An Analysis of Carbon Tax Treatment within Canada's Equalization Program

Tracy Snoddon[1]
Wilfrid Laurier University

Trevor Tombe[2]
University of Calgary

This Version: June 2019

Abstract

Carbon taxes are not only an efficient tool to mitigate greenhouse gas emissions, but they are an increasingly important source of government revenue. By 2022, a $50 per tonne carbon tax has the potential to become the fifth most important source of revenue for provincial governments, which could be used to lower taxes elsewhere, support public services, or deliver household rebates. The uneven distribution of carbon emissions, however, creates significant differences across provinces in terms of their fiscal capacity for such measures, but little is known about how Canada's equalization program and carbon taxes interact. In this paper, we examine and quantify the effect of (1) increasing carbon tax revenues on the allocation of equalization payments, (2) introducing emissions as a distinct tax base within the formula, and (3) the omission of carbon tax revenue under the federal backstop program. We quantify various considerations for policy makers looking to reform or improve the functioning and effectiveness of both equalization and climate policies in Canada.

[1] Snoddon: Associate Professor, Lazaridis School of Business and Economics, Wilfrid Laurier University. tsnoddon@wlu.ca.
[2] Tombe: Associate Professor, Department of Economics, University of Calgary. ttombe@ucalgary.ca.

Introduction

Canada's equalization program is, and has always been, controversial. It attracts attention in all provinces in part because there is a large amount of cash at stake, about $19.8 billion for 2019/20, and because not all provinces receive these transfers. Carbon taxes too face political challenges, especially the new federal backstop policy that implements carbon taxes in provinces without their own sufficiently stringent pricing scheme. The two policies interact in important, though previously unappreciated, ways. As carbon tax rates increase — to $50 per tonne by 2022, and possibly more afterwards — total carbon tax revenues have the potential to be the fifth most important source of provincial revenue within the equalization formula. And given how unevenly greenhouse gas (GHG) emissions are distributed across provinces, and therefore how unevenly carbon tax revenues per person are, pricing carbon meaningfully affects the size and allocation of equalization entitlements. The differential application of carbon pricing policies, either through variation in provincial policies or through selective application of the federal backstop program, compounds this issue. In short, Canada's federal structure poses challenges when it comes to carbon pricing implementation and carbon pricing itself presents some challenges for equalization, a program at the centre of Canada's system of fiscal federalism.

This paper therefore investigates the implications of growing carbon tax revenue and coverage for Canada's equalization program. While there is a large literature examining fiscal transfers in Canada, reviewed extensively in Boadway and Cuff (2017), little has been done to explore the interactions between a Pigouvian corrective tax, such as a carbon tax, and equalization.[3] We take as our starting point the equalization program as it currently operates, focusing on alternative treatments of carbon tax revenues within this system, the distribution of entitlements across provinces, and provincial incentives to reduce carbon emissions. We then quantify various considerations for equalization reform as carbon pricing revenues and coverage grow larger.[4]

To fix ideas, the underlying practical and theoretical rationales for equalization payments are worth keeping in mind. Equalization can help achieve both equity and efficiency goals, though its success in doing so depends crucially on its design. In terms of equity, section 36(2) of the Constitution Act 1982 commits Parliament to the principle of ensuring all provincial governments "have sufficient revenues to provide reasonably comparable levels of public services at reasonably comparable levels of taxation." In practice, this commitment motivates including all provincial revenues into the equalization formula and evaluating them in some "comparable" way. Provinces with limited ability to raise revenues are then topped up to some national average level. The notion of "reasonably comparable levels of taxation" has long motivated what is called the Representative Tax System (RTS) approach to equalization in Canada. Because provinces make different choices about taxes, an RTS defines a "representative" set of taxes, rates, and structures as the basis for measuring and

[3] A notable contribution here is by Garon and Seguin (2019), who demonstrate national environmental taxes may complement equalization payments by mitigating some inefficient spatial migration in a federation with unequally distributed resource endowments. Their work, however, abstracts from the detailed equalization formula that concern us here.

[4] We leave the question of how carbon tax revenues and equalization interact under fundamentally different equalization schemes, such as those proposed by Courchene (1984), Boothe and Hermanutz (1999), and Usher (2017), for future work.

comparing fiscal capacity. This system is informed by the set/universe of revenue generating measures adopted by provinces, including carbon taxes. In this way, the federal government is agnostic about actual tax choices. A why resource revenues were counted as "revenues" rather than asset sales, for example, Finance Minister Sharp in 1967 responded, "the federal government has simply accepted the practice of the provinces. Under the formula the federal government has undertaken to equalize the provincial revenues as reported in their public accounts."[5] Though this rationale behind equalization has a long history, it is not the only one.

In terms of efficiency, equalization can (in principle) offset inefficient migration patterns that might lower Canada's aggregate productivity. If people move in response to fiscal incentives (say, to capture a share of provincial resource revenues) then, at the margin, some may move to lower productivity jobs. One may individually be willing to make such a move despite lower productivity and wages if fiscal benefits (lower taxes, better services, etc.) make up the difference. Equalization payments to provinces with lower "net fiscal benefits" may therefore be efficiency enhancing.[6] Whether carbon tax revenues contribute to such fiscal benefit differentials may depend on how they are structured, their incidence on workers relative to capital owners, the way in which revenues are recycled, and so on. There is a large literature exploring each of these questions. Most recently, Fellows and Dobson (2017) show emissions embodied in Canada's trade are significant, creating a large difference between consumption and production emissions. Some of the incidence of one region's carbon pricing may therefore shift onto others elsewhere. Beck et al. (2015) and Fullerton and Heutel (2010) explore the distributional consequences of carbon taxes, demonstrating it crucially depends on many underlying factors. In principle, it is possible that carbon revenues collected and directly rebated to households create inefficient migration incentives if, for the marginal worker, the rebate exceeds their carbon tax costs. Including such revenues in equalization, even though they are not included directly in provincial public accounts, may therefore be justifiable. We take no position on this in the paper, but instead quantitatively explore various alternative considerations for equalization design that will become increasingly important for future work if carbon prices and coverage increase.

Underlying much of our analysis are two simple observations: first, provincial versus federal backstop carbon pricing regimes are currently treated differently; and second, there is wide dispersion in provincial fiscal capacity from carbon taxes. We show that the treatment and inclusion of different sources of carbon tax revenue matters for equalization. Under the new *Greenhouse Gas Pollution Pricing Act 2018*, the federal government imposes a carbon tax in provinces that do not have their own sufficiently stringent carbon pricing policy in place. Revenues from the federal backstop, about $11.3 billion of the projected $16.8 billion in total carbon pricing revenue in 2022/23, are currently excluded from the equalization formula when determining provincial fiscal capacity.[7] This is meaningful, in particular for the allocation of entitlements across provinces. Excluding backstop revenues affects equalization payments — both because there is less provincial revenues to be equalized and

[5] Canada, Parliament, *House of Commons Debates* at 13841 (March 10, 1967).
[6] Whether in practice equalization and other transfers achieve this goal is unclear. Albouy (2012) and Tombe and Winter (2018), for example, suggest current observed federal transfers subtract from aggregate productivity.
[7] Had the provinces where the federal backstop currently applies instead implemented an equivalent provincial carbon pricing policy, these revenues would be fully included in equalization.

because carbon tax revenues in particular are unevenly distributed. Our quantitative analysis, which captures a number of additional complexities, demonstrates that excluding carbon tax revenues from backstop provinces benefits have-not provinces with relatively higher levels of per capita consumption tax bases — such as Manitoba and the Maritimes — while it costs Quebec. Under a $50 per tonne carbon tax, but with backstop revenue in Alberta, Saskatchewan, Manitoba, Ontario, and New Brunswick excluded, we estimate Quebec equalization entitlements fall by $11 million per year, while Prince Edward Island would see a nearly insignificant reduction and other recipient provinces benefit with higher payments. As carbon prices increase over time, so too will the significance of this issue.

Independent of the treatment and inclusion of federal backstop revenues, rising carbon pricing revenues raises a number of separate questions related to optimal equalization design primarily because emissions are so unevenly distributed. That is, the same carbon tax will raise significantly different amounts in one province than another. A broad-based carbon tax set at $50 per tonne, for example, would raise over $2,300 per capita in Alberta, compared to just over $300 per capita in Quebec. Only resource revenues are more unevenly distributed. To show this, consider a simple measure of inequality across provinces: the Schutz Index. In 2017/18, resource revenues had a Schutz Index value of 0.44 — meaning 44 percent of total resource revenues would have to be reallocated to achieve equal per capita allocations across provinces. Greenhouse gas emissions are almost as unequal, with a Schutz value of 0.34. Meanwhile, provincial personal income tax bases are much more evenly distributed, with a Schutz value of just over 0.06.[8] The uneven distribution of emissions and natural resources matters. Since 1962/63, when resource revenues were first included in equalization, they have been the subject of much controversy largely because the uneven distribution of these revenues creates significant challenges to the design and implementation of equalization. The treatment of resource revenues has therefore been the subject of extensive research (Boadway et al., 1983; Boadway, 2004; Locke and Hobson, 2004; Courchene, 2005), but our paper is the first to examine the implications of rising, and unevenly distributed, carbon tax revenues on Canada's equalization program. We quantify a number of design considerations taking these observations into account.

First, the specific tax base chosen to equalize a particular provincial revenue source matters. Currently, carbon tax revenues are equalized within the consumption tax base. Provinces with smaller than average per capita consumption benefit and, as carbon tax revenues increase, this treatment tends to boost payments to Quebec and Prince Edward Island and decrease payments to other recipient provinces, all else equal. However, carbon taxes are not levied on consumption generally but on emissions specifically. And, as we noted, the distribution of emissions is highly uneven, much more so than tax bases within the consumption tax base category. Even gasoline usage, which is also equalized within the consumption tax category, for example, is much more evenly distributed than GHG emissions. The Schutz Index of provincial gasoline use is 0.05, which is only marginally above the 0.04 for the consumption tax base category as a whole.[9] We therefore examine

[8] See Tombe (2018) for a more detailed discussion of fiscal transfers in Canada and the Schutz Index measure of inequality and its relationship with the equalization program.
[9] The Schutz index for gasoline used for road vehicles is our own calculation based on Statistics Canada table 23-10-0066-01 and 17-10-0005-01 for 2017.

and quantify the effects of introducing a unique carbon tax base to evaluate provincial carbon tax fiscal capacity. Specifically, we explore using greenhouse gas emissions as the tax base upon which carbon pricing revenues are equalized.[10]

Our simulations show that this alternative treatment of carbon tax revenues has important implications for equalization entitlements. Qualitatively, provinces with relatively high emissions per capita see increases in their calculated relative measured fiscal capacity, while provinces with relatively low emissions per capita see the reverse. And quantitatively, we find that current non-receiving provinces are not affected but the re-allocation of equalization across currently have-not provinces can be significant. Quebec, for example, would see its equalization payment increase by nearly $350 million in a scenario where all provinces priced carbon at $50 per tonne. Payments to all other currently have-not provinces would fall.

A unique carbon tax base affects more than the allocation of equalization dollars, it also affects the incentives of recipient provinces to lower emissions. This turns the typically adverse incentives created by equalization payments for recipient governments — such as the incentive to increase tax rates to shrink local tax bases, as documented Courchene and Beavis (1973) and, more recently, Smart (2007) — into a potentially beneficial one. Any provincial action that shrinks (or appears to shrinks) a tax base would result in higher equalization payments. To the extent that this means lower economic activity and income in the province, this is an adverse incentive that the design of equalization has attempted to mitigate over the years. Greenhouse gas emissions are different. This particular tax base is associated with significant externalities in the form of its contribution to climate change. The inclusion of a specific carbon tax base in equalization would incent provincial actions to shrink emissions, particularly for a smaller province, over and above the direct incentives for abatement that carbon pricing itself creates. We show that for national average carbon taxes of $50 per tonne, the abatement incentive inherent in equalization would be equivalent to between $12 per tonne for Quebec and nearly $40 per tonne for PEI.

Another consideration is how revenues from large versus small emitters are treated. Currently, equalization treats all carbon pricing revenue the same whether it comes from a large or small emitter. Carbon tax revenue in British Columbia enters the formula in the same way as revenue from Quebec's cap-and-trade system. The Quebec system features a sizable number of free permits distributed to qualifying emitters but British Columbia's system does not offer any special treatment for larger emitters. Effectively, equalization's RTS does not take into account the design or structure of large-emitter systems that differ across provinces. The result is the current formula fully excludes the value of freely distributed permits and emissions credits under output-based pricing systems, equal to an estimated $9 billion in 2022/23. We show that the effect of including the value of free permits and credits on total equalization and individual province entitlements depends on the tax base used to equalize carbon tax revenues, on the large emitters' share of total priceable emissions in the province, and on whether carbon tax revenues in backstop provinces are included in equalization. This is not to say full inclusion is ideal, but to illustrate the importance of this as a consideration in equalization design as carbon revenues increase. A

[10] To be sure, the political feasibility of such a move is an open question.

full RTS treatment of large-emitter revenues is feasible, though beyond the scope of this paper.

Finally, our paper informs ongoing discussions around whether the aggregate cap on total equalization payments should remain in place. Quebec, for example, regularly argues for a removal of the cap, which was imposed in 2009 when Ontario became a recipient province following the financial crisis. We show that a decision to remove the cap can significantly increase the total cost of the equalization program. This is particularly the case when carbon prices are rising and if carbon pricing revenues are equalized using a distinct GHG base.

We begin our analysis with an overview of the carbon pricing policies in place in Canada before and after the introduction of the federal government's backstop policy in 2019. Following this, the basic mechanics of equalization given the current treatment of provincial carbon pricing revenues are presented in a stylized form to ground intuition and highlight key issues. We then examine the full equalization program and the precise implications of various carbon pricing issues. We first consider the effects of rising carbon prices and the differential treatment of federal backstop and provincial carbon pricing revenues given equalization as it currently operates. We then consider the implications for the size and allocation of equalization if carbon pricing revenues are treated as coming from a distinct GHG emissions tax base, highlighting the carbon abatement incentives under this approach. Finally, we consider the effects of an alternative treatment for large emitters' carbon tax revenues, and the removal of the cap on aggregate payments, on equalization.

Carbon Pricing in Canada

Provincial carbon pricing policies first appeared in the mid 2000s. British Columbia introduced a broad-based carbon tax in 2008 at an initial rate of $10 per tonne. The tax increased annually until reaching $30 per tonne in 2012. Six years later, the rate increased to $35 and, as of April 1, 2019, the province's carbon tax is $40 per tonne. Quebec and Ontario opted for a cap and trade approach to pricing carbon. Quebec's scheme was introduced in 2013. Ontario followed suit four years later, introducing a cap and trade program in 2017 and then cancelling it in 2018. Alberta has a hybrid system. The province introduced a broad-based carbon levy at $20 per tonne targeting fossil fuels used for transportation and heating in 2017. The levy was subsequently increased to $30 in 2018. An output-based pricing system (OBPS), introduced in 2018, regulates large emitters.[11] Covered facilities receive emission credits based on an industry-specific benchmark and on their output. The facility must pay the $30 per tonne carbon levy on emissions in excess of credits or cover the excess using surplus credits or eligible offsets. Finally, Manitoba introduced an emissions tax on coal and petroleum coke in 2011.

Prior to 2019, carbon prices varied across provinces and emission sources. The federal government was not directly involved in carbon pricing and there was no uniform, Canada-wide carbon price. This matters not only for efficient national climate policy and meeting our climate objectives in the least-cost manner, but it also inhibits interprovincial trade. The

[11] The Carbon Competitiveness Incentive Regulation (CCIR) introduced in 2018 replaced the Specified Gas Emitters Regulation (SGER) system, in place since 2007.

Senate of Canada went so far as to include variation in carbon tax prices, and climate policy generally, as one of Canada's "Top-Ten Weirdest Barriers to Trade" in its 2016 report *Tear Down These Walls*: *Dismantling Canada's Internal Trade Barriers*.

The carbon pricing landscape changed abruptly in 2019. With the implementation of the federal government's new carbon price backstop, the provinces and the federal government now jointly occupy the carbon pricing field. Under the federal plan, provinces are free to implement their own broad-based carbon pricing policies as long as these policies fully align with the federal government's benchmark requirements for the scope of emissions coverage (equal to the coverage of British Columbia's broad-based carbon tax) and for a minimum carbon price (equal to $20 per tonne in 2019/20, rising to $50 per tonne in 2022/23). The federal backstop will apply in any province that requests it or in provinces that do not have fully compliant policies in place. The backstop is similar in design to Alberta's hybrid system. It consists of a $20 per tonne carbon levy rising to $50 per tonne in 2022/23 and an OBPS for large emitters. This system is similar but not identical to Alberta's OBPS. Large industrial facilities covered under the system receive emissions credits based on their output and a sector-specific, emission-intensity performance standard. A covered facility must pay the carbon levy on excess emissions or cover the excess emissions using eligible offsets or surplus credits.[12]

Effective April 2019, a minimum carbon price on a broad base of GHG emissions is now achieved in each province using either a provincial policy, a federal policy, or a combination of federal and provincial policies. The federal backstop applies in full in Ontario, New Brunswick, and Manitoba because these provinces have not adopted compliant policies. In Saskatchewan, the carbon levy component of the federal backstop fully applies while the OBPS component applies only to those facilities not covered by the province's own OBPS. Prince Edward Island is implementing a compliant fuel charge but has requested the federal OBPS. And following its recent provincial election campaign, Alberta is slated to see the fuel levy portion of the federal backstop imposed sometime in summer 2019. The federal backstop will not apply in the other provinces. British Columbia and Quebec have compliant policies already in place and the federal government has indicated that the new carbon pricing policies coming into effect in 2019 in Nova Scotia (cap and trade) and Newfoundland and Labrador (carbon levy) satisfy its benchmark requirements.

Table 1 summarizes carbon pricing policies before and after implementation of the federal backstop.[13] Compared to the earlier province-only approach, Canada's new carbon pricing landscape is arguably more complex from an intergovernmental standpoint, involving a federal presence in some provinces but not others. As we shall see, this has important implications for equalization.

[12] The federal system covers facilities with annual emissions of 50 kt or more while the Alberta system covers facilities with emissions of 100 kt or greater per year.
[13] Although the federal carbon pricing plan applies to both provinces and territories, equalization is a program aimed at the provinces. As a result, we focus on provinces only.

Table 1: Carbon Pricing in Canada

	Pre-2019 No Federal Backstop	2019 with the Federal Backstop	2019 Policy Type
Provincial Carbon Pricing Only	British Columbia Quebec Ontario Alberta Manitoba	British Columbia	Carbon Tax
		Quebec	Cap and Trade
		Nova Scotia	Cap and Trade
		Newfoundland and Labrador	Carbon tax + performance standards for large emitters
Federal Carbon Backstop Only		New Brunswick	Federal carbon levy + OBPS
		Ontario	Federal carbon levy + OBPS
		Manitoba	Federal carbon levy + OBPS [a]
Federal + Provincial Policies		Saskatchewan	Federal carbon levy + OBPS + provincial OBPS
		Prince Edward Island	Federal OBPS (at the province's request) + provincial carbon levy
		Alberta	Federal carbon levy + provincial OBPS[b]

Source: Authors' construction.
[a] Manitoba is planning to phase out its current provincial emissions tax on coal and petroleum coke in favour of the federal OBPS.
[b] Alberta's new government committed to replacing the current large-emitter system (known as the CCIR) with another program that is unlikely to be compliant with federal backstop requirements. Effective January 1, 2020, Alberta may therefore see the federal OBPS imposed.

Carbon Pricing Revenues and Equalization

Broad-based carbon pricing policies are a market-based approach to incentivizing cost-effective reductions in GHG emissions. But carbon pricing is also a potential source of government revenue. Prior to 2019, all carbon pricing revenues were provincial revenues and would therefore be included in the determination of equalization entitlements. However, the federal government's entry into the carbon pricing field complicates matters as does the existence of "free" emissions credits and permits in some but not all provinces.

Table 2 shows carbon pricing revenues for 2017/18, by province, and estimates for 2019/20 and 2022/23. We construct these estimates using 2016 provincial emissions and applying provincial policies, and the federal backstop policy, where applicable.[14] Federal and provincial governments' shares of carbon pricing revenues and the fraction of total carbon pricing revenue included for the purposes of calculating equalization are also shown.

We distinguish between "gross" and "net" revenues. The net measure includes revenues from carbon taxes, auctioned permits, and large emitter payments for emissions in excess of credits.[15] Gross revenues include net revenues plus the revenues that would have been generated if all freely distributed permits and emissions credits had instead been subject to the carbon price. The distinction is important. Under the federal OBPS system, for example, covered emitters receive 70 to 90 percent of their emissions credits for free. In Quebec, about 23 percent of permits are freely distributed.[16] Net revenues are considerably less than would be achieved if all permits and emissions credits were subject to the carbon price. The differential treatment of gross versus net revenues within the equalization formula is an important part of our quantitative analysis to come.

Table 2 highlights several important features of carbon pricing. First, carbon pricing revenues, measured on either a net or gross basis, are considerable. In 2017/18, the five provinces with carbon pricing policies in place raised a combined total of $5.7 billion. Carbon pricing revenues are expected to increase significantly with the implementation of the federal backstop. An estimated $8.4 billion in net revenue is expected for 2019/20, which would increase to nearly $16.8 billion by 2022/23 assuming a $50 per tonne minimum carbon price. This would make carbon revenues the fifth largest revenue component within the equalization program — more important than all payroll tax revenues combined, for example. And if the value of the output-based subsidies implicit in free credits and permits is included, carbon pricing revenues are much larger, at nearly $26 billion by 2022/23.

Second, federal and provincial governments' carbon revenue shares depend on whether the federal backstop applies at the request of the province or is imposed by the federal government. For 2019, the federal backstop is imposed in Ontario, New Brunswick, Manitoba, and partially in Saskatchewan and Alberta, so the revenues generated belong exclusively to the federal government. In time, we anticipate Alberta to be fully within the federal backstop program. In contrast, Prince Edward Island has requested the OBPS component of the federal backstop. In this case, 100 percent of carbon revenues collected in the province are classified as provincial revenues even though the federal government collects the OBPS-related revenues.[17] As we shall see, the distinction between federal and provincial carbon pricing revenues matters for equalization.

[14] Given the uncertainties involved, the revenue estimates are illustrative.
[15] Table 2 assumes that OBPS-covered emitters pay the applicable carbon price on all emissions in excess of credits, assumed to be 20 percent of covered emissions. In practice, facilities could use surplus credits from previous years or eligible offsets.
[16] See Dobson, Winter and Boyd (2019).
[17] Section 4(1) (c) (xiv) of Federal-Provincial Fiscal Arrangements Regulations, 2007, SOR/2007-303.

Table 2: Carbon Pricing Revenues (in millions) and Provincial-Federal Shares

	2017/18	2019/20		2022/23		
	No Federal Backstop	Gross Total	Net Total[a]	Gross Total	Net Total[a]	Prov/ Federal Share
BC	1,255	1,859	1,859	2,254	2,254	100/0
AB	1,292	5,442	2,287	9,070	3,812	0/100[d]
SK		946	543	2,365	1,358	0/100[c]
MN	1.2	234	211	585	527	0/100
ON	2,401	2,698	2,107	6,745	5,268	0/100
QC[b]	785	1,252	897	3,131	2,242	100/0
NB		275	151	689	376	0/100
NS[b]		268	268	671	671	100/0
PEI		25	24	62	60	100/0
NL		149	82	372	204	100/0
Total (% in EQ)	5,724 (100%)	13,149 --	8,429 (47%)[d]	25,944 --	16,771 (32%)	

Source: Authors' calculations based on provincial emissions 2016 from Environmental and Climate Change Canada (2018), emissions coverage estimates from Dobson, Winter and Boyd (2019), and provincial plans.
[a] Net revenues include revenues from carbon taxes, auctioned permits, and large emitters payments for emissions in excess of credits (assumed to be 20 percent of covered emissions). [b] Price for auctioned permits assumed to be $20 and $50 per tonne in 2019/20 and 2022/23, respectively. Free permit share in Quebec is 22%, while it is not yet known for Nova Scotia. [c] To simplify, OBPS revenues in Saskatchewan are assumed to accrue to the federal government. [d] Given commitments made by the new Alberta government in 2019, we presume federal backstop policy will eventually be applied. The large-emitter system in Alberta, however, will be compliant through 2019, so we include roughly $900 million from that system in equalization in 2019 but exclude it in 2022.

Finally, the implementation of the federal backstop affects the fraction of carbon tax revenues included for the purposes of calculating equalization entitlements. In 2017/18, all $5.7 billion in carbon revenues were included in the calculations for equalization because only the provinces were pricing carbon. In 2019/20, however, only 47 percent (about $4 billion) of all net revenue from existing and new provincial policies will be included in the calculations for equalization. With Alberta's recent decision to (partially) join the backstop provinces, nearly 70 percent of that carbon tax revenue — $11.5 billion by 2022/23 — may be excluded from the equalization calculations. Had all provinces chosen to adopt compliant carbon pricing policies, the federal backstop would not be implemented. In this case, all carbon pricing revenues are provincial revenues and would enter into the equalization formula. We return to this issue later.

The Basic Mechanics of Equalization

To fix ideas, we begin by exploring the basic functioning of Canada's equalization system through a stylized representation of it. Later, we conduct all relevant quantitative analysis on the full formula, including all its complexity.

Though typically portrayed as complex, Canada's equalization system is fairly straightforward: first, estimate how much each province would raise if it had "average" tax rates (this is its "fiscal capacity"); and second, provide top-up transfers to provinces that raise below average levels of revenue at average tax rates. To illustrate, if there is only a single tax type then equalization for province i is

$$E_i = \left(\bar{b} - b_i\right)\bar{\tau}_i P_i, \tag{1}$$

where b_i is the province's per capita tax base, $\bar{b}$ is the average per capita tax base, $\bar{\tau}_i$ is the average tax rate in all provinces, and P_i is the province's population. This expression makes clear that the allocation of equalization depends on the allocation of tax bases. Provinces with larger per capita tax bases will, all else equal, be entitled to less equalization. Equivalently, and more useful for our purposes, the above can be re-formulated as

$$E_i = (p_i - f_i) \cdot R, \tag{2}$$

where province i's share of the national population is p_i, its share of the tax base f_i, and the total revenue within this tax base across all provinces R. For example, Quebec had 23 percent of Canada's population in 2016/17 but only 19 percent of the total personal income tax base. If Quebec had tax rates equal to the national average, it would raise less revenue from personal income taxes than the average province would. Equalization entitlements within this tax instrument are therefore 4 percent of the total provincial personal income tax revenue.

Multiple tax instruments complicates the picture somewhat, but not significantly. The above procedure is repeated across personal income taxes, corporate income taxes, consumption taxes, property and miscellaneous taxes, and (with adjustment) natural resources. Previous iterations of Canada's equalization program had a significantly more disaggregated classification of taxes. But this led to a well-known incentive problem: if a province could shrink its tax base f_i then it would receive more equalization.[18] To mitigate this, five broader categories were adopted in the 2007 reform.[19] As the base for carbon taxes (that is, greenhouse gas emissions) is qualitatively distinct from other bases in many important ways, it deserves special attention.

[18] See for example Smart (1998, 2007), and the Expert Panel on Equalization and Territorial Formula Financing (2006), Annex 4.

[19] The Expert Panel on Equalization and Territorial Formula Financing (2006) report argued that each of the 15 smaller non-resource tax bases be subsumed into one of the five larger tax bases. Specifically, a small tax base (for example, capital tax revenues) should be allocated to a larger tax base if the two are similarly distributed across provinces. For example, capital tax revenues were allocated to the business income tax base and payroll tax revenues were equalized in the personal income tax base.

GHG Emissions as a Tax Base

Currently, provincial carbon tax revenues are treated as consumption tax revenues. This category includes many taxes — general sales taxes, tobacco taxes, gasoline taxes, vehicle licensing, alcohol, lottery tickets, gambling revenues, and so on. The tax base for these revenue sources is the sum total of taxable consumer expenditures (that is, spending adjusted for sales tax exemptions), housing investment, and intermediate input and investment spending by businesses. Including carbon taxes within this category matters because it implicitly equalizes the yield of carbon tax revenues across provinces according to the distribution of the consumption tax base.

But greenhouse gases are different. The carbon tax base is priceable greenhouse gas emissions which are distributed unevenly across provinces. Table 3 reports the distribution of the five tax bases used for equalization purposes, population, and GHG emissions by province for 2016. For some, there are no significant differences. In Newfoundland and Labrador, for example, 1.5 percent of Canada's consumption tax base, emissions, and population are located there. The choice of carbon tax treatment is therefore irrelevant. For Alberta, though, the story is very different. The province has just under 12 percent of the population, over 14 percent of the consumption tax base, but well over one-third of GHG emissions. Saskatchewan also has a disproportionately high level of emissions, relative to its population.

Table 3: Distribution of Tax Bases, GHG Emissions, and Population 2016/17 (%)

	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL
Personal Income	13.6	15.6	3.0	2.9	40.5	19.0	1.5	2.1	0.3	1.4
Business Income	13.2	12.3	2.8	2.4	46.9	18.9	1.0	1.4	0.2	0.8
Consumption	14.3	14.4	3.3	3.3	38.7	19.9	1.9	2.3	0.3	1.5
Natural Resources	23.1	27.7	10.5	1.2	1.6	26.2	0.5	0.3	0.0	8.8
Property and Misc	16.0	13.7	3.2	3.1	40.6	18.5	1.3	2.0	0.3	1.4
Total[a]	14.7	15.0	3.4	3.0	39.0	19.4	1.5	2.0	0.3	1.7
Population Share	13.2	11.7	3.2	3.6	38.7	23.0	2.1	2.6	0.4	1.5
GHG Emissions	8.6	37.5	10.9	3.0	22.9	11.0	2.2	2.2	0.3	1.5

Source: Tombe (2018) and own calculations from Environment Climate Change Canada emissions data for 2016.
[a] All resource revenues are included to calculate the revenue-weighted average total per capita fiscal capacity.

In most other provinces, however, the share of national emissions is below their share of the national population. Quebec has 23 percent of the population, but only 11 percent of the emissions. Ontario has 39 percent of the population, but 23 percent of emissions. And so on. The choice over tax bases will therefore have large implications for the allocation of equalization dollars. To see this, consider an expanded (though still stylized) representation

of equalization entitlements to province i given by combining all revenue categories j according to

(3) $$E_i = \sum_{j=1}^{J} (p_i - {f_i}^j) R^j.$$

If carbon tax revenue is allocated according to the consumption tax base, as is currently the case, then it merely increases equalization payments to provinces according to the difference between their population shares and consumption tax base shares. There will be no effect on non-recipient provinces, and no (first-order) change in the distribution of equalization across recipient provinces. Though there will be a second-order effect for recipients to the extent that individual tax components have negative entitlements. Put another way, the distribution of overall fiscal capacity across provinces depends on the national revenue of each tax component R^j. And therefore, to a first approximation, including carbon tax revenue in the consumption tax base affects payments to each province by $(p_i - {f_i}^{cons})C$ where C is total provincial carbon tax revenue and ${f_i}^{cons}$ is province i's share of the national consumption tax base.

Presuming for a moment that the distribution of priceable emissions mirrors the distribution of total emissions across provinces, the contribution to equalization payments of provincial carbon taxation revenue is twofold. First, it adds to the revenue to be equalized R^j. Second, it is distributed across provinces differently than other tax bases. Specifically, if carbon tax revenue is apportioned according to its own base (i.e., GHG emissions), then total equalization payments become

(4) $$E_i = \sum_{j=1}^{J} (p_i - {f_i}^j) \tilde{R}^j + (p_i - g_i)C,$$

where g_i is province i's share of national emissions and $\tilde{R}^j$ is total non-carbon revenue from other included revenue sources. Differencing the two allocations yields

(5) $$E_i^{\,in\ Cons} - E_i^{\,as\ GHG} = (g_i - {f_i}^{cons})C.$$

Introducing a distinct tax base for carbon taxes therefore increases entitlements to provinces with a relatively small share of national GHG emissions. Thus, to a first approximation, current allocation rules provide smaller payment entitlements to Ontario, Quebec, British Columbia, Manitoba, and Nova Scotia. Alberta, Saskatchewan, and New Brunswick have larger entitlements, and all other provinces are left largely unchanged. Table 4 displays the distribution of provincial consumption tax bases, the distribution of GHG emissions, and the difference between them.

As indicated in equation (2), we can approximate the extent to which equalization entitlements increase with aggregate provincial carbon tax revenues. Summing the difference between population shares p_i and consumption tax base shares ${f_i}^{cons}$ for equalization-receiving provinces, using data reported in Table 4, we find that for each $100 in provincial carbon tax revenues included in the formula as consumption tax revenue

equalization increases by $4, with most of the increase going to Quebec.[20] If carbon tax revenue were distributed according to emissions, however, total equalization payments calculated using equation (3) would increase by nearly $29 dollars per $100 in aggregate provincial carbon tax revenues, now with Ontario as a significant recipient province. Importantly, Ontario's share of Canada's provincial consumption tax base is equal to its share of the population, while its share of emissions is significantly less. Whether Ontario receives equalization in this simple case depends on carbon taxes' share of total provincial revenues to be equalized.[21] For now, we presume Ontario receives equalization and turn to a complete model of actual equalization payments later in the paper.

Table 4: Distribution of Tax Bases, GHG Emissions, and Population 2016/17 (%)

	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL
Consumption Taxes	14.3	14.4	3.3	3.3	38.7	19.9	1.9	2.3	0.3	1.5
GHG Emissions	8.6	37.5	10.9	3.0	22.9	11.0	2.2	2.2	0.3	1.5
Difference	5.7	-23.1	-7.6	0.3	15.8	8.9	-0.3	0.1	0.0	0.0
Receive Equalization	No	No	No	Yes	Yes*	Yes	Yes	Yes	Yes	No
Population Share	13.2	11.7	3.2	3.6	38.7	23.0	2.1	2.6	0.4	1.5

Source: Tombe (2018) and own calculations from Environment Climate Change Canada emissions data for 2016. * Whether Ontario will receive equalization in this simple illustration depends on the total size of carbon tax revenues in the "GHG Emissions" base case. See Footnote 17 for details.

This is merely the stylized equalization formula, however. Differences arise when certain ad-hoc aspects of Canada's actual formula are taken into account. We presume here the same set of six provinces are receivers regardless of treatment, abstracting from interactions between the various tax bases. In particular, total equalization payments cannot increase in aggregate as there is a fixed pool of dollars available that sets a limit in any given year, which grows with a rolling average of national nominal GDP growth.[22] Effectively, the total payments are restricted to a fixed share of Canada's aggregate GDP. If total payments exceed this limit, as is typically but not always the case, then payments are reduced to each recipient by an equal per capita amount. This is straightforward to incorporate into the simple algebraic representation of the equalization formula above. In particular, among equalization-receiving provinces,

$$E_i^{in\ Cons} - E_i^{as\ GHG} = \left[\left(g_i - f_i{}^j\right) - (0.04 - 0.288)\tilde{p}_i\right]C, \tag{6}$$

[20] This follows from the difference between population shares and consumption tax base shares of 3.1 (23.0 - 19.9) for Quebec, 0.3 for Nova Scotia, 0.3 for Manitoba, 0.2 for New Brunswick, 0.1 for Prince Edward Island, and 0 for Ontario.

[21] Specifically, if carbon tax revenues exceed 2.5% of total revenues to be equalized then, given the data in Table 3, Ontario will receive equalization payments in the stylized model of this section. This is due to Ontario's share of total fiscal capacity falling from 39.0 to 38.6. Details available upon request.

[22] In 2009, Ontario, Canada's largest province, qualified for equalization. Concerns about the affordability of the program led the federal government to introduce the cap in its 2009 budget. The cap will play an important role as carbon tax revenues grow. We explore the implications of eliminating the cap later in the paper.

where 0.04 and 0.288 reflect the $4 and $28.80 total increases in basic entitlements for each $100 in carbon revenue described earlier, and $\tilde{p}_i$ is the population share of province i among provinces receiving equalization.

In Table 5, we display the effect of the aggregate cap on payments under the two different tax bases. The values in the table reflect the change in total equalization payments per $100 in provincial carbon tax revenue. Ontario and Quebec are both made worse off if carbon revenue is apportioned according to the consumption tax base while other provinces are better off. Ontario gains if the GHG emissions base is used, since its consumption tax base and population shares are the same, yet the growth cap binds tighter.

Table 5: Consumption vs GHG Base for Carbon Tax Equalization, with Cap

	MB	ON	QC	NB	NS	PE
Using consumption tax base, with fixed pool of EQ payments						
$100 of Carbon Revenue	0.30	0.00	3.10	0.20	0.30	0.10
Growth Cap Clawback	0.20	2.20	1.31	0.12	0.15	0.02
Net Change in Equalization	0.10	-2.20	1.79	0.08	0.15	0.08
Using GHG emissions, with fixed pool of EQ payments						
$100 of Carbon Revenue	0.60	15.80	12.00	-0.10	0.40	0.10
Growth Cap Clawback	1.47	15.83	9.41	0.86	1.06	0.16
Net Change in Equalization	-0.87	-0.03	2.59	-0.96	-0.66	-0.06
Difference	0.97	-2.17	-0.80	1.04	0.82	0.14

Source: Own calculations for a stylized equalization program. See text for details.

The above were stylized representations of the equalization program, to better clarify the competing pressures it faces as provincial carbon tax revenues increase. In the next section, we simulate the full effect of Canada's actual equalization payments under various alternative designs.

Quantitative Analysis of Carbon Tax Revenue in Canada's Equalization Program

In this section, we quantify equalization entitlements under current and alternative treatments of carbon tax revenues in the equalization formula. We first quantify baseline equalization payments — what payments would be if only 2017/18 fiscal capacity estimates and actual 2017/18 carbon tax revenues were used to determine 2019/20 payments and given the current treatment of carbon tax revenues. The actual formula uses a weighted average of three fiscal years from 2014/15 to 2017/18 to determine these payments, but by

neglecting this we can more clearly discern the effect of alternative design choices. In all the estimates that follow, British Columbia, Alberta, Saskatchewan, Ontario, and Newfoundland and Labrador do not receive equalization payments so they are excluded from the tables. These baseline estimates are shown in the first row of Table 6.

We then quantify equalization entitlements under various alternative designs to highlight some important considerations for equalization design under rising carbon price levels and coverage. The first concerns the differential treatment of federal versus provincial revenues. We quantify the effect of rising prices under the current formula's treatment and contrast this with a formula where all carbon pricing revenue is included. The second involves the choice of tax base to use to equalize carbon pricing revenues. We specifically quantify equalization entitlements when a distinct GHG emissions tax base is used to equalize provincial carbon tax revenues. This not only affects the allocation of entitlements but introduces emissions abatement incentives for equalization receiving provinces. Third, large-emitter pricing regimes often (but not always) feature output subsidies or free emissions permits. An important consideration for equalization design is whether to price gross versus net revenues. We quantify this effect. And finally, we consider the effects of removing the cap on equalization given rising carbon prices over time. Given the degree of inequality in GHG emissions, and therefore carbon pricing fiscal capacity, certain design details can have implications for how tightly the current cap on equalization payments binds.

Consideration 1: Differential Treatment of Federal Backstop Revenues

Prior to 2019, some provinces were actively pricing carbon, but there was no carbon pricing policy in place at the federal level. With the introduction of the federal backstop in 2019, provinces and the federal government now co-occupy this field. The backstop applies in any province that has not adopted carbon pricing policies satisfying the federal government's benchmark. Provinces can also voluntarily opt-into either or both components of the federal backstop. Prince Edward Island, for example, opted-in to the federal OBPS.

Within (involuntary) backstop provinces, the federal government will return most of the revenues from the carbon levy component of the backstop to provincial residents in the form of a Climate Action Incentive payment. The rest of the carbon levy proceeds will be used to support selected groups including small- and medium-sized businesses, remote communities, hospitals, and Indigenous communities. The federal government also intends to return all the proceeds from the OBPS system to the province of origin, but no additional details are available at this time.

This system has important implications for what carbon tax revenues are included for the purposes of equalization. If a province either implements its own pricing policy or voluntarily adopts the federal backstop then this carbon tax revenue is included in the equalization formula. The former is explicitly included as a carbon tax, levy, or revenue from auctioning allowances in an emissions trading scheme (i.e., cap and trade, as in Quebec), while the latter is included as "shared revenue" (i.e. as in the case of backstop revenues generated in Prince Edward Island). But if a province does not *voluntarily* accept the federal backstop, as is the case for Ontario, Manitoba, New Brunswick, Saskatchewan, and most recently Alberta, then the carbon tax is imposed, collected, and mostly recycled back to households in that province by the federal government. These carbon revenues, almost 45 percent of the

all carbon tax revenues for 2022/23, are excluded from the equalization formula when determining provincial fiscal capacity. This is significant.

If all provinces had chosen to adopt compliant carbon pricing policies, the federal backstop would not apply. All carbon pricing revenues would be provincial revenues and would be fully equalized. In reality, the federal backstop has been implemented in some provinces. How does this federal-provincial dimension to carbon pricing affect equalization? Conceptually, the differential treatment of provincial carbon tax revenues and federal backstop revenues affects the current equalization entitlements principally through R in equation (1). That is, if R^{fed} is total federal backstop revenue, then the basic (pre-cap) equalization entitlements are roughly decreased for recipient provinces by[23]

$$\Delta E_i = -(p_i - f_i) \cdot R^{fed}. \tag{7}$$

As the total payments are held fixed at a pre-determined aggregate level, the total change in basic entitlements is either clawed back from or distributed to recipient provinces on an equal per capita basis.

Table 6 reports the estimated effect of excluding federal backstop revenues on 2019/20 total equalization entitlements. A number of interesting results are revealed.

Table 6: Effect of Including Backstop Revenue in Equalization ($ Millions)

	MB	QC	NB	NS	PE
Based on 2017/18 Data	2,349	12,976	2,033	2,053	427
Carbon Price of $30 per Tonne					
All Provinces Included	2,347	12,978	2,032	2,052	427
Excluding Backstop Provinces	2,350	12,973	2,033	2,053	427
Carbon Price of $50 per Tonne					
All Provinces Included	2,343	12,986	2,030	2,052	428
Excluding Backstop Provinces	2,349	12,975	2,033	2,053	427

Source: Own calculations from Environment Climate Change Canada emissions data for 2016, and adjusting the current equalization formula to the underlying financial data provided by Finance Canada.

Excluding backstop revenues tends to lower equalization payments to Quebec, while increasing payments to other provinces. At $30 per tonne, excluding backstop provinces lowers Quebec payments by $5 million. Manitoba, meanwhile, sees its payments rise by $3 million. At $50 per tonne, the effects are larger. Excluding revenues to backstop provinces lowers equalization payments to Quebec by $11 million relative to a situation where all

[23] The actual change in entitlements will differ from this simple expression, as entitlements from the consumption tax portion of the equalization formula may differ in sign from entitlements in other portions. There are also aggregate and province-specific caps applied at different stages in the calculation.

carbon tax revenues are included. Broadly speaking, excluding backstop carbon tax revenues modestly lowers Quebec entitlements.

These estimates illustrate the effect of including backstop revenues. A related question concerns the effect, under the current formula, of individual provinces making decisions that affect whether they are covered by the federal backstop system. That is, when a province eliminates its own carbon pricing regime, this has implications for equalization entitlements elsewhere. To illustrate this, we estimate that the recent decisions by Alberta and Ontario to eliminate provincial carbon taxes and become backstop provinces will, at $50 per tonne, lower Quebec's entitlement by $8 million, for example. But overall, equalization payments are only modestly affected by increasing carbon prices under the current formula, regardless of how backstop revenues are treated.

Whether rebated federal backstop revenue should be included in the equalization formula revolves around a conceptual issue. In some sense, backstop revenue is as much a part of a province's fiscal capacity as any other revenue source. A province can, at any time, choose to repurpose the revenue towards any other initiative, by either levying their own carbon price in lieu of the federal price or by acceding to the federal backstop program and taking charge of the revenues. And if a province were to accept the backstop but keep the rebate regime in place, then nothing of any real economic or fiscal consequence would change except that this revenue would now be included in the equalization calculations. In addition, rebates of backstop revenues to households differ significantly across provinces – from a high of $1,419 for the average household in Saskatchewan by 2022 to a low of $583 in New Brunswick (Canada 2018). This may create net fiscal benefit differences that equalization is (at least in principal) attempting to mitigate. Indeed, the current formula incorporates non-provincial revenue sources in some areas, including transfers to provincial governments by the federal government of its own revenue sources. Offshore resource revenues, for example, are not provincial revenues but are wholly federal. The decision to transfer the bulk of such funds to provincial governments, principally Newfoundland and Labrador, is a policy choice not a legal requirement.[24] The decision to include such transfers in equalization is also a policy choice. There have also been recent explorations of whether federal taxes, which affect migration decisions, should also be incorporated into the equalization program, such as by Albouy (2012) and Tombe (2018), even though these taxes are outside of the control of provincial governments and not a source of provincial own-source revenue.

But, on the other hand, equalization historically aims to equalize provincial own-source revenues as understood by provincial public accounts. This is the heart of the Representative Tax System approach to equalization, which, as noted in the introduction, can be traced back to 1967 when equalization as we know it began. This approach suggests that since provinces do not consider backstop revenues as provincial revenues then equalization should not either. Regardless, under the current formula, inclusion of backstop revenues has only limited implications for the allocation of equalization payments. Other design considerations, to which we turn next, have larger implications.

[24] This is a long settled area of law, with two Supreme Court of Canada cases deciding the matter in *Reference Re: Offshore Mineral Rights [1967] SCR 792* and *Reference Re: Newfoundland Continental Shelf [1984] 1 SCR 86*.

Consideration 2: Distinct GHG Tax Base to Equalize Carbon Tax Revenues

The current formula does not capture the differences across provinces in their ability to raise revenue through carbon pricing — the distribution of consumption tax bases is too even. Emissions-intensive regions have an easier time raising revenues, on a per person basis, at national average carbon tax rates than the formula implies. Based on the shares reported in Table 4, and presuming all $16.8 billion in carbon revenue by 2022/23 is included in the formula, Alberta's yield at national average tax rates would be $570 per capita compared to Quebec's $400 if the consumption tax base was used.[25] But if emissions were the tax base, the formula would imply Alberta's yield would be $1,484 per capita compared to Quebec's $223 — which is arguably a more appropriate representation of each province's fiscal capacity from carbon taxes.

Table 7: Effect of Apportioning Carbon Tax Revenues According to GHGs ($ Millions)

	MB	QC	NB	NS	PE
Based on Actual 2017/18 Provincial Carbon Tax Revenues ($5.7 billion)					
Baseline	2,349	12,976	2,033	2,053	427
GHG Emissions Base	2,304	13,113	1,980	2,017	423
Change	-45	137	-53	-36	-4
If All Provinces Priced GHG Emissions at $30 per Tonne, Included in Equalization					
Consumption Tax Base	2,347	12,978	2,032	2,052	427
GHG Emissions Base	2,283	13,176	1,955	2,000	422
Change	-64	198	-77	-52	-5
If All Provinces Priced GHG Emissions at $50 per Tonne, Included in Equalization					
Consumption Tax Base	2,343	12,986	2,030	2,050	428
GHG Emissions Base	2,236	13,330	1,890	1,962	420
Change	-107	344	-140	-88	-8

Source: Own calculations from Environment Climate Change Canada emissions data for 2016, and applying the current equalization formula to the underlying financial data provided by Finance Canada. Changes may not sum to zero due to rounding.

Reallocating carbon tax revenues according to the distribution of priceable emissions leads to substantially different equalization entitlements. We display these results in each panel of Table 7. Two results stand out. First, apportioning carbon tax revenue according to GHG emissions increases equalization payments to Quebec and decreases payments to all other recipient provinces. Quebec's gains are sizable. Its entitlements increase, in the case of $50 per tonne carbon prices, by nearly $350 million per year. This reflects its relatively low level of per capita emissions, and therefore its limited fiscal capacity in terms of raising revenues

[25] This is derived from $16.8 billion times 0.144 (Alberta's share of the national consumption tax base) divided by Alberta's population. The other figures are derived similarly. Note that normal gasoline excise taxes in this scenario continue to be equalized according to the consumption tax base.

through carbon taxation. Second, an increasing carbon price has a large effect on the allocation of equalization across provinces. If all provinces priced at $30 per tonne, relative to baseline 2017/18 levels, Quebec payments would increase from $13.113 billion to $13.176 billion. All other provinces would see reduced payments on account of the more tightly binding aggregate cap on total payments. Increasing carbon tax rates to $50 per tonne from this level results in further increases to Quebec and decreases elsewhere.

Carbon Abatement Incentives from a GHG Base

Incorporating a distinct carbon tax base into equalization does more than simply re-allocate payments across provinces. This is a mechanical, static effect. There is an additional dynamic effect introduced by the incentives that such an equalization formula would create for recipient provincial governments. This is not dissimilar to existing incentive concerns around equalization design since the formula already creates an incentive for recipient provinces to potentially increase their tax rates, or otherwise shrink their tax bases, in order to increase their entitlements. This equalization “base-effect,” as it is known, is a well studied area and one of the core challenges various equalization designs have attempted to overcome, and a motivating factor behind the O’Brien Panel’s recommendation that the number of tax bases included in the formula shrink to five from the previous thirty-three. But if carbon emissions are the base for carbon taxes, this equalization base-effect may bring with it external benefits as it will, at the margin, incentivize additional carbon abatement actions by recipient provincial governments. These additional abatement incentives are large and are distinct from, and in addition to, the direct incentive to lower emissions among households and businesses that is the primary motivation behind carbon pricing.

We find that if Quebec lowers GHGs by 10 percent, then in the 2022/23 scenario reported above its equalization payments rise by 0.4 percent — equivalent to $56 million per year. As 10 percent of its priceable emissions is roughly equivalent to 4.5 million tonnes (MT) per year, this means equalization provides $12.50 per tonne to abate carbon emissions. This offsets a non-trivial share of any foregone carbon pricing revenues for a provincial government as well. In Quebec’s case, we estimate the foregone revenue from a 10 per cent reduction at roughly $220 million — so the equalization program here replaces one-quarter of the lost revenue.

Smaller provinces see even larger effects. For New Brunswick, lowering GHG emissions by 10 percent will increase their equalization payments by over $30 million. This is a 1.4 MT reduction, which implies a nearly $22 per tonne abatement incentive. With lost revenues of $37 million, New Brunswick is almost fully buffered. The same is true for Nova Scotia. This province sees almost $30 million increase in equalization, from a 10 percent (or 0.7 MT) emissions reduction — a $22 per tonne abatement incentive. Finally, Manitoba and Prince Edward Island see abatement incentives of $33 and $37 per tonne, respectively. Smaller provinces are different from Quebec since their small size, and therefore small increased payment, means the growth cap will be clawing back less per capita then when a larger province — such as Quebec — increases its equalization entitlement through carbon abatement.

Though there are environmental gains, there may be a loss in aggregate efficiency in terms of national emissions abatement. Uniform carbon pricing will minimize the national total

abatement costs for any given reduction in aggregate emissions, since marginal costs of abatement are equalized. If some provinces receive additional abatement incentives compared to others, they may over-abate relative to provinces that do not receive equalization.

Consideration 3: Treatment of Large-Emitter Revenues

An important consideration of carbon pricing design concerns the treatment of large-emitter revenues. Currently, equalization does not distinguish carbon tax revenue from small versus large emitters. This matters as federal and provincial carbon pricing policies differ in their treatment of industrial emitters. British Columbia imposes a broad-based carbon tax, which treats small and large emitters alike. Quebec's cap-and-trade system distributes free emissions permits to selected emitters. Alberta recently levied a carbon tax on fuel use and a separate carbon tax on large emitters; the overwhelming majority of its revenue was recycled back to industrial emitters in the form of an output subsidy. And federally, a large majority of revenues resulting from a price on carbon emissions within the OBPS regime will be recycled in the form of an output subsidy to covered emitters. No direct cash subsidy is actually provided, however. Rather, each sector is provided with a benchmark level of emissions intensity (tonnes per unit output) and each facility within that sector pays a carbon tax on emissions that exceed a threshold determined by their output times the sectoral benchmark. If their emissions fall below this threshold, they receive credits that can be sold to others. In effect, this is the carbon tax-equivalent of distributing free permits within a cap and trade system, where the free permits are allocated across producers in a manner proportional to their production volumes. It is equivalent to pricing carbon and subsidizing output (Fischer and Fox, 2007). Regardless of the approach taken, equalization does not account for these differences in carbon pricing regimes.

Under a representative tax system approach, equalization could quantify how much revenue a province would raise if it had a representative large emitter pricing regime. Put another way, provinces differ in the gap between gross and net revenues from large emitters but this difference is not reflected in the current equalization formula. To illustrate the importance of this consideration, we quantify the effect on equalization of two extremes: (1) the current situation of including only net revenues, and ignoring large-emitter pricing structures, and (2) including all gross revenues without subtracting OBA allocations. In effect, this latter case is the equivalent of assuming all provinces adopt British Columbia's approach of a broad-based carbon tax without differential treatment between small and large emitters. The full gross revenues from the application of a British Columbia-type carbon tax in each province are therefore included in the determination of equalization entitlements. The true "representative" province's large-emitter system is somewhere between these two cases.

If total gross revenues from carbon pricing were included in equalization, three interacting effects are worth noting. First, total pre-cap equalization payments would increase as total provincial revenues to be equalized would increase. Second, provinces with a relatively high share of large-emitter emissions in total priceable emissions would see an increase in their fiscal capacity relative to others. New Brunswick is a good example of this among recipient provinces; we estimate their gross revenues by 2022/23 are 83 percent larger than net revenues. Quebec, meanwhile, has gross revenues only 40 percent higher than net. Third,

and finally, the aggregate cap on payments would bind more tightly, leading to larger per-capita clawbacks from equalization-receiving provinces. We report the total effect in Table 8.

Table 8: Effect of Net vs Gross Carbon Revenues on Equalization ($ Millions)

	MB	QC	NB	NS	PE
Carbon Price of $50 per Tonne, Net Revenues Only					
All Provinces Included	2,343	12,986	2,030	2,052	428
All Provinces, GHG Base	2,236	13,330	1,890	1,962	420
Excluding Backstop Provinces	2,349	12,975	2,033	2,053	427
Excluding Backstops, GHG Base	2,310	13,098	1,986	2,021	424
Carbon Price of $50 per Tonne, Gross Revenues Included					
All Provinces Included	2,338	12,996	2,027	2,048	429
All Provinces, GHG Base	2,260	13,321	1,858	1,972	426
Excluding Backstop Provinces	2,348	12,977	2,033	2,053	427
Excluding Backstops, GHG Base	2,298	13,132	1,973	2,012	423

Source: Own calculations from Environment Climate Change Canada emissions data for 2016, and adjusting the current equalization formula to the underlying financial data provided by Finance Canada.

Overall, we find that the effect of including gross revenue versus net revenue depends on the tax base used to equalize revenues and on whether revenues from backstop provinces are included or not. If all provinces are included, but carbon revenues count in the consumption tax base, then equalization payments to Quebec and (modestly) to Prince Edward Island are higher if gross revenues are used. This is due to their relatively small consumption tax bases per capita, whereas other provinces see reduced payments on account of the more tightly binding aggregate cap on payments. If carbon tax revenues are equalized according to GHG emissions as their base, however, the result depends on each province's gross-to-net carbon revenue ratios. Manitoba, Prince Edward Island, and Nova Scotia (as seen in Table 2) have the lowest gross-to-net revenue ratios, and therefore see larger payments. Excluding backstop provinces reverses this, as provinces covered by the federal program disproportionately have higher shares of emissions covered by the large-emitter regime and therefore have high gross-to-net revenue ratios.

As in the case of whether backstop revenues should be included, the question of large-emitter treatment is largely a conceptual one. It is nonetheless a policy choice to consider. Current policy subtracts the value of free permits and OBA allocations from gross potential carbon tax revenue for the purposes of equalization. It includes only net revenues. Providing counteracting policies to help mitigate competitiveness and leakage concerns is a valid public policy objective, but it is a choice. Other measures exist, and some provinces opt for those. Provinces have fiscal capacity that enables them discretion to make individual policy choices, from lowering taxes to providing public services to offering business subsidies. Equalization is generally agnostic as to how provinces deploy their fiscal capacity, so including gross carbon revenues is defensible. At the very least, including only net revenues

departs from the representative tax system approach to current equalization policy. In any case, as carbon prices increase and coverage expands the gap between gross and net revenues grows larger and potentially exceeds $9 billion by 2022/23 (considering all provincial carbon revenue, whether in the backstop or not). The distribution of large-emitter revenues is also highly uneven, more so than emissions from fuel use. This is therefore an increasingly important consideration for equalization program design.

Consideration 4: The Cap on Aggregate Equalization Payments

Since 2009, equalization payments are limited by a cap indexed to nominal GDP growth. Given the uneven distribution of GHG emissions across provinces, the cap is increasingly binding as carbon prices increase. In fact, in a stylized representation of equalization without a fiscal capacity cap or aggregate cap on payments, total equalization payments increase proportionally with the Schutz Index of fiscal capacity inequality. Thus, using more unevenly distributed bases to equalize provincial revenues will therefore increase payments. We explore the implications of rising carbon tax revenues without the cap here.

Table 9: Effect of Carbon Tax Revenues on Equalization, No Cap ($ Millions)

	MB	QC	NB	NS	PE	Total
Based on 2017/18 Data	2,349	12,976	2,033	2,053	427	19,837
Carbon Price of $30 per Tonne, No Cap on Aggregate Payments						
All Provinces, Current Formula	2,409	13,362	2,067	2,096	434	20,368
All Provinces, GHG Base	2,431	14,097	2,041	2,105	438	21,113
Carbon Price of $50 per Tonne, No Cap on Aggregate Payments						
All Provinces, Current Formula	2,442	13,601	2,086	2,121	439	20,689
All Provinces, GHG Base	2,486	14,880	2,033	2,139	448	21,986

Source: Own calculations from Environment Climate Change Canada emissions data for 2016, and adjusting the current equalization formula to the underlying financial data provided by Finance Canada.

Removing the cap on aggregate payments increases the size of Canada's equalization program significantly. We summarize a set of results in Table 9 to illustrate the effect of various carbon tax rates and bases. At $30 per tonne, including revenues from all provinces, we find equalization increases to nearly $20.4 billion compared to $19.8 billion in the baseline case based on 2017/18 data. At $50 per tonne, the program increases to nearly $20.7 billion. As this exercise holds all other tax revenues and bases fixed, the increase of over $850 million is entirely due to rising carbon tax revenues. If such revenues are equalized according to GHG emissions, payments grow even more. At $50 per tonne, total payments increase to nearly $22 billion — an increase of over $2.1 billion, with over 90% of the increase accruing to Quebec on account of its relatively low GHG share. In no scenario explored here does Ontario become a recipient province.

Whether or not the cap on equalization should be lifted is an ongoing debate in Canada. Rising carbon tax revenues makes this discussion all the more important. On the one hand, the objective of equalization is to provide revenues to provinces with below-average fiscal capacity. To fulfill its mandate, the cap may need to be increased or eliminated entirely in future years as the importance of carbon tax revenues increase. If this change is made, the formula would then determine not only the allocation of equalization dollars but also the aggregate size of the program. On the other hand, the cap limits the federal government's budget risk as total payments are largely pre-determined. Historically, equalization payments typically fall short of the amount required to bring provinces with below-average fiscal capacity up to the national average level. Given certain design details and other complexities, explicit caps often bind tightly. Indeed, over the 1972-2016 period, equalization was on average 28 per cent below the amount required to fully equalize fiscal capacity (Tombe, 2018). Rising carbon pricing and coverage will increase the importance of this as an issue to consider in future equalization design discussions.

Conclusion

As carbon tax rates increase over time, and the corresponding revenues available to provincial governments to use for tax reductions or program spending increase, Canada's equalization program will confront new pressures. Carbon emissions are nearly as unevenly distributed across provinces as resource revenues are. The latter has been a continual source of tension and a stubbornly difficult aspect of equalization program design. Carbon tax revenues will require equally close attention in the coming years.

In this paper, we take a cautious first step towards mapping out the potentially important interactions between carbon tax revenues and Canada's equalization program. In particular, we identify the consequences of introducing a distinct carbon tax base into the equalization program. Given equalization payments are meant to ensure comparable taxes yield comparable revenues across provinces, the current approach that implicitly equalizes carbon tax revenues according to the consumption tax base may not be ideal. We find a distinct carbon tax base benefits provinces with relatively low per capita emissions (primarily Quebec). We also find a potentially large incentive effect that may encourage further provincial actions to lower emissions. Finally, federal carbon tax revenue from the application of the backstop in some provinces — which will soon account for the overwhelming majority of carbon tax revenues in Canada — is excluded from the calculation of equalization, despite directly affecting provincial net fiscal benefits available to residents. We find excluding such revenues currently shrinks payments to Quebec and increases them elsewhere. In general, provinces with few large-emitters and low emissions per capita benefit from using emissions as the carbon tax base and from including federal backstop revenue in equalization. In most, but not all, reforms, Quebec entitlements increase.

There remain other potentially important design details to explore, including appropriate treatment of output-based allocations within the federal OBPS regime or free-permit allocations within provincial cap and trade programs. We leave these questions to future research. But as equalization and carbon pricing are increasingly focal stress points between federal and provincial governments in Canada, ensuring their respective designs do not

interact in potentially adverse ways will be increasingly important. The tax base and revenue inclusion decisions explored in this paper are a natural first step.

References

Albouy, D. 2012. “Evaluating the efficiency and equity of federal fiscal equalization.” *Journal of Public Economics* 96 (9-10): 824-839.

Beck M., N. Rivers, R. Wigle, H. Yonezawa. 2015. “Carbon tax and revenue recycling: Impacts on households in British Columbia.” *Resource and Energy Economics* 41: 40-69.

Boadway, R., F. Flatters, and A. Leblanc. 1983. “Revenue Sharing and Equalization of Natural Resource Revenues.” *Canadian Public Policy / Analyse de Politiques* 9 (2): 174-180.

Boadway, R. 2004. “The Theory and Practice of Equalization.” *CESifo Economic Studies* 50 (1): 211-254.

Boadway, R. and K. Cuff. 2017. “The Impressive Contribution of Canadian Economists to Fiscal Federalism Theory and Policy.” *The Canadian Journal of Economics / Revue Canadienne d'Economique* 50 (5): 1348-1380.

Boothe, P. and D. Hermanutz. 1999. “Simply sharing: An equalization scheme for Canada.” Commentary 128 (Toronto: C. D. Howe Institute).

Canada. Environment and Climate Change Canada. 2018. “Fall 2018 update: Estimated impacts of the federal pollution pricing system.” https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/fall-2018-update-estimated-impacts-federal-pollution-pricing-system.html

Courchene, T. J. 1984. Equalization Payments: Past, Present and Future (Toronto: Ontario Economic Council).

Courchene, T. J. and D. Beavis. 1984. “Federal-Provincial Tax Equalization: An Evaluation.” *The Canadian Journal of Economics / Revue Canadienne d'Economique* 6 (4): 483-502.

Courchene, T. 2005. “Resource Revenues and Equalization: Five-Province vs. National-Average Standards, Alternatives to the Representative Tax System, and Revenue-Sharing Pools.” *IRPP Working Paper Series* 2005-04.

Dobson, S., J. Winter, and B. Boyd. 2019. “The Greenhouse Gas Emissions Coverage of Carbon Pricing Instruments for Canadian Provinces.” *The School of Public Policy Publications* 12 (6). doi: https://doi.org/10.11575/sppp.v12i0.53155.

Expert Panel on Equalization and Territorial Formula Financing. 2006. *Achieving a National Purpose: Putting Equalization Back on Track*. Cat. No.: F2-176/2006E. Ottawa: Department of Finance.

Fellows, G. K. and S. Dobson. 2017. “Embodied Emissions in Inputs and Outputs: A Value-Added Approach to National Emissions Accounting,” *Canadian Public Policy*, 43 (2): 140-164.

Fischer, C., and A. Fox. 2007. “Output-Based Allocation of Emissions Permits for Mitigating Tax and Trade Interactions.” *Land Economics* 83 (4): 575-599.

Fullerton D. and G. Heutel. 2010. “Analytical general equilibrium effects of energy policy on output and factor prices.” *B.E. J. Econ. Anal. Policy* 10 (2): 376.

Garon, J.D. and C. Seguin. 2019. “Environmental tax reform in a federation with rent-induced migration.” *Mimeo.*

Locke, W., and P. Hobson. 2004. “An Examination of the Interaction between Natural Resource Revenues and Equalization Payments: Lessons for Atlantic Canada.” *IRPP Working Paper Series* 2004-10.

Smart, M. 1998. “Taxation and Deadweight Loss in a System of Intergovernmental Transfers.” *The Canadian Journal of Economics / Revue Canadienne d'Économique* 31 (1): 189-206. doi:10.2307/136384.

Smart, M. 2007. “Raising Taxes through Equalization.” *Canadian Journal of Economics / Revue Canadienne d'Économique* 40 (4): 1188-1212. doi:10.1111/j.1365-2966.2007.00448.x.

Tombe, T. 2018. “Final and Unalterable — But Up for Negotiation: Federal-Provincial Transfers in Canada.” *Canadian Tax Journal / Revue Fiscale Canadienne* 66 (4): 871-917.

Tombe, T. and J. Winter. 2018. “Fiscal Integration with Internal Trade: Quantifying the Effects of Equalizing Transfers.” *University of Calgary Working Paper.*

Usher, D. 2017. “The Reform of Equalization Payment.” *Canadian Public Policy* 33(3): 337-366.