Carbon Pricing in Canada: Options and Specifics

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1 Introduction

There have been a number of policies proposed to reduce greenhouse gas emissions (GHG) thereby mitigating climate change. An important class of climate policies involves putting a "price" on carbon, either by implementing a carbon tax or some form of tradeable permit scheme. In theory, carbon pricing is a cost effective way of resolving the externality problem, thereby improving efficiency. These policies may also generate government revenue, in the form of tax or permit revenue, and these revenues may be used to generate further efficiency gains by lowering distortionary taxes. Alternatively, some of the revenues earned can be allocated to various measures intended to promote emissions reductions. Carbon pricing policies also have important effects on the distribution of welfare across individuals, sectors, regions, and time.

There are some unique challenges when it comes to the implementation of carbon pricing in Canada. Federal and provincial governments not only share responsibility for the environment but also share directly or indirectly most major tax bases like the carbon tax base. Either level of government could implement carbon pricing to address GHG emissions. Indeed, as we shall see, both levels of government are already involved. Intergovernmental coordination (or lack thereof) and revenue sharing between federal and provincial governments are important characteristics of the federation and may play a role when it comes to implementing carbon pricing. As well, recent developments in the United States further complicate climate policy in Canada at both levels of government.

Against this backdrop, this paper identifies and assesses challenges to the implementation of carbon pricing in Canada, with a particular focus on federal-provincial dimensions of the challenge. We begin with a brief review of the basic carbon pricing instruments and of the current state of carbon pricing policy in Canada. Four federal-provincial challenges – revenue recycling, revenue sharing, intergovernmental coordination, and the North American context – are then discussed. Where available, we draw on the scholarly literature to help inform our assessment of the challenges. In section four, we outline a carbon pricing research agenda for Canada. The "next steps" agenda targets key carbon pricing scenarios of particular relevance to the Canadian debate.

2 Carbon Pricing: Options and Outcomes

There are two carbon pricing policy options - a carbon tax or some form of tradeable permits scheme. Under a carbon tax, the price is fixed while the quantity of emissions reductions achieved is variable and dependent on existing and new technologies. The most common forms of tradeable permits schemes are 'cap and trade' or 'baseline and credit'.

Under a cap and trade scheme, a market for GHG emissions is established. A cap for aggregate emissions is set to achieve some specified reductions in emissions (such as the Kyoto target or the federal government's 2020 and 2050 targets[1]). Emissions permits are distributed to firms (freely or auctioned). Emitters who generate fewer emissions than allowances can sell the surplus. Others who emit in excess of their allowances can purchase permits to cover the shortfall. Here, the quantity of emissions reduction is certain but the price at which permits trade is variable.

An alternative to the cap and trade system is a baseline and credit system. Here, emitters are given a baseline emissions target. The target may be based on an emission intensity target, defined as a specified rate of emissions per unit of input or output, or on historical emissions. Credits are given to firms with emissions below their baseline which can be sold to emitters with emissions above baseline. Under the baseline and credit system, aggregate emissions can grow with aggregate output.

If the tradeable permit scheme does not cover all emitters, an additional design issue may arise. This concerns the use of 'offsets.' Offsets are credits generated from outside the covered emitters. Their use is somewhat controversial, because it may be difficult to determine whether emission reductions credited with offsets are indeed incremental.

Baseline and credit systems implicitly assume that firms get some initial allocation of permits, normally based on historic emissions. Cap and trade systems may also work this way, or the allowances can all be auctioned, generating potentially significant revenues.

So far, we have assumed the imposition of a single instrument, either a carbon tax or a tradeable permit scheme, to reduce emissions. The current state of climate policy in Canada and in the United States suggests, however, that more complex scenarios will emerge.

[1]These targets are specified in the federal government's *Turning the Corner* plan introduced in 2007.

For instance, two provinces have introduced carbon taxes (British Columbia and Quebec). In both cases, the tax has been set at a low level. A number of provinces, including British Columbia and Quebec, are already party to US-based climate initiatives that are proposing cap and trade type systems. Even without the introduction of a federal carbon pricing policy, it seems likely that both carbon taxes and cap and trade systems will be in effect at the same time.

Further complications arise when we consider the North American context. In addition to the regional initiatives already underway, the President of the United States is now actively pursuing a national climate policy. These developments place additional constraints on climate policy in Canada. US pressures may force the federal government to back away from its current baseline and credit plan and to adopt a cap and trade system on a faster timetable than originally intended. Both federal and provincial governments could be involved in carbon pricing. Joint occupancy of the carbon revenue base suggests that carbon pricing policies may, of necessity, involve some form of revenue sharing between federal and provincial governments.

Given these developments, there is a significant probability that the policy environment will be characterized by the existence of multiple carbon pricing instruments in operation at the same time and at more than one level of government.

2.1 Policy Modalities

Rather than detail all aspects of all possible regimes, this section discusses key issues that arise with the simplest cases.

For example, we discuss the cases where a cap and trade system (or systems) coexist with a carbon tax. We consider the case where the carbon price restriction (total value of carbon taxes) is binding and then the case where the quantity restrictions (restrictive effect of all overlapping cap and trade schemes) is binding. It could also arise that the carbon price binds in some provinces whereas the carbon quantity is binding in others.

2.1.1 Pure Tax Regimes

The most cost-effective tax approach would be a harmonized carbon tax applied across Canada. This could be imposed by either level of government or both, as long as the total tax charged was the same in all provinces, and

covered all emitters. This assures that the marginal cost of abatement is equalized across all sources.

If carbon taxes were collected by both the federal government and some subset of provinces, the cost-effectiveness argument for carbon taxes is eroded to the extent that the total carbon penalty differs between sources. In addition to vertical tax externalities arising from joint occupancy of the carbon tax base, the policy could be administratively complex if the definition of the tax base and exemptions differed across jurisdictions. Revenues would accrue to both levels of governments, and they would need to decide how to use the revenues raised.

2.1.2 Hybrid: Dominant Carbon Tax

In this case, carbon tax(es) coexist with cap and trade, but the carbon price (sum of all carbon taxes applied) is the binding constraint. In this case, the cap and trade allowances are worthless.

Note that, in the event that cap and trade schemes apply to selected sectors (energy-intensive industrial emitters, for example) the carbon price could still be binding in some sectors, even though the carbon quantity is binding throughout the sector covered by cap and trade.

2.1.3 Hybrid: Dominant Cap

In this case both a cap and trade system and a carbon tax are in effect but the cap is binding. Here, the value of the cap and trade allowances is reduced by the total value of carbon taxes imposed. Depending on whether the allocations of permits are auctioned, there may be permit revenues to consider, as well as tax revenues. This scenario seems likely to arise in provinces which are involved in regional GHG initiatives (cap and trade) but which also face a carbon price as well. British Columbia, for example participates in the Western Climate Initiative (WCI), a regional cap and trade system, but continues to impose its own carbon tax.

2.1.4 Pure Cap Regimes

The most cost-effective cap and trade regime would have only one binding cap applying to all emitters. This would not prevent different levels of government allocating some or all of the allowances, and collecting any revenues from auctions.

If more than one cap applies to a given source's emissions, it is possible that cost effectiveness will be reduced. This would be the case if more than one system overlapped, and the credits from alternative schemes were not allowed under the competing systems. While there is some discussion of the basis for exchange of state-issued allowances in the draft Waxman–Markey US climate bill (sec 790)[2], the same issues would arise in the context of Canadian jurisdictions participating in the WCI and Regional Greenhouse Gas Initiative (RGGI).

To take a concrete case, suppose that WCI allowances were worth $30 and Canadian allowances were worth $10. One could imagine three possibilities:

no crediting In this case, sources in WCI provinces would pay $40/t and those in other provinces would pay $10/t.

one-way crediting Here the WCI credits could be credited towards satisfying the Canadian cap. Canadian sources in WCI provinces would face $30/t and others $10/t.

bilateral crediting Here WCI and Canadian credits are completely interchangeable. If the prices of credits were different, no one would worry about the higher-priced (likely WCI) credits, just using the lower priced (Canadian) ones. Without restrictions, this would lead to pressures to reduce the value of WCI credits and increase the value of Canadian credits until the two were equal.

In any event, the mechanics of exchanging between federal, regional and provincial allowances raise a further set of issues. If significant crediting was anticipated, serious thought would need to go into the basis of exchange among allowances from differing systems. An allowance registry would likewise be required.

2.1.5 Summary

The literature is heavily focused on the single instrument scenarios, either a carbon tax or a cap and trade system, usually at the national or international level. Yet, the emerging carbon policy environment in North America

[2]California and the Regional Greenhouse Gas Initiative (RGGI) are mentioned explicitly but presumably this would apply to the WCI also.

involves multiple carbon pricing instruments and multiple levels of governments. Moreover, even the simplest of policy modalities outlined above have significant federal-provincial dimensions. We discuss these next.

3 Federal-Provincial Challenges

We identify four key federal-provincial challenges that are likely to influence what and how carbon pricing policies, if any, are introduced: revenue recycling, revenue sharing, intergovernmental coordination and the North American context.

3.1 Revenue Recycling

With carbon pricing, a key question is how the revenues, if any, from carbon pricing get recycled.

Revenue recycling has received significant attention in the literature, with a variety of models applied to different countries and different carbon pricing policies.[3] Most studies adopt a national perspective and focus on aggregate welfare and/or GDP effects and on the effects on GHG emissions. Sectoral effects and individual distributional concerns are sometimes considered.

The benchmark recycling scenario often assumes revenues are returned to the consumer in a lump sum fashion. The most common tax recycling experiments are reductions in payroll and employment (income) taxes and reductions in sales or value added (VAT) taxes. Less common are experiments where carbon pricing revenues are recycled by reducing corporate/capital taxes or by direct investment or subsidization of clean technology and research and development.

For Canada, climate policy research includes work by Dissou (2005), (2006), Snoddon and Wigle (2007), (2008), Ab Iorwerth et. al. (2000), Government of Canada (2002) and, most recently, NRTEE (2009a),(2009b).[4] Most of these studies focus on the tax and permit options but some include analysis of non-revenue generating policy options, like performance standards, voluntary measures and subsidies for clean technology.

[3]For an excellent survey of the literature and carbon pricing policies in practice, see Ekins and Barker (2001).

[4]See Wigle (2001) for a brief summary of earlier literature on a carbon tax for Canada.

Generally, this research indicates that reducing GHG emissions in a significant way will be costly for Canada, with welfare and GDP losses in the range of 1% to 2% and 0.5% to 4.5%, respectively, as compared to the business-as-usual (BAU) case. Results may vary, however, depending on key differences in:

- policy instruments used,
- stringency of the emissions reductions target and time frame for achieving it,
- recycling options,
- type of model used (computable general equilibrium model, bottom-up, energy economy models), and
- static versus dynamic modelling.

To illustrate these differences, we consider some recent analyses. Dissou (2006) focuses on the tradeoff between the efficiency and sectoral effects associated with different permit schemes. A dynamic computable general equilibrium (CGE) model of the aggregate Canadian economy is used to simulate the effects of reducing GHG emissions to 6% below below 1990 levels (or achieving 190 MT reduction relative to the 2010 baseline) by 2010.[5] All experiments require that the target be achieved by domestic emissions reductions only (i.e. no international permit trading).

Three policy scenarios are considered. First, permits are assumed to be freely distributed based on current output. The second scenario assumes permits are freely allocated based on historical emissions. In both these experiments, the government budget is kept at the BAU level by lump sum adjustments to the representative consumer. In the third scenario, permits are auctioned and the revenues are used to reduce payroll taxes. The welfare effects are smallest in the third experiment (a welfare loss relative to BAU of 1.3% as compared to a loss of 2.9% and 2.1% for grandfathered and output-based permit allocation systems respectively).

Next consider the recent study on carbon pricing for Canada undertaken by the National Round Table on the Environment and the Economy in 2009

[5]The required gap in emissions given the Kyoto target is in fact 240 MT. Dissou requires the permit system to contribute 190 MT of the 240 MT gap.

(herein referred to as NRTEE (2009a)). The report evaluates the effects of a cost minimizing approach to achieving the federal government's 2020 and 2050 emissions reduction targets. The 2020 target entails reducing emissions to 20% below 2006 levels by 2020 (or 278 MT below BAU in 2020). A Canada-wide cap and trade permit system with auctioning of permits is the main carbon pricing policy modelled. The permit system achieves about 65% of the 2020 reduction target. Limited international permit trading is allowed. The analysis uses a variety of models including a dynamic CGE model combined with the CIMS technology model and a macro model to assess the effects of alternative policies.

Four revenue recycling options are considered: corporate income tax reductions, sales tax reductions, personal income and payroll tax reductions and technology development and innovation expenditures.

The report finds that in the shorter run, 2020, sales tax recycling increases welfare relative to BAU by 0.9% as compared to a -0.8% and -0.2% change in welfare given corporate and labour/payroll tax recycling respectively. By 2050, sales tax recycling causes welfare to fall relative to BAU by -4.4% as compared to -2.0% and -3.2% with corporate and labour income tax recycling. In the long run, sales tax recycling is least preferred owing to its negative effects on economic growth. The report does not provide comparative GDP figures for the scenario where revenues are deployed to support technology.

Much of the literature has focused on revenue neutral policy experiments. Mintz and Olewiler (2008) proposes replacing the fuel excise tax with a broad based environmental tax. They support a revenue neutral approach, recycling the revenues to lower corporate and business taxes. This option represents an alternative to recycling revenues to direct technology investment. Business tax reductions combined with the carbon price signal can stimulate investment in technology, including clean technology. Dissou (2006) and Snoddon and Wigle (2008), discussed below, also conduct revenue neutral policy simulations. In contrast, NRTEE (2009b) advocates for recycling revenues to support technology development and innovation rather than tax recycling.[6] It is important to note that the technology recycling option represents something in the order of an $18 billion dollar tax increase.

From their comprehensive survey of the literature, Ekins and Barker (2001) conclude that the extent to which tax recycling can significantly reduce welfare or GDP losses resulting from carbon pricing depends on the

[6]See the accompanying technical report, NRTEE (2009b), page 100.

extent to which an economy is below full employment. The stringency of the target and time frame under consideration are also important factors.

There are a number of gaps in the literature on revenue recycling. The regional welfare implications associated with different national recycling options are not well explored in the literature; more attention is given to distribution issues for individuals and sectors. Regional welfare implications are nevertheless important.

Snoddon and Wigle (2008) show that the regional welfare effects are sensitive to how federal climate policies (including subsidies and international permit purchases) are financed. The policy experiments are simulated using a static regional CGE model and all scenarios require an emissions reduction target of 6% below 1990 levels.

The policy packages investigated give rise to a *shortfall* in federal revenues, in contrast to carbon pricing policies which generate a surplus.[7] Two options for financing the shortfall are considered: an increase in federal direct (income) taxes and an increase in indirect (consumption) taxes. Aggregate welfare losses are similar in all cases, ranging from -0.53% to -0.63%. These welfare losses are lower than those in Dissou (2006) and NRTEE (2009a) owing to a greater reliance on international permits and the static modelling approach. The regional results indicate that, for a given set of policies, provincial welfare losses tend to be lower but more uneven with income tax financing as compared to consumption tax financing. Ontario is the exception, faring better with consumption tax financing. These results partly reflect the distribution of tax bases across provinces.

Snoddon and Wigle's results emphasis an important challenge for implementing climate policy in Canada. Provincial governments may have strong and conflicting preferences over carbon pricing and tax recycling options. And, since provinces have some entitlements to the carbon revenue base, these conflicting preferences will need to be addressed. For example, the adoption of a Canada-wide carbon pricing policy might require provincial concessions, depending on the regional distribution of the burden under alternative recycling scenarios.

All of the above studies focus on revenue recycling at the federal level, ignoring the effects on lower level governments' fiscal positions. However, car-

[7]Policies include subsidies for clean technologies like wind, international permit purchases, a renewable portfolio standard for electricity generation and a vehicle emissions standard.

bon pricing policies can alter a significant number of prices in the economy. Snoddon and Wigle (2008) track changes in provincial government revenues but assume budget balances are maintained by adjusting provincial transfers to the representative consumer. Alternative responses include provincial government tax increases. These tax adjustments can have additional impacts on the economy and welfare but there are no estimates in the literature to suggest how significant these impacts will be.

Carbon pricing policies (and possibly carbon revenues) may exist at both federal and provincial governments, requiring some form of revenue recycling at both levels. There is little research on the issue of carbon pricing at multiple levels of government and no work on how different recycling options pursued by federal and provincial governments may impact on the aggregate and regional welfare burden or the cost-effectiveness of carbon pricing policies.

3.2 Revenue-sharing

The existing literature's heavy emphasis on national level, harmonized carbon pricing policies is motivated by the desire to find a low cost or cost effective method of achieving emissions reductions. In Canada, both federal and provincial governments have access to carbon pricing revenues as a result of the joint occupancy of the carbon revenue base. If a national or harmonized carbon pricing policy is adopted, the question of federal-provincial revenue sharing will emerge fairly quickly. And with the possibility that some revenues are returned to provinces, the question of how the shared revenues get recycled at the provincial level also arises.

Revenue sharing, a central feature in Canada's fiscal federal arrangements, may prove critical to the implementation of a national carbon pricing policy. The main vehicles for revenue sharing in Canada include federal cash grants to provinces and tax collection agreements and are motivated in theory by the presence of vertical and horizontal fiscal imbalances (that arise partly as a result of the constitutional assignment of revenue and expenditure responsibilities) and by efficiency concerns.

Carbon revenue sharing could be handled through a tax collection agreement. For instance, tax collection agreements exist for personal and corporate income taxes and for the harmonized sales tax (HST). These agreements have evolved over time to deal with issues arising from shared tax bases and in response to changing revenue needs, changing demands for greater decen-

tralization, and a desire for greater efficiencies in tax collection.[8]

Consider the personal income tax base, jointly occupied by both federal and provincial governments. Tax collection agreements provide for a common definition of the tax base but each level of government sets its own tax rate, so that the total tax collected on the last dollar of personal income generated is equal to the sum of the federal and provincial taxes. The federal government collects these revenues on behalf of provinces (except in Quebec), and returns provincial income taxes on a derivation basis.

Is this a model for sharing the carbon tax base? Probably not since carbon pricing requires a single price across all provinces and all sources of emissions. With complete freedom to set provincial tax rates, it is unlikely that a single price for carbon will prevail and even more unlikely that it will be the price necessary to achieve a given emissions reduction target.

Revenue sharing in the form of a cash transfer may emerge as a viable option. A Canada-wide carbon pricing policy can be implemented by the federal government, with an agreement to return back some of the revenues to the provinces. A cash revenue sharing arrangement has two components. The first component determines how much of the total revenue generated will be returned to provinces (vertical dimension). The second component determines how this amount is allocated among the provinces (horizontal dimension).

Since most analyses of climate policy are focused on the national economy with a single representative consumer, the issue of intergovernmental revenue sharing cannot be addressed. Snoddon and Wigle (2007), (2008) represent an exception to this. A regional CGE model is used to study various climate policies. The model tracks taxes and expenditures at both the federal and provincial levels. In effect, the model has 10 provinces and 10 representative consumers. In their benchmark experiments, Snoddon and Wigle consider federal climate policies that are revenue neutral for the federal government. Budgetary shortfalls (surpluses) in the benchmark experiments are shared with provinces by adjusting transfers to provinces based on provinces' contributions to federal direct (income) tax revenues. This revenue sharing rule embeds some regional redistribution to the extent that the distribution of federal carbon revenues by province differs from the distribution of federal direct tax revenues. An alternative sharing rule (more in keeping with the

[8]For a discussion of tax collection arrangements and intergovernmental grants in Canada, see Perry (1997) and Boadway and Hobson (1993).

current tax collection agreements for income tax) would be to return the revenues on a derivation basis.

There is some literature on the optimal amount of revenue sharing between levels of government given shared tax bases. Much of this research is theoretical, with a focus on VAT or income taxes. Zee (2008), for example, considers inter jurisdictional sharing with respect to the VAT. Sharing can involve a single jurisdiction setting the tax rate and base and sharing the revenues in some way. Alternatively, jurisdictions could share base and rate setting powers or co-occupy the tax field. This works indicates that revenue sharing depends in part on revenue needs (expenditure responsibilities) of the two levels of government and the availability of other revenue generating instruments.

We are unable to find any research that focuses on revenue sharing within a federation as it pertains to carbon pricing policies.

3.3 Intergovernmental Coordination

Results from the literature support the cost advantage to harmonized policies (with a single carbon price) to address GHG emissions. For example, significant costs savings have been estimated for a jointly implemented permit trading system for Finland, Denmark, Norway and Sweden.[9] Conrad and Schmidt (1998) use a multi-country CGE model to look at the costs of achieving a 10% reduction in emissions in one year for 11 EU countries, comparing an EU wide carbon tax with the case where each individual country sets its own carbon tax. Tax rates are shown to vary considerably in the uncoordinated case. NRTEE (2009b) finds a similar result, showing that the carbon price is likely to be significantly lower if a Canada-wide carbon pricing policy is adopted.

The emerging policy reality is, however, quite different from the harmonized approach adopted in most analyses. Two provinces have already introduced a carbon tax. Quebec introduced the Green Fund duty as part of its June 2006 climate plan. The tax varies by fuel, ranging from a low of about 0.5 cents per litre of propane to $8 per tonne of coal.[10] The province plans to use these revenues, estimated at about $200 million a year, to finance the activities of their Green Fund. These activities include funding for

[9] Ekins and Barker (2001), page 331.

[10] See `http://www.ec.gc.ca/doc/virage-corner/2008-03/571/Annex3_eng.htm`

technology measures, public awareness campaigns and measures for energy and transportation. British Columbia introduced a modest carbon tax as part of its climate plan. Starting at $10 per tonne in 2008, the tax is slated to reach $30 per tonne of carbon emissions in 2012. According to the provincial government's 2009 budget, the new tax is expected to generate $2.27 billion over the period 2009-10 to 2011-12. In contrast to Quebec, British Columbia intends to recycle the carbon tax revenues to tax cuts for individuals and business. Carbon tax levels and revenue recycling options clearly differ across the two provinces.

Several provinces have signed on to regional initiatives linking some US states and some Canadian provinces. For example, BC, Manitoba, Ontario and Quebec are members of the WCI which hopes to launch a market-based cap and trade system. Participation in the regional initiatives suggests a degree of horizontal governmental coordination, at least between some provincial and state level governments. There appears to be little coordination with respect to carbon pricing policies across provinces or between the federal and provincial governments (the latter being referred to as vertical coordination).

Vertical tax externalities arise from co-occupancy of tax bases. In the absence of coordination measures, lower level governments fail to take into account the effects of increases in their tax rate on the higher level government's tax base and revenues. Horizontal tax externalities arise when tax bases are mobile across jurisdictions.

While there is a growing public economics literature on fiscal externalities, the issue is relatively unexplored in the context of a carbon taxes. An exception is Saveyn and Proost (2005) where vertical tax externalities are examined using a CGE model. The simulation is used to model an environmental tax reform with revenue recycling undertaken by a sub national jurisdiction. and to investigate how this regional reform affects the federal government's tax revenues and base. The results indicate that the size of the vertical externality tends to fall as the number of sub-national jurisdictions increases and the size of each jurisdiction in the national economy falls.

Coordination or harmonization can help address vertical and horizontal fiscal externalities. Research is needed to investigate how vertical and horizontal coordination (or lack thereof) affects the cost-effectiveness of carbon pricing policies in Canada and aggregate and regional welfare burdens.

3.4 North American Context

Pre-existing agreements such as those between some Canadian provinces and US-based regional climate initiatives and the push for a United States' climate policy under President Obama represent additional challenges to implementing carbon pricing policies in Canada. There has been a significant amount of media attention on these issues in 2009, much of it focused on harmonizing Canada's climate policy with the US approach and on border tax adjustments. Significant uncertainty continues, however, to surround the debate. One possibility is that pressure from the US may force the federal government to adopt more stringent policies to address GHG emissions and to do so sooner rather than later. If this is the case, whatever the policies adopted, the federal-provincial challenges will become more pressing.

4 A Research Agenda for Carbon Pricing in Canada

Existing research indicates that carbon pricing policy operated at higher levels of government (i.e. national level versus sub-national levels) is a cost effective means of achieving a given emissions reduction target. Given this, why does the policy environment as it is emerging in Canada look so different from this approach? What obstacles must be addressed to move to a Canada-wide carbon pricing policy?

We have identified several important federal-provincial challenges to the implementation of carbon pricing in Canada. In outlining a future research agenda, we argue that research on the federal-provincial dimensions must be included as a key component. Rather than describe all possible avenues for future research, we outline key "next steps" research questions.

Our "next steps" research agenda focuses on two federal-provincial challenges to implementing a Canada-wide carbon pricing policy. First, we argue that a move from the current policy environment to a national, carbon pricing policy involves the provincial governments giving up tax room and/or potential carbon revenues. Thus the first (and perhaps most important) challenge that needs to be addressed is federal-provincial revenue sharing. Second, while revenue sharing may be the key to getting provinces to go along with a national level carbon pricing policy, revenue sharing now means that revenues must somehow be recycled at both the federal and provincial

levels. Governments may opt to all pursue the same revenue recycling option (a harmonized approach). Alternatively, governments may opt to recycle revenues in an uncoordinated or independent fashion.

"Next steps" research should investigate revenue sharing and revenue recycling, focusing on the implications of different arrangements for aggregate and regional welfare burdens, GHG emissions, and sectoral activity levels. Research should also evaluate how coordinated and uncoordinated revenue recycling at the federal and provincial government levels affect welfare and emissions.

We illustrate some "next steps" policy experiments in figures 1 and 2. These experiments are differentiated along four dimensions - revenue sharing, revenue recycling, federal-provincial (vertical) coordination and provincial-provincial (horizontal) coordination. In figure 1, provinces are assumed to pursue the same revenue recycling option (i.e. provincial actions are coordinated). Figure 2 illustrates the case where provincial governments' revenue recycling approaches are not coordinated.

We briefly describe each dimension.

Revenue Sharing

The percentage of carbon pricing revenues that can be shared with the provinces, denoted as s, can take on any value between 0 and 100. In figure 1, we illustrate three possibilities: no revenue sharing ($s = 0$), as the standard case adopted in the literature; full revenue sharing ($s = 100$) where all revenues are shared with the provinces; and, an intermediate case where s% of carbon revenues are returned to the provinces ($0 < s < 100$).

The second component of any revenue sharing arrangement (not captured in figures 1 and 2) is how the revenues are allocated to individual provinces. One possibility requires that shared carbon revenues be distributed on a derivation basis. For example, if 40% of carbon revenues are generated in province i, then 40% of the shared revenues are returned to this province. Alternatively, shared revenues could be returned on an equal per capita basis.

Revenue Recycling

How are revenues recycled? We illustrate two tax revenue recycling options: a reduction in direct taxes and a reduction in indirect or

consumption taxes. These tax recycling options are the most common options examined in the literature. Other possibilities (not included in figures 1 and 2) include non-tax recycling options such as deploying revenues to technology innovation and research and development.

Intergovernmental Co-ordination

To what extent do the two levels of government coordinate their recycling policies? Two possibilities are shown in figure 1. The first possibility is that the federal government and all provincial governments choose the same recycling option (i.e. a reduction in income taxes). This is referred to as vertical coordination. The second possibility assumes that the federal government's choice of recycling option differs from the recycling option identically chosen by all provinces (i.e. no vertical coordination). Figure 2 illustrates some policy experiments when there is partial horizontal coordination. We illustrate the case where one group of provinces pursues the same recycling option as the federal government while the other group chooses a different option.

We have illustrated a subset of possible policy experiments aimed at investigating two federal-provincial challenges, revenue sharing and revenue recycling. It is instructive to note that the bulk of experiments investigated in the literature are located along the upper branch of figure 1. We argue that the emerging policy environment will not be situated along this branch, at least in the short to medium run. The figures are therefore useful in identifying some important gaps in the existing body of research on carbon pricing.

As climate policy continues to evolve in Canada, these federal-provincial challenges will be front and centre on the agenda. There will be a demand from policymakers and leaders for an assessment of carbon revenue sharing and alternative recycling options. In particular, there will be a demand for research on how different solutions to federal-provincial challenges influence the cost effectiveness of carbon pricing policies and the distributional impacts for provinces, people and sectors. The current body of research does not meet this challenge. By addressing the "next steps" research questions, the research community will be in a position to provide valuable input to some of the key federal-provincial challenges to implementing carbon pricing policies in Canada.

Figure 1
Carbon Pricing Policy Experiments:
Coordinated provincial action

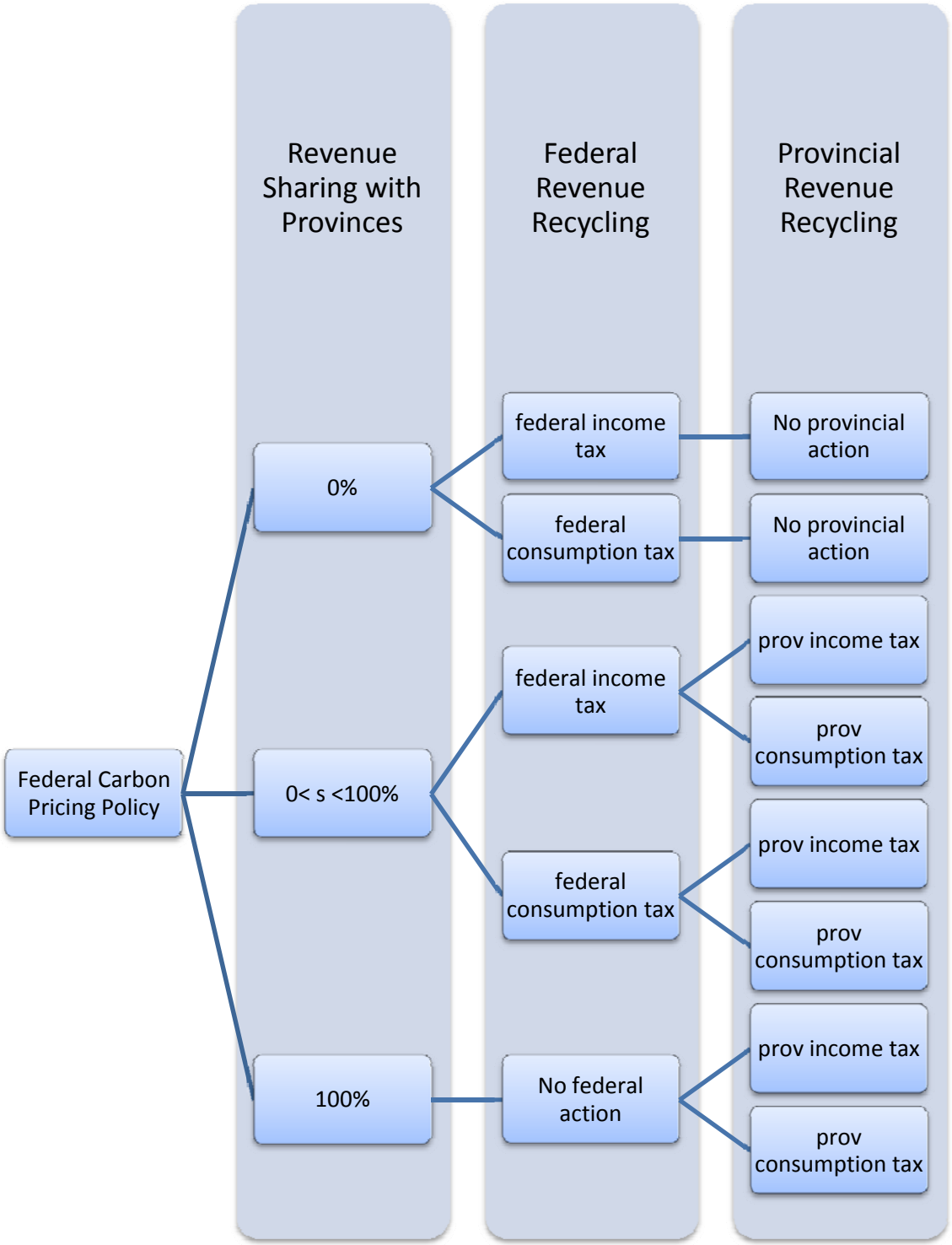
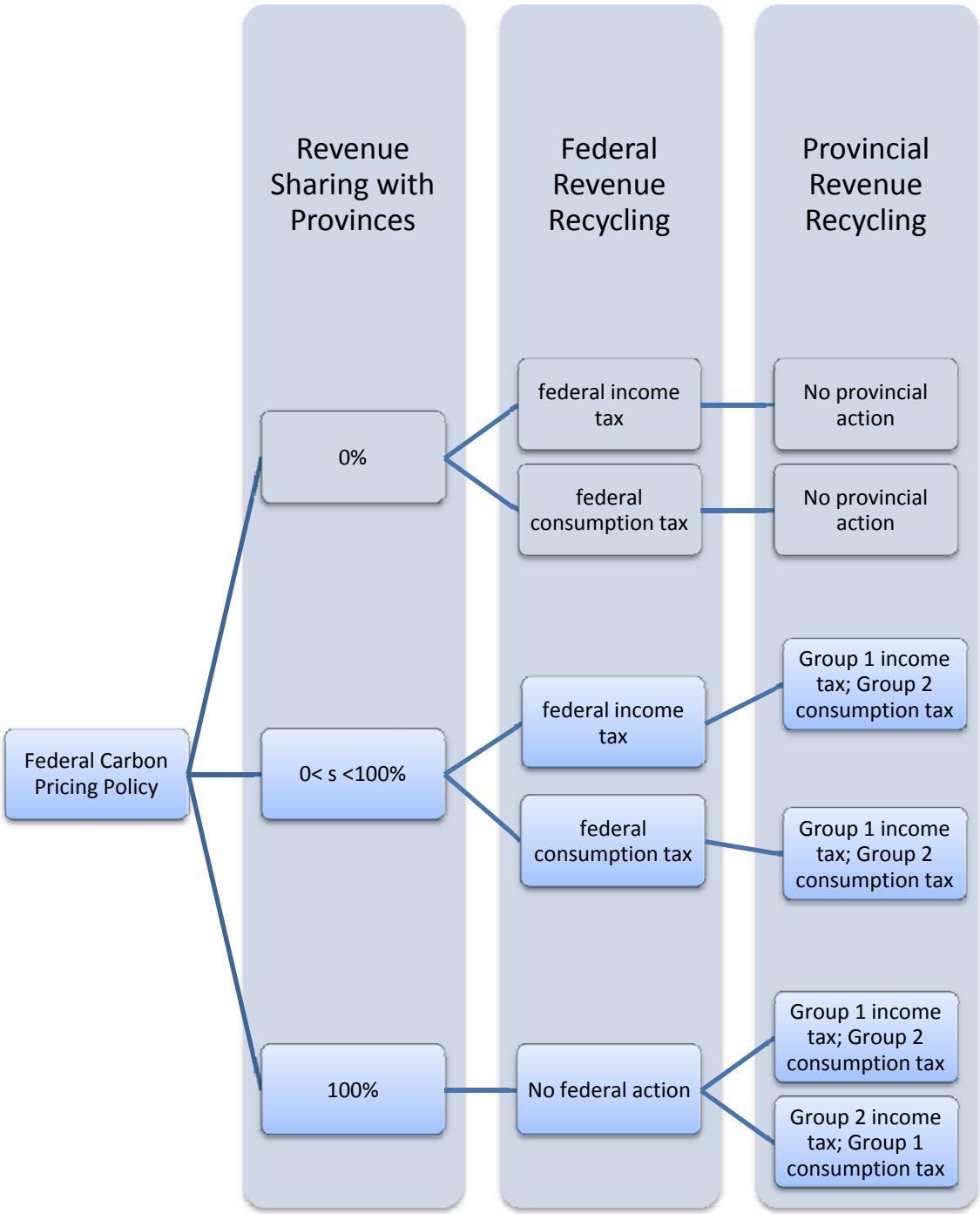


Figure 2
Carbon Pricing Policy Experiments:
Uncoordinated provincial action



References

Ab Iorwerth, A. et. al. (2000) ``A Computable General Equilibrium Analysis of Greenhouse-gas Reduction Paths and Scenarios'' in Analysis and Modelling Group, National Climate Change Process (eds.) *An Assessment of the Economic and Environmental Implications for Canada of the Kyoto Protocol* (Ottawa).

Boadway, R. and P. Hobson (1993) *Intergovernmental Fiscal Relations in Canada* (Toronto: Canadian Tax Foundation, 1993).

Conrad, K. and T. Schmidt (1998) "Economic Effects of an Uncoordinated Versus a Coordinated Carbon Dioxide Policy in the European Union: An Applied General Equilibrium Analysis", Economic Systems Research, 10(2), 161-182.

Dissou, Y. (2005) "Cost-effectiveness of the Performance Standard System to Reduce CO_2 Emissions in Canada: A General Equilibrium Approach", *Resource and Energy Economics*, 27, 187-207.

Dissou, Y. (2006) "Efficiency and Sectoral Distributional Impacts of Output-based Emissions Allowances in Canada", *Contributions to Economic Analysis and Policy* 5(1), article 26.

Ekins, Paul and Terry Barker (2002). "Carbon Taxes and Carbon Emissions Trading**",** *Journal of Economic Surveys* 15(3), 325-376.

Environment Canada (2008). *Turning the Corner: Regulatory Framework for Industrial Greenhouse Gas Emissions*. Government of Canada: Ottawa, ON.

Government of Canada (2002). *A Discussion Paper on Canada's Contribution to Addressing Climate Plan* (Ottawa: Minister of Supply and Services).

Mintz, J. and N. Olewiler (2008) "*A Simple Approach for Bettering the Environment and the Economy: Restructuring the Federal Fuel Excise Tax.* Sustainable Prosperity (www.sustainableprosperity.ca).

National Roundtable on the Environment and the Economy (2009a) *Achieving 2050: A Carbon Pricing Policy for Canada* (Ottawa: National Roundtable on the Environment and the Economy).

National Roundtable on the Environment and the Economy (2009b) *Technical Report on Achieving 2050: A Carbon Pricing Policy for Canada* (Ottawa: National Roundtable on the Environment and the Economy).

Perry, David B. Financing *the Canadian Federation, 1867 to 1995: Setting the Stage for Change*. (Toronto: Canadian Tax Foundation, 1997).

Saveyn, Bert and Stef Proost (2005) "Environmental Tax Reform with Vertical Tax Externalities", Centre for Economic Studies Discussion Paper Series 05.14, Leuven Catholieke Universiteit.

Snoddon, T. and R. Wigle (2007) "Regional Incidence of the Costs of Greenhouse Policy", *Canadian Journal of Regional Science*, 30(2), 313-336.

Snoddon, T. and R. Wigle (2008) "Fraying over Paying: Who Will Bear the Costs of Greenhouse Policy?" in Critical Issues in Environmental Taxation, Volume V, eds. N. Chalifour, J. Milne, H. Ashiabor, K. Deketelaere and L. Kreiser (New York: Oxford University Press, p. 235-255).

Wigle, R. (2001) *Sectoral Impacts of Kyoto Compliance*, Industry Canada Working Paper 34 (Ottawa: Canada).

Zee, Howell (2008) "Aspects of Interjurisdictional Sharing of the Value-Added Tax", *Public Finance Review* 36(2), 147-168.