suited to dealing with financial institutions, for instance: it simply retains interest deductibility, while their appropriate treatment under a cash flow system requires the unfamiliar device of in effect taxing all inflows, and providing deductions, of principal as well as interest. Application to smaller businesses, on the other hand, is likely to be simpler under a cash flow approach.

⁶⁰ See for instance, see Klemm (2007), Zangari (2014) and Hebous and Ruf (2017); the later shows, for instance, that the ACE has been effective in addressing debt bias. Canada itself had a form of ACE in its 1916 business profits tax (Boadway, 2017).

⁶¹ Rent taxation of this kind has been applied in the extractive industries, for example in Norway. Of general applicability, Mexico operated a CFT (the *Impuesto empresaria a tasa única*, IETU) as a minimum CIT from 2008 to 2013. Issues have been raised about the creditability of CFT under tax treaties, but the movement towards territoriality in the advanced economies makes this much less of concern.

⁶² The case for movement to an ACE in Canada is made in detail by Boadway and Tremblay (2014, 2016).

Transition issues appear manageable in either case: the U.S. is to some degree showing the way for movement towards a CFT, and transition issues may be even less under the ACE, since there is no issue of handling pre-existing debt and no need to change depreciation arrangements. The cash flow approach, on the other hand, has closer similarities with the direction of reform across the border under the TCJA. And neither approach resolves potential problems of profit shifting.⁶³

37. In each case, taxation of the normal return to capital would need to be shifted to the personal level. Moving towards a rent tax would mean that the CIT is focused on raising revenue, rather than withholding against personal income tax.⁶⁴ One approach, for example, would be to impute to corporate owners a normal return on assets subject to the rent tax and bringing that into tax at personal level. The latter might involve for instance, applying some notional return to the capital value of assets subject to the tax (irrespective of actual dividends and capital gains);⁶⁵ that return could then be taxed at a flat rate or, aggregated across assets, by a progressive schedule.⁶⁶

38. Rent taxation, at an unchanged statutory rate, could involve some loss of corporate level tax revenue. Absent behavioral responses, this is clear under the ACE, movement to which is unambiguously base-narrowing; it is less clear-cut for CFT, given at least some offset through the elimination of interest deductions. For either form, there would be some revenue gain from the increase in investment to the extent that a positive METR means that some investments yielding an infra-marginal profit are not undertaken, and from the dissipation of the base through excess leverage. But these effects are unlikely to offset the first order loss of revenue. That loss, moreover, cannot be recouped by raising the statutory rate without exacerbating problems of profit shifting. Attention must thus shift to other revenue sources: Boadway and Tremblay (2014) argue, for instance, that the revenue costs of an ACE would be amply covered by elimination of the dividend tax credit.

Dealing with the Revenue Consequences of Corporate Tax Reform

39. The pressures are evidently towards a reduction in CIT revenues, and there is some scope to mitigate this by base broadening within the CIT... The tighter limitation on interest deductions suggested above is one such measure. Some possible measures that have been raised, however, risk amplifying the distortions that it should be the objective of policy to reduce: restricting loss carry forward and carry back, for instance, would act in the direction of increasing METRs.

⁶³ Profit shifting problems may though take different forms from now: under neither an ACE/C nor a CFT, for instance, does borrowing create a net deduction (by simple exclusion under a CFT, because of an offsetting effect through a reduced future notional allowance for equity under the ACE). Issues of transfer pricing in relation to goods and services remain.

⁶⁴ Boadway (2017) elaborates on and argues for such a change in the focus of Canadian CIT.

⁶⁵ The Netherlands (in the 'Box 3' arrangement) takes an approach of this kind, applying a notional rate to the capital value of net assets (which is then subject to a flat rate of tax, though progressive taxation would also be possible).

⁶⁶ There would be no efficiency grounds for giving a credit in respect of taxes charged on rents.

40. ...but ultimately other sources of revenue may need to be tapped more fully. With the strongly progressive personal income taxation, among the questions for any wider review must be the case for heavier reliance on indirect taxation, and notably the GST. As a ready reckoner, a loss of revenue of one percent of GDP would be recouped, roughly speaking by a 1.2 percentage point increase in the federation wide rate of GST.

Appendix I. Estimating the Potential Impact of the U.S. Tax Reform on Canada

This appendix outlines the derivation of the empirical results reported in Section B.

Data

1. The main dataset used is the Inward Foreign Affiliate Statistics (FATS), which provides information on economic and financial activities of foreign majority-owned affiliates in Canada (FMOCAs) during 2010-2015. This is merged with data on country-level statutory CIT rates, METRs and key macro variables (including GDP, GDP per-capita, unemployment rate). This produces an unbalanced panel of FMOCAs from 34 countries, including their assets, revenues, profits¹, and corporate tax rates.

Investment Effects

2. In a competitive world with markets segmented between countries and companies unconstrained in the amount of capital they can mobilize, the METR in one country would not be expected to directly affect investment in others. Such effects can arise, however, if companies' access to capital is constrained or they serve integrated markets in which they have some degree of market power. In either case, statutory tax rates in both countries also have an effect (in the latter model, to an extent that reflect relative levels of production in the two countries). Allowing for these possibilities, a dynamic gravity-like panel specification relating the assets of foreign corporations in Canada to these tax variables and a range of controls is estimated in the basic form:²

$$\begin{aligned} \ln Assets_{jt} = & \alpha_j + \lambda Assets_{j,t-1} + \beta_{CIT} CIT_Diff_{jt} + \beta_{CIT-R} CIT_Diff_{jt} \times R_{jt} \\ & + \beta_{METR} METR_{jt} + \beta_{METR-R} METR_{jt} \times R_{jt} + \beta_X X_{jt} + \eta_t + \varepsilon_{it} \end{aligned}$$

where CIT_Diff_{jt} is the difference in the statutory CIT rate between country j and Canada, R_{jt} is the share of all sales revenue of non-Canadian multinationals in Canada earned by those from country j (averaged over the sample period). $METR_{jt}$ is the METR in country j at time t , and controls

¹ Profits in the FATS statistics are operating profits before interest and royalty payments, and thus exclude profit shifting arrangements through debt shifting or royalties. This suggests that analysis using the FATS profits may understate the extent of profit shifting.

² More precisely, the latter model implies that for a multinational operating in countries A and B, its investment in A would depend on the difference between the statutory CIT rates in the two countries weighted by the proportion of its production that takes place in country A. Given data limitations, the latter is proxied by the sales revenue variable. Investment in A would also depend on the METR in A, and indirectly (through its effect on production levels) on that in B. Theory does not predict that the impact of the METR in A should vary with production shares, but from completeness we allow and test for this possibility in the estimation.

X_{jt} include the natural logarithm of GDP ($\ln GDP_{jt}$) and GDP per-capita ($\ln GDPPC_{jt}$), exchange rate relative to USD ($Xrate_{jt}$), unemployment rate ($Unempl_{jt}$), and an index for current account openness ($Open_{jt}$) in country j in year t .³ By including country and year fixed effects (α_j and η_t), the regression exploits the within-country time variation in the CIT/METR to identify the effects of taxes.

3. Results are reported in Table A1. Taking as preferred results those in Column (4) (estimated by instrumental variable estimation and including both country and time effects) suggest that the effects of both the METR in the country of the originating parent company and the differential between the Canadian and originating statutory rates, weighted by revenue share, to be significant at 5 and 10 percent respectively.

Appendix I. Table 1. Effects of Corporate Taxes on MNC Investment in Canada					
	OLS		IV		GMM
	(1)	(2)	(3)	(4)	(5)
Panel A:					
CIT_Diff	0.052**	0.037*	0.150**	0.095	0.033
	(0.023)	(0.020)	(0.060)	(0.071)	(0.061)
CIT_Diff × R		0.553*	0.564*	0.478*	0.634**
		(0.314)	(0.308)	(0.270)	(0.314)
METR				0.084**	0.072***
				(0.036)	(0.026)
METR × R				-0.564	0.106
				(0.931)	(0.713)
L.Total assets	-0.002	-0.001	-0.002	-0.002	-0.002
	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)
Panel B: Long-Run Effect					
CIT_Diff	0.052**	0.036*	0.15**	0.095	0.033
	(0.023)	(0.020)	(0.060)	(0.071)	(0.061)
CIT_Diff × R		0.553*	0.562*	0.477*	0.633**
		(0.314)	(0.307)	(0.269)	(0.312)
METR				0.084**	0.072***
				(0.036)	(0.026)
METR × R				-0.562	-23.239
				(0.929)	(647.799)

³ With the presence of a time effect, there is insufficient time variation in the Canadian METR over the sample period to meaningfully include it the regressions: doing so, and replacing the time effect with a time trend, its effect is insignificant.

Appendix I. Table 1. Effects of Corporate Taxes on MNC Investment in Canada (Concluded)

Panel C: Test Statistics					
Cragg-Donald Wald F					
Statistics			6.00	6.48	
Hansen J <i>p</i> -value			0.52	0.36	0.20
AR1 <i>p</i> -value					0.23
AR2 <i>p</i> -value					0.21
Parent Country Controls	Y	Y	Y	Y	Y
<i>R</i> ²	0.986	0.986	0.286	0.333	
N	116	114	57	52	37

Notes: Country-level characteristics, country and year fixed effects are included in all estimated equations. Panel A reports the estimation results; The IV and GMM regressions in columns (3)-(5) use the same set of instruments, including the first difference of one-period lagged assets, two-period lagged assets, and two-period lagged profits, to address the potential heterogeneity in the lagged assets variable. The GMM takes the first difference of the regression equation to eliminate fixed effects and thus includes fewer observations than the IV; panel B reports the long-run coefficients of the tax variables; panel C reports test statistics for the IV and GMM regressions in columns (3)-(5), respectively. ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively. Standard errors are clustered by parent country.

Applying in the estimated equation both a 14-point reduction in the statutory rate differential (weighted by the revenue share of U.S. companies) and a 13-point reduction in the U.S. METR, the implied long run reduction in U.S. companies' assets held in Canada is around 6 percent (with a 95 percent confidence interval of between 0.4 and 14 percent), which is equivalent to about 3 percent of GDP.

Profit Shifting

4. The estimating equation used to assess this relates the profits reported in Canada by multinationals in each originating country to the difference between the CIT rate there and in Canada,⁴ allowing for both (a) asymmetries in respect of inward- and outward shifting and (b) threshold effects by which profit shifting is concentrated in countries for which the absolute tax differential relative to Canada is particularly large. Specifically, in the most complete specification reported:

$$Profits_{jt} = \alpha_j + \beta_{low} |CIT_{Diff}_{jt}| \times Low_j + \beta'_{Low} |CIT_{Diff}_{jt}| \times Low_j \times I_{low} + \beta_{High} |CIT_{Diff}_{jt}| \times High_j + \beta'_{high} |CIT_{Diff}_{jt}| \times High_j \times I_{high} + \beta_A Assets_{jt} + \beta_E Employees_{jt} + \eta_t + \varepsilon_{it}$$

where the CIT difference in absolute value ($|CIT_{Diff}_{jt}|$) is interacted with a dummy indicator (Low_j) that takes the value of 1 for countries j with a lower CIT rate than Canada throughout the sample

⁴ While using macro-level data does not control for firm-specific heterogeneity, the direction of bias in estimated tax sensitivity can be in either direction; the macro estimate of profit shifting represents an average effect for all multinationals in Canada.

period, and with a dummy indicator ($High_j$) taking the value of 1 for countries with a higher CIT rate than Canada throughout, respectively; the dummy indicator I_{low} takes the value of 1 for a CIT differential larger than 5.1 percent in low-tax countries, and above 12.8 percent in high-tax countries.⁵

5. The results in Table A2 point to large outward profit shifting to low tax countries, but—most relevant here—to no inward profit shifting from high-tax countries except those with a CIT rate at least 12.8 percentage point higher than the Canadian rate: that is (in the sample used) from Japan and the US.⁶

Appendix I. Table 2. Effects of Corporate Taxes on Foreign Multinational's Profits in Canada						
	Pooled Regressions				Within Group	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>CIT_Diff</i>	0.301*** (0.105)	0.339** (0.143)	0.027** (0.011)			
<i>CIT_Diff</i> × <i>Low</i>				-0.012 (0.010)	-0.295* (0.176)	-0.159* (0.088)
<i>CIT_Diff</i> × <i>High</i>				0.080*** (0.030)	0.136 (0.112)	0.069 (0.073)
<i>CIT_Diff</i> × <i>Low</i> × I_{low}						-0.143*** (0.030)
<i>CIT_Diff</i> × <i>High</i> × I_{High}						0.382*** (0.022)
Total assets (USD Billion)			0.022*** (0.007)	0.024*** (0.007)	0.052*** (0.011)	0.050*** (0.004)
No. of employees (thousands)			0.019*** (0.006)	0.017*** (0.006)	0.037 (0.033)	0.002 (0.016)
Parent Country Characteristics	N	Y	Y	Y	Y	Y
Country FE	N	N	N	N	Y	Y
	Y	Y	Y	Y	Y	Y
R^2	0.217	0.986	0.990	0.991	0.996	0.997
N	157	140	133	133	162	162

Notes: This table reports the results of examining the effect of corporate taxes on MNC profits in Canada. Regressions in Columns (1)-(3) take the form of: $Profits_{jt} = \alpha_j + \beta_{CIT}CIT_Diff_{jt} + \beta_A Assets_{jt} + \beta_E Employees_{jt} + \eta_t + \varepsilon_{it}$. Regressions in Columns (4)-(5) are based on the equation: $Profits_{jt} = \alpha_j + \beta_{low}|CIT_Diff_{jt}| \times Low_j + \beta_{high}|CIT_Diff_{jt}| \times High_j + \beta_A Assets_{jt} + \beta_E Employees_{jt} + \eta_t + \varepsilon_{it}$, and regression in column (6) is based on equation (2). ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively. Standard errors are clustered by parent country.

⁵ Estimated by grid search to minimize the sum of squared residuals.

⁶ The implied semi-elasticity of reported profits with respect to statutory CIT rate differential for US multinationals is around 1.2. This is comparable, though slightly smaller, to the average semi-elasticity of 1.4 reported in Dowd et al (2017) that uses micro U.S. tax return data over the period of 2002-2012, and the consensus semi-elasticity of 1.5 for the year 2015, as found in a recent meta-analysis by Beer et al (2018).

Applying a 14-point reduction in the statutory rate in the U.S., the results in Column (6) of Table A2 imply a reduction of around 15 percent of total profits of U.S. multinationals reported in Canada, which is around 0.31 percent of GDP.

Revenue Implications

6. Relative to assets, the effective tax rate paid in Canada by U.S. corporations is about one percent. Applying this to the estimated reduction in U.S. assets in Canada of 0.3 points of GDP gives a reduction in CIT revenue of around 0.03 percent, which is about 6 percent of CIT currently paid in Canada by U.S. corporations.⁷

7. At a combined statutory rate of 26.9 percent, the estimated reduction in annual reported profits in Canada of U.S. corporations of 0.31 percent of GDP would reduce total CIT revenue by about 0.08 percent, which is approximately 17 percent of all current CIT revenue from US multinationals. Overall, the long run loss in CIT revenue from U.S. corporations is thus estimated to be about 23 percent of their current payments, with a 95 percent confidence interval of between 0.16 to 0.31 percent.

⁷ Total CIT revenue in Canada is about 3.2 percent of GDP, of which US MNCs pay about 15 percent.

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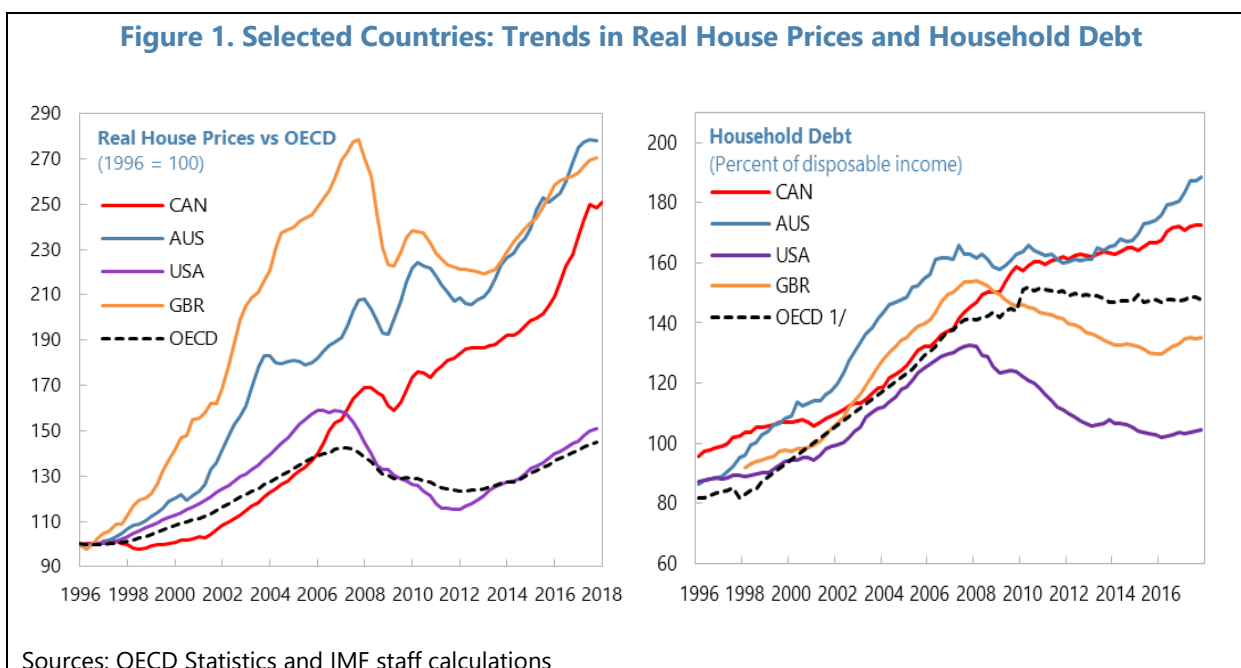
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BALANCING FINANCIAL STABILITY AND HOUSING AFFORDABILITY: THE CASE OF CANADA¹

Housing market imbalances are a key source of systemic risk and can adversely affect housing affordability. This chapter utilizes a stylized model of the Canadian economy that includes policymakers with differing objectives—macroeconomic stability, financial stability, and housing affordability. Not surprisingly, when faced with multiple objectives, deploying more policy instruments can lead to better outcomes. Macroprudential policy can be more effective than policies based on adjusting property-transfer taxes because property-tax policy entails excessive volatility in tax rates. If property-transfer taxes are used, taxes targeted at a broader-set of homebuyers can be more effective than measures targeted at a smaller subset of homebuyers, such as nonresident homebuyers.

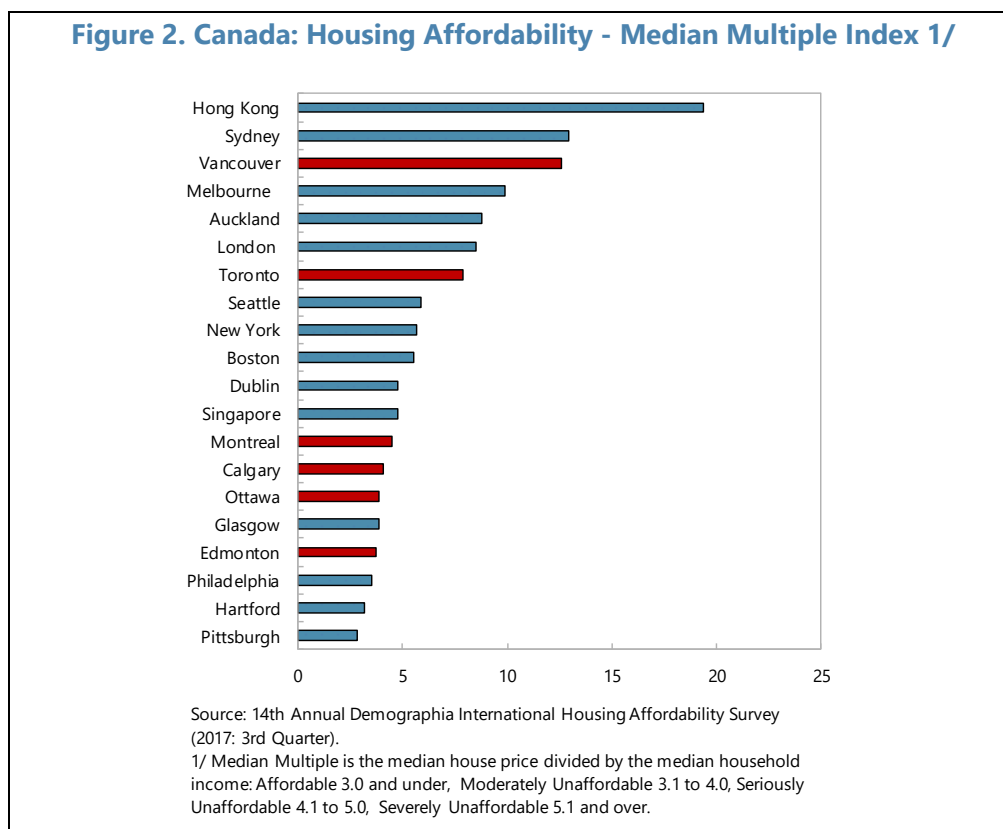
A. Introduction

1. Housing market imbalances are prominent in Canada and are a key source of systemic risk. Rapidly-rising house prices are usually coupled with rising household indebtedness (figure 1). High household debt raises the vulnerability of financial institutions to sharp corrections in house prices, and the interconnectedness of financial institutions make this risk systemic, not merely idiosyncratic. As such, agencies in charge of macroprudential policy/systemic risk oversight typically use macroprudential measures aimed at mitigating these risks to contain the build-up of vulnerabilities over time and enhance the resilience of the financial sector.



¹ Prepared by Troy Matheson (WHD).

2. In addition to financial stability concerns, the rapid rise in housing prices has led to worsening housing affordability, posing a major problem to some of Canada's most dynamic metropolitan regions. Although Canada's overall affordability indices are not yet among the worst globally, the Toronto and Vancouver regions are becoming severely unaffordable (figure 2). This raises important social and economic concerns.



3. The federal government has introduced a raft of macroprudential measures over the past ten years to tackle growing housing market imbalances and associated risks to financial stability.² Initially, the measures were aimed at the high LTV ratio, government-backed insured mortgage market, helping to reduce the government's exposure to the housing sector. In early 2018, the Office of the Superintendent of Financial Institutions (OSFI) tightened underwriting requirements for low-ratio mortgages to stem rising risk in the uninsured mortgage market. Low-ratio mortgages are now subject to: (i) a stress test for mortgage interest rates; (ii) Loan-to-Value (LTV) measures and limits that reflect housing market risks, to be updated as housing markets and the economic environment evolve; and (iii) restrictions on combining mortgages with other lending products (e.g. co-lending arrangements) that could circumvent LTV limits (see 2018 Article IV, Canada, Annex III).

²See 2017 Selected Issues Papers, "Macroprudential Tools at Work in Canada", by Z. Arvai, I. Krznar, and Y. Ustyugova.

4. The governments of British Columbia and Ontario have also recently deployed property-tax measures to stem speculative activity and improve housing affordability in their major cities. A 15 percent nonresident property-transfer tax was introduced for the Toronto and Vancouver areas between 2016–17. More recently, the British Columbia government increased the property-transfer tax on nonresident homebuyers to 20 percent and expanded its geographic coverage.

5. The question remains: Which policy—macroprudential policy or property-tax policy—best satisfies the overall objectives of policymakers? This chapter develops a simple Dynamic-Stochastic-General-Equilibrium (DSGE) framework to assess the effectiveness of a specific macroprudential policy—an LTV limit—against property-tax measures. The model is estimated using Bayesian methods and Canadian data. Operational objectives are specified for the central bank, the macroprudential authority, and the property-tax authority (assumed to be provincial governments). Optimal policy experiments are conducted to assess the overall performance of each policy given the specified objectives.

B. Model

6. The model used is a simple DSGE model that contains a housing sector, monetary policy, an LTV limit, and a property-transfer tax.³ Key features of the model are:

- Households are divided into borrowers and savers. Borrowers differ from savers in that they discount the future at a faster rate. To prevent borrowing without limit, borrowers are assumed to face credit constraints tied to their collateral—an LTV limit. Savers, on the other hand, do not face collateral constraints.
- There are two sectors, producing housing and non-housing consumer goods. There are three policy instruments: an interest rate (set by the central bank), an LTV limit (set by the macroprudential authority), and a property-transfer tax rate applied the purchase of houses (set by the property-tax authority). For simplicity, the government is assumed to run a balanced budget in each period using lump-sum transfers to households.

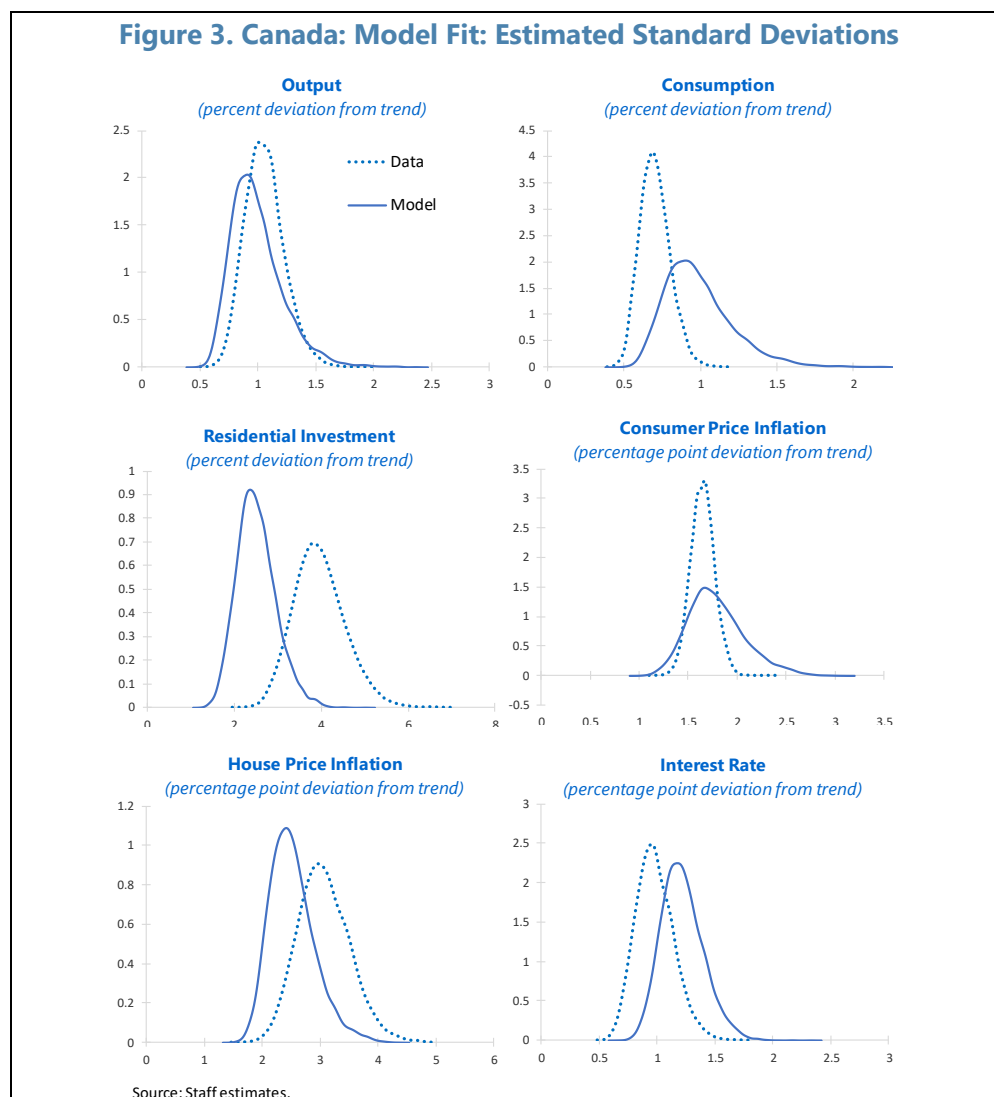
C. Estimation

7. The model is estimated using Bayesian methods and quarterly data ranging from 1993 to 2017. The measurement variables used in estimation are real GDP per capita, real consumption per capita, real residential investment per capita, employment per capita, headline CPI inflation, house price inflation, and the overnight policy interest rate. For the purposes of estimation, monetary policy is assumed to operate according to a standard Taylor-type rule. Despite recent policy changes, LTV limits and property-transfer taxes have been broadly constant over the sample.

³ The model is described in greater detail in the appendix.

As such, during estimation, the average LTV on new mortgages is set at 60 percent and the property-transfer tax is assumed to be fixed at 5 percent.⁴

8. The estimated model does a good job at explaining the volatility seen in historical data. The policy experiments that follow rely on policymakers setting policy instruments that minimize the variance of several key variables. As such, the model should be able to adequately capture the volatility seen in data observed over history. Simulated data from the estimated model have comparable standard deviations to those seen in historical data, suggesting that the model fits the data reasonably well (figure 3).⁵



⁴ This 'steady state' property-transfer tax captures the average administrative cost associated with purchasing a house in Canada.

⁵ The standard deviations in historical data are estimated using a vector-autoregressive model (VAR) that uses the same sample period and data as the DSGE model. The VAR includes 4 lags and is simulated 1000 times using bootstrapping methods. In the chart, the uncertainty around the model and data estimates reflects both parameter and shock uncertainty.

D. Policy Objectives

This section specifies the objectives of the central bank, the macroprudential authority, and the tax authority.

Central Bank Policy

9. The central bank is given the objective of stabilizing inflation and output and aims to minimize the loss function:

$$L^{cb} = \frac{1}{(\Omega_{\pi}^{cb} + \Omega_y^{cb} + \Omega_{\Delta r}^{cb})} [\Omega_{\pi}^{cb} \sigma_{\pi_c}^2 + \Omega_y^{cb} \sigma_y^2 + \Omega_{\Delta r}^{cb} \sigma_{\Delta r}^2] \quad (1)$$

and where σ^2 represents the asymptotic variance of consumer-price inflation (π_c), output (y), and changes in the policy interest rate (r). The weights Ω^{cb} characterize the policymaker's preferences over these variables, with $\Omega_{\pi}^{cb}, \Omega_y^{cb}, \Omega_{\Delta r}^{cb} \geq 0$. As discussed in Angelini et al (2014), a positive $\Omega_{\Delta r}^{cb}$ is warranted to avoid excessive volatility in the policy interest rate.

Macroprudential Policy

10. Modelling the objectives of macroprudential policy is difficult because systemic risk can come in a variety of forms and most models do not have a specific proxy for it. Following Angelini et al (2014), this paper assumes that the macroprudential authority reacts to the "abnormal" behavior of credit, where abnormal behavior is determined with respect to the level of economic activity. Thus, the key argument in the macroprudential authority's loss function is the debt-to-GDP ratio (z). Like the central bank, the macroprudential authority is also concerned with the variability of its policy instrument, the LTV ratio.

$$L^{mp} = \frac{1}{(\Omega_z^{mp} + \Omega_{\Delta LTV}^{mp})} [\Omega_z^{mp} \sigma_z^2 + \Omega_{\Delta LTV}^{mp} \sigma_{\Delta LTV}^2] \quad (2)$$

where $\Omega_z^{mp}, \Omega_{\Delta LTV}^{mp} \geq 0$. Note that the symmetric nature of the loss function implies that the macroprudential authority dislikes both excessively high leverage and excessively low leverage. Here, it is assumed that low leverage can result in a credit crunch with adverse feedback effects on economic activity and ultimately financial stability.

Tax Policy

11. The property-tax authority is concerned with housing affordability. As with the objectives of the macroprudential authority, there are a variety of indicators of housing affordability that can be considered in practice. There are several relevant aspects in dealing with affordability. The first is making housing cheaper for vulnerable populations which, in the long term, depends more on supply responses to rising demand. The second is one of dealing with price/affordability stability from a short-term, demand-side perspective. This is a worthy objective since large fluctuations can have adverse welfare consequences. The measure of housing affordability included in the tax authority's loss function is the house-price-to-income ratio (u). Like the other

policymakers, the tax authority is concerned about the variability of its policy instrument, the property-transfer tax rate, TAX .

$$L^{tp} = \frac{1}{(\Omega_u^{tp} + \Omega_{\Delta TAX}^{tp})} [\Omega_u^{tp} \sigma_u^2 + \Omega_{\Delta TAX}^{tp} \sigma_{\Delta TAX}^2] \quad (3)$$

with $\Omega_u^{tp}, \Omega_{\Delta TAX}^{tp} \geq 0$. Note that the tax rate can be applied to either all home purchases or only to those houses purchased by savers that are not subject to the collateral constraint.

12. The savers in the economy encompass nonresident homebuyers. Assuming nonresident homebuyers are not collateral constrained, they will not be subject to LTV limits imposed by the macroprudential authority. Nonresidents of Canada are less likely to have access to mortgage loans in Canada and are more likely to purchase houses with cash. As such, from a modelling perspective, nonresident homebuyers are encompassed by the savers in the economy that are not subject to collateral constraints.

Overall Objectives

13. The overall loss function for the economy is a simple weighted average of the loss functions of the three policy-setting authorities:

$$L = \Psi^{cb} L^{cb} + (1 - \Psi^{cb})(\Psi^{mp} L^{mp} + (1 - \Psi^{mp}) L^{tp}) \quad (4)$$

where the weights associated with the individual loss functions, Ψ^{cb}, Ψ^{mp} , are between 0 and 1. Thus, the total loss of the economy depends on the weights associated with the objectives of monetary policy, macroprudential policy, and property-transfer tax policy.

Optimal Policy

14. The authorities are assumed to select policy rules that minimize the total loss of the economy in an optimal way. Optimal policy rules determine the paths of the policy interest rate, the LTV ratio, and the property tax rate that minimize the intertemporal version of the total loss function (4) (see Woodford, 2003). In this case, the three policy instruments will be functions of all variables in the model (and Lagrange multipliers). In the analysis that follows, the weights in the individual loss functions of each policymaker are fixed at values that are standard in the monetary policy and macroprudential policy literature, and the standard deviation of monetary policy shocks is set to zero.⁶ All other parameters are set to their estimated values. The baseline weights in the loss functions (1, 2, and 3) are:

$$\Omega_{\pi}^{cb} = 1, \Omega_y^{cb} = 0.5, \Omega_{\Delta r}^{cb} = 0.1; \Omega_z^{mp} = 1, \Omega_{\Delta LTV}^{mp} = 0.1; \Omega_u^{tp} = 1, \Omega_{\Delta TAX}^{tp} = 0.1$$

⁶ See, for example, Angelini and others (2014). Optimized simple policy rules have also been examined and the results are qualitatively very similar to those found in the context of optimal rules. These results are available from the author on request.

15. Six different optimal policies are examined, depending on which of the four policy instruments (interest rate, LTV, property-transfer tax rate, and property-transfer tax rate on savers only) are operating. When a policy instrument is not in operation (*LTV* or *TAX*), the policymaker responsible for that instrument is assumed to be “passive” in the sense that it relies on the other authorities to adjust their instruments to minimize the total loss in the economy, including the objectives of all other policymakers. A summary of the optimal policy scenarios examined are displayed in table 1.

Table 1. Canada: Policy Options	
	Active Policy Instrument(s)
Monetary Policy	r
LTV Policy	r, LTV
Tax Policy	r, TAX
Tax Policy (savers)	r, TAX (savers)
ALL Policies	r, LTV, TAX
ALL Policies (savers tax)	r, LTV, TAX (savers)

16. For robustness, three different scenarios are also examined, depending on how much weight each policymaker’s objective has in the overall loss function of the economy. In the baseline specification, the central bank’s loss function has a 50 percent share in overall loss, with the remainder of total loss allocated evenly across the objectives of the macroprudential and tax authorities. Two other specifications are examined, one in which overall loss has more weight on managing household debt levels than affordability and the other in which overall loss has more weight on managing affordability than on household debt (see table 2).

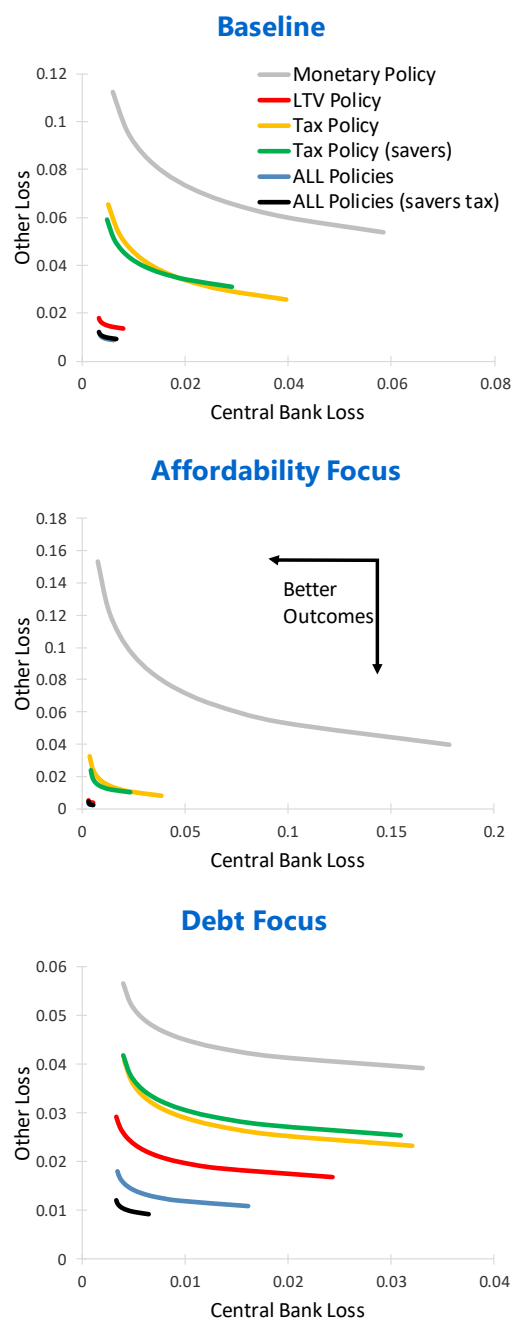
Table 2. Canada: Focus of Objectives		
Baseline	$\Psi^{cb} = 0.5,$	$\Psi^{mp} = 0.5$
Debt Focus	$\Psi^{cb} = 0.5,$	$\Psi^{mp} = 0.9$
Affordability Focus	$\Psi^{cb} = 0.5,$	$\Psi^{mp} = 0.1$

E. Results

17. Some policies satisfy objectives better than others. The optimal policy frontiers for each model are displayed in figure 4.⁷ The results suggest:

- *Having more policy instruments leads to better outcomes.* Regardless of the overall focus of objectives, monetary policy alone leads to higher losses than when monetary policy is augmented with LTV and/or tax policy, and having all policies in operation leads to even greater gains.
- *Macroprudential policy is better than tax policy.* LTV policy reduces overall loss by more than tax policy, regardless of whether the tax is applied to all homebuyers or only to savers that are not subject to collateral constraints.
- *The ‘best’ policies depend on the focus of objectives.* In the baseline specification, applying all policy instruments leads to slightly better outcomes than when tax policy is not operating. When the focus of objectives is on households’ debt and all policies are operating, a tax on savers is better than a tax on all homebuyers. However, when the focus of objectives is on affordability and all policies are operating, a tax on all homebuyers is very similar to imposing a tax on savers alone. Overall, the ‘best’ policy from a loss-minimization perspective depends on the focus of policymakers’ objectives. It is also worthwhile to evaluate the viability of each policy with respect to the volatility of the policy instrument(s) over the normal course of the business cycle.

Figure 4. Canada: Optimal Policy Frontiers
(Ψ^{cb} ranging between 0 and 1)



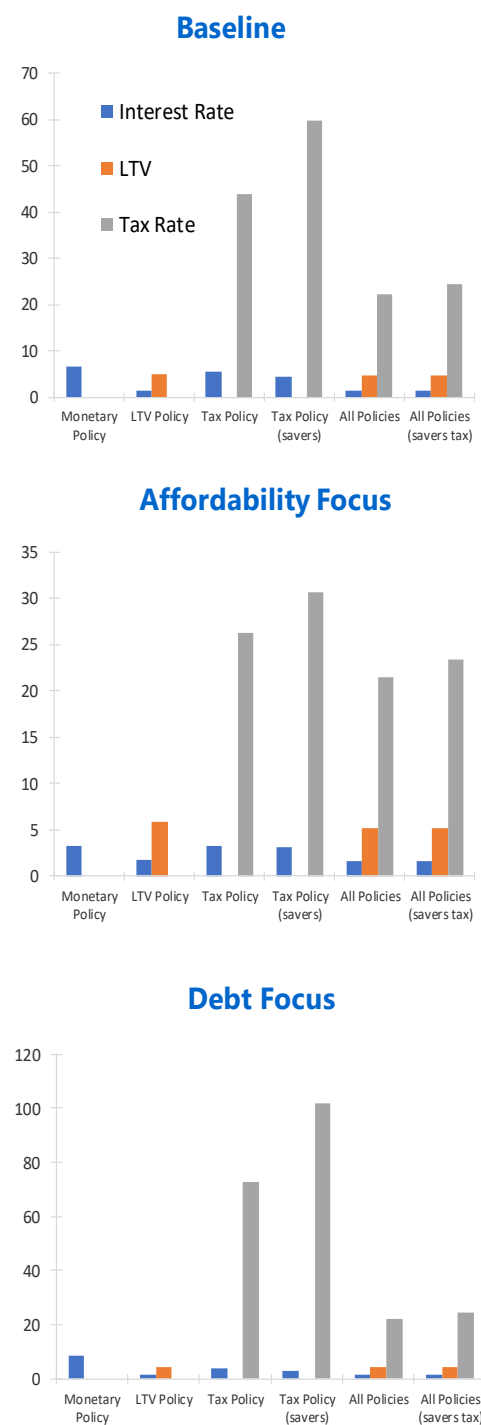
Source: Staff Estimates

⁷ Other loss is the weighted average of the macroprudential and tax authorities’ loss functions.

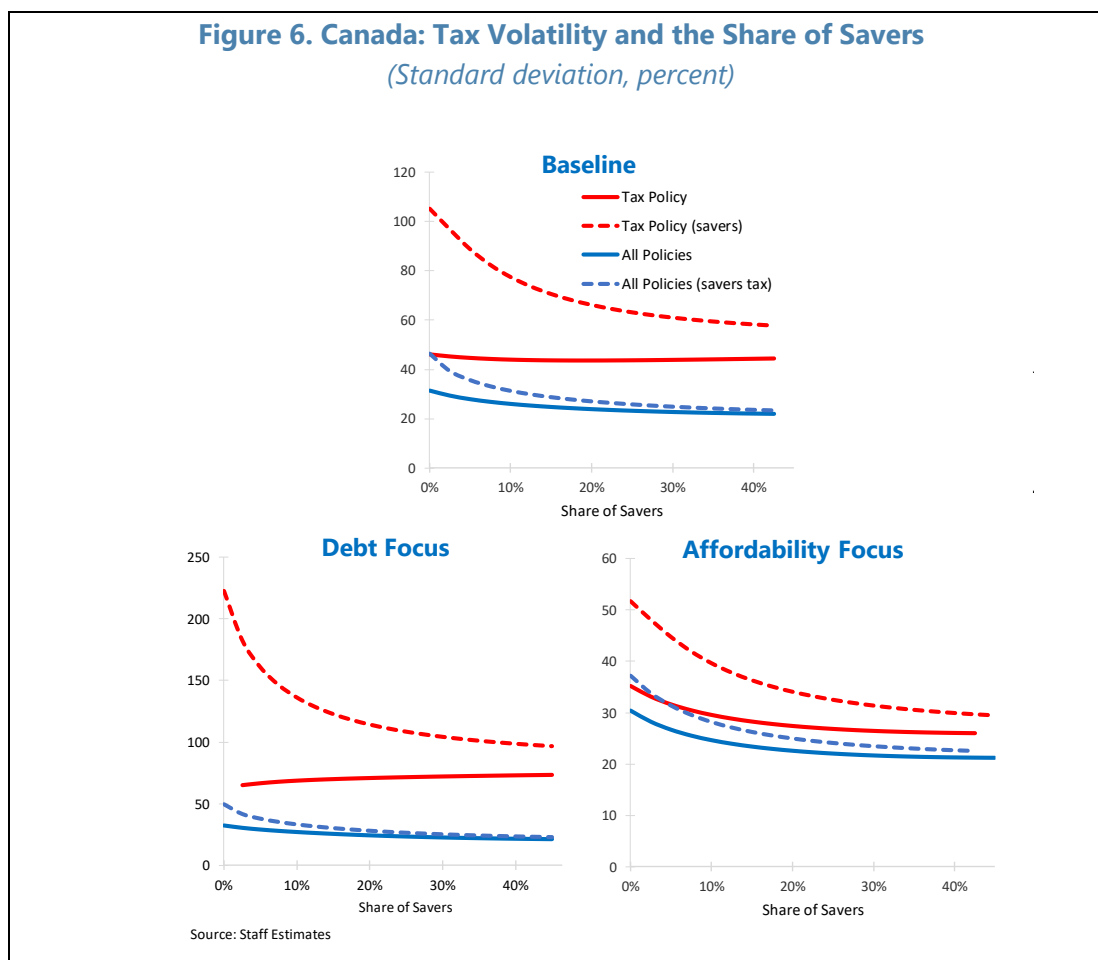
18. Optimal property-tax policy leads to excessive volatility in tax rates. The volatility of policy instruments for all models and objectives for the baseline specification are displayed in figure 5. The results show that the volatility of tax rates required to satisfy objectives is very high relative to when monetary policy and/or LTV policy are operating alone. In the baseline specification, for example, the asymptotic standard deviation of the property tax rate is about 45 percent, suggesting that a 99 percent confidence interval around the typical dynamics of the economy would require the tax rate to swing by around 150 percentage points around its steady state level. This is clearly excessive, requiring negative tax rates in downturns and rates above 100 percent in expansions. Tax rate volatility is even higher when the taxes are targeted at savers alone, irrespective of the focus of policymakers' objectives.

19. Property-tax policy targeted at savers alone leads to greater volatility in taxes than a tax that targets all homebuyers. Figure 6 displays the volatility of property-tax rates as the share of savers in the economy increases. Irrespective of whether a property-transfer tax is applied on its own or in conjunction with LTV policy, the volatility of the tax rate is higher when it is applied only to savers. Indeed, the volatility of the property tax rate is particularly high when taxes are targeted at savers and the share of savers in the economy is low. Tax rate volatility tends to decline when the share of savers increases, but, irrespective of the share of savers, targeting a narrower set of homebuyers leads to greater volatility in the tax rate than when the tax targets at all homebuyers.

Figure 5. Canada: Instrument Volatility
(standard deviation, percent)



Source: Staff estimates



F. Summary and Policy Messages

20. This chapter examines the effectiveness of LTV limits versus property-transfer taxes in achieving policymakers' overall objectives, including macroeconomic and financial stability, and housing affordability. The results show that multiple policy instruments can lead to better outcomes when policymakers face of multiple policy objectives. Faced with a choice between an LTV limit or using a property-transfer tax, policymakers should choose an LTV limit because it can be more effective in achieving desired objectives. In this framework, deploying multiple policy instruments can lead to excessive volatility in property-tax rates and this problem is exacerbated when the taxes are targeted at a narrower base of homebuyers.

21. Targeting property-transfer taxes at a broader-set of homebuyers is more effective than measures aimed solely at savers (or nonresident home buyers). The results suggest that targeting property tax rates at savers alone—instead of all homebuyers—would require greater swings in tax rates to achieve desired objectives. To the extent that nonresident homebuyers are not collateral constrained, this suggests that property-transfer taxes targeted at them would require greater swings in tax rates than if the taxes were targeted at all homebuyers. Recent data show that that nonresident homeowners represent only a small fraction of the existing housing stock in

Vancouver and Toronto, potentially limiting the effectiveness of the BC and Ontario property transfer taxes on nonresidents. As such, the evidence presented here suggests that to the extent that speculators are found to be driving excessive house price inflation and raising housing affordability concerns, tax measures targeting the speculative demand of residents and non-residents alike would likely be more effective than targeting demand from nonresidents alone.

22. Caveats and future work. The model used in this chapter is stylized and very simple. Like most macroeconomic models, the model used here does not explicitly include the key distortion that macroprudential policy should address—systemic risk. This partly reflects the elusive nature of this risk and difficulties in modeling it in a rigorous way. Likewise, the impact of housing affordability on the welfare of consumers has not been studied in models of the type used here. As such, a purely welfare-based analysis of the policies discussed is beyond reach for now, but it remains a fruitful avenue for future research. In this sense, this analysis is limited to using ad-hoc objective functions for policymakers instead of using more micro-founded, welfare-based analysis. The policy experiments in this chapter also assume that policymakers cooperate to achieve the overall objectives for the economy. In future work, this assumption could be relaxed to assess optimal policy when policymaker's do not cooperate and only focus on their own objectives. Future work could also explicitly model the behavior of nonresident homebuyers instead of using the assumption that they behave in the same way as domestic savers.

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Appendix I. Model and Estimation

Model

1. This appendix sketches out the baseline DSGE framework used in the paper. The model follows closely from the models developed by Funke and Paetz (2018) and Funke and Others (2017). Households are divided into ω borrowers and $(1 - \omega)$ savers. Borrowers differ from savers in that they discount the future at a faster rate. To prevent borrowing without limit, borrowers are assumed to face credit constraints tied to their collateral. The model contains two sectors producing housing goods and non-housing consumer goods (denoted H and C , respectively). Firms producing intermediate goods are assumed to be monopolistically competitive and the output of final goods producers of consumer goods is traded both domestically and internationally.

2. The model includes three policy instruments: an interest rate, a loan-to-value (LTV) ratio, and a tax rate applied the purchase of houses. For simplicity, the government is assumed to run a balanced budget in each period using lump-sum transfers to households.

Households

3. Households are assumed to consume, work, and accumulate housing. There are two types of households that differ in terms their degree of patience, where patient households (savers) have a higher discount factor than impatient households (borrowers). This heterogeneity gives rise to positive financial flows, as patient households save and impatient households borrow against the value of their housing stock. Housing is in fixed supply and is traded between the two household types.

Borrowers

4. The representative impatient borrower is infinitely lived and maximizes expected utility:

$$E_0 \sum_{t=0}^{\infty} (\beta^b)^t \left[\frac{1}{1+\sigma} (X_t^b)^{(1-\sigma)} - \frac{1}{1+\phi} (N_{C,t}^b)^{(1+\phi)} - \frac{1}{1+\phi} (N_{H,t}^b)^{(1+\phi)} \right] \quad (1)$$

where E_0 is the conditional expectation operator evaluated at time 0, X_t^b is the welfare-relevant consumption index and $N_{j,t}^b$ represents the labor supply in sector j . The parameters σ and ϕ are the intertemporal elasticities of substitution with respect to consumption and labor, respectively, and β^b is the borrowers discount factor.

5. The welfare-relevant consumption index is a weighted average of the flow of non-housing consumption and the stock of housing:

$$X_t^b \equiv (\tilde{C}_t^b)^{(1-\gamma\varepsilon_t)} (H_t^b)^{\gamma\varepsilon_t}$$

where $\tilde{C}_t^b = C_t^b - hC_{t-1}^b$ and C_t^b is a composite index of non-housing consumption and the flow of housing services is H_t^b . The parameters γ and h represent habit formation in consumption and the share of housing in consumption, respectively. Borrowers also face a housing preference shock that affects the marginal rate of substitution between housing and non-housing goods, where $\varepsilon_t = \exp(\epsilon_t)$.¹

6. Borrowers can trade nominal riskless bonds but cannot borrow from international markets to finance their expenditures. They face a sequence of budget constraints given by:

$$C_t^b + Q_t(1 + \tau)I_t^b \varepsilon_t^\tau - B_t^b = -R_{t-1} \frac{B_{t-1}^b}{\Pi_{C,t}} + \frac{W_{C,t}^b}{P_{C,t}} + \frac{W_{H,t}^b}{P_{C,t}} + T_t^b \quad (2)$$

where $\Pi_{C,t} \equiv P_{C,t}/P_{C,t-1}$ is the period-to-period gross inflation rate based on the consumer-price index, $P_{C,t}$, Q_t is the real house price and B_t^b is the borrowers' stock of real debt (both deflated with the consumer price index). The nominal interest rate on a loan contract issued in period $t - 1$ is R_{t-1} , $W_{j,t}^b$ is sector-specific wage rate, and I_t^b is borrowers' housing investment, with $I_t^b \equiv H_t^b - (1 - \delta)H_{t-1}^b$, where δ is the depreciation rate on the stock of housing. The parameter τ is the steady-state tax rate on new housing investment, and the shock, $\varepsilon_t^\tau \equiv \exp(TAX_t)$, represents policy-related variations in the property-transfer tax rate, and T_t^b is government lump-sum transfers including those received from property-transfer taxes via $(1 + \tau)\varepsilon_t^\tau$.

7. Borrowers do not save and are restricted by the borrowing constraint:

$$R_t B_t^b \leq (1 - \chi)(1 - \delta)E_t[Q_{t+1}H_t^b \Pi_{C,t+1}] \varepsilon_t^{LTV} \quad (3)$$

where χ represents the fraction of households' housing assets that cannot be used as collateral. Thus, $(1 - \chi)$ is the loan-to-value ratio (LTV), and the shock, $\varepsilon_t^{LTV} \equiv \exp(LTV_t)$, represents policy-related variations in the LTV ratio. This relates the amount that will be repaid by borrowers in the following period to the expected future value of housing (adjusted for depreciation and the LTV ratio). Domestic agents cannot access international markets the LTV ratio is binding.

8. Borrowers maximize 1 subject to 2 and 3, which yields the first-order conditions:

$$\frac{W_{j,t}^b}{P_{C,t}} = \frac{(X_t^b)^\sigma (N_{j,t}^b)^\phi (\tilde{c}_t^b)^{\varepsilon_t}}{(1 - \gamma \varepsilon_t)(H_t^b)^\phi}, j = C, H \quad (4)$$

$$(1 + \tau)Q_t \varepsilon_t^\tau = \frac{\gamma \varepsilon_t}{(1 - \gamma \varepsilon_t)} \frac{\tilde{C}_t^b}{\tilde{H}_t^b} + (1 - \chi)(1 - \delta)\psi_t E_t[Q_{t+1} \Pi_{C,t+1}] +$$

¹ The shock captures changes in social and institutional norms that shift preferences toward housing

$$\beta^b(1-\delta)(1+\tau)E_t \left[\frac{(1-\gamma\varepsilon_{t+1})}{(1-\gamma\varepsilon_t)} \left(\frac{X_{t+1}^b}{X_t^b} \right)^{-\sigma} \left(\frac{H_{t+1}^b}{\bar{C}_{t+1}^b} \right)^{\gamma\varepsilon_{t+1}} \left(\frac{\bar{C}_t^b}{H_t^b} \right)^{\gamma\varepsilon_t} Q_{t+1} \varepsilon_{t+1}^\tau \right] \quad (5)$$

$$R_t \psi_t = 1 - \beta^b E_t \left[\frac{(1-\gamma\varepsilon_{t+1})}{(1-\gamma\varepsilon_t)} \left(\frac{X_{t+1}^b}{X_t^b} \right)^{-\sigma} \left(\frac{H_{t+1}^b}{\bar{C}_{t+1}^b} \right)^{\gamma\varepsilon_{t+1}} \left(\frac{\bar{C}_t^b}{H_t^b} \right)^{\gamma\varepsilon_t} \frac{R_t}{\Pi_{C,t+1}} \right] \quad (6)$$

where $\lambda_t \psi_t$ is the Lagrange multiplier for the borrowing constraint and ψ_t can be interpreted as the marginal value of borrowing.² Equation (4) represents the standard labor-leisure tradeoff, equating the marginal disutility of an additional unit of labor to the marginal utility received from additional consumption, equation (5) equates the marginal utility from non-housing consumption to the shadow value of housing services. Finally, equation (6) is the consumption Euler equation adjusted to capture the borrowing constraint. Note that, for $\psi_t = 0$, equation (6) reduces to the standard New Keynesian Euler equation so that a rise in ψ_t represents a tightening of the collateral constraint.

Savers

9. Patient households (savers) make intertemporal decisions in the standard way. The representative household is infinitely-lived and maximizes the expected utility:

$$E_0 \sum_{i=1}^{\infty} (\beta^s)^t \left[\frac{1}{1+\sigma} (X_t^s)^{(1-\sigma)} - \frac{1}{1+\phi} (N_{C,t}^s)^{(1+\phi)} - \frac{1}{1+\phi} (N_{H,t}^s)^{(1+\phi)} \right] \quad (7)$$

10. Subject to the budget constraint:

$$C_t^s + Q_t(1+\tau)I_t^s \varepsilon_t^\tau - B_t^s - Z_t B_t^{s,F} = -R_{t-1} \frac{B_{t-1}^s}{\Pi_{C,t}} - R_{t-1}^* \frac{Z_t B_{t-1}^{s,F}}{\Pi_{C,t}} + \frac{W_{C,t}^s}{P_{C,t}} + \frac{W_{H,t}^s}{P_{C,t}} + T_t^s \quad (8)$$

where Z_t represents the nominal exchange rate, $B_t^{s,F}$ is foreign bond holdings, R_t^* is the foreign interest rate, and all other variables are defined in the same way as for borrowers.

11. The first order conditions that result from maximizing equation (7) with respect to the budget constraint (8) exactly mirror those of borrowers when $\psi_t = 0$, since savers do not face a borrowing constraint. Savers, however, have an additional first-order condition, reflecting the intertemporal saving decision rather than for borrowing:

$$1 = \beta^s E_t \left[\frac{(1-\gamma\varepsilon_{t+1})}{(1-\gamma\varepsilon_t)} \left(\frac{X_{t+1}^s}{X_t^s} \right)^{-\sigma} \left(\frac{H_{t+1}^s}{\bar{C}_{t+1}^s} \right)^{\gamma\varepsilon_{t+1}} \left(\frac{\bar{C}_t^s}{H_t^s} \right)^{\gamma\varepsilon_t} \frac{Z_{t+1}}{Z_t} \frac{R_t}{\Pi_{C,t+1}} \right] \quad (9)$$

² Note, the optimality condition can be interpreted as equating the marginal rate of substitution between housing and non-housing consumption to the user cost of housing.

Tradable Goods Sector

12. The non-housing consumption index is given by a weighted average of domestic and foreign consumption, with subscripts D and F , respectively.³

$$C_t \equiv \left[(1 - \alpha)^{\frac{1}{\eta}} C_{D,t}^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} C_{F,t}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}$$

where

$$C_{D,t} \equiv \left[\int_0^1 C_{D,t}(k)^{\frac{\epsilon-1}{\epsilon}} \right]^{\frac{\epsilon}{\epsilon-1}}, \quad C_{F,t} \equiv \left[\int_0^1 C_{F,t}(k)^{\frac{\zeta-1}{\zeta}} \right]^{\frac{\zeta}{\zeta-1}}, \quad C_{i,t} \equiv \left[\int_0^1 C_{i,t}(k)^{\frac{\epsilon-1}{\epsilon}} \right]^{\frac{\epsilon}{\epsilon-1}}$$

and where η represents the intra-temporal substitution elasticity between domestic and foreign goods, ζ is the intra-temporal substitution elasticity between goods produced in the rest of the world, and ϵ is the intra-temporal substitution elasticity between differentiated goods within one country, and α is the degree of openness of the domestic economy.⁴ Consequently, the price consumer's price index is given by:

$$P_t \equiv \left[(1 - \alpha) P_{C,D,t}^{1-\eta} + \alpha P_{C,F,t}^{1-\eta} \right]^{\frac{\eta}{\eta-1}} \quad (10)$$

13. Assuming the law of one price holds, aggregation over all tradable products and countries yields the terms of trade (see Funke and Others, 2017, for more details):

$$S_t = \frac{Z_t P_{C,F,t}^*}{P_{C,D,t}} = \frac{P_{C,F,t}}{P_{C,D,t}} = \frac{P_{C,F,t}^*}{P_{C,D,t}^*} \quad (11)$$

14. Finally, the consumer price index based real exchange rate \mathcal{R}_t can be written as:

$$\mathcal{R}_t = \frac{S_t P_t^*}{P_t} \quad (12)$$

International Risk Sharing

15. Savers are able to share country-specific risks internationally via trading bonds in complete security markets, implying the risk-sharing condition:

³ The superscripts for borrowers and savers have been dropped, because all arguments hold for borrowers, savers, and aggregates.

⁴ For simplicity, ϵ is assumed to be the same in each sector.

$$\mathcal{R}_t = \left(\frac{X_t^S}{X_t^{S,*}} \right)^{-\sigma} \left(\frac{\tilde{C}_t^{S,\varepsilon_t}}{\tilde{C}_t^{S,*\varepsilon_t}} \right)^\gamma \left(\frac{H_t^{S,\varepsilon_t}}{H_t^{S,*\varepsilon_t}} \right)^\gamma \quad (13)$$

where $\tilde{C}_t^{S,*}$ is the composite index of foreign savers' non-durable consumption after accounting for habit persistence, $H_t^{S,*}$ is the index of housing consumption, $X_t^{S,*}$ is the index of foreign savers' consumption and ε_t^* is the foreign counterpart to domestic preference shocks.

Firms

16. Retailers are assumed to produce final goods in sector j by combining domestic intermediate goods using a constant elasticity of substitution production function.

Furthermore, the wholesale sector produces intermediate goods using a Cobb–Douglas production function, $Y_{j,t}(k) = A_{j,t}N_{j,t}(k)$, where $A_{j,t}$ is a sector specific productivity measure.

17. The price adjustments of the monopolistically competitive firms are assumed to follow a variant of Calvo pricing. Specifically, a randomly-selected fraction of the firms in each sector $(1 - \theta_j)$ adjust prices, while the remaining fraction of firms θ_j does not adjust. In addition, a fraction $(1 - \iota_j)$ of the firms behaves in a forward-looking way, while the remaining fraction ι_j uses the recent history of the aggregate price index to set prices. Thus, ι_j is a measure of the degree of backward-looking price-setting. These assumptions yield the conventional mark-up rule, whereby firms set the price as a mark-up over current and future real marginal costs (mc_k). First-order log-linear approximation around the steady states yields fairly standard New Keynesian Phillips curves for inflation in the consumption and housing sectors:

$$(1 + \beta^S \iota_C) \hat{\pi}_{C,t} = \beta^S E_t \hat{\pi}_{C,t+1} + \iota_C \hat{\pi}_{C,t-1} + \kappa_C \widehat{mc}_{C,t-1} + \epsilon_t^{\mu_C} \quad (14)$$

$$(1 + \beta^S \iota_H) \hat{\pi}_{H,t} = \beta^S E_t \hat{\pi}_{H,t+1} + \iota_H \hat{\pi}_{H,t-1} + \kappa_H \widehat{mc}_{H,t-1} + \epsilon_t^{\mu_H} \quad (15)$$

where $\kappa_j = \frac{(1-\theta_j)(1-\beta^S\theta_j)}{\theta_j}$ is the slope of the New Keynesian Phillips curve and $\epsilon_t^{\mu_j}$ is a sector-specific cost-push shock.

Equilibrium

18. Government is assumed to purchase a time-varying fraction f_t of output of each good in each sector, financed by lump-sum taxation (see Gali, 2003). Consequently, aggregate goods market clearing for each good k in each sector j requires:

$$(1 - f_t)Y_{C,t}(k) = C_{D,t}(k) + \int_0^1 C_{D,t}^i(k) \quad (16)$$

$$(1 - f_t)Y_{H,t}(k) = I_t(k) \quad (17)$$

where $C_{D,t}^i$ represents non-durable consumption from country i . Defining a government expenditure shock g_t as $\log(1 - f_t) = \exp(-g_t)$, these equations can be approximated around a symmetric steady state by:

$$\hat{y}_{C,t} = (1 - \alpha)\hat{c}_t + \alpha\hat{c}_t^* + \alpha(\zeta + \eta(1 - \alpha))\hat{s}_t + g_t \quad (18)$$

$$\hat{y}_{H,t} = \hat{i}_t + g_t \quad (19)$$

19. Aggregate consumption of non-durable goods and the housing stock is given by:

$$C_t = \omega C_t^b + (1 - \omega)C_t^s, H_t = \omega H_t^b + (1 - \omega)H_t^s$$

and aggregate labor supply and real debt are:

$$N_t = \omega N_t^b + (1 - \omega)N_t^s, B_t = \omega B_t^b + (1 - \omega)B_t^s$$

20. Finally, aggregate real output (denominated with the in the aggregate producer price index, $P_{D,t}$) must satisfy $P_{D,t}Y_t = P_{C,D,t}Y_{C,t} + P_{H,t}Y_{H,t}$, where the price index of aggregate output is a weighted average of prices of domestic consumption and housing.

Monetary Policy

21. Monetary policy is assumed to follow a standard Taylor-type rule. The log-linearized rule expressed in deviations from a symmetric steady state is:

$$\hat{r}_t = \rho_r \hat{r}_{t-1} + (1 - \rho_r)(\phi_\pi \hat{\pi}_{C,t} + \phi_y \Delta \hat{y}_t) + v_t^r \quad (20)$$

where the central bank adjusts the policy interest rate when CPI inflation deviates from target and output growth deviates from trend. The parameters ϕ_π and ϕ_y represent the responsiveness of the interest rate to inflation and output growth, respectively, ρ_r represents the inertia of policy adjustments, and v_t^r is a monetary policy shock.

Exogenous Processes

22. To estimate the model, the model is log-linearized using a first-order Taylor approximation and all variables are expressed as log-deviations from steady state levels. The exogenous forces driving the dynamics of the model are:

$$a_{C,t} = \rho_{a_C} a_{C,t-1} + v_t^{a_C} \quad (21)$$

$$a_{H,t} = \rho_{a_H} a_{H,t-1} + v_t^{a_H} \quad (22)$$

$$\hat{c}_t^* = \rho_{c^*} \hat{c}_{t-1}^* + v_t^{c^*} \quad (23)$$

$$\epsilon_t^{\mu_C} = \rho_{\mu_C} \epsilon_{t-1}^{\mu_C} + v_t^{\mu_C} \quad (24)$$

$$\epsilon_t^{\mu_H} = \rho_{\mu_H} \epsilon_{t-1}^{\mu_H} + v_t^{\mu_H} \quad (25)$$

$$\epsilon_t = \rho \epsilon_{t-1} + v_t \quad (26)$$

$$g_t = \rho_g g_{t-1} + v_t^g \quad (27)$$

$$v_t^r = v_t^r \quad (28)$$

where all $v_t^i \sim N(0, \sigma_i^2)$. With the exception of the monetary policy shock v_t^r , all shocks are assumed to follow AR(1) processes. Equations (21) and (22) represent shocks to technology in the non-durable consumption and housing sectors, respectively. Equation (23) is a foreign demand shock, and equations (24) and (25) are cost-push shocks in the non-durable consumption and housing sectors, respectively. Finally, equation (26) is a housing preference shock and equation (27) is a government spending shock. For the purposes of estimation, LTV and tax policy are assumed to be inactive over the sample period (i.e., ϵ_t^τ and ϵ_t^{LTV} are set to zero).

Data and Estimation

Data

23. The model parameters are estimated using quarterly data ranging from 1993 to 2017.

The measurement variables used in estimation are real GDP per capita, real consumption per capita, real residential investment per capita, employment per capita, headline CPI inflation, house price inflation, and the overnight policy interest rate. Each variable is expressed in log deviations from steady states, where steady states are computed using the Hodrick-Prescott filter for the real variables and as sample averages for the nominal variables.

Estimation

24. The model is estimated using Bayesian methods (see An and Schorfheide, 2007). The parameters determining the steady-state of the model are calibrated to produce reasonable values to steady-state values and ratios. Some of the other parameters are difficult to estimate given our set of observable variables. The calibrated parameters and their values are displayed in table 1. The steady state ratios for the discount factors, depreciation of the housing stock, and the LTV are set broadly in line with previous studies. The property tax rate parameter τ is an estimate of average settlement costs of buying real estate in Canada (around 5 percent) and the degree of openness is calibrated to roughly match the share of imports in aggregate Canadian production.

25. The statistics relating to the prior and posterior distributions of the estimated parameters are displayed in table 2.⁵

β^s	Discount factor (savers)	0.99
β^b	Discount factor (borrowers)	0.98
δ	Depreciation rate of housing stock	0.01
$(1 - \chi)$	Loan-to-value ratio steady state	0.60
τ	Property tax steady state	0.05
α	Degree of openness	0.30
γ	Share of housing in utility	0.30

Parameter	Description	Prior Distribution	Posterior Mean	Posterior [10%, 90%]
σ	Elasticity of substitution (consumption/labor)	$\beta(1, 0.05)$	1.05	[0.97, 1.12]
ψ	Elasticity of substitution (labor)	$\Gamma(2, 0.1)$	1.97	[1.81, 2.13]
h	Habit persistence	$\beta(0.5, 0.05)$	0.69	[0.67, 0.71]
ω	Share of borrowers	$\beta(0.3, 0.05)$	0.61	[0.59, 0.63]
ζ	Elasticity of substitution (foreign)	$\Gamma(1, 0.05)$	1.13	[1.06, 1.21]
η	Elasticity of substitution (domestic/foreign)	$\Gamma(1, 0.05)$	1.09	[1.01, 1.17]
ϵ	Elasticity of substitution (domestic goods)	$\Gamma(4, 0.1)$	4.05	[3.89, 4.21]
ρ_r	Monetary policy rule: Interest smoothing	$\beta(0.8, 0.05)$	0.76	[0.72, 0.79]
ϕ_π	Monetary policy rule: Inflation reaction	$\Gamma(2, 0.1)$	2.10	[1.83, 2.36]
ϕ_y	Monetary policy rule: Output reaction	$\Gamma(0.2, 0.05)$	0.21	[0.13, 0.29]
θ_c	Calvo parameter (consumption)	$\beta(0.5, 0.1)$	0.71	[0.67, 0.74]
θ_H	Calvo parameter (housing)	$\beta(0.5, 0.1)$	0.50	[0.47, 0.54]
ι_c	Inflation inertia (consumption)	$\beta(0.8, 0.05)$	0.80	[0.72, 0.89]
ι_H	Inflation inertia (housing)	$\beta(0.8, 0.05)$	0.79	[0.71, 0.88]
ρ_{a_c}	Persistence (technology in consumption sector shock)	$\beta(0.5, 0.1)$	0.56	[0.50, 0.62]
ρ_{a_H}	Persistence (technology in housing sector shock)	$\beta(0.5, 0.1)$	0.52	[0.47, 0.56]
ρ_{c^*}	Persistence (foreign consumption shock)	$\beta(0.5, 0.1)$	0.60	[0.50, 0.70]
ρ_{μ_c}	Persistence (consumption cost-push shock)	$\beta(0.5, 0.1)$	0.82	[0.77, 0.86]
ρ_{μ_H}	Persistence (housing cost-push shock)	$\beta(0.5, 0.1)$	0.56	[0.47, 0.66]
ρ	Persistence (housing preference shock)	$\beta(0.5, 0.1)$	0.93	[0.92, 0.94]
ρ_G	Persistence (government spending shock)	$\beta(0.5, 0.1)$	0.64	[0.58, 0.70]

⁵ The Metropolis-Hastings algorithm is used to draw 500,000 sets of parameters from the posterior distribution. The first half of the draws is discarded to ensure convergence.

Appendix I. Table 2. Estimated Parameters (Concluded)

σ_{a_c}	Std dev: Productivity in consumption sector shock	$\Gamma^{-1}(1, 2)$	1.09	[0.67, 1.51]
σ_{a_H}	Std dev: Productivity in housing sector shock	$\Gamma^{-1}(1, 2)$	0.79	[0.18, 1.38]
σ_r	Std dev: Monetary policy shock	$\Gamma^{-1}(1, 2)$	0.18	[0.11, 0.24]
σ_{c^*}	Std dev: Foreign consumption shock	$\Gamma^{-1}(1, 2)$	1.95	[1.21, 2.67]
σ_{μ_c}	Std dev: Consumption cost-push shock	$\Gamma^{-1}(1, 2)$	0.50	[0.30, 0.69]
σ_{μ_H}	Std dev: Housing cost-push shock	$\Gamma^{-1}(1, 2)$	1.36	[0.18, 2.44]
σ	Std dev: Housing preference shock	$\Gamma^{-1}(1, 2)$	2.19	[1.30, 3.11]
σ_g	Std dev: Government spending shock	$\Gamma^{-1}(1, 2)$	0.55	[0.34, 0.76]

HOW TO IMPROVE HOUSING AFFORDABILITY IN CANADA'S DYNAMIC REGIONS?¹

A. Introduction

1. Housing affordability is becoming an increasing social and economic concern in

Canada. While Canada's overall affordability rankings² are not among the worst in its peer group, its most dynamic regions, particularly around Vancouver and Toronto are severely unaffordable (Table 1). Moreover, some smaller housing markets are also becoming unaffordable, as demand pressures are spreading from the major markets to nearby markets. Deteriorating affordability raises not only important social concerns, but also economic ones, as it works against attracting and keeping talent in Canada's most dynamic urban centers. Thus, it can have a negative effect on growth, productivity, and innovation. This note focuses on the housing markets in the Greater Toronto Area (GTA) and Greater Vancouver Area (GVA) where demand pressures have been the most acute.

Table 1. Canada: Selected Countries: Housing Affordability Ratings by Country: All Markets

Country	Affordable (3.0 and under)	Moderately Unaffordable (3.1 to 4.0)	Seriously Unaffordable (4.1 to 5.0)	Severely Unaffordable (5.1 and over)	Total	Median Market
Australia	0	2	5	15	22	5.9
Canada	11	15	6	14	46	3.9
Hong Kong SAR	0	0	0	1	1	19.4
Ireland	2	2	1	0	5	3.7
Japan	0	1	1	0	2	4.2
New Zealand	0	0	2	6	8	5.8
Singapore	0	0	1	0	1	4.8
United Kingdom	0	5	18	10	33	4.5
United States	49	59	37	30	175	3.7
Total	62	84	71	76	293	4.1

Source: 14th Annual Demographia International Housing Affordability Survey, 2018.

2. Driving the deterioration of affordability has been the significant imbalance between housing demand and supply in the most affected regions. House prices nearly doubled between early 2010 and spring 2018 in Vancouver and Toronto as demand from domestic and foreign buyers outstripped the supply of homes. House price appreciation has been slower in other parts of the country, with virtually no appreciation in the resource rich areas in the same period.

¹ Prepared by Zsofia Arvai.

² This analysis uses the "Median Multiple" (median house price divided by gross pre-tax annual median household income) to assess housing affordability. See the Demographia 2018 survey for the coverage of markets.

B. Demand-side Measures Focusing on Housing Market Imbalances

3. The main drivers of housing market pressures in the GTA and GVA from the demand side included: (i) robust economic growth; (ii) population growth from both international and interprovincial migration; (iii) low interest rates; (iv) ample credit supply; (v) increasing investor demand, both from domestic and foreign buyers; (vi) some tax incentives for investment in housing (e.g., expenses, including mortgage interest are tax deductible if rented out) for domestic buyers.³

4. Numerous measures have been introduced to tackle housing market imbalances from the demand side. These measures had two intertwined objectives: (i) macroprudential measures by the federal authorities to address direct financial stability risks and indirect macroeconomic risks related to high household indebtedness,⁴ and (ii) tax measures by the provincial authorities to address rising unaffordability, most notably the introduction of hefty property transfer taxes for nonresident buyers in British Columbia and Ontario. In addition, some tightening of tax treatment of home sales has also been introduced at the federal level: capital gains exemption can only be claimed by Canadian residents. Current measures appear to be containing housing-related financial sector risk, but continued vigilance is needed as the banking system remains highly exposed to household debt and vulnerable to a sharp reversal in house prices.

C. Tackling the Main Constraints to Housing Supply

5. A broad set of supply-side policies is needed to durably improve housing affordability in addition to the already implemented demand-focused policies. Most importantly, complementary strategies are needed for infrastructure and public services, immigration, and housing supply policies. Both the GTA and GVA have experienced significant demand due to immigration and interprovincial migration, as well from nonresident buyers. Upgrading the transportation infrastructure has not kept up with the demand on roads and on various forms of urban and suburban public transportation.

6. The authorities at all levels of government are cognizant of the importance of increasing housing supply and improving housing affordability. In 2017, the federal government announced a [National Housing Strategy](#), a 10-year, C\$40 billion plan focusing mostly on improving social housing. Ontario's [Fair Housing Plan](#) of April 2017 includes several planned actions to increase affordable housing supply and purpose-built rental housing. British Columbia's [Homes for B.C.](#), introduced in February 2018, is a 30-point plan to improve housing affordability which was identified as the single biggest policy challenge in the province.

³ See CMHC (2018) for a detailed analysis on the drivers of housing demand across Canada.

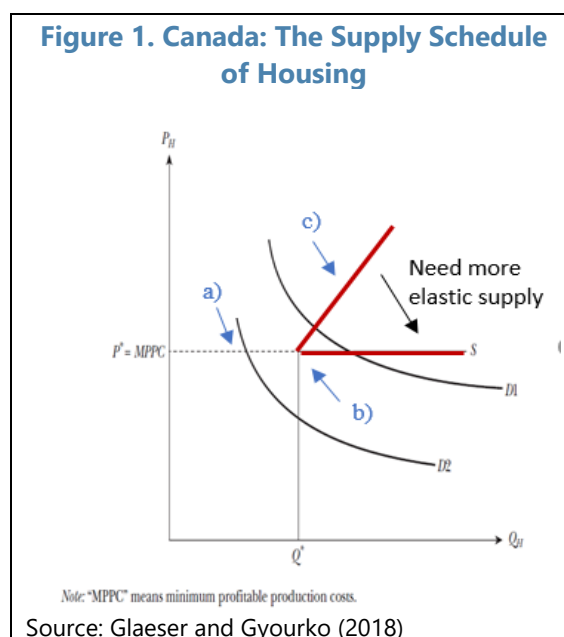
⁴ For a comprehensive list of macroprudential and other regulatory measures aimed at insured and uninsured mortgages, see Annex III of the Staff Report for the 2018 Article IV Consultation.

7. Basic economics of housing supply suggest that the housing market is well-functioning if the market price (roughly) equals the cost of producing the housing unit.

Glaeser and Gyourko (2018) employs a cost-based approach to gauge whether housing is being delivered at an appropriate price. In cases where housing prices are above the production cost,⁵ the gap between the price and production cost can be understood as a regulatory tax. Land regulation is often aimed at reducing negative externalities such as urban sprawl and the loss of green areas or agricultural land. This regulatory tax may or may not be efficiently incorporating the negative externalities of new housing production. As Figure 1 illustrates⁶,

- a) in **lightly regulated housing markets** with growing population and economies, the supply curve for housing is relatively flat;
- b) in a housing market **where housing demand declined sharply**, the supply curve for housing has a kink at the existing level of built housing. This is because housing is durable and does not diminish quickly when demand falls. As a result, a reduction in demand leads to lower prices for housing and minimal new construction.
- c) in **heavily regulated housing markets** with growing economies, the supply curve for housing slopes up. As a result, additional demand for housing translates into prices that are substantially above the minimum profitable production cost, with rising land values driving up total costs;

8. Highly inelastic housing supply, in a rising demand context, limits the effectiveness of macroprudential and tax-based policies to target demand for housing. Without an adequate supply response, tighter measures aimed at demand will lead to more and more buyers being squeezed out of the housing market, with the strongest negative impact on first-time buyers in general.



9. The supply response in the GTA and GVA housing markets has been inadequate as indicated by the divergence in the trend of house prices and permits.⁷ The time path of house prices in the Toronto area is representative of a common pattern: cities with inelastic housing supply

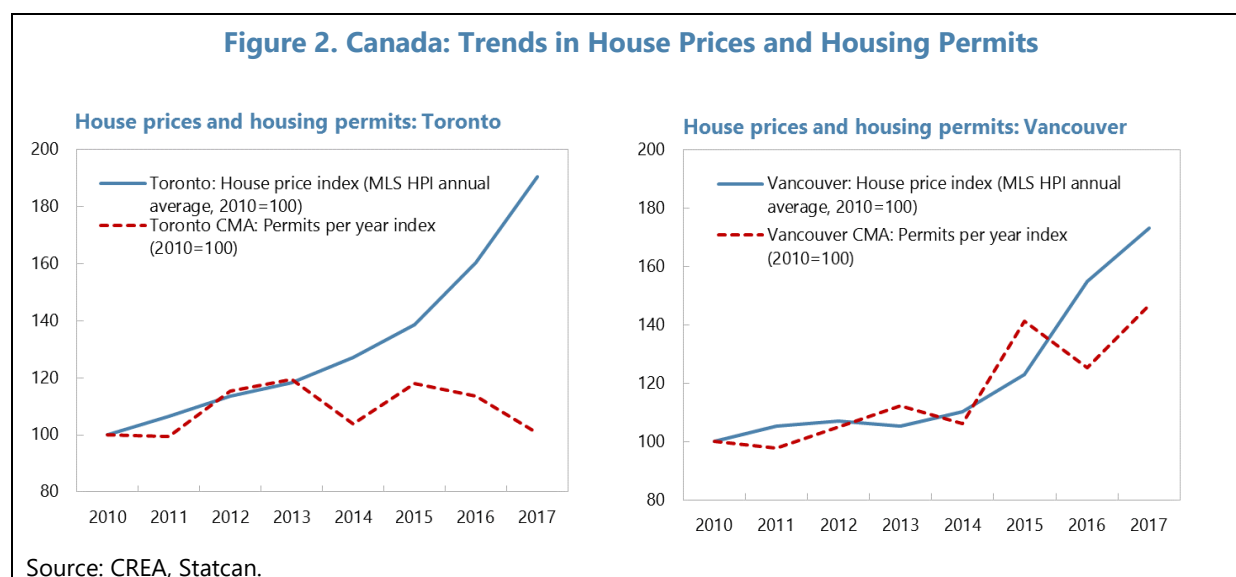
⁵ In Glaeser and Gyourko (2018), the underlying land price is included in the production cost based on land values in a relatively free market with few restrictions on building.

⁶ In Figure 1, P, Q, and D denote house price, housing supply, and the demand curve, respectively.

⁷ Estimates for long-run supply elasticity of housing starts are particularly low for Toronto and Vancouver, see CMHC (2018), "Examining Escalating House Prices in Large Canadian Metropolitan Centres", p7.

and high demand generally experienced more extreme run-up in house prices (Figure 2).⁸ The supply response in the Vancouver area was more elastic after 2014, but fell between 2015-16, while increased demand led to an upsurge in prices from 2014.

10. Not only has the overall supply response been insufficient, but the mix of new supply has also not been supportive of affordability. A common complaint in both Vancouver and Toronto is that new supply has been tilted toward higher-end one- and two-bedroom condominiums, often catering to demand for investment property, and not enough units have been built at the affordable end. Nevertheless, the recent robust price increase in the condominium market, particularly in Vancouver, indicates that the elasticity of supply of condominiums remains low overall. Demand for rowhouses and medium-density housing also seems to be unmet.



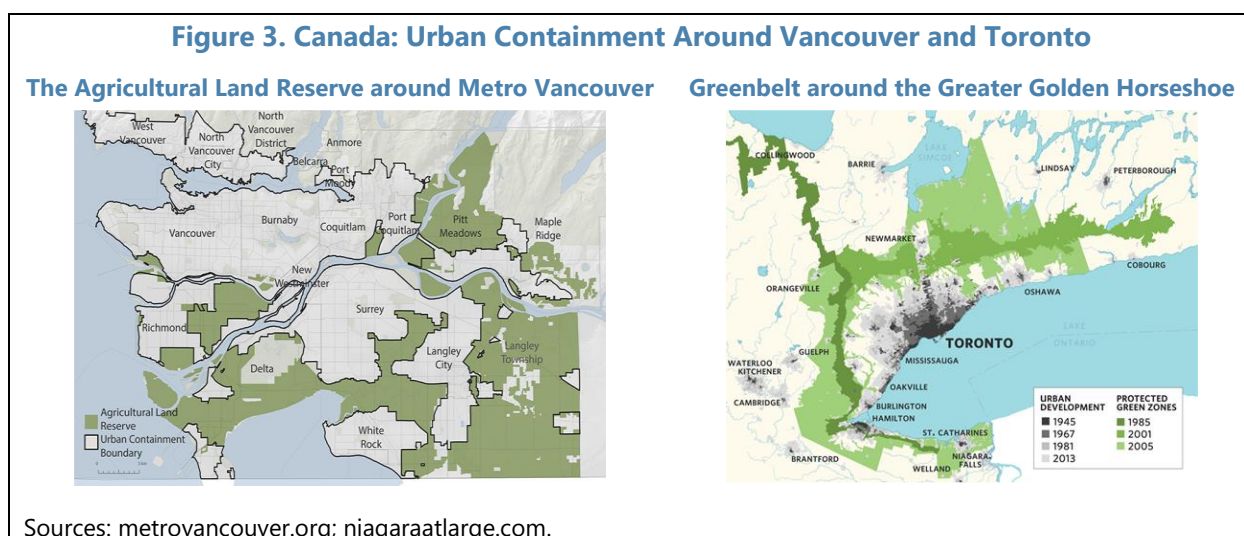
11. The reasons behind insufficient housing supply can be manifold. They can include natural barriers that restrict land development, urban containment, zoning restrictions, inefficiencies in permitting, extensive specification requirements for approval and construction, mismatch in the type of housing supply and demand, construction labor shortages, bottlenecks in infrastructure that obstruct the delivery of serviced land, roads, public transportation, or public services.

12. Both the Toronto and Vancouver regions have some natural barriers and urban containment policies that limit the fully flexible expansion of land supply, but the main bottleneck seems to be the shortage of serviced land ready for development and other supporting infrastructure.⁹ Toronto's downtown area borders on Lake Ontario, while Vancouver is

⁸ See e.g. Bellisario et al (2016) for a discussion on San Francisco's affordability crisis and policies to address it.

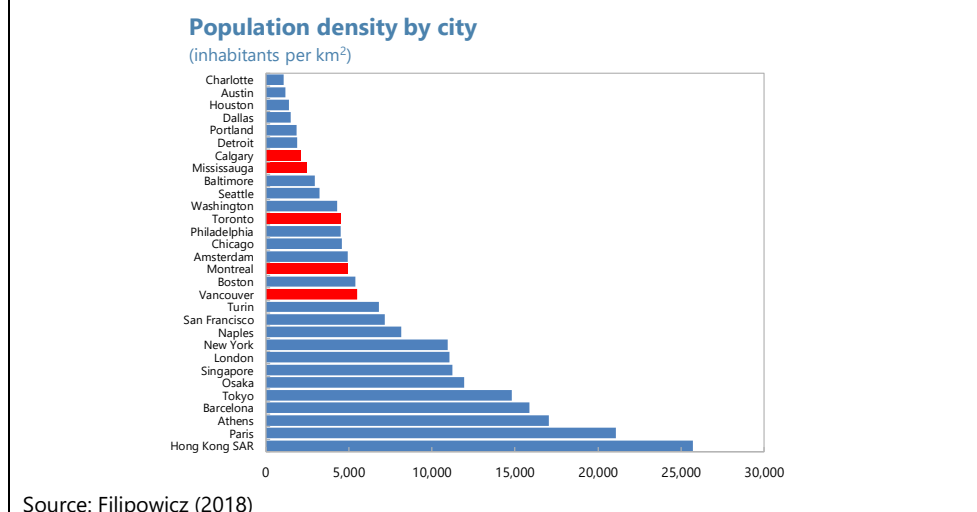
⁹ A recent study analyzing the cost of barriers to housing supply in Canada found that restrictions and extra costs on building new housing – such as zoning regulations, development charges, and limits on housing development in urban containment areas – are dramatically increasing the price of housing. See Dachis and Thivierge (2018).

surrounded by the sea and mountains. In addition, with the Agricultural Land Reserve around Vancouver and the Greater Golden Horseshoe Greenbelt, both the GVA and GTA have had urban containment policies in place that restrict or bans development in urban fringe areas (Figure 3). Despite the urban containment policies, there seems to be sufficient land useable for future development, particularly in the GTA.¹⁰ A major constraint to further urban expansion is that the delivery of land prepared with the necessary infrastructure for development and other public infrastructure (e.g., roads, public transportation, public services) have not kept pace with the rapid rise of demand for housing. Assessing the reasons behind the shortage of serviced land ready for development and accelerating its delivery would be important measures to improve housing supply. Data availability on land supply and serviced land also seems to be inadequate in several municipalities.



13. Increasing urban density in Toronto and especially in Vancouver is widely recognized as key to improving affordability. Canada is one of the world’s most urban countries, but the urban density of its major cities is in the low-to mid-density range compared to major cities in high-income countries (Figure 4). This suggests significant scope to further increase density. Increasing density, however, has some cultural implications as well, as it requires some adjustment in expectations by buyers and increasing acceptance of condominiums and rental apartments as opposed to low-density housing for raising families.

¹⁰ Ontario’s Fair Housing Plan states that as part of the implementation of the Growth Plan for the Greater Golden Horseshoe, 2006, enough land was set aside in municipal official plans to accommodate forecasted growth to at least 2031.

Figure 4. Canada: Population Density in Major Cities Around the World

14. In housing markets with significant imbalance between supply and demand, developers can be incentivized to delay construction and release of units to keep prices high rather than meet demand. They may also engage in land banking so that other developers cannot build on the land. If this type of behavior is prevalent, the authorities may consider ways to introduce public land value capture policies. Public authorities could explore the legal means to purchase land at existing use value, so that the uplift in land value is captured for the public good. In addition, local authorities can play a significant role in bringing land to market, and bank significant tracts of land to maintain a healthy supply of potential construction sites. In Germany, for example, “urban development measures” allow local authorities to assemble land for development by paying private owners the existing value of the plot, and then sell it on after redevelopment at the final value. In the Netherlands, local authorities can purchase land at existing use value which is then developed cheaply for social housing, and some of it is sold off to commercial developers at a profit.

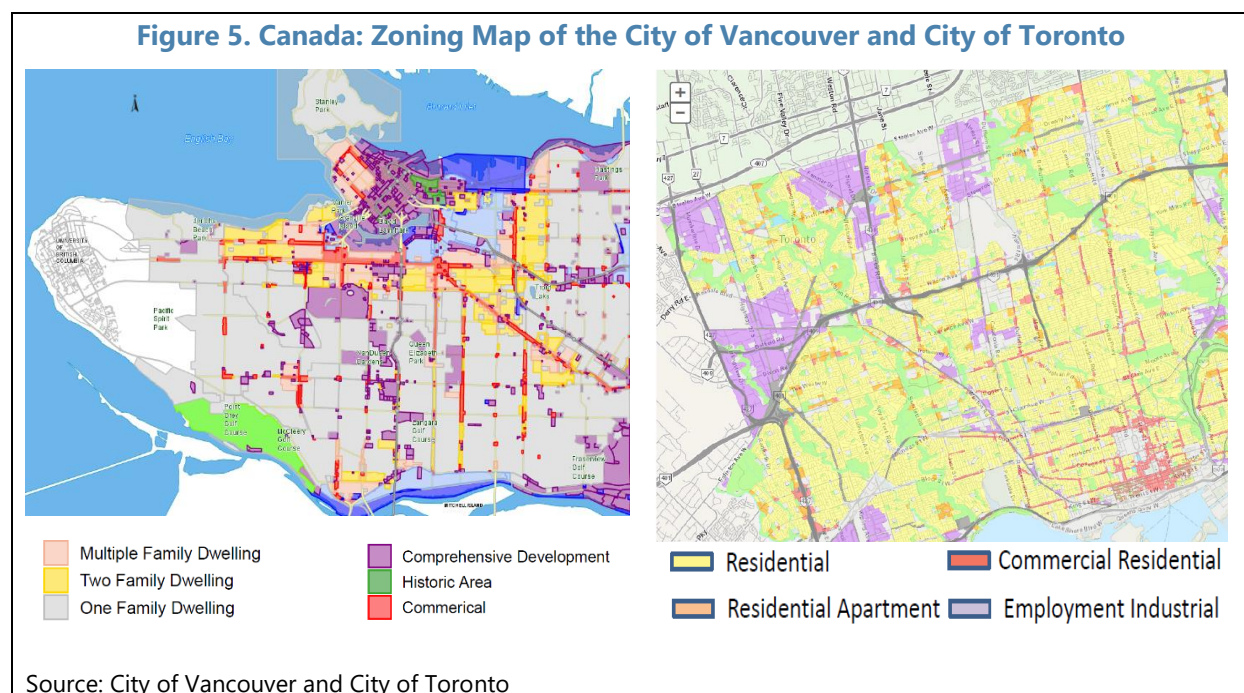
15. Determining development charges can also slow down the construction process.¹¹ As there is an uplift in land value from granting permission for development, municipalities capture some of this uplift by imposing development and other charges. Determining the increase in land value and the development charge is not necessarily straightforward and can significantly extend the time before the actual development can take place.¹²

¹¹ In Vancouver, determining the Community Amenity Contribution (CAC) also seems to be a relatively opaque process. CACs are developer contributions triggered when a site being developed requires rezoning. CACs are negotiated agreements aimed at funding off-site community amenities such as public art.

¹² Arriving at the final amount of development charges can take some amount of time. There is a multitude of charges municipalities can levy for various services. Pricing the value of these services involves judgement and negotiation with developers.

16. The lengthy and non-transparent approval process for building permits is frequently cited as a major obstacle to ramping up the supply response. Building approval, particularly of multiple family residences is a complex process, involving many stakeholders and regulatory agencies. Regulatory inefficiencies such as excessive restrictions on design specifications and intra-regional variations in codes and requirements are also likely to slow development approvals. Building approval for high-rise buildings can take 1.5 to 3 years in the GVA and GTA.¹³ Insufficient staffing at municipalities, lack of clarity on standards, expectations and process, conflicts between different agency requirements are potential reasons behind the lengthy approval process.

17. The slow and unpredictable re-zoning process in particular is a major impediment to increasing density in the GTA and GVA. The current zoning map of the City of Vancouver is especially striking, with the city overwhelmingly zoned for single-family dwellings (Figure 5). Re-zoning areas for higher density buildings on a case-by-case basis is a particularly slow and cumbersome process both in Vancouver and Toronto.¹⁴ The process is often delayed by extensive consultations with residents of the affected area, with NIMBYsm (“not-in-my-backyard) towards higher density buildings being a common obstacle slowing down the re-zoning process further.



¹³ A study by the Centre for Urban Research and Land Development at Ryerson University (2017) found that average approval times in Ontario for more complex buildings, such as condominiums, is 28 months.

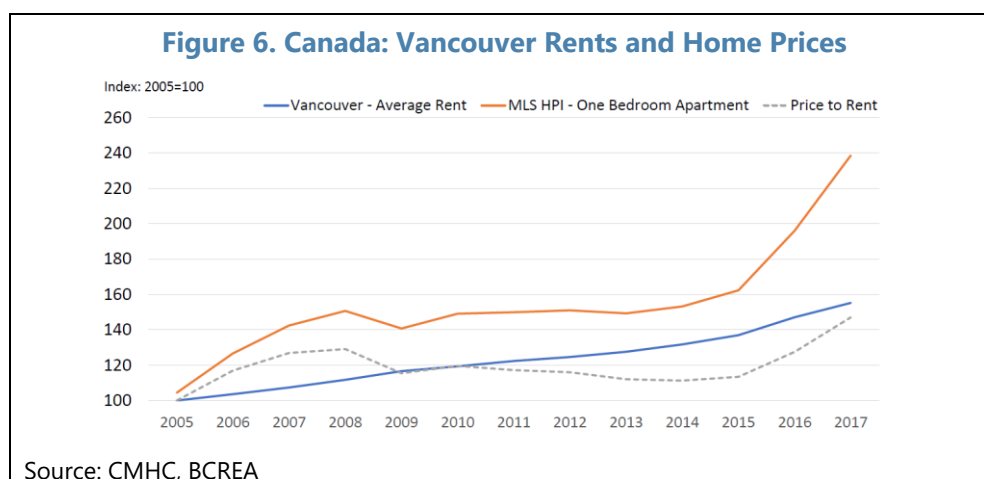
¹⁴ E.g., according to a survey in Green and Filipowicz (2017), the average time for re-zoning was around 10 months in the City of Vancouver. A similar survey for Ontario in Green, Herzog and Filipowicz (2016) found re-zoning adds on average 7 months to the approval timeline for the City of Toronto.

18. Several measures could be considered to shorten the re-zoning and approval process for building permits:

- Conducting a comprehensive assessment of the bottlenecks in the process;
- Exploring ways to re-zone larger areas at a time given the long process of re-zoning on a project-by-project basis;
- Improving the transparency and certainty about the timelines of the different steps involved in the development approval process;
- Providing greater certainty to developers by guaranteeing that if an application meets the conditions of the designated zone where planning permission is being applied, the permission would be granted;
- Considering making development plans time-limited after the building permit is granted (sunset clauses) to give a strong incentive to pursue development and help avoid construction delays;
- Modernizing the technology of the permitting system, particularly in Ontario, to allow files to be more easily transferred between municipal and provincial agencies.¹⁵
- Increasing human resources dedicated to the approval process.

D. Increasing the Supply of Rental Housing

19. Like the owner-occupied segment, the rental market has become increasingly tight in the GTA and GVA (Figure 6). The rental vacancy rate has hovered below 1 percent for years in Vancouver and recently fell below 1 percent in Toronto.¹⁶ Low vacancy rates have pushed rents higher and led to lower rental turnover rates.



¹⁵ Ibid.

¹⁶ See CMHC (2017) Fall Rental Market Reports for British Columbia and Ontario.

20. The rental market is an important part of the housing supply mix, and a healthy rental market is particularly important for labor mobility. Affordable rentals are key to retaining and attracting the workforce dynamic labor markets need. Many young households are not able to purchase their first homes due to the price increases in the GTA and GVA. The rental market also provides a viable option for households who fail to meet eligibility criteria for social housing.

21. The composition of the rental housing also matters. A mix of purpose-built rentals and secondary rentals (rentals provided by individual owners)¹⁷ is desirable to achieve a degree of professionalism in the management of rental properties. Landlords of secondary rentals may lack the necessary knowledge or skills to responsibly manage their properties. Larger property portfolio managers might also achieve economies of scale in management.

22. Despite the low vacancy and turnover rates, the supply of new purpose-built rental housing has not taken off in GTA and GVA. The new supply of purpose-built rental buildings has been low for decades, both compared to demand and to some other advanced countries, e.g., US and Germany. Fast rising prices in the condo market incentivized the construction of condo units with higher profit margins for developers.¹⁸ The surge in housing prices incentivized investment in real estate, condominiums in particular, for individual buyers who often found it profitable to rent out these additional holdings as secondary rentals. Investor demand has been tilted for properties supplying higher-end rental properties to the market. According to CMHC's most recent Rental Market Surveys, about a quarter of the condominium apartments in Vancouver and one-third in Toronto are occupied by renters.¹⁹

23. There is renewed interest in reviving the purpose-built rental market to provide an alternative to secondary rentals. Ontario's Fair Housing Plan and British Columbia's Homes for B.C. both emphasize the need for incentives for purpose-built rental:

- Ontario's plan includes that property tax for new multi-residential apartment buildings should be charged at a similar rate as other residential properties. This is to apply to the entire province. It also includes introducing a targeted \$125-million, five-year program to further encourage the construction of new rental apartment buildings by rebating a portion of development charges.

¹⁷ Moreover, a run-up in investment properties with the intention to rent them out can worsen affordability further. These investors affect the broader housing and mortgage markets as they compete to buy the same pool of properties as primary home buyers. They can also add to financial stability risks, since in a housing market downturn, investors selling secondary properties into an illiquid market could amplify the fall in house prices, potentially raising losses for all mortgages. This could be a particular concern in a rising interest rate environment, if renting out properties becomes unprofitable given higher debt-servicing costs.

¹⁸ There are also structural differences that incentivize condominium development (e.g., developers can pre-sell condos, reducing their upfront financing needs, but cannot do so for rentals).

¹⁹ See CMHC (2018)

Working with municipalities, the government would target projects in those communities that are most in need of new purpose-built rental housing.

- In British Columbia, qualifying purpose-built rentals are eligible for the waiver of municipal property taxes. The province will match these waivers by eliminating provincial property taxes.

24. Municipalities in the GVA and GTA already have a host of incentives for purpose-built rental housing, but a comprehensive assessment whether these incentives are effective would be useful. The existing incentives include density bonuses, various forms of property tax breaks, reductions in development costs such as development charges and building permit fees, and expedited processing.²⁰ However, the incentives appear insufficient or not well targeted in light of the scarcity of new purpose-built rental construction. Thus, the provincial and municipal governments of British Columbia and Ontario could usefully assess whether the current funding and tax incentives for purpose-built rental developments are effective in achieving their objectives, and whether expanding them would contribute to greater supply.

25. The role of rent control policies in rental property supply should also be evaluated to ensure that it does not constrain new supply. Both British Columbia and Ontario have had rent control policies for a long period of time.²¹ Ontario's Fair Housing Plan expanded rent control to all private rental units in Ontario, including those built after 1991. If the limits for rent increase are set too low, they can have several adverse consequences, including inhibiting new rental supply.²² Reviewing the limits and modalities of these rent control policies is especially important in the tight rental market environment.

E. Conclusion

26. Addressing housing supply constraints is a complex exercise. It will require complementary transportation, immigration, and housing strategies at all levels of government. Some of the constraints and bottlenecks can be addressed relatively easily e.g., by streamlining and modernizing processes, establishing databases and information sharing. Others, such as accelerating rezoning and the delivery of serviced land are more difficult issues, as they reflect deeper structural constraints. Nevertheless, addressing housing supply issues should be handled as a matter of urgency as the social and economic costs of deteriorating affordability are increasing.

²⁰ See E.g., Ryerson University School of Urban and Regional Planning (2015). "Promoting Rental Housing in the Greater Toronto Area".

²¹ See details for Ontario's [rent increase guideline](#) and British Columbia's [rent increase rules](#) on the provinces' websites.

²² By forcing rents below the market price, rent control reduces the profitability of rental housing, directing capital to other more profitable markets. By reducing the return on investments in rental housing, rent control can also lead to a decline in the quality and quantity of existing rental stock.

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A CLOSER LOOK AT LABOR PRODUCTIVITY IN CANADA¹

A. Recent and Historical Trends

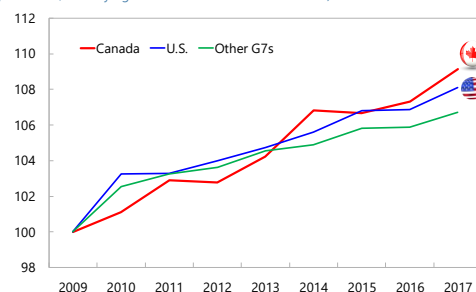
1. The strong cyclical upturn helped boost labor productivity growth in Canada last year.² As oil prices stabilized and aggregate demand was boosted by accommodative monetary and fiscal policies, output growth rebounded strongly to 3 percent in 2017 (top among the G7). With output growth outpacing labor input growth, labor productivity also rebounded strongly to 1.7 percent.

2. Nonetheless, from a long-term perspective, Canada's productivity remains much weaker than the leading G7 economies. OECD estimates of labor productivity (at constant purchasing power parity) suggest that Canada enjoyed the second highest productivity level after the U.S. in the 1970s. However, labor productivity has since grown more slowly in Canada than in other economies, and as a result, Canada has fallen behind France and Germany, and its productivity gap with the U.S. has widened from around 12 percent in the 1970s to 24 percent today.

3. Looking forward, an aging population will put a drag on growth in Canada. Statistics Canada projects that the share of working age population (ages 15-64) would fall from around 67-68 percent today to 60 percent in 2040 (under its medium-growth scenario). This implies that growth of the working age population would decelerate from 1 percent to less than 0.5 percent a year. Were labor productivity growth to stay the same (an average of 1.2 percent in 2010-17), GDP growth would decelerate to 1.7 percent a year, significantly below the average growth rate of 2.2 percent over the past one and a half decades. To reverse the negative implications of an aging population, Canada will need to boost labor productivity.

Labor Productivity Growth

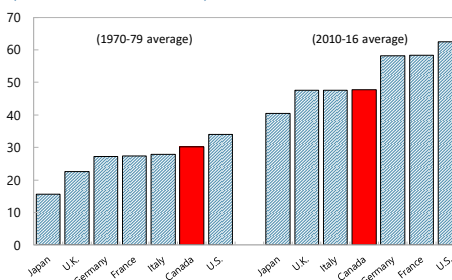
(2010=100; underlying data are constant local currencies)



Sources: Haver Analytics

G7 Economies Labor Productivity

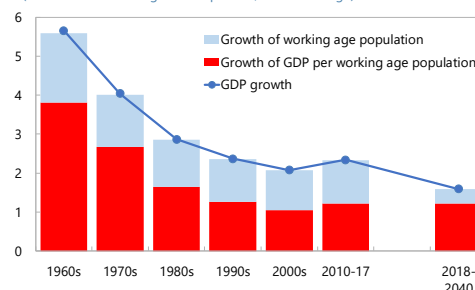
(Constant 2010 PPPs in U.S. dollar)



Source: OECD.Stat

Canada: Long-term Growth

(Contribution to GDP growth in percent, annual average)



Sources: Statistics Canada; Haver Analytics; and IMF staff calculations.

¹ Prepared by Jorge Alvarez, Yurani Arias Granada, Kotaro Ishi (all WHD); and Sanjana Goswami (University of California, Irvine).

² In this chapter, unless otherwise indicated, labor productivity is measured as output per total hours worked.

4. Using data from Canadian firms, as well as industry-level and provincial data, we analyze labor productivity and business investment trends. We ask the following three questions.³

Q1. What is restraining labor productivity growth? We look at labor productivity trends using a shift-share approach and growth accounting approach (Section B).

Q2. How has firms' productivity been associated with investment? We estimate markup measures as proxy for firm-level productivity and examine how markups are associated with business investment (Section C).

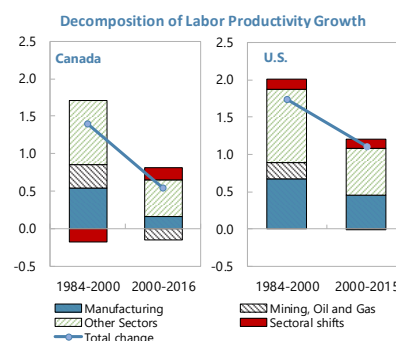
Q3. How important is the technology and productivity diffusion channel from the U.S. to Canada? The U.S. is the most important trade partner for Canada. Many studies show that trade is an important channel for technology diffusion (IMF, 2017). We attempt to find the evidence of spillover effects from the U.S. to Canada (Section D).

B. What is Restraining Labor Productivity Growth?

5. The structure of Canadian industry has evolved markedly over the past decades. As in many other advanced economies, Canada's industry structure has shifted towards the service sector, with the share of manufacturing industry halved from over 20 percent in the 1960s to about 10 percent today. Given that the growth of labor productivity in manufacturing industry has been much higher than most of other industries, its shrinking share could explain part of the long-term declining trend of labor productivity growth.

6. To analyze if aggregate productivity growth has been driven by specific sectors ("within effects") or changes in the sector composition of employment ("shift effects"), we employ a shift-share decomposition analysis (see Box 1). We compare the pattern of labor productivity growth (excluding the public sector) in Canada with that in the U.S., and split the sample before and after 2000 when the stagnation of productivity growth became evident.

- Overall, the shift-share analysis indicates that the productivity slowdown mostly results from "within effects," rather than "shift effects."
- The "within effects" contribution of the mining, oil and gas sector fell from 0.3 percentage points (annual average) in 1984-2000 to –0.1 percentage point in 2000-16 (Table 1). Similarly, the "within effects" contribution of the manufacturing sector



Source: OECD and staff calculations.
Note: Comparable US 2016 data not available. Total growth divided by period length shown.

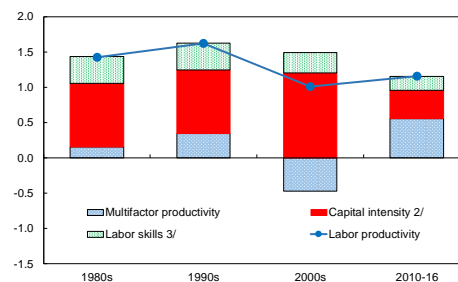
³ There are many other channels to explain labor productivity. For example, using Canadian provincial data, Petersson et al (2017) present empirical evidence that an increase in female labor force participation is positively associated with labor productivity growth. Ishi and Mariscal (forthcoming) present some evidence that public investment in infrastructure could boost economic growth and complement private investment.

decreased sharply from 0.5 percentage points in the first period to 0.2 percentage points in the second period. In both sectors, “shift effects” were small or negative, reflecting a decline in employment shares.

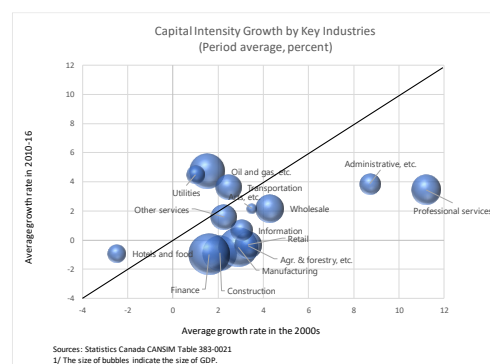
- In the U.S., the contribution of the mining, oil and gas sector and the manufacturing sector has also fallen, but less so than in Canada.
- Encouragingly, “shifts effects” have turned positive in Canada in 2000-16 (from -0.1 percentage points in the first period to 0.2 percentage points in the second period). This implies that more labor was allocated to sectors with higher labor productivity growth, contributing to higher aggregate-level productivity growth.

7. Using growth accounting, we also ask whether the weakened productivity growth reflected multifactor productivity or capital accumulation. Growth accounting estimates by Statistics Canada show that the deceleration in labor productivity growth in the 2000s mainly reflected a decrease in multifactor productivity (in part due to the impact of the 2008-09 global financial crisis), while capital intensity (defined as capital stock per total hours worked) increased its positive contribution to overall labor productivity growth. Since 2010, multifactor productivity growth has recovered, but instead, capital intensity growth has slowed markedly, with its contribution to overall productivity growth halved. The decline in capital intensity growth was broad based: all industries (except for few industries, such as mining, oil and gas, and transportation) had lower capital intensity growth, with some (such as manufacturing, construction, retail and finance) incurring negative growth.

Canada: Sources of Labor Productivity Growth 1/
(Percent, annual average)



1/ The business sector, which includes the whole economy less public administration, non-profit institutions and the rental value owner-occupied dwellings.
2/ Growth in capital stock per total hours worked.
3/ Growth in the educational attainment and work experience of the labor force.
Sources: Statistics Canada CANSIM 383-0021; and IMF staff calculations.



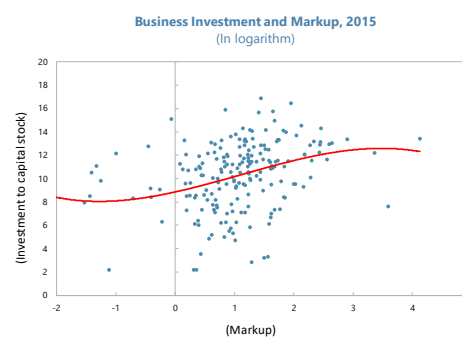
Sources: Statistics Canada CANSIM Table 383-0021
1/ The size of bubbles indicate the size of GDP.

C. How Does Firm Productivity Relate to Investment?

8. Several factors could explain the slowdown in business investment growth. Among them, aggregate demand, financial constraints, and policy uncertainty are generally viewed as the most important drivers of the dynamics of business investment (see for example, IMF, 2015). In the aftermath of the global financial crisis, a recovery in economic activity in Canada’s trading partners (most importantly, the U.S.) was weak. Moreover, although U.S. economy finally began to gain momentum around 2014, global oil prices dropped sharply, hitting the Canadian economy. More recently, heightened trade tensions in the North America region may have contributed to dampening business investment.

9. We look at another possible factor: Canadian firms' productivity. Because measuring productivity using micro firm-level data has some challenges (for example, due to the lack of data for firms' output prices), we instead estimated firms' markups (defined as price over marginal costs), following the empirical framework developed by De Loecker and Warzynski (2012). As well argued in De Loecker and Warzynski (2012), firms' productivity and markups are closely associated, as productive firms tend to set higher markups.⁴ Due to data constraints, our analysis below focuses on markups for large Canadian (non-energy) firms using Worldscope database (see Appendix I for more detail). Note that energy firms are excluded from our analysis because we are mainly interested in the productivity trend in the non-energy sector.

10. We found some evidence of close correlations between markups and business investment in our sample data. It appears that markups and business investment are positively associated, but less so when markups are too high. This could suggest that highly profitable firms with too high markups might not be motivated to invest. Accordingly, positive relations between markups and business investment are not necessarily monotonic, but nonlinear. We test this hypothesis in the empirical analysis below.



11. Furthermore, consistent with firm-level data, some industry-level indicators suggest waning competitiveness of Canadian industries.

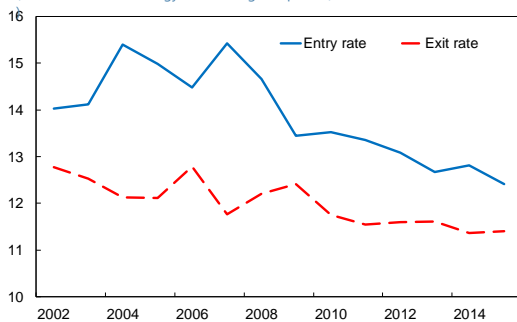
- The measure of firm entry and exit rates in Canada (the number of firms that start business or go out of business as a percent of total firms) shows a downward trend. Shortly after the global financial crisis, the entry and exit rate recovered somewhat, but has resumed a downward trend in most sectors since 2012. There is no clear consensus on why entry and exit rates have fallen, but the decreased entry and exit may signal weakened firm dynamism.⁵

⁴ Our focus on firms' productivity and markups is in part motivated by some growing concerns that there are not so many globally competitive firms in Canada. For example, in the list of Fortune 500 (2017), only 11 Canadian firms made it to the list, of which 6 companies are from the financial or the energy sector. Many also argued that Canada's cooperate sector is dominated by small-and medium-sized enterprises, which are less competitive and less capital intensive than big firms (Canadian Chamber of Commerce, 2016).

⁵ See Cao et al (2017) and St-Amant, P., and D. Tessier (2018). Possible factors discussed in the literature are: increased industrial concentration, like the entry of a big retailer such as Walmart, which operates on a large and increasing scale, discouraging new entry; and less interest in entrepreneurship among highly educated young people.

Business Sector: Entry and Exit Rate

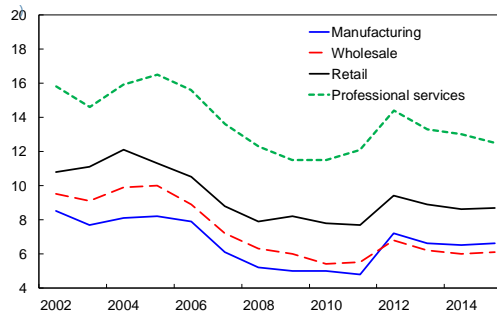
(Percent, excludes energy and mining companies)



Source: Statistics Canada CANSIM Table 527-0001

Business Sector: Entry Rate by Key Sector

(Percent)

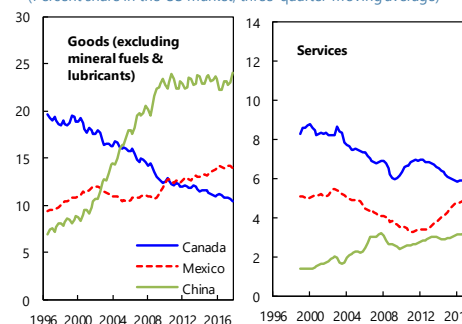


Source: Statistics Canada CANSIM Table 527-0001

- The import share of Canadian goods and services in the U.S. market has been on the steady decline. The share of Canadian non-energy goods and services in the US import market has been steadily on the decline, with the share of China steadily rising. Using a shift-share analysis, Barnett and Charbonneau (2015) analyzed that the loss of Canada's market share was attributed more to weakened competitiveness than to a change in US consumers' preference.⁶

U.S.: Imports from Canada, Mexico, and China

(Percent share in the US market, three-quarter moving average)



Sources: U.S. Census Bureau; and Haver Analytics.

12. We estimate Tobin Q's type investment models

to examine whether these markup and industry competitiveness measures could be considered as part of business investment determinants. We embed markups and industry level

competitive indicators, such as entry and exit rates and China's import penetration rates, in a standard Tobin Q's type investment model (Appendix II). The sample period is 1997-2016. The estimation methodology is OLS with fixed effects, and regression results are reported in Table 2.

- **The coefficient on markups is positive and highly significant**, indicating positive relations between markups and business investment (Model 1). The positive association is stronger for exporters than domestic firms (Model 2 and 3). For exporters, Model 2 suggests that a 10 percent increase in markup is associated with 0.6 percentage points increase in the investment to capital stock ratio for non-energy exporters.
- **Evidence of nonlinearity.** Model 4 (all firms) and Model 5 (exporters) show that the coefficient on the quadratic term of the markup variable is negative, indicating that if markup is too high,

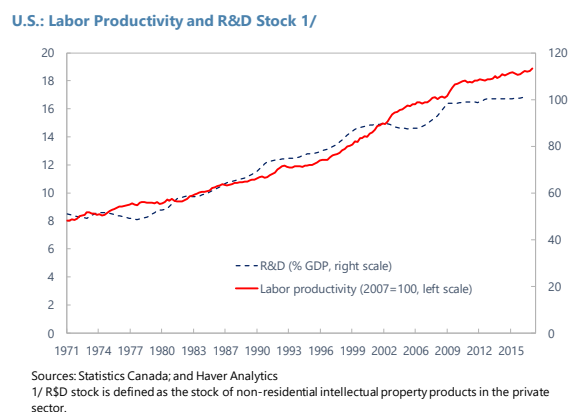
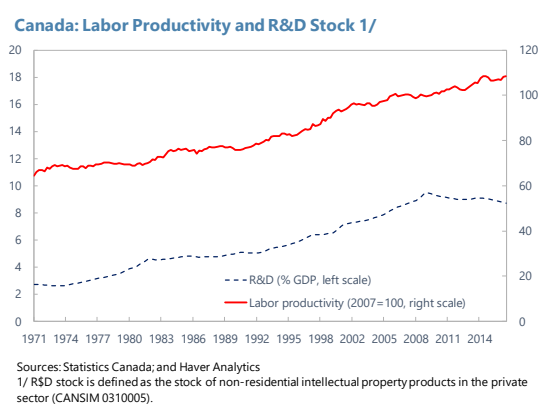
⁶ They estimated that two-thirds of the decline in Canada's share of the U.S. non-energy import market (between 2002 and 2014) is attributable to reduced competitiveness, and 16 percent of the decline is attributable to changes in the composition of U.S. import demand. By sector, almost three-quarters of Canada's total loss in market share was concentrated in two sectors: motor vehicles and parts (reflecting a reduction in U.S. demand for large cars) and forestry products and building and packaging materials (reflecting the collapse in the U.S. housing market).

business investment would decline. This said, this result should be treated as tentative because the estimated coefficients are not statistically significant.

- **Industry level competitiveness and business investment.** The coefficient on the entry and exit rate is positive but not statistically significant (Model 6).⁷ We also tried FDI inflows (as a percent of GDP)—our hypothesis is that higher FDI inflows directly boost business investment but also indirectly by enhancing competition. But the estimated coefficient is nearly zero and not statistically significant (Model 7). We thus attempted to interact these two variables and found that the coefficient on the cross term is positive and highly significant. This would suggest that higher FDI combined with entry and exit rates are associated with higher business investment, possibly through positive competition effects (Model 8).
- **Impact of China’s import penetration.** In Model 9 (all firms), the coefficient on China’s important penetration is negative and highly significant: a one percentage point increase in China’s share in total U.S. imports led to a 0.2 percentage points decline in Canada’s investment ratio. This competition effect is more evident for exporters (Model 10) than for domestic producers (Model 11).

D. How Important is Technology and Productivity Diffusion from the U.S. to Canada?

13. R&D activity in Canada remains relatively weak, especially compared to that in the U.S. R&D stock in the U.S. was about 9 percent of GDP in the early 1970s, and has since increased to 17 percent of GDP in 2016, although the pace of growth has decelerated since the global financial crisis. In Canada, R&D stock was much lower, compared to the U.S., at about 3 percent of GDP in the early 1970s. R&D stock in Canada has since increased, but only to about 9½ percent of GDP by 2008, and has been flat over the past decade.



⁷ Entrants and incumbents can create new products and displace the products of competitors. How exactly the process of innovation works has been much debated since Schumpeter (1939). Most recently, Acemoglu et al (2017) argue that policies to encourage exit of less productive firms would help free up resources and improve economic growth and welfare. In contrast, Gracia-Macia, Hsieh, and Klenow (2018) show that innovation comes more from incumbents, using U.S. firm-level data.

14. What about spillovers from the U.S. to Canada? Even though R&D stock in Canada remains lower than that in the U.S., Canada should have been benefitted from technology and knowledge spillover effects across its southern border, and such spillover effects may have been magnified as the economic ties between the two economies have become stronger since the Canada-United States Free Trade Agreement (1987) and North American Free Trade Agreement (1994).

15. We test productivity spillover channels from the U.S. to Canada. Using data from 10 Canadian provinces, labor productivity growth models are estimated (Appendix III).⁸ The sample period is from 1990 to 2015, and the annual data are averaged for five 5-year periods (a balanced panel data set). We are interested in long-term relationships and thus want to exclude cyclical effects arising from short-run business fluctuations. Our hypothesis is that labor productivity growth or real R&D expenditure in the U.S. would affect Canada's productivity through trade channels. We calculated $Weight_{i,j}$ as Canadian province i 's total trade (=exports + imports) with U.S. state j as a percent of province i 's GDP, which is used to weight U.S. labor productivity growth or real R&D expenditure (as percent of employment) in each U.S. state.

16. The regression results are presented in Table 3.

- Models 1-4 present the results of OLS fixed-effects models. Consistent with our priors, U.S. labor productivity growth and U.S. R&D spending growth are positively and significantly correlated with Canada's labor productivity growth. Note that coefficients are greater if U.S. labor productivity growth and U.S. R&D spending are weighted by the trade share, which is consistent with possible productivity and technology spillover channel through trade.⁹
- Because our dataset has a relatively short sample period combined with large cross section data ("small T, and large N"), as robustness checks, we also employ the Generalized Method of Moments (GMM) estimator (Models 5-10). The results confirm robust relationships between U.S. productivity growth or U.S. R&D spending growth and Canada's labor productivity growth as estimated coefficients are much larger and more highly significant compared to OLS estimates (Models 5-8).¹⁰

⁸ The 10 Canadian provinces are Alberta (AB), British Columbia (BC), Manitoba (MB), New Brunswick (NB), Nova Scotia (NS), Newfoundland and Labrador (NL), Ontario (ON), Prince Edward Island (PE), Quebec (QC), and Saskatchewan (SK).

⁹ Trade and productivity linkages could arise through several channels. For example, Keller (2000) stresses the technology diffusion channel through intermediate goods imports from technological leaders, while Blalock and Veloso (2007) present evidence that vertical supply relationships are the channel through which import-driven technology transfer occurs. Bloom, Draca, and Reenen (2016) also show some evidence of import competition and technical advancement.

¹⁰ Note that our GMM models do not fully take account of endogeneity problems arising from omitted variables. For example, Canada's labor productivity could rise due to an increase in more competitive US imports, leading to exits of less productive Canadian firms.

- In Model 9, both simple average U.S. productivity growth and weighted U.S. productivity growth are included. The coefficient on the former turns to be insignificant, while the coefficient on the latter remains highly significant, which suggests evidence of the productivity spillover through trade channels.
- In Model 10, we also found similar evidence for R&D spending, with the coefficient on the weighted U.S. R&D spending greater than that on the simple U.S. R&D spending. However, these coefficients are not significant, suggesting that productivity spillover channels are more complex and factors beyond R&D and trade could matter.

E. Conclusion

17. Key empirical findings in this chapter are as follows.

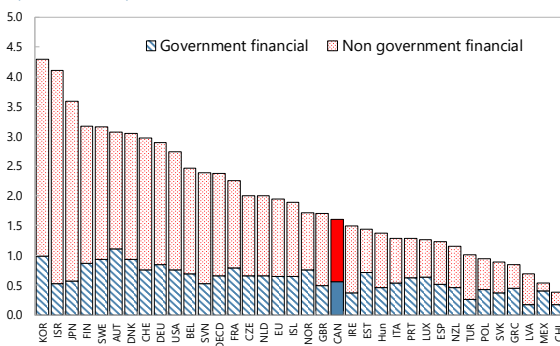
- The recent slowdown in labor productivity growth can be explained mainly by a deceleration in capital intensity growth. Disaggregated analysis shows that the slowdown in capital intensity and labor productivity has been broad-based and not attributed to particular industries.
- The firm-level panel data analysis suggests positive relations between markups and business investment, together with some evidence of nonlinearity.
- We also found some evidence that lackluster business investment in recent years could also be associated with weakened firm dynamism (as reflected in lower entry and exit rate).
- We found evidence that is consistent with spillover effects from U.S. productivity or U.S. technology investment to Canada productivity through trade channels.

18. The Canadian authorities' renewed efforts to boost labor productivity are welcome.

The authorities are rightly focusing on measures to enhance innovation activity, given that spending on R&D and the density of industrial robots in Canada are much lower than top performers in OECD economies.

OECD: Research and Development Spending

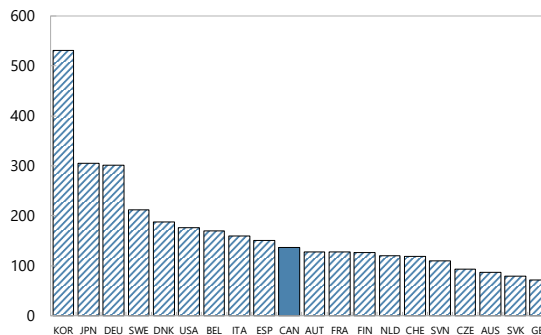
(Percent of GDP)



Sources: OECD Statistics.

OECD: Industrial Robot Density, 2015

(Number of multiple industrial robots per 10,000 employees in manufacturing industry)



Source: International Federation of Robotics

19. But more can be done to enhance investment, innovation, and the diffusion of new technologies.

- On the external trade front, a heightened level of trade tensions in the North America region is a concern, given the importance of trade in supporting Canada's productivity through the diffusion of technology. Earlier resolution of trade disputes will help put Canada's growth path on a higher and sustainable path. In addition, a further reduction of the preferential treatment given to domestic firms and suppliers could also be considered to maximize potential benefits from trade.¹¹
- By analogy, although this chapter has not covered internal trade issues, our analysis suggests that reducing barriers to internal trade should also be important to enhance the diffusion of technology across Canadian provinces. The implementation of the Canadian Free Trade Agreement should be accelerated, aimed at reducing barriers to internal trade, investment, and labor mobility, and harmonizing regulations and standards.
- Another area that requires concerted efforts by all levels of jurisdiction is product market reform. OECD Study (2016) shows that Canada's regulatory framework is relatively restrictive compared to other OECD economies (Table 4). There is apparently room to reduce barriers in professional, retail, and network services, and regulatory protection of incumbents by streamlining licensing and registration requirements.

¹¹ Foreign ownership is restricted in some sectors (e.g., network industry), and foreign suppliers may not be able to fully participate in public procurement contracts in selected sectors (e.g. transportation services, computer services, construction, telecom, and professional services).

Box 1. Shift-Share Analysis

Aggregate productivity growth can be decomposed into growth of sectoral productivity, and gains from the reallocation of labor resource across sectors (Fagerberg, 2000 and Andersson, 2006).

$$\begin{aligned} \Delta LP_t / LP_0 &\equiv (LP_t - LP_0) / LP_0 && \text{Aggregate labor productivity growth} \\ &= \frac{1}{LP_0} \sum s_{j0} \Delta LP_{jt} && \text{Sum of sector productivity growth ("within effects")} \\ &+ \frac{1}{LP_0} \sum LP_{j0} \Delta S_{jt} && \text{Sectoral shifts in employment shares ("shift effects")} \\ &+ \frac{1}{LP_0} \sum \Delta LP_{jt} * \Delta S_{jt} && \text{Cross-sectoral component ("co-movement effects")} \end{aligned}$$

where s_{jt} is the employment share of sector j at time t ; labor productivity LP_t is defined as gross value added per total hours worked (excluding the public sector).

The first component measures the effect of labor productivity growth within each sector holding the employment share constant ("within effects"). The second component measures the impact on aggregate labor productivity growth resulting from the movement of labor across sectors holding the level of labor productivity in each sector constant ("shift effects"). Finally, the cross-sectoral component measures the effect of the change in both labor productivity and the employment share ("co-movement effects"). The positive sign of the cross-sectoral component indicates that the "within effects" and "shift effects" are complementary, thus labor resources are reallocated towards sectors with higher productivity growth.

For both Canada and the U.S., we decompose aggregate productivity growth into key 6 sectors: agriculture, forestry, fishing, and hunting; mining, quarrying, and oil and gas; manufacturing; construction; utilities; and other sectors including services.

Table 1. Productivity Growth Decomposition
(Percentage points)

	Total	Agriculture	Oil & Mining	Manu- facturing	Construction	Utilities	Other sectors (incl. services)
Canada							
1984-2000							
Productivity growth within sector	1.71	0.02	0.32	0.54	0.04	0.01	0.79
Employment share shifts	-0.18	-0.02	-0.18	-0.14	-0.05	-0.01	0.22
Cross-sectoral	-0.14	0.00	-0.10	-0.08	0.00	0.00	0.04
Total change in productivity	1.40	0.00	0.05	0.31	-0.01	-0.01	1.05
2000-2016							
Productivity growth within sector	0.51	0.04	-0.14	0.16	-0.05	0.00	0.50
Employment share shifts	0.16	-0.02	0.20	-0.39	0.18	0.00	0.19
Cross-sectoral	-0.13	-0.01	-0.06	-0.06	-0.02	0.00	0.02
Total change in productivity	0.55	0.01	0.00	-0.29	0.11	0.00	0.72
United States							
1984-2000							
Productivity growth within sector	1.87	0.06	0.22	0.67	-0.02	0.07	0.87
Employment share shifts	0.14	-0.02	-0.09	-0.21	0.06	-0.05	0.44
Cross-sectoral	-0.27	-0.02	-0.13	-0.19	0.00	-0.02	0.08
Total change in productivity	1.73	0.02	0.01	0.27	0.03	0.00	1.40
2000-2015 1/							
Productivity growth within sector	1.07	0.02	0.00	0.46	-0.08	-0.03	0.71
Employment share shifts	0.12	0.00	0.10	-0.25	-0.03	0.00	0.30
Cross-sectoral	-0.09	0.00	0.00	-0.13	0.01	0.00	0.04
Total change in productivity	1.11	0.02	0.09	0.08	-0.11	-0.03	1.06
1/ Comparable US 2016 data not available.							
Sources: OECD Stat. and IMF staff calculations.							

Table 2. Results of Firm Level Panel Regressions 1/
(Excluding energy firms)

Dependent variable: log investment to capital											
	Baseline			Non linear effects		Entry and Exit Rate and FDI			Chinese Imports		
	All	Exporters	Domestic	All	Exporters	All	All	All	All	Exporters	Domestic
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Log markup	0.071*** (0.03)	0.060** (0.03)	0.148 (0.11)	0.087*** (0.03)	0.082** (0.03)	0.071 (0.07)	0.073 (0.06)	0.079 (0.08)	0.132*** (0.05)	0.073 (0.05)	0.346** (0.17)
Log markup * markup				-0.001 (0.00)	-0.001 (0.00)						
Lagged log return on assets	0.176*** (0.02)	0.177*** (0.02)	0.145*** (0.05)	0.176*** (0.02)	0.177*** (0.02)	0.168*** (0.02)	0.170*** (0.03)	0.167*** (0.02)	0.176*** (0.02)	0.173*** (0.02)	0.147** (0.06)
Log effective interest rate	-0.160*** (0.02)	-0.152*** (0.02)	-0.218*** (0.07)	-0.160*** (0.02)	-0.152*** (0.02)	-0.154*** (0.03)	-0.164*** (0.03)	-0.152*** (0.03)	-0.113*** (0.03)	-0.102*** (0.03)	-0.194** (0.09)
Tobin's q	0.149*** (0.02)	0.189*** (0.03)	0.101** (0.04)	0.149*** (0.02)	0.190*** (0.03)	0.128*** (0.04)	0.129*** (0.03)	0.117*** (0.04)	0.091*** (0.02)	0.154*** (0.03)	0.027 (0.05)
Log REER	-0.258* (0.14)	-0.240* (0.13)	-0.333 (0.70)	-0.255* (0.14)	-0.237* (0.13)	0.324 (0.25)	0.079 (0.20)	0.368 (0.25)	0.748** (0.29)	0.890*** (0.29)	-0.023 (1.12)
US output gap						0.029*** (0.01)	0.037*** (0.01)	0.032*** (0.01)	0.042*** (0.01)	0.041*** (0.01)	0.048 (0.03)
Chinese imports share in the U.S.									-0.168*** (0.06)	-0.155** (0.06)	-0.378 (0.27)
Entry and Exit Rates						0.005 (0.02)		-0.014 (0.02)			
FDI Inflows							-0.000 (0.00)	-0.009* (0.00)			
Entry&Exit Rates * FDI Inflows								0.001** (0.00)			
Constant	-1.638*** (0.61)	-1.761*** (0.61)	-1.235 (3.23)	-1.665*** (0.61)	-1.793*** (0.61)	-4.316*** (1.29)	-3.121*** (0.86)	-4.224*** (1.29)	-5.723*** (1.25)	-6.374*** (1.24)	-2.000 (4.89)
<i>Memorandum items:</i>											
Observations	4026	3500	526	4026	3500	3076	3774	2933	2112	1760	352
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

1/ Robust standard errors in parentheses, with ***, **, * indicating significance level at 1 percent, 5 percent, and 10 percent level, respectively.

Table 3. Results of Provincial Level Spillover Regressions 1/




































Dependent variable: log labor productivity growth (five year average)

	OLS Fixed Effect Estimates				GMM Estimators					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Log. initial labor productivity (GDP/hour worked)	-14.270** (2.988)	-11.848** (2.050)	-12.757** (3.251)	-8.522** (3.143)	-26.788*** (5.733)	22.554*** (2.993)	19.344*** (2.364)	13.034*** (2.294)	25.551*** (6.187)	18.235*** (2.298)
Change in net-migration in provinces to population	1.980** (0.939)	1.773* (0.962)	0.987 (1.143)	0.997 (1.230)	1.493** (0.681)	1.331** (0.557)	1.090 (1.720)	0.690 (0.837)	1.421** (0.647)	1.012 (1.500)
Exports to other provinces (growth rate)	0.054 (0.043)	0.056 (0.045)	0.096** (0.036)	0.107** (0.048)	-0.025 (0.027)	0.010 (0.018)	0.035* (0.018)	0.108*** (0.023)	-0.010 (0.038)	0.054** (0.028)
Rule of Law: Estimate	4.296*** (1.112)	5.512*** (0.839)	0.976 (2.437)	1.365 (2.715)	3.734*** (1.202)	6.778*** (1.021)	0.226 (1.832)	0.961 (1.558)	5.452*** (1.848)	0.515 (1.987)
Unweighted US labor productivity growth	0.055* (0.028)				0.158*** (0.059)				0.072 (0.093)	
Weighted (with X+M/GDP) US labor productivity growth		0.080* (0.045)				0.325*** (0.088)			0.208** (0.099)	
Unweighted US R&D per employee growth			0.035*** (0.010)				0.071*** (0.012)			0.051 (0.032)
Weighted (with X+M/GDP) US R&D per employee growth				0.093* (0.050)				0.486*** (0.138)		0.181 (0.248)
Memorandum items:										
Observations	60	60	50	50	50	50	40	40	50	40
R-squared	0.583	0.575	0.630	0.552						
Adjusted R-squared	0.454	0.442	0.482	0.373						
AR(1) p-value					0.176	0.217	0.0855	0.272	0.286	0.168
AR(2) p-value					0.0726	0.866	0.310	0.104	0.827	0.228
Sargan p-value					0.141	0.315	0.0268	0.0228	0.209	0.0133
Hansen p-value					0.988	0.877	0.954	0.987	0.993	0.981

1/ Robust standard errors in parentheses with ***, **, and * indicating significance level at 1 percent, 5 percent, and 10 percent, respectively.

Table 4. OECD Product Market Regulation Indicators, 2013 /1

(Index from zero to six, with higher index indicating less competition friendly regulatory stance)

	Canada 2/	U.S.	Best G7	OECD Average
Overall market	 1.4	1.6	1.1	1.5
State control	 1.9	2.7	1.6	2.2
Barriers to entrepreneurship	 1.3	1.6	1.2	1.7
<i>Of which:</i>				
Barriers in services sectors	 3.7	3.0	3.0	3.3
Regulatory protection of incumbents	 1.4	2.1	0.6	1.3
Barriers in network sectors	 3.0	3.0	1.0	2.7
Antitrust exemptions	 0.7	2.9	0.0	0.4
Other barriers to entrepreneurship	 0.9	0.9	0.5	1.5
Barriers to trade and investment	 1.0	0.5	0.4	0.5
<i>Of which:</i>				
Explicit barriers to trade and Investment	 0.5	0.3	0.1	0.0
Barriers to FDI	 1.0	0.5	0.1	0.0
Tariff barriers	 0.0	0.0	0.0	0.0
Other barriers to trade and investment	 1.5	0.8	0.2	0.0
Differential treatment of foreign suppliers	 1.8	1.3	0.1	0.0
Barriers to trade facilitation	 1.2	0.2	0.2	0.0
Professional services	 3.1	1.1	2.0	2.0
Accounting	 3.5	1.3	2.4	2.3
Architect	 3.3	0.8	1.8	1.6
Engineer	 2.6	0.8	1.1	1.3
Legal	 3.2	1.5	2.6	3.0
Network services	 1.7	1.4	1.7	2.1
Airlines	 1.0	1.0	0.3	1.0
Telecoms	 0.5	0.3	0.8	0.9
Electricity	 3.4	1.5	1.8	2.4
Gas	 1.5	0.9	1.6	2.5
Post	 2.7	2.3	2.5	2.5
Rail	 2.3	3.0	2.4	3.5
Road	 0.8	0.8	2.6	1.9
Retail services	 2.5	1.9	2.5	2.0
Registration and licensing requirements	 5.7	4.8	3.0	3.5
Specific regulation of large outlet	 0.0	..	4.6	2.3
Protection of existing firms	 3.0	3.0	2.4	2.0
Regulation concerning shop opening hours	 2.3	0.0	0.5	1.2
Price controls	 4.0	1.7	1.7	1.6
Promotions/discounts	 0.0	0.0	3.0	1.3

Source: OECD Product Market Regulation database,

1/ The 2013 questionnaire contains around 1,400 questions on economy-wide or industry-specific regulatory provisions. A bit more than 700 of the questions are used to compute the economy-wide PMR indicator and the NMR indicators on sector regulation.⁵ All of these questions are closed questions that can either be answered with numerical values (e.g. the number of bodies that need to be contacted to start a business) or by selecting an answer from a pre-defined set of menu (e.g. the question whether a specific regulation exists can be answered with 'yes' or 'no'). The qualitative information is transformed into quantitative information by assigning a numerical value to each possible response to a given question. The coded information is normalized over a zero to six scale, where a lower value reflects a more competition-friendly regulatory stance.

2/ "Green" indicates below the OECD average; and "pink" indicates above the OECD average.

Appendix I. Estimating Markups

1. Markups are estimated at the firm level following De Loecker and Warzynski (2012).

Their method can accommodate a large class of price-setting models and does not need to rely on very restrictive assumptions. Consider the following cost-minimization problem for firm i in period t :

$$\begin{aligned} & \text{Min } P_{it}^l \text{ labor}_{it} + r_{it} \text{ capital}_{it} \\ & \text{subject to } \bar{Y}_{it} = Y_{it}(\text{labor}_{it}, \text{capital}_{it}), \end{aligned}$$

where P_{it}^l and r_{it} are the prices of labor and capital respectively, $Y_{it}(\cdot)$ is production technology, and \bar{Y}_{it} is a scalar. Note that the *Lagrangian* parameter associated with the first-order condition can be interpreted as a direct measure of marginal cost (MC). We define the markup as the price for the output good over the marginal cost, which are both not observable. However, by solving the first order condition, we get a simple expression for the markup as following.

$$\text{markup}_{it} = P_{it} / MC_{it} = \theta_{it}^l / \alpha_{it}^l,$$

where θ_{it}^l is the output elasticity of labor_{it} and α_{it}^l is the share of expenditures on labor_{it} in total net sales.

2. We can directly observe α_{it}^l , calculated as total wages divided by net sales, where total wages are calculated as the number of employees in each firm multiplied by the average industry-level wage. However, θ_{it}^l is not directly observable and needs to be estimated. We estimated the following production function by industry (in logarithm).

$$\text{output}_{it} = \beta_0 + \beta_l \text{labor}_{it} + \beta_k \text{capitalstock}_{it} + \omega_{it} + \epsilon_{it},$$

where ω_{it} is the firm's productivity, and ϵ_{it} is idiosyncratic shock. The estimated coefficient $\hat{\beta}_l$ is the output elasticity of labor input, θ_{it}^l , which we can use for calculating markups.

3. However, in estimating this production function, there could be potential correlation between labor input and unobserved firm-specific shocks, ω_{it} , leading to biased estimates. To solve this endogeneity problem, Olley and Pakes (1996) assume that the firm can observe productivity term ω_{it} and adjust inputs depending on ω_{it} . We can rewrite the production function as following.

$$\text{output}_{it} = \beta_l \text{labor}_{it} + \phi_{it}(i_{it}, k_{it}) + \eta_{it}$$

where $\phi_{it}(i_{it}, k_{it}) = \beta_0 + \beta_k \text{capitalstock}_{it} + \omega_{it}(\text{investment}_{it}, \text{capitalstock}_{it})$, and η_{it} is idiosyncratic shock. We approximate $\phi_{it}(\cdot)$ with a second-order polynomial. The partially linear

production function above can then be estimated by OLS. Since $\phi_{it}(\cdot)$ controls for unobserved productivity, the error term is no longer correlated with the inputs.

4. In the Worldscope database, data for real output is not available, and thus we used “net sales” deflated by industry-level GDP deflators. All other nominal variables such as capital and investment are also deflated using industry-level deflators. Data for industry-level wages is from Statistics Canada. The sample period is 1997-2016 (annual data). Because we are interested in the productivity trend of non-energy firms, our sample dataset excludes energy firms.

Caveats

- The output elasticity is estimated using industry-level panel data, and constant though the sample period. Ideally, time varying elasticities for each company could be estimated, but such data are not available. Thus, the up and down of this markup measures is purely driven by a change in labor shares (e.g., lower labor share means, higher $\theta_{it}^x / \alpha_{it}^x$ and thus higher markups).
- It is assumed that cost minimizing firms take wage setting as given, which may not always hold if firms' wage setting is determined by their productivity levels.

Data Description

Worldscope Data

Variable	Description	World scope codes
Output	Annual net sales or revenue	WC01001
Labor	The number of employees	WC07011
Investment	Capital expenditures	WC04601
Capital stock	Net property, plant and equipment	WC02501

Data sample

	Number of firms	Avg. Net Sales (C\$ mill.)	Avg. Investment (C\$ mill.)
Total (non-energy)	945	931	472
Exporters	635	1,200	608
Non-exporters	310	66	28

Industry level data

- GDP deflator. CANSIM Table 383-0021
- Wages. CANSIM Table 382-0006

Appendix II. Firm Level Analysis: Regression Model Specification and Data

1. We run firm-level panel regressions, using data from the Worldscope database for publicly traded Canadian companies. We restrict our sample to include non-financial firms (excluding energy firms). The sample period is from 1997 to 2016 (annual data), and the panel dataset is unbalanced. The following standard Tobin Q's investment model is estimated.

$$\ln\left(\frac{I_{it}}{K_{i,t-1}}\right) = \alpha_{it} + \beta_{MU} MU_{it} + \beta_X X_{it} + \beta_S Z_{it} + d_t + \eta_i + v_{it}$$

where i denotes a company, I_{it} is fixed investment, K_{it} fixed capital stock, d_t time fixed effect, η_i firm fixed effect, and v_{it} idiosyncratic shock. MU_{it} is a vector of firm level markups that we discussed in the previous section. X_{it} is a vector of determinants of investment, including return on assets (reflecting profitability), the effective interest rate on debt (reflecting cost of borrowing), U.S. output gap; and Tobin's Q. Z_{it} is a vector of market-level competitiveness variables, including firm entry and exit rates, foreign direct investment (FDI) inflows, and China's import share in the United States (all at the industry level).

Data Description

Macro and industry data

- **Real effective exchange rate.** In logarithm. Source, Haver Analytics.
- **United States output gap.** In percent. Source, IMF World Economic Outlook database.
- **Entry and exit rates.** Calculated as $\frac{\text{Number of Entrant+Exits}}{\text{Number of Active Employer Businesses}} \times 100\%$ by industry.

Source, CANSIM Table 527-0001.

- **Foreign Direct Investment inflows.** FDI inward inflows as a percent of GDP (constant terms) by industry. Source, CANSIM Table 376-0122.
- **Share of Chinese imports in the United States.** Calculated as

$$\frac{\text{U.S. imports from China}}{\text{U.S. domestic GDP} + \text{U.S. imports} - \text{U.S. exports}}$$

by industry. Trade data are from UN Comtrade; and U.S.

industry GDP data are from the Bureau of Economic Analysis.

Industry classification. (1) agriculture, forestry, fishing, and hunting; (2) construction; (3) manufacturing; (4) wholesale trade; (5) retail trade; (6) transportation and warehousing; (7) utilities; (8) information and cultural industries; (9) professional and scientific services; (10) administrative and

support, waste management, remediation services; (11) arts, entertainment, and recreation; (12) accommodation and food Services

Firm-level data from Worldscope

Variable	Definition	World scope codes
Investment to capital ratio (logarithm)	Capital expenditures as the ratio of lagged net capital stock (property, plant, and equipment)	WC04601/WC02501
Effective interest rate (logarithm)	Interest expense as the ratio of total debt	WC01251/WC03255
Return on assets (logarithm)	Lagged return on assets	WC08326
Exporter dummy	Firms with foreign Sales for at least three consecutive years	WC08731
Tobin's Q	(Equity market value + liabilities market value) / (equity book value + liabilities book value)	(WC08001 + WC03351) / (WC03501 + WC03351)

Appendix III. Provincial Level Analysis: Regression Model Specification and Data

1. Following the setup used in many growth studies (for example, Barro and Lee 2001), we estimate the following model:

$$\Delta LP_{it} = \beta_0 + \beta_1 \sum_{j=1}^k Weight_{ijt} \Delta LP_{jt}^{US} (or \Delta R\&D_{jt}^{US}) + \gamma X_{it} + \mu_i + \varepsilon_{it}$$

where i, j , and t denote Canadian provinces, US states, and time, respectively; μ_i denotes an unobserved fixed effect capturing time-invariable heterogeneity across Canadian provinces; and $\varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2)$ is a white-noise error term.

2. The dependent variable, ΔLP_{it} , is labor productivity growth for each Canadian province. Explanatory variables are: ΔLP_{jt}^{US} , labor productivity growth for each US state; $\Delta R\&D_{jt}^{US}$ real research and development expenditure per employee growth for each US state; and ΔX_{it} , control variables including the initial level of labor productivity; the growth rate of interprovincial trade; the change in net migration inflows as a percent of population; and the rule of law index (a proxy for the quality of institutions).

3. We estimate the above equation using OLS with fixed-effects and the Generalized Method of Moments (GMM) estimator. Among various GMM estimators, we choose the difference GMM estimator from Arellano and Bond (1991), because it addresses problems related to inconsistent estimators due to variable endogeneity and a relatively short sample period combined with a fairly large cross section data ("small T, and large N"). We use as instrument the initial level of labor productivity.

Data Description

- **Canada productivity growth.** Growth rate of real GDP divided by hours worked. Gross domestic product at market prices, chained 2007 comes from CANSIM Table 384-0038. Data for provincial GDP prior to 1980 were estimated using nominal GDP data (CANSIM Table 384-0015) divided by the GDP deflator for Canada. Actual hours worked (all Jobs, both sexes, 15 years and over) is from the Labor Force Survey.
- **Exports and Imports as a percent of GDP.** Canada nominal exports and imports from the US by province are from https://open.canada.ca/data/en/dataset?sort=metadata_modified+desc&q=CIMT&organization=statcan. Nominal GDP is from CANSIM Table 384-0038.
- **Change in net-migration in provinces to population.** Net migration is from CANSIM Table 051-0018, and total population is from CANSIM Table 051-0001.

- **Growth rate exports to other provinces.** CANSIM TABLE 384-0038.
- **Rule of Law.** Worldwide Governance Indicators database, World Bank Group.
- **U.S. productivity growth.** Growth rate of real GDP divided by number of employees. GDP (chained 2009) by state is from Gross State Product database (Bureau of Economic Analysis). Number employed is from U.S. Regional Household Employment database (total U.S., states and selected areas).
- **U.S. R & D per employee growth.** Total R & D expenditure (constant PPP prices) is from OECD Statistics. Number employed is from U.S. Regional Household Employment database (total U.S., states and selected areas).

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