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ECONOMIC GROWTH AND INNOVATION

Better Together?

The Implications of Linking Canada – US Greenhouse Gas Policies

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Canada can take action to reduce greenhouse gases while minimizing the risk of getting out of line with the US on the cost of carbon emission permits.

THE STUDY IN BRIEF

The Canadian and American economies are inextricably intertwined through trade. As the two countries debate plans to curb greenhouse gas (GHG) emissions, policymakers in both countries must consider how emissions policies, such as an emissions trading system that sets economy-wide limits on GHG emissions and allows firms to trade GHG emissions permits for the right to pollute, might coexist. This *Commentary* analyzes the implications of linking elements of potential Canadian and American GHG emissions trading systems, including the scope of emissions covered by the systems, national emissions-reduction targets, emissions permit prices, and cross-border trade of emissions permits.

While Canada has chosen to harmonize emission targets with the United States, and indicated an interest in following the US lead on emission trading, Canada has much more to gain, or potentially lose, from linking policies.

The economic rationale for linking the two countries' permit trading systems is that Canada now has the same short-term emissions reduction targets as the US. However, with these targets, Canada's abatement costs are likely to be higher than those in the US, owing to several factors: faster growing emissions in Canada; fewer low-cost opportunities to reduce emissions in the electricity sector due to a generation mix that already produces lower emissions; and the high costs of emissions reductions in the oil and gas sector. Importing permits from the US would equalize emissions permit prices, and lower the economic costs of emissions reductions in Canada, but at the cost of large financial outflows to the US.

If Canada is indeed to seek deeper emissions cuts in the future, as Canada's longer-term 2050 emissions reduction targets imply, innovation must be allowed to drive transformative technologies. However, Canada-US trade in emissions permits would lower Canadian permit prices, and hence returns to domestic innovations, particularly for carbon capture and storage in the oil and gas sector.

While GHG emissions legislation is at present going nowhere in the US Congress, and the US has not expressed much interest in linking their policies with foreign emissions trading systems, to wait for the US to legislate emissions policies would mean delay for Canada without any guarantee that the eventual US approach would include linkages with Canada's system.

Our assessment indicates that linked allowance trade with the US would not necessarily be the best policy for Canada to pursue, as the US develops its own system. Instead, Canada should forge ahead with its own system, while minimizing the risk of getting too far out of step with the US on relative carbon prices. A policy of "go-it-alone" with similar carbon price expectations, and a targeted innovation agenda, seems to be a low-risk strategy for Canada as it develops its emissions policies.

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INDEPENDENT • REASONED • RELEVANT

The governments of Canada and the United States have both committed to support the global effort to mitigate greenhouse gas (GHG) emissions. Policymakers in both countries are evaluating market-based approaches to limit carbon dioxide emissions, a major greenhouse gas,[1] with some form of emissions trading system (also known as cap-and-trade) likely to become the centerpiece of any GHG emissions reduction strategy.

Both countries already have emissions reductions targets in place and both have proposed legislation that enacts policy tools to reach these targets. The two countries have close economic ties, and both sides see potential benefits from efforts to link their emissions trading programs or possibly even to develop a North American emissions permit market that would enable cross-border permit trading. Indeed, each country may be wary of undertaking unilateral actions without some kind of comparable effort by its major trade partners. These two economies have quite different characteristics, however, and it would be wise to understand them before attempting to design compatible climate policies and deciding whether and how to link them.

In this *Commentary*, we discuss climate policies that have been put forward in both countries and model the expected economic effect of these policies to predict the national and sector-level impacts of linked Canada-US permit[2] trade. Canada can greatly reduce the economic cost of reducing GHGs by linking with the United States, but there are challenges. Rather than linking Canadian and US permit trading systems, Canada should keep permit prices comparable through a price ceiling matched to the US price. This approach would do the most to reduce economic costs and prepare Canada to develop needed low-carbon technology required for the long term.

The Climate Policies that Might be Linked

Although neither country yet has a federal emissions trading program in place, recent proposals may give some clues to the potential forms of future climate regulation. Emissions trading systems of GHG emissions permits (also known as allowances) have a variety of important design options that can influence the costs and benefits of linking two systems with different policies. These options range from the stringency of the emissions reductions targets, to the banking and borrowing provisions attached to permits, to other cost-control mechanisms. We begin with a brief review of the current proposals in the United States and Canada, and then discuss various ETS design options.

Current US Proposals

The *American Clean Energy and Security Act*, 2009 (ACESA, also known as H.R. 2454 or Waxman-Markey) passed the US House of Representatives on June 26, 2009. Among other provisions not directly related to greenhouse gases, the bill proposes a cap-and-trade system to reduce carbon emissions by the year 2020 to a level that is 17 percent below the 2005 levels, with significantly greater reductions thereafter. The proposed cap-and-trade system would cover the entire economy, using a hybrid of downstream regulation of large emitters,[3] such as power plants, and upstream regulation of transportation and other fuels. In this context, upstream regulation caps emissions from fossil fuels where they first enter the economy – at the refinery, natural gas distributor, or at the border – and downstream regulation caps emissions from those fuels and industrial processes at the plant.

Income generated from the sale of allowances is to be earmarked for a variety of uses, including transfers to low-income households, transitional assistance for

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1 In this paper, we will refer equivalently to emissions, GHGs, carbon and carbon dioxide, and carbon dioxide equivalent.

2 We use the terms "permit" and "allowance" interchangeably. A permit allows its holder to emit 1 tonne of CO_2 equivalent.

3 ACESA defines large emitters as stationary sources emitting more than 25,000 tonnes of CO_2 equivalent annually.

firms facing high costs for emissions reductions, technology research, adapting to the possible consequences of climate change, and ultimately deficit reduction. Allowances may be auctioned off to the various sectors or given out freely. Thirty-five percent of the allowances would be allocated to the electricity sector, but to electricity distributors known as load distribution companies (LDCs) rather than utilities, because, as regulated entities, the LDCs must pass on the allowance values to customers in the form of lower retail bills. Refineries would be allocated 2.5 percent of allowances under the emissions cap, roughly equivalent to half of their direct emissions.[4] Some US industries that consume high levels of energy may have difficulties competing on the world stage if they are constrained by caps while their international competitors are not. These energy-intensive trade-exposed (EITE) manufacturing sectors[5] would receive up to 15 percent of the cap, but in the form of output-based rebates designed to mitigate the risk of emissions leakage from lost competitive-ness. Firms in these sectors would receive allowances in proportion to their production, with the per-unit allocation equal to the industry (as opposed to their own) average emissions, offsetting (on average) the cost of emission allowances. This would keep marginal production costs from rising while preserving the incentive of the carbon price to reduce emissions intensity.

In later years, and at the discretion of the President, provisions would allow these rebates to be replaced gradually by border carbon adjustments on imports from foreign producers in the same EITE manufacturing sectors as domestic producers. This would entail a charge on imported goods equivalent to the costs imposed on domestic producers for carbon emissions. However, the President would have some discretion over whether to initiate the program and what its details would be, since the basis for these adjustments and conditions for application are not well defined in the legislation. Provisions would offer exemptions to countries that are (i) party to binding international agreements to reduce GHG emissions (along with the US) and have economy-wide reduction measures of comparable stringency; (ii) that have sectoral agreements; or (iii) that have lower emissions intensities in those sectors.

Several provisions allow for cost smoothing and cost containment over time. Companies would be able to save unused allowances from one year to use in another (allowance bankability). Within limits, they might also be allowed to borrow against allowances they expect to receive in future years. These provisions are intended to prevent large swings in permit prices from year to year. Another provision, the strategic allowance reserve, enables the government to set aside small percentages of the allowances in reserve for future use. These allowances would be made available for emitters to purchase if prices spiked over 160 percent of a 36-month rolling average daily reserve price.

Analysis by the US Environmental Protection Agency (EPA) and Energy Information Agency (EIA) indicates that generous carbon offset provisions contribute the most toward keeping expected prices low (between $16-32 per tonne of CO_2 in 2020). With a carbon offset, instead of reducing its own carbon emissions, an entity may comply with its carbon emissions cap by providing funds to another entity that is conducting a project that reduces carbon emissions. ACESA sets an annual ceiling for offsets of two billion credits[6] (or about 40 percent of the cap). One billion credits are to come from domestic sources, primarily agricultural sequestration practices that trap carbon in agricultural plants or soils. The remaining credits are to come from international sources, primarily through reduced emissions from deforestation and degradation (REDD), a program that provides

4 ACESA leaves the formula for these distributions up to the Administration.

5 These are industries that face the dual problem of cost increases from a cap-and-trade system and competition with importers from countries not facing a carbon price, who thereby gain a competitive advantage. ACESA defines EITE sectors as manufacturing sectors – at the detailed 6-digit level of the North American Industrial Classification (NAICS) Code – for which energy (or potential GHG) costs exceed 5 percent of the value of their shipments and for which imports and exports exceed 15 percent of total production plus imports, or for which energy costs exceed 20 percent of total value of shipments. Refineries are excluded. Approximately 33 sectors would be presumptively eligible, mostly primary goods manufacturers like steel, lime, cement, glass, pulp and paper, chemicals, etc.

6 Credits are not permits allocated under the cap, but come from outside the cap. Until 2018, one offset credit is equal to one allowance then 1.25 credits equals one allowance.

Table 1: Canadian and US Climate Policies in 2020

	Canada: New Targets and some elements of Turning the Corner	US: ACESA, 2009 H.R. 2454 (Waxman-Markey)	US: *American Power Act,* 2010 S. 1733 (Kerry-Lieberman)
Target	17 percent below 2005 (new target), modeled as a hard cap; 20 percent below 2006 – (old target).	17 percent below 2005, hard cap.	17 percent below 2005, hard cap.
Allowance Trading Coverage	Industrial energy users and producers (electricity, oil & gas, energy-intensive manufacturing); ~42 percent of current national emissions, no fixed process emissions.	Economy-wide (upstream coverage of fossil fuels and downstream coverage of heavy emitters); ~85 percent in 2020 of all emissions.	Economy-wide (upstream coverage of fossil fuels and downstream coverage of heavy emitters); ~85 percent in 2020 of all emissions.
Flexibility Mechanisms	Technology Fund created, but phased out prior to 2020.	Banking, borrowing, Strategic Allowance Reserve created to limit price volatility (starting at $28/tonne).	Banking, borrowing, cost containment reserve ($25 rising to $35/tonne in 2020).
Domestic and International Offsets	No domestic limit. International offsets can be no more than 10 percent of compliance.	2 billion tonne limit, 40 percent of compliance, split 50/50, although international offsets can rise to 1.5 billion if domestic offsets are limited; After 2018, 1.25 international offset credits must be submitted for each equivalent allowance.	2 billion tonne limit annually, 75 percent domestic and 25 percent international. After 2018, 1.25 international offset credits must be submitted for each equivalent allowance.
Allocation	Allocation plans not announced. We assume free allocation to covered entities based on historic emissions (but likely on emission intensity).	After phase-in, output-based for EITE sectors (15 percent) and, in effect, for electricity (35 percent) and natural gas distribution companies (8.8 percent); grandfathering for refineries (2.25 percent); most of remainder is auctioned but with revenues earmarked.	After phase-in, output-based for EITE sectors (15 percent) and, in effect, for electricity (35 percent) and natural gas distribution companies (9 percent); transportation efficiency (9.2 percent); refiners (3.75 percent); and strategic reserve (1.5 percent).

Source: Authors' interpretation of US and Canada legislation.

international offsets. International credits equating to 1.5 billion tonnes of emissions may be substituted for an equal amount of domestic credits.[7]

Similar policy parameters to ACESA were put forward in now-defunct companion legislation in the Senate, the *American Power Act* (APA) which was submitted by Senators Kerry and Lieberman on May 10, 2010). The cap-and-trade provisions in the APA looked very similar to the ACESA with respect to coverage, stringency, sectoral allocations, and treatment of EITE sectors. Some minor differences included the emission sources covered by the cap, and some variations in sectoral allowance allocations. A material difference was a price collar that limited the trading range for allowances, had called for a floor price of $12 (increasing at 3 percent annually in real terms) and a ceiling price at $25 (increasing at 5 percent annually in real terms). The treatment of downstream emissions from transportation fuels also included measures to keep those prices more stable. More detail on the specific differences is provided in Table 1.

7 ACESA also includes many provisions unrelated to the cap-and-trade program, including a federal renewable energy standard for electricity generation, energy efficiency measures, and support for a variety of clean energy technologies.

In the meantime, climate regulation continues simultaneously on two other paths in the US. At the federal government level, the EPA is going forward with GHG regulations, following a court finding that GHGs endanger human health and the environment, thus enabling the EPA to regulate GHG emissions. Under the auspices of the *Clean Air Act,* the agency has been drafting emissions standards and regulations for vehicles and developing regulations that apply to large facilities that emit GHGs. It is unclear whether the EPA, in the absence of Congressional legislation, could create an emissions trading scheme, but the regulatory option provides a credible backstop for the Administration's commitments in the Copenhagen Accord, as well as some encouragement to Congress to legislate a more cost-effective solution than the type of regulations the EPA can enact. Many regions and states have also launched initiatives. Several states are engaged in emissions trading programs: the Regional Greenhouse Gas Initiative (RGGI) is already underway among a block of northeastern states, with some Canadian provinces as observers; the Western Climate Initiative, which also includes some Canadian provinces, is planning a trading system, as is California. Midwestern states are exploring similar cooperation on climate policies.

Current Canadian Proposals

In 2007, the Canadian government unveiled *Turning the Corner: an Action Plan to Reduce Greenhouse Gases and Air Pollution* (hereafter referred to as the TTC plan), which aimed to reduce GHG emissions to 20 percent below 2006 levels by 2020 and between 60 to 70 percent below 2006 levels by 2050. Although little policy implementation has happened since then, that same year the government issued its *Regulatory Framework on Air Emissions* (which was to implement elements of the TTC plan). It proposes intensity-based standards – regulations that cap the amount of emissions per unit of output – for existing Canadian large industrial emitters.[8] Its target: a GHG reduction of 18 percent below the 2006 emissions intensity by 2012, and then a 2 percent annual improvement thereafter. Thus, no hard cap is placed on emissions. Instead, the intensity standard allows overall emissions to grow while reducing the intensity of production.

Compliance options for firms include: abatement; permit purchases and sales between regulated entities; domestic offsets; and credits from the international Clean Development Mechanism (CDM), an emissions offset provision of the Kyoto Protocol. These options are available for up to 10 percent of a single entity's compliance. Until 2017, rather than reducing emissions or purchasing offsets, entities may also pay an equivalent amount to a technology fund that supports innovative ways to develop and disseminate technologies to reduce GHG emissions. Coverage under the regulatory framework includes about 50 percent of Canada's national emissions inventory.

The regulatory framework provides a three-year exemption from mandated reductions in greenhouse gas intensity for new facilities that begin operation after the regulations are introduced, followed by a requirement of a 2 percent annual improvement. New coal-fired electricity plants, in situ bitumen extraction facilities, and facilities that convert bitumen into synthetic crude oil (upgraders) to be built after 2012 are required to meet a carbon capture and storage greenhouse gas intensity standard, meaning they must use carbon capture and storage technology or meet the equivalent emissions intensity by 2018.

The TTC plan was shelved in 2009, with no clear policy guidance on a path forward.[9] In January 2010, the government of Canada harmonized GHG reduction targets with the US, to 17 percent below 2005 levels in 2020. This had the effect of weakening Canada's targets by about 32 Megatonnes (Mt).

8 Facilities with emissions greater than 50 kilotonnes CO_2e: CO_2e (CO_2 equivalent) is the globally accepted unit to measure the global warming potential of greenhouse gases. TTC proposed to cover the following sectors: fossil fuel electricity generators, petroleum refineries, heavy crude oil and bitumen upgraders, oil and gas producers, processors and transmission, chemical production, cement and lime production, iron and steel plants, metal smelters and processors, some large mines, and pulp and paper facilities.

9 As evidenced by the Government of Canada's document: A Climate Change Plan for the Purposes of the Kyoto Protocol Implementation Act – 2010. In this document there is no reference to The Regulatory Framework and no policies moving forward. http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=AD9054AB-6F3E-4A78-9557-E4010A980D92

By examining the current behavior of the Canadian government, we can predict future policy directions. The government of Canada in recent years has demonstrated a desire to accommodate relatively unfettered growth of industrial emissions and has been particularly supportive of increased oil sands development. These desires are likely to be central to future policy directions. Closely aligned elements include some form of technology fund to act as a *safety valve,* i.e., with a maximum price on emissions permits and revenues ultimately funding research and pilot projects to develop low-carbon technologies such as carbon capture and storage capabilities in the oil sector. Finally, much of the debate in Canada hinges on concerns over competitiveness impacts with the United States. The lack of action in the United States has been and continues to be an oft-cited reason for Canada to delay action of its own. The perceived threat of US border measures, California's low carbon fuel standard, and regulations on the GHG-intensity of motor fuels has underscored this concern.

In looking to the future, one can envision a new policy based on TTC, but with some sort of hard cap, similar to the one envisioned in the United States. A technology fund is likely to figure prominently, with output-based allocations to help energy-intensive and trade-exposed sectors. Future targets and policy elements may emphasize policy similarities and eventual permit trading with the United States.

However, while a US system would apply to the entire economy as currently envisaged, the same is not the case in Canada. Transportation and buildings account for about 36 percent of the national carbon emission inventory in Canada, but it is unclear whether the Canadian government intends to put emissions caps on these sectors. This presents an obvious distinction between US and Canadian climate policy proposals. Another contrast in policy concerns permit auctioning. The United States intends to eventually auction permits, and thus collect government revenues from emissions permits, whereas there is no mention of permit auctioning in Canadian policy circles.

Fundamentals of Linking

The case for linking is much the same as the case for choosing a cap-and-trade system in the first place: economic efficiency. To achieve an economy-wide reduction in carbon emissions at the lowest possible economic cost, it is infeasible to demand identical reductions from all regulated entities. To do this would ignore important cost differences among the actors, which may comprise power plants of different vintages and fuels, a variety of manufacturers, or households with different energy needs. Instead, the cap-and-trade program asks all these actors to meet the goal collectively and cost-effectively, by sending a common price signal in the form of the market value of carbon allowances. Lower cost actors can take more reductions in return for lower carbon allowance costs, while higher cost actors can comply by surrendering more allowances rather than taking on costlier reductions.

The rationale of gains from trade is similar from an international perspective, in which countries that have very different energy and industry structures can face very different costs to achieve the same reduction target. In this case, the high-cost country gains by purchasing allowances, rather than by reducing its own emissions further. The low-cost country gains from increasing its abatement in return for the allowance values. The same collective target can be met more cost-effectively when marginal abatement costs are equalized across countries.

Aside from the economic efficiency argument, linking carbon-trading systems may also promote operational efficiency, because harmonized compliance regimes can facilitate business transactions for multinationals and ease cross-border trade. Canada trades at least two-thirds of its energy intensive manufactured goods with the United States.[10]

Linking carbon-trading systems has implications on other activities as well, including the distributional effects of climate policies, capital flows, the terms of trade, and the management of cost uncertainty and price volatility. These implications may well differ for a small country compared to a large one.[11]

10 Canada is the largest or second-largest source of US imports and exports in emissions-intensive industries such as paper, aluminum, iron and steel, chemicals and cement (Interagency Report, 2009).

11 For a general review of issues in linking emissions trading systems, see e.g., Jaffe and Stavins (2007) and Flachsland et al. (2009).

The Price Effects of Linking

Ultimately, most of the effects of linking relate directly or indirectly to the carbon price changes experienced by the partner countries. Therefore, it is important to understand how linking affects these prices.

As just discussed, linked cap-and-trade regimes exploit the gains from trade created by the price differences between markets. As a result, emissions are reallocated across the two economies, flowing from the low-cost to the high-cost country. The market price of allowances will find a new equilibrium in between the unlinked prices, but in general, it will stay closer to that of the larger market and move farther away from the market with the more steeply rising abatement costs. In the North American case, the United States is 10 times the size of Canada in terms of both GDP and GHG emissions.[12] Consequently, one can expect the US carbon market to drive allowance prices.

The sensitivity of the carbon price depends not only on the size of the dominant market, but also on critical climate-policy design choices that can keep marginal abatement costs from rising too sharply. These design choices – such as offsets for emission-reducing activities outside the cap, as well as price-control mechanisms like a price ceiling – help moderate allowance prices, but raise additional issues for linked systems.

Before we discuss these choices in turn, we note that trade theory suggests that pressures exist to equalize carbon prices even in the absence of linking, due to trade in other goods (Taylor and Copeland 2005). Without linking, emissions-intensive production would gradually relocate toward the lower cost country, driving up carbon prices there, while the high-cost country would shift more toward low-carbon production, bringing down abatement costs. Thus, if emissions are not reallocated through allowance trade, output is ultimately reallocated through goods trade, bringing carbon prices closer together in the long run.[13] Linking – or other policy choices – harmonizes prices in the short run, mitigating pressures to reallocate production.

Offsets

Offsets provide credits for emissions reductions taken outside the cap, to be used for compliance under the cap. They leverage the power of the carbon market to create incentives for reductions in sectors and countries that are otherwise unregulated. The rationale is similar to that of trading: to access low-cost emissions reduction opportunities wherever they are. However, these project-based mechanisms remain controversial because it is difficult to account for the reductions, which involves estimating an unverifiable baseline of what would have happened in the absence of the project.[14] Thus, the emissions consequences are less certain, and over-allocation of credits means an erosion of the integrity of the emissions cap. On the other hand, many of these mechanisms are seen as essential to a transition in which developing countries take on greater roles in carbon emissions mitigation.

ACESA includes a generous system of offsets from domestic agricultural sequestration and international credits for reduced emissions from deforestation and degradation (REDD) that together can reach up to 40 percent of the cap. However, not all countries may have the same preferences for offset systems. For example, the European Union's emissions trading systems allows compliance credits from the Kyoto Protocol's CDM, but not from REDD. The US reliance on large quantities of international offsets differs significantly from Canada, where the TTC plan allowed only 10 percent of compliance to come from the CDM.

It is not possible to link to an emissions trading system without linking to the offsets associated with it. Linking implies that the weakest standard for offsets becomes the de facto rule. For example, if Canada barred Canadian firms from using REDD credits, while the US recognized them, US

12 2008 GDP data from the World Bank and 2007 emissions data from the UNFCCC. http://siteresources.worldbank.org/DATASTATISTICS/Resources/GDP.pdf http://unfccc.int/di/DetailedByParty.do

13 Taylor and Copeland (2005) also point out that trade, by raising incomes in low-cost countries, can increase demand for addressing environmental problems like climate change.

14 See, e.g., Fischer (2005).

firms could purchase REDD credits for compliance and sell their own US allowances to Canadian firms for compliance. The net effect is the same as allowing Canadian firms to buy REDD credits directly. Thus, governments concerned about stringency need to be aware of all such measures and determine whether they are mutually acceptable.

Other Cost-Containment Measures

Cost-containment measures affect both the relative costs of the unilateral emissions trading systems and their price sensitivity. Cap levels are the key determinant of allowance prices. By extension, they govern the size of the efficiency gains and the distributional effects from linking. However, other design aspects, such as price ceilings and floors, as well as offset systems, also affect the degree to which carbon prices may rise or fall.

As mentioned above, a safety valve is a ceiling on the price of allowances. ACESA provides for a Strategic Allowance Reserve that will auction additional allowances if prices spike above a certain level, with the proceeds dedicated to buying REDD offsets. The APA has a fixed, rather than rolling, price ceiling. In Canada, there is discussion of a safety valve, with payments going into a technology fund. There is a potential cost to safety valves. By limiting the possibility of high allowance prices, the incentive to invest in low-carbon technological innovations is also limited. A price collar, which combines a price ceiling with a price floor, effectively creates a trading band that limits price deviations in both directions. Thus, unacceptably high allowance price outcomes are avoided, but low price outcomes are also avoided, allowing for additional reductions when they are cheap and ensuring a minimum incentive for investments. This option was included in the APA.

In a linked system, when a safety valve or price collar binds, it binds the whole system. In this manner, a small system can have a large effect if it has a lower safety valve price than the larger emissions trading system. Safety valves have the potential to trigger large financial transfers to the auctioning government, which can raise political questions. In linking, governments may want to consider harmonizing safety valves or price collars and allocating the resulting revenues across jurisdictions.

In sum, it is difficult to link and only select components of a partner's cap-and-trade system. Linking leads to de facto harmonization of all cost-containment measures. The only way to prevent any linking-induced increase in the use of cost-containment measures is to establish a system, such as a one-way link, that prevents net sales of any allowances from the more generous system. Other potential restrictions include some of those we see in offset systems: restrictions on the quantity of allowances that can be sold into or purchased from another system, an exchange rate of allowances other than one-to-one, or fees that make one system more expensive to use. Restrictions could also depend on whether the safety valve is used. Although these kinds of transaction costs and restrictions on intersystem trading may be necessary, they may also reduce cost savings from linking.

Distributional Effects of Lower Prices

Changing carbon prices affect more than just the location of emissions; linking to the United States results in lower carbon prices for Canada for a comparable emissions target.

On the one hand, lower carbon prices mean lower compliance costs for abating industries and, thus, generally smaller adverse impacts on production and employment in energy-intensive sectors. On the other hand, they also mean lower values for any allowances that are allocated to industries, meaning smaller windfall profits for net owners of allowances. Meanwhile, other sectors that rely on higher carbon prices for their profitability – renewable and other low-carbon energy sources, carbon capture and sequestration, energy-saving technologies, advanced technology research, and domestic agricultural offset programs – become less profitable.

For consumers, lower carbon prices mean lower energy costs. They also mean reduced incentives to conserve energy or to invest in energy efficiency, including energy-saving appliances, weatherization, and fuel-efficient vehicles. If households receive rebates, dividends, or lower taxes from the allowance revenues, those values also diminish.

For the government, lower prices mean fewer revenues from allowance auctions. Because these auctions fund investments in energy efficiency and clean energy technologies, which are essential to meet long-term targets, it would be necessary to find additional funding sources, which can place additional burdens on government budgets.

Revenue Flows

Linking also affects financial flows across countries. Whether through revenues from trade or from auctioned allowances, capital will flow from the high-cost country to the low-cost one. In the case of auctioned allowances, this could mean a transfer of wealth to a foreign government. This transfer is less expensive than requiring domestic firms to perform additional reductions, but there may be political resistance to such capital flows.

Alternative designs can allow for some of the benefits of linking without the corresponding transfers. For example, a comparable safety valve (allowance price cap linked to the price in the partner country) achieves the same domestic reductions while keeping revenues at home. However, unless the revenues are used to buy additional offsets elsewhere, the global emissions consequences are not the same.

Stringency

The benefits and distributional effects of linking depend on the size of the price differential between two emissions trading systems. However, the size of this differential is closely intertwined with the stringency of the targets: a high carbon price may reflect higher domestic abatement costs, or it may reflect a more stringent policy. This motivation may be politically important for linking, since a country that adopts ambitious targets may question seeking low-cost allowances from a country with weak targets. One can also consider the reverse situation; a country in which high carbon prices are politically unacceptable may hesitate to forge a link that will drive up allowance prices.

Linking may also change the incentives for partner countries to set targets in the future. For example, when a country acts alone, more stringent targets always mean higher costs. However, with linking, allowance prices become less sensitive to the stringency of the targets – and potentially insensitive to those set by a relatively small country. A side effect of this price insensitivity is that domestic emissions also decouple from the domestic target, since they are determined by the carbon price.

Linking also creates some countervailing incentives. For example, it might be possible for one government to adopt more stringent domestic targets by linking, because linking ensures that domestic carbon prices would not rise accordingly. (In a sense, this is the role foreseen for international offsets in ACESA). On the other hand, if the primary concern of domestic policymakers is the net costs of a policy, they may prefer to relax their emissions targets, which does not greatly affect domestic abatement but does reduce the need to import allowances – or increase the supply of allowances for export. If a country is a large enough player in the market, relaxing its targets also drives down prices, which is less desired by a seller of allowances. Net sellers of emissions allowances particularly want to avoid situations in which other trading systems relax their caps in order to get additional revenue from linkage (Helm 2003; Rehdanz and Tol 2005).

In the absence of international cooperation, the likely net effect of these strictly economic incentives is to increase total emissions. In this case, even though there are efficiency gains from trade, the policy becomes less economically efficient due to the setting of inefficiently low abatement levels (Holtsmark and Sommervoll 2008). Thus, in linked systems, strategies for target setting may require careful scrutiny and additional negotiations to ensure stringency.

Price Volatility

Unlike emissions taxes, cap-and-trade programs allow the carbon prices to be set by markets, which are subject to a variety of shocks that could push prices up and down. For example, an unusually hot summer or cold winter can drive up energy demand, causing carbon prices to rise. An economic recession can relax demand for carbon allowances. Energy supply shocks are also likely to affect carbon prices.

Linking broadens the overall carbon market, which may then offer some diversification that can reduce price volatility. On the other hand, linking also means that cost shocks in one part of the system transmit throughout the linked system, exposing each country to volatility in the other systems. Thus, domestic price shocks can find an outlet abroad, which can have a stabilizing effect on prices at home, but foreign price shocks will also be felt at home.

Given that the Canadian market would be much smaller on its own, particularly if it focuses only on large final emitters, linking has the potential to improve market liquidity. On the other hand, with linking, price volatility would be driven largely by the larger US market.

If price shocks – particularly due to energy supply and demand changes – correlate across the economies, linking is unlikely to dampen overall price volatility. The United States and Canada, for example, have integrated natural gas markets and common weather patterns, meaning energy shocks can often hit both partners simultaneously. In contrast, Europe relies on differentiated natural gas markets and is influenced by different weather systems. Thus, linking with the European Union's Emissions Trading System (ETS) would be likely to provide more diversification in the emissions trading portfolio than linking in North America.

Terms of Trade

A less obvious effect of linkage is on the *terms of trade,* the value of exports relative to imports. Emission pricing reduces demand and prices for fossil fuels; thus, it tends to reduce the terms of trade in fossil-fuel exporting regions. In this manner, an increase in US emissions prices can deteriorate Canadian terms of trade as an energy exporter. Meanwhile, one would expect the prices of energy intensive manufactured goods to rise. For exporters of other goods implementing their own emissions pricing, the reduction in domestic consumption and imports can improve the terms of trade (Farmer et al. 2008). However, the net effect depends on the composition of imports and exports. Alexeeva-Talebi and Anger (2007) find that member states of the European Union (EU) improve their terms of trade by integrating with (and importing allowances from) emerging ETS, while all non-EU linking candidates face competiveness losses by linking up, as they see their costs rise.

The strongest effects on the terms of trade are from the domestic climate policies themselves. Canada will see the value of its energy exports change, regardless of whether the systems are linked. Linking, alone, would only have a significant influence on the terms of trade if it would substantially change emissions prices.

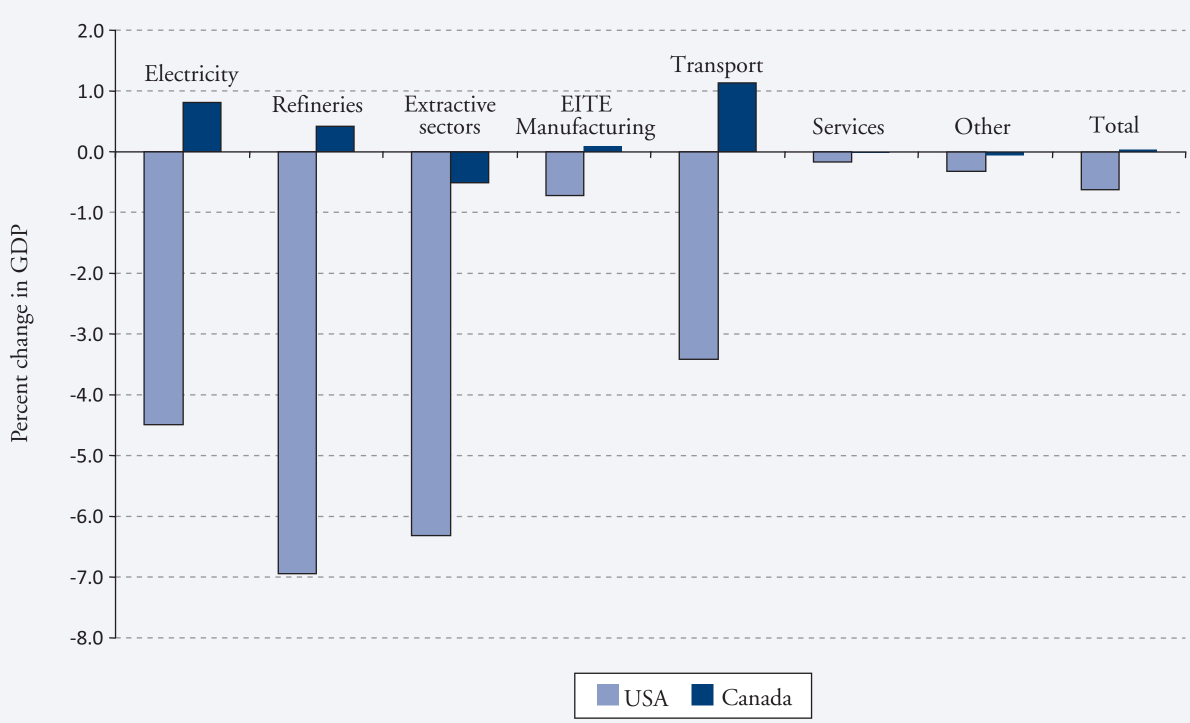
Linked without Linking

These two facts are key: (a) the primary effects come from the climate policies themselves, while linking is secondary, and (b) Canada and the United States have closely linked economies, regardless of whether they link their emissions trading systems. Approximately 80 percent of Canadian exports go to the United States, including exports from energy intensive sectors, and 70 percent of Canadian imports come from the United States.

As a result, US climate policy will have significant effects on Canada, regardless of Canada's own climate policy. If we consider US policy to always operate in the background for Canadian policy, it is useful to understand what those baseline effects are. The results of a simulation from the FFEAT model[15] of the US implementing a stylized version of ACESA on different sectors in the United States and Canada provide sector-level estimates of economic effects (Figure 1). This model assumes no linkage between Canada and the United States. In this simulation, energy-intensive sectors in Canada would benefit from the US policy, which would improve Canadian competitiveness, while some would lose, namely the extractive sectors that would face reduced demand from a carbon-constrained US economy. Production in energy-intensive manufacturing sectors would not be greatly

15 The Fischer Fox Emissions and Trade (FFEAT) model is a static computable general equilibrium (CGE) model; that is, it does not project forward, but represents how economies respond to climate policies from a base year of 2004. The scenario takes the real carbon price from EIA (2009) central scenario, and includes output-based allocations for energy intensive, trade-exposed sectors and in the electricity sector, which mimics allocations to the load distribution companies. In the absence of these allocations, the competitiveness impacts for energy-intensive manufacturing would be larger.

Figure 1: Changes in Production from Unilateral US Emissions Reduction Target of 20 percent



Source: Authors' calculations from FFEAT model.

affected in either country, because of the output-based allocations proposed in ACESA, which would keep product prices stable. The Canadian transport sector would benefit from falling oil prices, because US demand would drop. Overall, the effect of US policy on Canada would be positive but negligible.

A variety of other climate-related policies in the United States may affect Canada. A renewable energy standard would affect electricity trade and prices. Widespread adoption of California's low-carbon fuel standard (LCFS) would affect oil industries, particularly the more emissions-intensive oil sands. Several aspects of the cap-and-trade design, including the scope of sector coverage and the choice of allowance allocation mechanisms, can be expected to affect the competitiveness of these sectors and the efficiency of the overall emissions trading system.

These spillover effects from US policy remain, whether the Canadian policy baseline includes carbon regulation or not. Furthermore, linking will not change these spillover effects unless it moves the US price significantly. On the other hand, linking does have the potential to change the effects of Canadian policy, if (as many suspect) it does have a significant effect on the Canadian carbon price. In the next section, we explore the potential effects in Canada of linking emissions trading between Canada and the United States.

Modeling Linked Canada-US Emissions Trading Systems

To explore the implications of linking a Canadian emissions trading system to the presumed US system, we proceeded in two steps. First, we use a cross-border allowance trade model. This partial equilibrium model uses sector-abatement-cost estimates in both Canada and the United States to determine aggregate emissions reductions, allowance prices, allowance flows across borders, and total costs under a number of alternative scenarios. Second, we used a computable general equilibrium model to determine macroeconomic impacts of the alternative scenarios on Canada in 2020. We do not model the US macroeconomic effects of linked allowance trade, but these are likely to be less significant, given that bilaterally traded allowances will account for a small share of US emissions. In the Appendix, we discuss the models used in detail.

The Outcomes that Matter

We use a common set of assessment criteria to assess the implications of alternative Canada and US climate policies. The important national and sector impacts of the policies include total emissions reductions, allowance prices, total compliance costs, revenue transfers between countries and sectors, and macroeconomic and competitiveness impacts. More specifically:

- Compliance and emission reductions. Under each scenario, we assessed a mix of compliance options by sector. Abatement may be conducted, or allowances can be purchased, through trade with other firms and countries, indirect reductions from domestic and international offsets, or flexibility mechanisms such as technology funds or strategic reserves that, depending on how revenue is spent, may or may not deliver emission reductions.
- Costs. These include two metrics, (a) the allowance price, which is the equilibrium price of carbon that emerges under each policy through trading and is a function of stringency, coverage, flexibility mechanisms, and relative abatement costs and (b) compliance costs, which include expenditures on abatement including offsets, measured as the area under the cost curve for given prices and quantities, and net expenditures on allowances, credits, or other flexibility mechanisms.
- Macroeconomic impacts. These include impacts on (a) *gross domestic product,* which indicates the level of macroeconomic activity under each scenario, including the impact of compliance payments between sectors and countries,[16] (b) *gross output,* which is a measure of the total economic output for the sector, and (c) *net exports,* which indicate how trade with rest of the world is affected by the policy.

Linking Scenarios

There is considerable uncertainty about how Canadian and US climate policy will proceed. New targets have been announced in Canada, yet the architecture of how these targets will be met remains uncertain, whereas in the US, competing climate policies are continually emerging. In this section we start with stylized versions of recently proposed climate policies in both countries and then explore possible options that might emerge, including cross-border permit trade. We assess variations on three scenarios:

(1) **Same targets but different policies.** Under this scenario, we explore the current reduction targets and main elements of recent Canadian and US climate policy proposals. While Canada has harmonized its targets with the US, at 17 percent below 2005 levels, the main elements of climate policy remain unannounced. That said, Canada has conveyed its preferences through its *Turning the Corner* plan, where its cap-and-trade aspirations are focused on the large industrial emitters with flexibility mechanisms that include a safety valve technology fund that ends well before 2020, domestic offsets and international offsets limited to 10 percent. US aspirations, as communicated through the ACESA and the APA would establish an economy-wide cap-and-trade program with very generous international offset limits and other flexibility mechanisms such as banking and borrowing. We assess variations on this scenario and conclude that even with aligned reduction targets, carbon policies would result in significantly higher costs on the Canadian economy relative to the US under current policy configurations.

(2) **Same targets with comparable climate policies.** This scenario explores what would happen if Canada implemented a policy comparable to the US ACESA or the APA with a view to harmonizing policy and avoiding border carbon measures. The main

16 Allowance payments are included in GDP because we are tracking GDP at basic price, which includes indirect taxes.

policy elements include full coverage of all emissions, 30 percent international offsets[17] and unlimited domestic offsets. We assess both the Canada-alone and linked-allowance approaches. The scenario reveals that linked permit trade is extremely beneficial to industrial emitters, both in terms of cost and impacts on exports. The trade-off is that lower carbon prices will reduce incentives for innovation and hence increase longer term costs of deeper emission reductions.

(3) **Go it alone with same carbon prices.** This is a final alternative that can be implemented if trading with the US is not feasible, yet competitiveness concerns remain. Under this scenario, the US permit price sets a safety valve price that limits Canadian cost exposure, with payments to a technology fund to further technology research, development and deployment. This scenario concludes that harmonizing carbon prices may lower costs but, to the extent that a safety valve is used, lower emission reductions can jeopardize the ability of Canada to meet emissions reduction targets on its own.

1. Same Targets but Different Policies

Variations on this scenario look at the implications of harmonizing targets, but with diverging elements of cap-and-trade design between Canada and the US. The alternative policies are drawn from stylized versions of the leading recently proposed climate polices in Canada and the United States: a Canadian cap-and-trade system based on elements of the government of Canada's Regulatory Framework and a US cap-and-trade system based on ACESA and the APA (Table 1). Notably, we do not model the Canadian intensity standard under TTC, but instead assume a hard cap subject to compliance mechanisms. We focus on 2020 to allow for short-term uncertainty in policy implementation, but also to keep the analytics straightforward by not having to make assumptions about very long-term actions. These two proposed national policies serve as the benchmarks used to assess the implications under scenarios with and without linked trade.

The alternatives include:

- **Old and new targets with elements of TTC (old/new targets Canada alone).** In this approach the target reduction for industrial emitters, comprising about 42 percent of all Canadian emissions in 2020 is 20 percent below 2006 levels (old, TTC plan) and 17 percent below 2005 levels (new, as of January 2010). Unlike the intensity standard in TTC, the approach is modeled as a hard cap. Similar to TTC, compliance options include trade between covered sectors, unlimited domestic offsets and 10 percent from international offsets. Although TTC foresees a technology fund, it was proposed to be phased out in 2017, so given our model's focus in 2020, we assume that the technology fund safety valve is not a compliance option in this scenario. We do include this safety-valve option in later cases.
- **United States alone under the proposed ACESA approach.** This approach covers about 85 percent of all US emissions with a cap by 2020 at a level that is 17 percent below 2005 levels. The United States implements ACESA/APA as described in Table 1, with 40 percent of total compliance from offsets and the remaining gap to the target level attained through domestic abatement including domestic offsets. The allowance price ceiling of US $35 per tonne under APA is a noticeable difference with ACESA.
- **Canada and the United States linked through cross-border allowance trade.** Both policies are then linked through cross-border allowance trade.

It would seem that the compliance targets in the US and Canadian "go-it-alone" policies of acting independently are not comparable given the significantly lower coverage under current

17 30 percent is a compromise between ACESA, which allows up to 50 percent international offsets and the APA, which allows 25 percent international offsets. However, under both of these Acts, if the domestic offset ceiling is not reached, up to 50 percent can then be obtained internationally.

Table 2: Coverage and Targets, 2020 Canada Old and New Targets and the US ACESA

		Baseline Emissions 2020	Compliance Target		
		Megatonnes	Megatonnes	Percent Below 2005	Percent Below 2020 BAU
Canada: Old Target (2006)	Covered Emissions	329	~253	-20 (2006)	-23
	National Emissions	741		-11	-10
Canada: New Target	Covered Emissions	329	~263	-17	-20
	National Emissions	741		-10	-9
US: ACESA	Covered Emissions	5,793	~4,823	-17	-17
	National Emissions	7,492		-13	-13

Source: Authors' calculations derived from CIMS, GEEM and EIA models.

Canadian policy. The Canadian focus on industrial emitters covers just 42 percent of national emissions and the United States covers 85 percent (Table 2). However, overall coverage does not tell the whole story. Despite harmonized targets, Canada requires a larger percentage reduction from its large industrial energy users and producers (which we call industrials) by 2020 than the United States demands from these sectors, given a rising level of business-as-usual (BAU) emissions relative to their American counterparts and the fixed baseline target in 2005. This places a somewhat greater reduction obligation on Canadian industry, which must achieve approximately a 20 percent reduction, as opposed to the US target of 17 percent relative to 2020 BAU emissions.[18] In effect, the industrials must do more in 2020, and Canada's industrials are a larger share of the total emissions relative to the United States. This trend is exacerbated under the old Canadian targets, which require about 9 Mt of CO_2 more from the industrials and total about 3 percent of their forecast 2020 emissions.

The main elements of the two countries' approaches differ primarily on coverage and use of international offsets, but the limit on international offsets drives the major compliance differences (Table 3). Despite much broader policy coverage in the United States, the higher limit on international offsets reduces the level of internal US abatement. As a share of national emissions, domestic abatement[19] is less in the United States than in Canada, but international allowance purchases are much larger relatively. Under the Canadian policy, this lower international limit shifts compliance toward more domestic offsets relative to the United States and more abatement from the covered sectors.[20]

18 Energy Information Administration (2009).

19 Domestic offsets plus covered sector reductions.

20 We assume Canada is a price taker for international offsets and the United States is the price setter, given their large relative demand. At the US allowance price, the supply of international allowances is bound by the limit on international offsets.

Table 3: Independent Policies without Allowance Trade, 2020 Compliance and Abatement Canada Old and New Targets and the US ACESA

Independent Policies without Allowance Trade		Compliance			
		Total	Covered Sector Abatement	Domestic Offsets	International Offsets
Canada: Old Targets	% shares of total abatement		55	35	10
	Mt	76	42	27	8
Canada: New Targets	% shares of total abatement		53	37	10
	Mt	67	35	25	7
US: ACESA	% shares of total abatement		46	25	29
	Mt	970	446	247	277

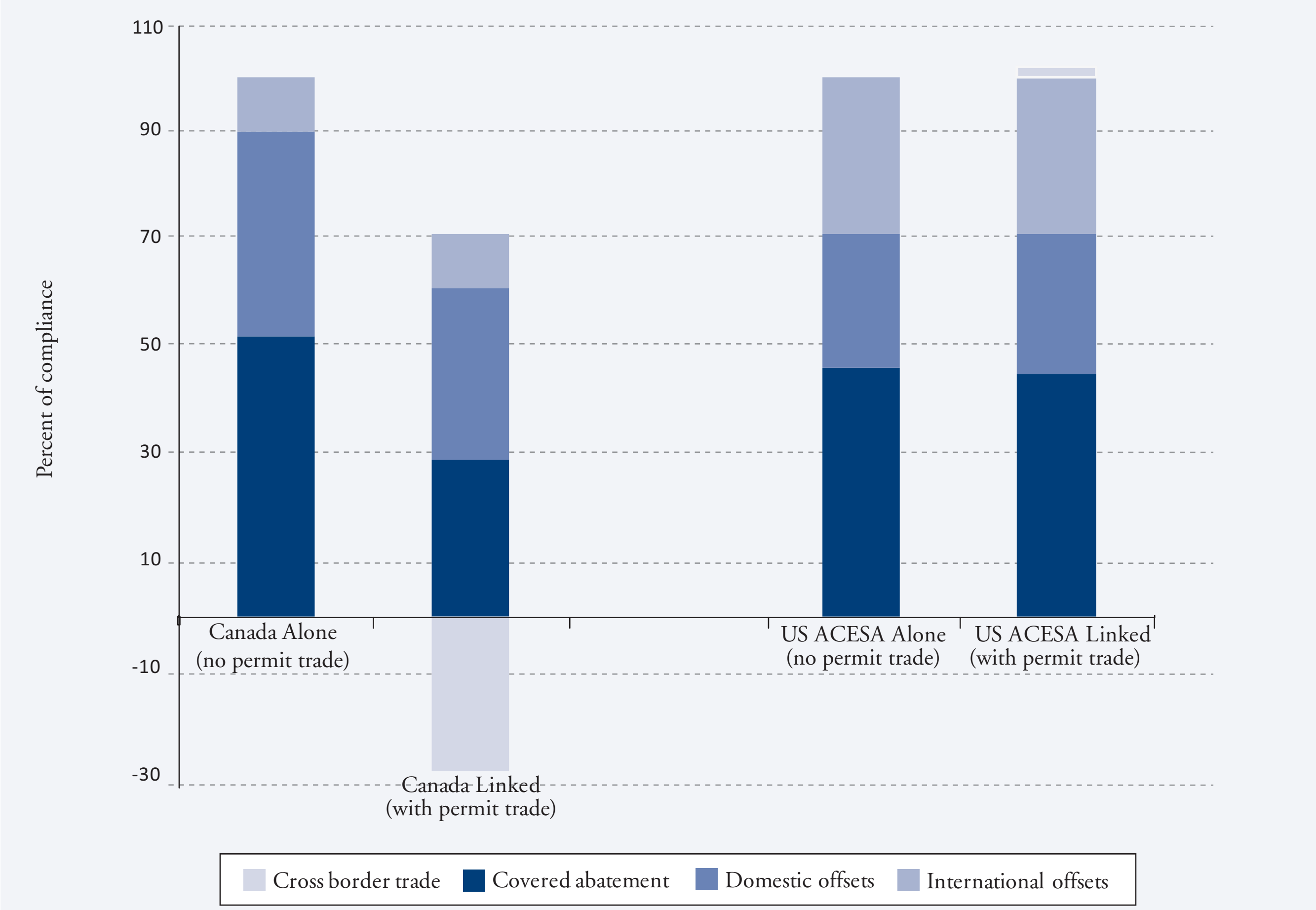
Source: Authors' calculations derived from CIMS, GEEM and EIA models.

Table 4: Independent Policies with Allowance Trade, 2020 Compliance and Abatement for Covered Sectors Canada Old and New Targets and ACESA

Independent Policies with Allowance Trade		Compliance			
		Covered Sector Abatement	Domestic Offsets	International Offsets	Cross-Border Allowance Trade
Canada: Old Targets	% shares of total abatement	37	30	10	23
	Mt	28	23	8	17
Canada: New Targets	% shares of total abatement	34	33	10	23
	Mt	23	22	7	15
US: ACESA	% shares of total abatement	46	26	29	-2
	Mt	441	251	277	-15

Source: Authors' calculations derived from CIMS, GEEM and EIA models.

Figure 2: Emissions and Compliance, Same Targets (17 percent) Independent Policies With and Without Linked Allowance Trade



Source: Authors' calculations derived from CIMS, GEEM and EIA models.

With allowance trading enabled, cross-border trade reduces abatement from Canadian industrials significantly, and electricity in particular, as these entities are no longer net sellers of allowances. The oil and gas industry is the major net purchaser of allowances, while the US electricity sector is a net seller. With cross-border allowance trade, the additional US compliance conducted to sell allowances to Canada is about 2 percent of the national target, whereas for Canada net purchases are about 23 percent of compliance (Table 4 and Figure 1).

Although the two policies deliver comparable reductions from the covered sectors, the same cannot be said for the economic implications of approaches with the same targets but different policies. Our assessment suggests that allowance prices would be much higher in Canada than in the United States without linkage, on the order of 40 percent more (Table 5). The total costs of the policies, which include the cost of domestic abatement plus allowances bought internationally, are estimated to be about $1.7 billion for Canada and $18.5 billion for the US (ACESA in Table 5). As a share of GDP, the Canadian policy costs are about equal to those in the United States, even though total domestic emission reductions are lower. This finding confirms a common view that Canadian abatement costs are higher than those in the US, although this conclusion may not hold at higher levels of reductions where carbon capture and storage becomes economic.

Although these differences can be attributed to different international offset limits, emissions growth in Canada also is a factor. In the emission forecasts we use, US-covered emissions remain more or less flat while Canadian-covered emissions grow roughly 7 percent between now and 2020.

With comparable fixed-base-year targets (i.e., reductions below 2005), Canadian firms must take more action to hit the target, which further drives up allowance prices.[21]

Linked allowance trading under these approaches reduces the Canadian allowance price, bringing it close to the prevailing US market price, which serves to lower overall compliance costs by about 25 percent in Canada. Covered entities in Canada in effect benefit from the generous US offset limits under linked trade, which keeps allowance prices and costs low. US compliance costs would likely increase slightly, given the small increase in the allowance price due to Canadian demand for allowances. Meanwhile, the total cost of the policy for Canada falls to GDP shares below that of the United States, but emissions coverage is less, as is the quantity of reduced emissions (Table 5). Reducing the Canadian target drops the Canada alone scenario permit prices from $60 to $49 per tonne.

Although allowance flows are to the United States, with capital leaving Canada, the benefits from avoided carbon costs more than outweigh the loss in capital. The cross-border financial flows out of Canada to import allowances are about $500 million in 2020, which avoids additional costs above this transfer of about $300 million if cross-border allowance trade is not present.

The lower compliance costs with allowance trade reduce adverse macroeconomic impacts in Canada. With permit trade, the impact on national GDP is halved, from about 0.37 percent in 2020 down to 0.2 percent (Table 6). Output is also less impacted with linking. Importantly, linking significantly reduces competitiveness impacts by smoothing differences in the price of traded goods. With similar carbon prices in Canada and the US through linking, the change in Canadian net exports drops significantly from 0.18 percent in the unlinked scenario to 0.03 percent in the linked approach. This is a small net effect.

The sector impacts are not uniform, with some winning and some losing under linking (Table 7). Clear winners are Canadian allowance buyers, notably in the oil and gas industry, who see compliance costs fall, as measured by sector GDP impacts.[22] However, Canadian allowance sellers suffer, as US allowance imports displace allowance sales from sectors such as electricity. Offset providers are also worse off, as they see the value of their allowance sales more than halved because of the lower allowance price under a linked cap-and-trade system. Greater access to the US market may benefit Canadian offset sellers; however, they must then compete with international and domestic US offsets.

2. Same Targets with Comparable Climate Policies

Threats of trade sanctions under ACESA have led many to argue that Canada should implement a policy equivalent to the US to avoid border carbon adjustments. To demonstrate equivalent policy, and possibly avoid trade sanctions, Canada could implement policy according to the main elements of ACESA, with comparable coverage, compliance targets, and flexibility mechanisms. In this group of scenarios, we investigate the implications for Canada of implementing an ACESA style cap-and-trade system under linked and unlinked scenarios.

Implementing a policy similar to the ACESA in Canada would require the expanded coverage of the now defunct TTC policy to buildings, transportation, other manufacturing, and agriculture (not carbon sequestration).[23] This policy coverage would equal about 90 percent of Canadian emissions in 2020 or 681 Mt from a forecast baseline of 741 Mt, with a target of about 552 Mt. International offsets would also need to be expanded from current limits of about 10 percent to roughly 30 percent as under ACESA, with a maximum allowable quantity of about 46 Mt. As with the defunct TTC policy, ACESA allows generous domestic offsets. As above, we model firms as able to trade allowances domestically in an unlinked scenario and across borders in an linked scenario.

21 We discuss the implications of relative abatement cost in later scenarios.

22 GDP is at basic prices and therefore includes indirect taxes including the allowance value.

23 Output based allocations are used for all emitters, although the ACESA carves out petroleum refining.

Table 5: 2020 Compliance Costs Independent Policies With and Without Allowance Trade Canada New Targets and the US ACESA

		Allowance Price	Total Cost ($CDN, billions)	Cost of Share of 2008 GDP[a]
Independent Policies without Allowance Trade	Canada: Old Targets	$60	$2.4	0.18
	Canada: New Targets	$49	$1.7	0.13
	US: ACESA	$30[b]	$18.5	0.13
Independent Policies with Allowance Trade	Canada: New Targets		$1.4	0.10
	US: ACESA	$31[c]	$19.1	0.13

a Using 2008 GDP based on PPP from the IMF, World Economic Outlook Database, 2008. This is total compliance cost divided by 2008 GDP.
b This is very close to the US Energy Information Administration (EIA) estimate of $32 US.
c The APA price ceiling of $35 is not reached under these scenarios.

Source: Authors' calculations derived from CIMS, GEEM and EIA models.

Table 6: Canadian Macroeconomic Impacts in 2020 Independent Policies and Allowance Trade, Same Targets (17 percent) Differing Policies

	Percent Change Relative to No Policy Case		
Canada	**GDP**	**Net Exports**	**Gross Output**
Without Permit Trade	-0.37	-0.17	-0.57
With Permit Trade	-0.20	-0.03	-0.25

Source: Authors' calculations derived from CIMS, GEEM and EIA models.

Table 7: 2020 Sector GDP Impacts in Canada Same Targets Different Policies

	Percent Change in GDP in Canada Relative to No Policy Case	
Sector	**Without Permit Trade**	**With Permit Trade**
Oil and Gas	-6.4	-4.0
Mining	-2.9	-1.1
Petroleum Refining	-1.3	-0.9
Other Manufacturing	-1.1	-0.4
Industrial Minerals	-0.7	-0.2
Iron and Steel	-2.2	-0.7
Pulp and Paper	5.2	3.3
Electricity	9.2	6.0

Source: Authors' calculations derived from CIMS, GEEM and EIA models.

In a scenario with comparable climate policies in Canada and the US, where Canada implements the main elements of the ACESA, but without Canada-US trade in permits, domestic abatement contributes significantly, or slightly more than 50 percent of total compliance (Figure 3). As the price of domestic offsets is driven up, supply potentials in Canada are reached at about 20 percent of compliance while the international offset limit is also reached.[24]

With Canada-US permit trade under comparable policies, Canadian purchases of US allowances significantly reduces covered sector abatement in Canada. Covered-sector abatement in Canada drops from 53 percent to less than 30 percent of compliance relative to the comparable policies alone scenario, with another 30 percent compliance obtained from allowance imports from the US (Figure 4). Canadian offset providers also supply less as domestic offset purchases fall. With a full third of compliance obtained from allowance trade with the US, the abatement cost differentials between the two countries, at least under these scenarios, would suggest that linked trade is a very important flexibility mechanism.

The costs of the 'Canada alone' and 'comparable policies' scenario is higher than the previous Canada alone scenario with limited coverage of industrial emitters, despite the generous offsets limit primarily due to the policy being expanded to cover buildings and transportation.[25] Although the international offsets limit of 30 percent puts downward pressure on the Canadian allowance price,[26] it is countervailed as abatement costs in the buildings and transportation sectors puts upward pressure on allowance prices. The net result of the expanded coverage, even with the international offsets limit of 30 percent, is an allowance price of $59 per tonne. Total costs are then about $4.3 billion which is about 0.3 percent of GDP. This compares to the US under the same scenario that has costs of about 0.1 percent of GDP with an allowance price of $30 per tonne.

Linking the two countries through allowance trade then lowers allowance prices and total costs in Canada considerably (Table 8). But as expected the US allowance price under a linked system is slightly higher reflecting increased Canadian demand, although it is only marginally higher. This then increases the US policy costs, which are still well below the Canadian total costs as a share of GDP. Allowance purchases by Canada are about $1.2 billion annually, which avoids an additional $900 million in compliance costs relative to the same scenario with no linking.

Under this "ACESA type" scenario with no allowance trade, Canadian GDP drops in the order of 1.7 percent, while net exports fall 0.7 percent. These effects are partially ameliorated with allowance trade, with GDP losses more than halved (Table 9). Linking reduces differences in the market prices of competing Canadian and US goods and it is the export sectors that benefits most.

While the short-term economic benefits of linking seem assured, a long-term evaluation would need to take into account the role of Canadian innovation and learning-by-doing, which are outside the scope of our modeling. Lower allowance prices under linking and outflows of capital to finance abatement technology in the US would reduce Canadian incentives to innovate, which could leave Canadian industry less prepared for deeper emission reductions that may be necessary in the future. Thus, in the next scenario, we consider an alignment option that generates funds for addressing future technology needs.

3. Canada Alone with the Same Carbon Prices

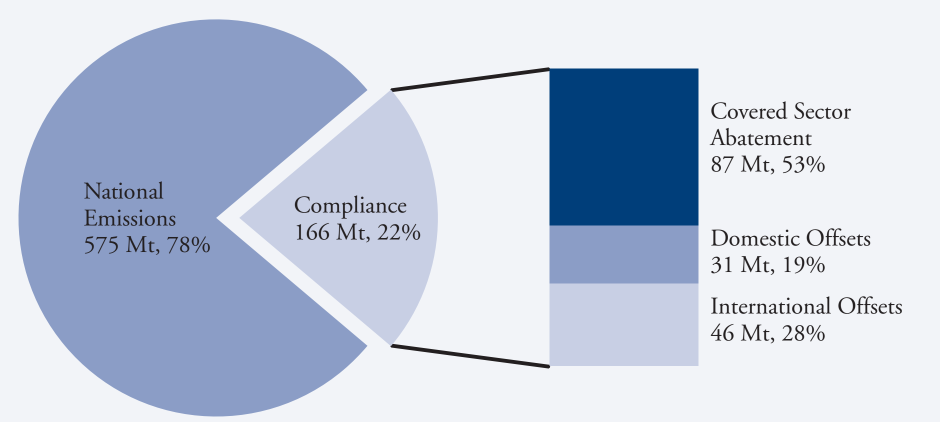
In this scenario, Canada keeps its current policy preferences, with coverage of industrial emitters and a 10 percent international offset limit, but implements a price limit equal to the US allowance price. The price limit on the scenario is

24 We assume international offset supply prices are set by US demand, which in turn is a function of US compliance with our stylized version of ACESA. The international offset price is $30 per tonne, and since this is lower than the unlinked price, offsets are fully subscribed. The scenario allowance price is provided below.

25 These sectors are known to have higher compliance costs relative to the industrial emitters for the same level of reductions.

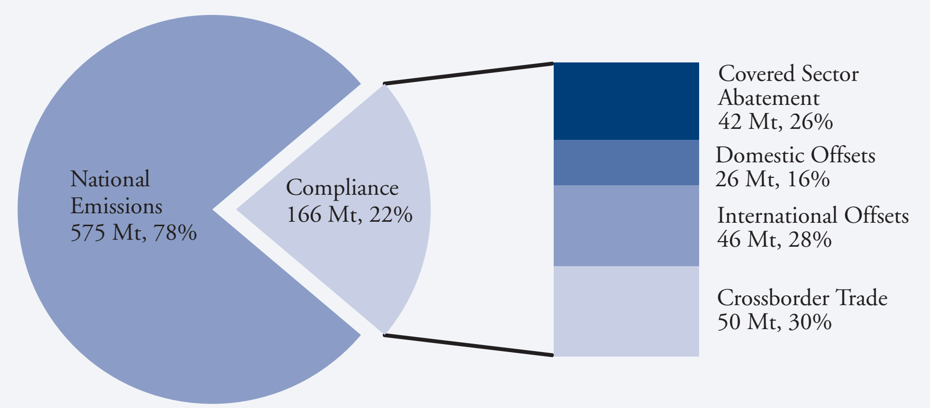
26 Recall we assume the US is the price setter for international offsets, with the US allowance price setting the international offsets price. Canada is then a price taker for international offsets. In effect, the US and international markets are in equilibrium.

Figure 3: Emissions and Compliance Without Permit Trade, Same Targets and Comparable Policy



Source: Authors' calculations derived from CIMS, GEEM and EIA models.

Figure 4: Emissions and Compliance With Permit Trade, Same Targets and Comparable Policy



Source: Authors' calculations derived from CIMS, GEEM and EIA models.

implemented as a technology fund that can be accessed at US allowance prices as estimated above from US alone scenario under ACESA ($30 per tonne). The compliance target remains a 17 percent reduction below 2005 emission levels in 2020, with covered emissions about 329 Mt and a compliance target of 266 Mt, resulting in a 9 percent reduction in national emissions.

The motivations for including this scenario are twofold. First, Canada-US allowance trade may not become a reality for any number of reasons, such as political reticence in the US or the inability to come to agreement on policy architecture. Second, the lower incentive to innovate under allowance trading creates a long-term risk both to achieving targets and to minimizing policy costs. The scenario is therefore designed to show that even in the absence of allowance trade with the US, climate policy costs can be lowered to minimize competitiveness impacts through aligning carbon prices while bolstering the incentive to innovate through earmarking the savings to the technology fund. The trade-off is uncertain target stringency, as payments to the

Table 8: Policy Costs in 2020 Same Targets and Comparable Policies

	Allowance Price		Total Cost ($Billion CDN)		Costs as a Share Of 2008 GDP	
	Canada	US	Canada	US	Canada	US
Canada: Comparable Independent Policy	$59		$4.4		0.33%	
US: Comparable Independent Policy		$30		$18.5		0.13%
Canada: Comparable Linked Policies[a]	$32		$3.5		0.27%	
US: Comparable Linked Policies		$32		$19.7		0.14%

a Canada expanded coverage to all emissions

Source: Authors' calculations derived from CIMS, GEEM and EIA models.

Table 9: Macroeconomic Impacts in Canada in 2020 Same Targets and Comparable Policies

	Percent Change Relative to No Policy Case		
Comparable Policies	**Gross Output**	**National GDP**	**Net Exports**
Without Permit Trade	-1.67	-1.42	-0.74
With Permit Trade	-0.79	-0.71	-0.30

Source: Authors' calculations derived from CIMS, GEEM and EIA models.

technology fund would lead to uncertain and delayed emission reductions.

If Canada were to set a technology fund price above the US ACESA price of $30,[27] the simulations suggest it would be readily accessed by emitters.[28] With the lower price comes less domestic abatement from the covered industrial energy users and producers, with abatement totaling 34 percent of compliance for covered sectors. Domestic offset supplies are somewhat insensitive to the price drop and still supply significant levels of compliance (Figure 5). The technology fund is heavily subscribed, accounting for 22 percent of compliance, which takes away significantly from domestic abatement. These effects on abatement are similar to those with linked trade, but the additional compliance payments are put into the fund rather than used to buy additional abatement in the United States (or abroad).

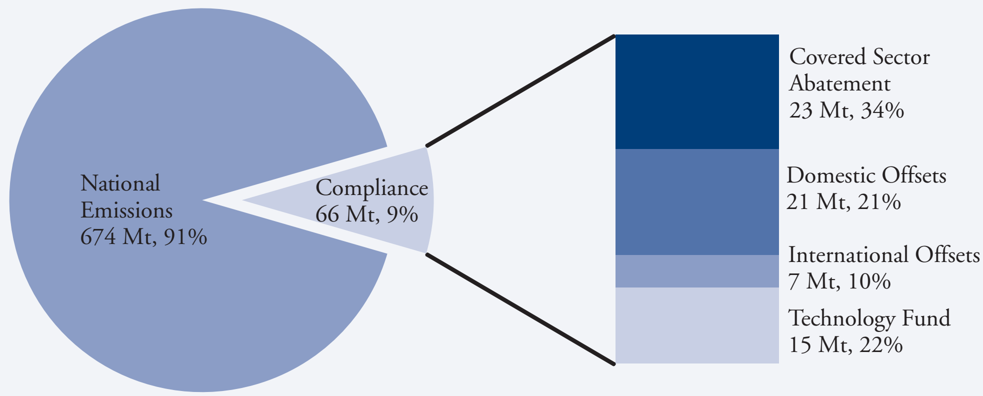
As expected, aligning carbon prices with the United States through a technology fund lowers overall costs, with allowance prices almost halved. This lowers overall costs to about 0.1 percent of GDP. With the technology fund capturing a large share of total compliance, fund payments are about $500 million. This is equal to the cross-border allowance flows under the linked scenarios described above.

One oft-cited argument against allowance purchases from outside national or provincial borders is that money leaves the jurisdiction, thereby lowering the level of economic activity locally. In our simulations, this is not an issue nationally, where

27 Estimated as above so that it acts like a true safety valve.

28 See Table 5 where in the same scenario (targets, coverage, etc.) but with no flexibility the allowance price is $49 per tonne.

Figure 5: Equivalency on Price with TTC: Emissions and Compliance



Source: Authors' calculations derived from CIMS, GEEM and EIA models.

GDP impacts are identical when costs are contained using a technology fund or cross-border allowance imports. But regionally there are differences. In Alberta, for example, the simulations suggest that a when the technology fund is spent locally to subsidize carbon capture and storage, the GDP cost impact is lower, with a reduction in GDP by 1.4 percent relative to 2.4 percent if allowances were instead imported from the US.

This scenario highlights that it is the alignment of prices that is the larger determinant of GDP impact and cost, and not whether that alignment comes through linking allowance trade with the United States. Having carbon reductions come from lower cost sources is beneficial[29] (at least from an economic perspective), regardless of the form of the cost containment. One important difference, however, is the loss of the price signal with linking or alignment, where the lower carbon price sets lower expectations, thereby driving less technology deployment and hence innovation to reduce emissions. In this regard, the technology fund, with the ability to spur domestic innovation, especially if Canada is seeking deeper reductions in the longer-term, is an important distinction in the choice of choosing between cross-border allowance purchases and domestic spending. However, one can question the wisdom of earmarking all these funds to specific technologies, like carbon capture and storage, or of relying solely on the fund for financing climate-related activities outside the cap. Appropriate levels of funding should first be determined by merit, based on what is a cost-effective portfolio of investments to prepare Canada for the future low-carbon economy. At the proposed safety valve price and sector coverage, the transfers to the technology fund would be $450 million annually in 2020 – however, that amount could be much larger (as would reductions) if coverage were expanded economy-wide.

What is constant across all scenarios is the use of cost-containment measures by Canadian industrials. Under scenarios where cost containment is available, be it international offsets, cross-border trade, a technology fund, or another form of safety valve, these opportunities will be fully subscribed. Indeed, we see these options as substitutes, reducing domestic abatement to more or less similar degrees.

29 This comes from moving down the marginal abatement cost curve.

Conclusions

Canada has harmonized its targets with the US and says it will harmonize policy as well. But our assessment indicates this is a high-risk strategy for three reasons.

- First, the strong economic rationale for linking allowance-trading systems with the US is that Canada has harmonized targets with the US. At these targets, Canada's abatement costs are likely to be significantly higher than those in the US, and Canada's emissions are growing faster, making the costs of harmonized targets yet more expensive in Canada. Importing permits from the US under uneven emissions growth and abatement costs will smooth relative carbon prices and lower short-term costs in Canada. With harmonized targets from the same fixed base year, large financial outflows to the US under linked allowance trade can be expected. In particular, the oil and gas sectors in Canada will seek lower cost abatement opportunities abroad, while the US electricity sector expands its abatement in response. From a US perspective, however, these financial flows and price changes are relatively small.
- Second, the lower allowance price with cross-border allowance trade decreases the incentive to develop and deploy important backstop technologies, notably carbon capture and storage. If Canada is indeed seeking more GHG reductions in the future, as Canada's longer-term aspirational 2050 targets would imply,[30] transformative technologies need innovation. But Canada-US allowance trade lowers allowance prices significantly in Canada, and hence lowers learning by doing and returns to domestic innovation. This is particularly a concern for carbon capture and storage in the oil and gas sector. This sector is the high cost of abatement sector in Canada with carbon capture providing an important long-term abatement opportunity. But with allowance prices forecast to be about $31 per tonne in 2020 under allowance trade with the US, there is little private incentive to develop and test high-cost technologies, that may be needed to meet future, deeper reduction targets. This will then likely increase the overall costs of long-term reductions in Canada. Innovation in carbon capture – not to mention energy efficiency, renewables, and other carbon-reducing technologies – could be supplemented with government expenditures, but those would need a financing mechanism.
- Third, the US has not expressed much interest in linking, and waiting for an explicit policy would result in delay. With linked permit trade, US costs rise, which then raises questions about the acceptability of linked trade to the US, especially during the initial development phase of a US system when cost concerns are so acute. Our analysis indicates that Canada-US allowance trade will increase US costs by about $1 billion annually or about 5 percent. If Canada were to delay its entire policy, waiting for the US to sanction linking, it will necessarily delay the deployment of low emitting capital making longer-term policy costs more expensive. However, since Canada is likely a buyer of allowances, Canada would not necessarily need the US to formally approve linked markets; Canada could merely allow purchased US allowances to be surrendered for compliance in the Canadian system. The APA does have trading regulations intended to limit speculation, but it is not clear whether that would ultimately hamper allowance purchases by non-US regulated entities.

Instead of linked permit trade, a policy of harmonizing allowance prices and policy coverage, rather than specific targets or mechanisms, is a largely equivalent and simpler option with several attractive properties. This policy should alleviate competitiveness concerns, as all Canadian sectors would face comparable cost conditions to their US counterparts and comparable incentives for carbon reductions.[31] Under such a system, Canada would peg its domestic carbon price in a domestic cap-

30 See Government of Canada News Release, March 10, 2008. Government Delivers Details of Greenhouse Gas Regulatory Framework. http://www.ec.gc.ca/default.asp?lang=En&n=714D9AAE-1&news=B2B42466-B768-424C-9A5B-6D59C2AE1C36

31 Price equivalency should be sufficient to avoid border adjustments; in ACESA the purpose of the International Reserve Allowance Program is to minimize "the likelihood of carbon leakage as a result of differences between (A) the direct and indirect costs of complying with section 722; and (B) the direct and indirect costs, if any, of complying in other countries with greenhouse gas regulatory programs… . "

and-trade system to that of the US through the use of a price ceiling. By using a rolling average, price volatility would be limited. Firms would use the price ceiling to make decisions on whether to abate internally, buy permits or make payments to a technology fund. If the Canadian allowance price rose to the ceiling level, Canadian emitters would likely prefer to make compliance payments to the Canadian government. The amount of those payments will ultimately depend on the target chosen for Canada. Given that the price ceiling would lessen the incentive to innovate, part of the compliance payments could then be used to incent technology, especially carbon capture and storage. Because the technology fund payments would not result in real emission reductions, at least not initially, the hard cap would in effect be relaxed. This could be partly addressed through using some of the technology fund payments to buy additional offsets, either domestic or international. Another approach would be to borrow some portion of the cap from the future thereby creating a carbon debt that would make the cap more stringent in later periods. In any case, if the chosen targets reflect high aspirations, fund payments are likely to be substantial, requiring careful institutional management to invest appropriately in a wide range of climate-related activities.

In exploring the implications of linked cap-and-trade systems between Canada and the US, one key question arose: is linked allowance trade the best policy for Canada? Our assessment indicates that linked allowance trade with the US is not necessarily the best policy for Canada to pursue while the US develops its own system. Instead, Canada should not delay and should forge ahead with its own system, while minimizing the risk of getting out of step with the US, notably on relative carbon prices. A policy of go it alone with similar carbon price expectations and a targeted innovation agenda seems to be a low-risk strategy.

Appendix Modeling Methodology

We first use the CIMS energy technology model to explore the linked and unlinked allowance trade scenarios in 2020. CIMS is maintained by researchers at Simon Fraser University. CIMS provides indicators of abatement costs and potential, given coverage, stringency, and limits on offsets. This determines the allowance price and the compliance shortfall that international offsets can fill, subject to limits.

CIMS simulates the technological evolution of fixed capital stocks in Canada (such as buildings, vehicles, and equipment) and the resulting effect on costs, energy use, emissions, and other material flows of various carbon polices such as pricing and standards. With the carbon policy, old stocks are retrofitted to reflect the increased cost of carbon while new and less emission-intensive capital stocks are acquired at retirement and with growth in stock demand (e.g., rising electricity demand). Market shares of technologies competing to meet new stock demands with the carbon policy are determined by standard financial factors as well as behavioral parameters from empirical research on consumer and business technology preferences.

To supplement CIMS, and to study the macroeconomic implications for Canada of carbon polices, we use a static computable general equilibrium and emissions model, GEEM. The allowance prices and flows that emerge from CIMS are then fed into GEEM to calculate the macroeconomic outcomes.

The version of GEEM used for this paper is a static general equilibrium model of the Canadian economy in 2020. In the model, a representative household supplies labor and capital to industrial sectors. The industrial sectors supply intermediate inputs to one another, and final commodities to the household. Imports and exports to the rest of the world are explicitly modeled. All markets interact through relative producer and consumer prices with policy shocks changing these prices, leading to new equilibriums in the various markets. GEEM was developed based on a collaborative research effort between Nic Rivers, Chris Bataille and Jotham Peters.

Finally, to determine the implications of linked allowance trade between Canada and the US, we developed a partial equilibrium model of Canada-US allowance trading.

We made abatement choices in the model that minimize compliance costs subject to emission reduction targets, policy coverage, and cost-containment measures such as offsets. The model then solves for the equilibrium allowance price in 2020, subject to sector abatement responses and compliance choices. Allowance flows, both between sectors and countries, are then a function of the mix of compliance that comes from abatement and the compliance mechanisms. Canadian abatement cost curves are developed from CIMS. US abatement cost curves are from 10 model runs of H.R. 2454 (Waxman-Markey) completed by the Energy Information Administration (EIA).

US abatement responses are developed from the EIA Runs of H.R. 2454. Abatement responses at the various carbon prices are used to specify a series of marginal abatement cost curves from 10 of the 11 runs posted.[32] The "high banking" scenario was not used due to large additions in current years with the banking provision. Table A1 provides an overview of the cost curves for Canada and the United States.

32 See http://www.eia.doe.gov/oiaf/servicerpt/hr2454/index.html

Table A1 Linear Marginal Abatement Cost Curves for Canada and the US 2005 $CDN

	United States Slope	United States Intercept	Canada Slope	Canada Intercept
Residential	3.933	14.530	0.044	0.069
Commercial	4.326	9.986	0.063	-0.160
Chemicals	0.548	8.529	0.036	-0.110
Industrial Minerals	0.101	4.975	0.019	-0.026
Iron and Steel	0.217	7.681	0.006	-0.070
Metal Smelting	0.123	3.693	0.002	0.016
Refining	0.299	0.698	0.042	-0.150
Mining, Oil and Gas	0.025	9.313	0.308	2.198
Pulp and Paper	0.195	6.427	0.001	0.027
Other Manufacturing	1.213	11.931	0.046	0.055
Agriculture	0.180	9.289	0.023	1.973
Transportation	0.520	10.983	0.420	-2.943
Electricity	7.656	172.638	0.233	1.000
Domestic Offsets (Agriculture)	4.563	110.988	0.165	-0.312
Waste			0.023	20.930

Source: Authors' calculations derived from CIMS, GEEM and EIA models.

References

Alexeeva-Talebi, Victoria, and Niels Anger. 2007. "Developing Supra-European Emissions Trading Schemes: An Efficiency and International Trade Analysis." ZEW Discussion Paper No. 07-038, Mannheim.

Energy Information Administration. 2009. "Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009."

Farmer, Karl, Birgit Friedl and Andreas Rainer. 2008. "Effects of Unilateral Climate Policy on Terms of Trade, Capital Accumulation, and Welfare in a World Economy." CESifo Working Paper No. 2375. Munich: CESifo Group.

Fischer, Carolyn. 2005. "Project-based mechanisms for emissions reductions: balancing trade-offs with baselines." *Energy Policy* 33(14): 1807-1823.

Flachsland, Christian, Robert Marschinski, and Ottmar Edenhofer. 2009. "To link or not to link: Benefits and disadvantages of linking cap-and-trade systems." *Climate Policy* 9: 358-372.

Helm, Carsten. 2003. "International Emissions Trading with Endogenous Allowance Choices." *Journal of Public Economics* 87(12): 2737-2747.

Holtsmark, Bjart J., and Dag Einar Sommervoll. 2008. "International emissions trading in a non-cooperative equilibrium." Discussion Papers No. 542, May 2008. Oslo: Statistics Norway, Research Department.

Interagency Report. 2009. "The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries An Interagency Report Responding to a Request from Senators Bayh, Specter, Stabenow, McCaskill, and Brown."

Jaffe, Judson, and Robert Stavins. 2007. "Linking Tradable Permit Systems for Greenhouse Gas Emissions: Opportunities, Implications, and Challenges." Report Prepared for the International Emissions Trading Association and the Electric Power Research Institute.

Rehdanz, Katrin, and Richard S.J. Tol. 2005. "Unilateral Regulation of Bilateral Trade in Greenhouse Gas Emission Permits." *Ecological Economics* 54: 397-416.

Taylor, M. Scott, and Brian R. Copeland. 2005. "Free Trade and Global Warming: a Trade Theory View of the Kyoto Protocol." *Journal of Environmental Economics and Management* 49 (2): 205-234.

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NOTES

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