Analysis of Carbon Tax Treatment in Canada's Equalization Program

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Non seulement les taxes sur le carbone sont-elles un mécanisme efficace pour limiter les émissions de gaz à effet de serre, mais elles constituent aussi une source de recettes publiques de plus en plus importante. Les disparités dans la distribution des émissions engendrent toutefois des écarts appréciables entre les provinces quant aux recettes potentielles. Les paiements de péréquation peuvent atténuer ces écarts, mais nos connaissances sont limitées quant à la nature de l'interaction du système de péréquation et des taxes sur le carbone. Les auteurs procèdent à l'analyse quantitative de cette interaction et explorent d'autres facteurs intervenant dans la conception de la péréquation — comme les recettes à inclure ou le système de taxation à utiliser — qui pourraient motiver des changements propres à améliorer le fonctionnement et l'efficacité tant de la politique de péréquation que de la politique climatique.

Mots clés : effet incitatif, fédéralisme fiscal, filet de sécurité fédéral pour la tarification de la pollution causée par le carbone, péréquation, taxes sur le carbone

Carbon taxes are not only an efficient tool to mitigate greenhouse gas emissions, but they are also an increasingly important source of government revenue. The uneven distribution of emissions, however, creates significant differences across provinces in terms of their revenue potential. Equalization payments can mitigate these differences, but little is known about how this program interacts with carbon taxes. In this article, we quantitatively analyze this interaction and explore alternative considerations for equalization design—such as which revenues to include or tax bases to use—that may motivate changes to improve the functioning and effectiveness of both equalization and climate policy.

Keywords: equalization, carbon taxes, federal carbon backstop, fiscal federalism, incentive effects

Introduction

Canada's equalization program is, and has always been, controversial. It attracts attention in all provinces in part because a large amount of cash is at stake, about $19.8 billion for 2019/20, and because not all provinces receive these transfers. Carbon taxes also 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, although previously unappreciated, ways. As carbon tax rates increase—to $50 per tonne by 2022, and possibly more afterward—total carbon tax revenues have the potential to be the fifth most important source of provincial revenue in the equalization formula. Given how unevenly greenhouse gas (GHG) emissions are distributed across provinces, and therefore how uneven 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.

In this article, therefore, we investigate the implications of growing carbon tax revenue and coverage for Canada's equalization program. Although a large literature examines 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.[1] We take as our starting point the equalization program as it currently operates, focusing on alternative treatments of carbon tax revenues in 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.[2]

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, although 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 that 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 comparing fiscal capacity. This system is informed by the set or universe of revenue-generating measures adopted by provinces, including carbon taxes. In this way, the federal government is agnostic about actual tax choices. Asked why resource revenues were counted as revenues rather than as asset sales, for example, Finance Minister Sharp (Canada 1967, 509) 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." Although 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.[3] Whether carbon tax revenues contribute to such fiscal benefit differentials may depend on how they are structured, their incidence among workers relative to capital owners, the way in which revenues are recycled, and so on. A large literature explores each of these questions. Most recently, Fellows and Dobson (2017) show that 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 (2011) explore the distributional consequences of carbon taxes, demonstrating that they crucially depend 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 article 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 and federal backstop carbon pricing regimes are currently treated differently; 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 matter 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.[4] This is meaningful, in particular for the allocation of entitlements across provinces. Excluding backstop revenues affects equalization payments—both because there are fewer provincial revenues to be equalized and 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 the have-not provinces with relatively higher levels of per capita consumption tax bases—such as Manitoba and the Maritimes—whereas 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, whereas Prince Edward Island would see a nearly insignificant reduction and other recipient provinces would 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 raise 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 in another. A broad-based carbon tax set at $50 per tonne, for example, would raise more than $2,300 per capita in Alberta, compared with just more than $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. GHG 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 more than 0.06.[5] 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 2004; Boadway, Flatters, and Leblanc 1983; Courchene 2005; Locke and Hobson 2004), but our article 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 that take 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. Also, 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 in 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.[6] We therefore examine and quantify the effects of introducing a unique carbon tax base to evaluate provincial carbon tax fiscal capacity. Specifically, we explore using GHG emissions as the tax base on which carbon pricing revenues are equalized.[7]

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, and provinces with relatively low emissions per capita see the reverse. Quantitatively, we find that current non-receiving provinces are not affected but that the reallocation 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 in which 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 by 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. GHG 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 create an incentive for 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 Prince Edward Island.

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. Quebec's 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 that 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 rather to illustrate its importance as a consideration in equalization design as carbon revenues increase. A full RTS treatment of large-emitter revenues is feasible, although beyond the scope of this article.

Finally, our article 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 after 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. After 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 carbon tax revenues from large emitters, 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 it reached $30 per tonne in 2012. Six years later, the rate increased to $35 and, as of 1 April 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.[8] 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.

Before 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 Canada's climate objectives in the least-cost manner, but it also inhibits interprovincial trade. The 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 report *Tear Down These Walls*: *Dismantling Canada's Internal Trade Barriers* (Canada 2016, 60).

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 consists of a $20-per-tonne carbon levy that rises 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.[9]

Effective April 2019, a minimum carbon price on a broad base of GHG emissions is now achieved in each province using 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, whereas 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. Following its recent provincial election campaign, Alberta is slated to see the fuel levy portion of the federal backstop imposed 1 January 2020. 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.[10] Compared with 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 show, this has important implications for equalization.

Carbon Pricing Revenues and Equalization

Broad-based carbon pricing policies are a market-based approach to incentivizing cost-effective reductions in GHG emissions. However, carbon pricing is also a potential source of government revenue. Before 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.[11] 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.[12] 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 70–90 percent of their emissions credits for free. In Quebec, about 23 percent of permits are freely distributed (see Dobson, Winter, and Boyd 2019). 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 in 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 a 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

Table 1: Carbon Pricing in Canada

Level of Government	Pre-2019 with No Federal Backstop	2019 with the Federal Backstop	2019 Policy Type
Provincial carbon pricing only	British Columbia	British Columbia	Carbon tax
	Quebec	Quebec	Cap and trade
	Ontario	Nova Scotia	Cap and trade
	Alberta	Newfoundland and Labrador	Carbon tax + performance standards for large emitters
	Manitoba		
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]

Note: OBPS = output-based pricing system.

[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 Carbon Competitiveness Incentive Regulation) with another program that is unlikely to be compliant with federal backstop requirements. Effective 1 January 2020, Alberta may therefore see the federal OBPS imposed.

Source: Authors' construction.

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 in the equalization program—more important than all payroll tax revenues combined, for example. 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, and Manitoba and partially in Saskatchewan and Alberta, so the revenues generated belong exclusively to the federal government. In time, we anticipate Alberta will 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 (Canada 2007, § 4[1][c][xiv]). As we show, the distinction between federal and provincial carbon pricing revenues matters for equalization.

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.

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.

Although 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); second, provide top-up

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

		2019/20		2022/23		
Province	2017/18: No Federal Backstop	Gross Total	Net Total[a]	Gross Total	Net Total[a]	Provincial/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[b]
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[d]	785	1,252	897	3,131	2,242	100/0
NB		275	151	689	376	0/100
NS[d]		268	268	671	671	100/0
PE		25	24	62	60	100/0
NL		149	82	372	204	100/0
Total (% in EQ)	5,724	13,149	8,429	25,944	16,771	
	(100)	—	(47)[d]	—	(32)	

Note: EQ = equalization; OBPS = output-based pricing system.

[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] 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.

[c] To simplify, OBPS revenues in Saskatchewan are assumed to accrue to the federal government.

[d] The price for auctioned permits is assumed to be $20 per tonne and $50 per tonne in 2019/20 and 2022/23, respectively. Free permit share in Quebec is 22 percent; the share for Nova Scotia is not yet known.

Source: Authors' calculations based on provincial emissions 2016 from Canada (2018b); emissions coverage estimates from Dobson et al. (2019) and provincial plans.

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

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

where b_i is the province's per capita tax base, $\overline{b}$ is the average per capita tax base, $\overline{\tau}_i$ is the national average tax rate across 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, this can be re-formulated as

$$E_i=(p_i - f_i) \cdot R, \quad (2)$$

where province i's share of the national population is p_i, its share of the tax base is f_i, and the total revenue within this tax base across all provinces is 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 would the average province. Equalization entitlements within this tax instrument are therefore 4 percent of the total provincial personal income tax revenue.

Multiple tax instruments complicate the picture somewhat, but not significantly. The preceding 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. However, this led to a well-known incentive problem: if a province could shrink its tax base f_i, then it would receive more equalization.[13] To mitigate this, five broader categories were adopted in the 2007 reform.[14] The base for carbon taxes (i.e., GHG emissions) is qualitatively distinct from other bases in many important ways, so it deserves special attention.

Greenhouse Gas Emissions as a Tax Base

Currently, provincial carbon tax revenues are treated as consumption tax revenues. This category includes many taxes—general sales, tobacco, gasoline, 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 (i.e., spending adjusted for sales tax exemptions), housing investment, and intermediate input and investment spending by businesses. Including carbon taxes in this category matters because it implicitly equalizes the yield of carbon tax revenues across provinces according to the distribution of the consumption tax base.

However, GHGs are different. The carbon tax base is priceable GHG 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. For example, Newfoundland and Labrador has 1.5 percent of Canada's consumption tax base, emissions, and population. The choice of carbon tax treatment is therefore irrelevant. For Alberta, though, the story is very different. The province has just less than 12 percent of the population, more than 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.

For most other provinces, however, their share of national emissions is less than 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

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

Item	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL
Tax base										
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 miscellaneous	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	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

Note: GHG = greenhouse gas.

[a] All resource revenues are included to calculate the revenue-weighted average total per capita fiscal capacity.

Source: Tombe (2018) and authors' calculations using 2016 emissions data from Canada (2018b).

see this, consider an expanded (although still stylized) representation of equalization entitlements to province i given by combining all revenue categories j according to

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

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, although 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. Therefore, to a first approximation, including carbon tax revenue in the consumption tax base affects payments to each province by $\left(p_i - f_i^{cons}\right)C$, 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

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

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

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

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 (3), 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 and 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.[15] If carbon tax revenue were distributed according to emissions, however, total equalization payments calculated using Equation (4) would increase by nearly $29 dollars per $100 in aggregate provincial carbon tax revenues, now with Ontario as a significant recipient province. More important, Ontario's share of Canada's provincial consumption tax base is equal to its share of the population, whereas 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.[16] For now, we presume Ontario receives equalization and turn to a complete model of actual equalization payments later in the article.

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 that 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 because there is a fixed pool of dollars available that sets a limit in any given

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

Item	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[a]	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

Note: GHG = greenhouse gas.

[a] 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 Note 16 for details.

Source: Tombe (2018) and authors' calculations using 2016 emissions data from Canada (2018b).

year, which grows with a rolling average of national nominal gross domestic product (GDP) growth.[17] 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 earlier equalization formula. In particular, among equalization-receiving provinces,

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

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, whereas other provinces are better off. Ontario gains if the GHG emissions base is used because its consumption tax base and population shares are the same, yet the growth cap binds tighter.

The preceding 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 in which 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 include gross versus net revenues. We quantify this effect. 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.

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

Scenario	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 EQ	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 EQ	−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

Note: EQ = equalization; GHG = greenhouse gas.

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

Consideration 1: Differential Treatment of Federal Backstop Revenues

Before 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 that satisfy 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 into the federal OBPS.

In (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), whereas the latter is included as shared revenue (i.e., as in the case of backstop revenues generated in Prince Edward Island). If a province does not voluntarily accept the federal backstop, however, 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 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[18]

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

Because the total payments are held fixed at a predetermined 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.

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 in which all 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. Overall, however, 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

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

Scenario	MB	QC	NB	NS	PE
Baseline based on 2017/18 data	2,349	12,976	2,033	2,053	427
Carbon price of $30/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/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: Authors' calculations using 2016 emissions data from Canada (2018b) and adjusting the current equalization formula to the underlying financial data provided by Finance Canada.

revenue source. A province can, at any time, choose to repurpose the revenue toward any other initiative, either by levying its own carbon price in lieu of the federal price or by acceding to the federal backstop program and taking charge of the revenues. 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 2018a). 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.[19] The decision to include such transfers in equalization is also a policy choice. There have also been recent explorations, such as those by Albouy (2012) and Tombe (2018), of whether federal taxes, which affect migration decisions, should also be incorporated into the equalization program, even though these taxes are outside of the control of provincial governments and not a source of provincial own-source revenue.

However, equalization historically aims to equalize provincial own-source revenues as understood by provincial public accounts. This is the heart of the RTS approach to equalization, which, as noted in the introduction, can be traced back to 1967 when equalization as it is now known began. This approach suggests that because 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.

Consideration 2: Distinct Greenhouse Gas 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. On the basis of 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 with Quebec's $400 if the consumption tax base was used.[20] However, if emissions were the tax base, the formula would imply that Alberta's yield would be $1,484 per capita compared with 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)

Scenario	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/tonne, included in EQ					
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/tonne, included in EQ					
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

Note: Changes may not sum to zero due to rounding. EQ = equalization; GHG = greenhouse gas.

Source: Authors' calculations using 2016 emissions data from Canada (2018b) and applying the current equalization formula to the underlying financial data provided by Finance Canada.

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 through carbon taxation. Second, an increasing carbon price has a large effect on the allocation of equalization across provinces. If all provinces priced GHGs 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 Greenhouse Gas Base

Incorporating a distinct carbon tax base into equalization does more than simply reallocate 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 because the formula already creates an incentive for recipient provinces to potentially increase their tax rates, or otherwise shrink their tax bases, 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 it is 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 33 (Expert Panel 2006). If carbon emissions are the base for carbon taxes, however, this equalization base effect may bring with it external benefits because 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 $50-per-tonne scenario reported in Table 7 its equalization payments rise by 0.4 percent—equivalent to $56 million per year. Because 10 percent of its priceable emissions is roughly equivalent to 4.5 million tonnes 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 percent 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 its equalization payments by more than $30 million. This is a 1.4-million-tonne 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 an almost $30 million increase in equalization, from a 10 percent (or 0.7 million tonne) 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 because their small size, and therefore small increased payment, means the growth cap will be clawing back less per capita than when a larger province—such as Quebec—increases its equalization entitlement through carbon abatement.

Although 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, because the marginal costs of abatement are equalized. If some provinces receive additional abatement incentives compared with 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 because 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. Federally, a large majority of revenues resulting from a price on carbon emissions in the OBPS regime will be recycled in the form of an output subsidy to covered emitters. These subsidies are known as *output-based allocations* (OBAs). 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 in 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 in a cap-and-trade system, in which 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 an RTS 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: (a) the current situation of including only net revenues and ignoring large-emitter pricing structures and (b) 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 its 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.

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 because of 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, because 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.

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

Scenario	MB	QC	NB	NS	PE
Carbon price of $50/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/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

Note: GHG = greenhouse gas.

Source: Authors' calculations using 2016 emissions data from Canada (2018b) and adjusting the current equalization formula to the underlying financial data provided by Finance Canada.

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 RTS 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: Cap on Aggregate Equalization Payments

Since 2009, equalization payments have been 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.

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 with $19.8 billion in the baseline case based on 2017/18 data. At $50 per tonne, the program increases to nearly $20.7 billion. This exercise holds all other tax revenues and bases fixed, so the increase of more than $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 more than $2.1 billion, with more than 90 percent 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 make this discussion all the more important. On 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 increases. 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 because total payments are largely predetermined. 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 percent 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 are resource revenues. 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 article, we take a cautious first step toward 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 that equalization payments are meant to ensure that 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 that a distinct carbon tax base

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

Scenario	MB	QC	NB	NS	PE	Total
Baseline based on 2017/18 data	2,349	12,976	2,033	2,053	427	19,837
Carbon price of $30/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/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

Note: GHG = greenhouse gas.

Source: Authors' calculations using 2016 emissions data from Canada (2018b) and adjusting the current equalization formula to the underlying financial data provided by Finance Canada.

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. However, because 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 article are a natural first step.

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Notes

1 A notable contribution is that by Garon and Séguin (2019), who demonstrate that 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 concerns us here.

2 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 (2007), for future work.

3 Whether equalization and other transfers achieve this goal in practice is unclear. Albouy (2012) and Tombe and Winter (2018), for example, suggest current observed federal transfers subtract from aggregate productivity.

4 Had the provinces in which the federal backstop currently applies instead implemented an equivalent provincial carbon pricing policy, these revenues would be fully included in equalization.

5 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.

6 The Schutz Index for gasoline used for road vehicles is our own calculation, based on Statistics Canada Tables 23-10-0066-01 and 17-10-0005-01 for 2017.

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

8 The Carbon Competitiveness Incentive Regulation introduced in 2018 replaced the Specified Gas Emitters Regulation system, in place since 2007.

9 The federal system covers facilities with annual emissions of 50 kilotonnes or more per year, whereas the Alberta system covers facilities with emissions of 100 kilotonnes or more per year.

10 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.

11 Given the uncertainties involved, the revenue estimates are illustrative.

12 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.

13 See, for example, Smart (1998, 2007) and Expert Panel (2006, Annex 4).

14 The Expert Panel (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 (e.g., 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.

15 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.

16 Specifically, if carbon tax revenues exceed 2.5 percent 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 are available on request.

17 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 article.

18 The actual change in entitlements will differ from this simple expression, because 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.

19 This is a long settled area of law, with two Supreme Court of Canada cases deciding the matter (*Reference Re: Offshore Mineral Rights* 1967 and *Reference Re: Newfoundland Continental Shelf* 1984).

20 This is derived from $16.8 billion × 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.

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