

Framework

1 Perspectives on Action

Analysis of the economic effects of Climate change action is framed as comparing an economic future in which specifically identified actions on Climate Change are undertaken compared to a future in which these do not occur (a Business as Usual Case). For purposes of this discussion, we will describe the specifically identified actions as “direct” impacts on the economy.

A case can occasionally be made that the benefits to a firm or sector (e.g., reduction in operating costs following from lowered energy intensity) exceed the costs (e.g., investment and debt servicing costs, and transition to a new form of production) of Climate Change action. Barriers to information are the typical explanations for this. This would be typically regarded as a “rare” event, so a basic presumption of analysis is that there is a net cost to the firm or sector of undertaking action. From the national economy’s perspective, the central idea is that resources are shifted from a higher to less productive activity – as measured by markets. In the longer term, this reduces real incomes.

Our review of the literature suggests that most of the analytical frameworks implicitly assume that Climate Change commitments are limited to the country or broader jurisdiction (e.g., the European Union) on which the study focuses. That is the firms and sectors in that jurisdiction assume net costs that are unmatched by foreign competitors, a feature that produces a “competitiveness” loss in the form of reduced exports and increased imports.

This was a key assumption of the Analysis and Modeling Group that underpinned the Canadian 2000-01 analysis underlying policy formulation to meet Kyoto obligations. Given that the US had refused to make Kyoto commitments, this was a “reasonable” convenient assumption. But a shift of emphasis to a post-Kyoto timeframe, including to mid-Century with sharp emission reduction targets globally suggests that this unilateral circumstance will not imply. That is, there will be net additional costs for operating steel mills in Canada, the US, Europe, and over the longer term, among developing economies. In this circumstance, the conventional focus of analysis may still include standard “competitiveness” concerns, but should shift to the effects on Canadian real incomes of reduced productivity and real incomes globally.

In this report, we focus mainly on describing the traditional framework for analysis, but add to it a section that follows from “thinking about” how global action would shift analytical detail.

2 Unilateral Action

2.1 Basic Technical Framework

The first thing to note is that while actions undertaken by firms and sectors (and by households) define the amount of capital formation and the paired energy saving that occurs and is central to modelling, these may be stimulated by different strategies or “measures”. Typically, these are identified as:

- Co₂ taxes,
- Emissions trading (including, cap and trade), and
- Traditional forms of regulation.

As a general characterization, the last option is typically considered the most costly (“net”) because it does not allow the flexibility to shift toward the cheapest mitigation opportunities. There are important distinctions between the first two regimes but it is not unambiguously clear that net cost distinctions can be asserted when institutional enforcement and fiscal considerations are accounted for. Further, taxes make the emissions price certain but amount of emissions reduction uncertain. Permit systems fix the emission reduction but make the price uncertain. In the former case, economic effects of mitigation are uncertain, and in the latter case, effects on business capital formation would be uncertain.

The central point to take away from this is that one cannot be certain, perhaps within meaningful boundaries, of the kinds of actions that result from a given strategy, including one in which a hybrid system is employed, as appears to be evolving in the federal Canadian approach to meeting emissions targets by 2020. Judging from the many impact statements that have been modelled and are based on assumptions of unilateral action, it is widely agreed that aggregate activity and real income effects of Climate Change actions will be “small”, with effects on individual firms larger – but typically “small” to “modest” with an occasional indication of “large” negative effects.¹ The uncertain link between policy approaches and actions noted above is not likely to affect the view of aggregate impacts beyond the basic idea that policies centered on regulations would have a larger negative effect, but the link makes the impacts for sectors a significantly uncertain prospect.

¹ These are ambiguous terms. Think of a “large” impact, being one that reduced activity in a future year (say 2020) to below current levels. Compared to the BAU levels of 2020 this would typically be a very large number – in the range of more than 40 per cent. If the industry would otherwise grow at 2.5 per cent annually. Reports of impacts of this scale are *very rare*. Impacts (from BAU) in the range of 1-2 per cent (“small”) are typical with those of as much as up to 10 per cent (“modest”) an occasional impact.

Focussing on sector effects, the reasonable, standard view is that vulnerability depends on:

- The sector's energy intensity,
- The extent to which the sector is trade exposed (exports are a large proportion of production and imports a large proportion of domestic demand),² and
- From the economy's perspective, the extent to which energy-intensive, trade exposed sectors compete with sectors in economies that take no action and are a significant proportion of trade flows and the economic structure is basic to the overall arithmetic.

From the firm and sector's point of view, the extent to which increased net costs can be passed on to clients, or pushed back on labour and suppliers of material inputs is significant. From the overall economy's point of view, this is less significant since increased prices in domestic markets (and the induced or multiplier effects of trade impacts) are at least a partial trade off with negative effects concentrated on the firm or sector.

Our view of the more technical aspects of the framework follow. We reference effects on four industries – basic chemicals, transportation equipment, producers of leather goods and restaurant operators to illustrate some important analytical distinctions.

Assume that policy requires each to undertake investments that reduce energy intensity (or "conservation" effects) that produces reduced costs of energy in operations as the capital is brought on stream, and that the net impact on the income and expenditure account is to increase costs of operations. From the total economy's point of view, one important element of the analysis centres on the extent to which the supplies of the required new capital goods are produced domestically or have high import leakage. (Assuming there no changes to location of supply for the required capital, investments in equipment will have high import leakage while actions that require significant "construction" content [i.e., development of sequestration capacity] will have low import leakage. Including "indirect" impacts (effects on the suppliers of goods and services to the equipment manufacturer or contractor), for the economy, investment in equipment will have a small positive effect on domestic GDP (as an offset to relative cost effects) while those focussed on construction capital will have a relatively large positive offset. Similarly, effects on the economy of reduced energy demand will be sensitive to the extent to which the energy is supplied domestically or from foreign sources, and whether net cost effects on domestic energy suppliers lead to a shift in domestic/foreign sourcing by domestic energy users..

² We have committed to develop indicators of sector trade sensitivity. Based on this review of the literature, we will add a task to provide a ranking of the industries on energy intensity to ensure that there is a consistent view of industries on these two measures.

From the sector's point of view, it will be important to estimate the extent to which the added costs can be passed on to export markets. There are two distinct possibilities. For price takers (basic chemicals would be an example), commodities produced by the industry are priced in world markets that would be unaffected by Canadian supply, so the added costs of operations will be borne by shareholders, or as likely, by sector labour and/or suppliers of materials and services. In this event, there is a loss to shareholder (dividend), but also labour and supplier incomes. Over time, it suggests that there would be a reduction of investment in the capital required to produce the sector's commodities so that negative effects on sector operations would erode by increasing amounts over time. Other sectors (transportation equipment and leather goods are an example), would more likely attempt to increase price in the export market but would see an immediate reduction in real demand and therefore output. Income losses from reduced employment in the sector and among supplying industries (as well as some push back on compensation rates and supplier prices) would be immediate.

Notice that in a fully interdependent view of economic activity, there should a widespread loss of real income through price and compensation effects in the domestic economy as well as through real activity and employment impacts so that almost all sectors would be negatively affected. The restaurant industry, little affected directly by Climate Change policy, should see reduced activity. Effects on it, as well as on all other domestic industries will be a product of income as well as price elasticities. There are possibilities for some positive sector effects if the capital formation (e.g., construction of transit systems) includes low import content or if the operation of the system is a major replacement for other activity (reduced personal transportation implies lower road repair construction, automotive fuel and other servicing, etc.)

Notice too that there should be some offsetting dampening effects on prices as firms and sectors adjust the costs of actions, at least during transition periods. Considering that the scale of emissions reductions that are being considered are large and will require decades to implement, the "transition periods" should extend over similarly long time frames. In an ideal analytical framework, this offsetting dampening on prices should feed back to the view of the *ex ante* capital costs associated with taking the initial action.³

These considerations noted, our a priori expectations are consistent with the "standard" mode of impacts. Relatively large increases in input costs of energy-intensive industries (including energy producing industries) should produce a relatively large negative effect for these industries in a context where almost all industries operate at a lower level of activity in the long term. Domestic price and income elasticities will moderate this outcome, as will trade elasticities. Per unit of cost increase, we would expect transition considerations to produce different time profiles for sector adjustment. Industries producing price-taker products should see initial small negative effects on activity that

³ Typically, the view of capital costs required to reduce energy inputs is developed as exogenous to the economic scenario.

Climate Policy and Competitiveness

build over time as reduced returns lead to diminished capital formation in capital used to produce the sector's products.

The following considerations can substantially alter this basic view of the outcome.

- Basic policy approaches can alter the direct cost impacts on sectors. Programs based on offsets, or Industrial funds, effectively “subsidize” the capital formation of recipient industries, so that in these cases, and allowing for the reduction in energy costs, a reduction in industry operating costs is possible. Careful, sector by sector assessment of how these funds impact costs are important.
- Revenue recycling of carbon taxes should generally be expected to provide a major offset to the real income loss of domestic households and businesses (overall) so that induced negative effects that would otherwise occur would be mitigated. This should reduce the negative effects on all sectors, including trade sensitive industries, but the positive offsets should be largest for those that are trade insensitive (i.e., services). This said, whether the revenues are recycled as indirect or direct tax reductions, or are used on the expenditures side for infrastructure or current spending can produce widely differing aggregate and sector offsets. This is an entire area of research for which there is substantial dispute.
- The anticipation of resource reallocation typically centres on capital, where this focuses on related industry development (promote a domestic ethanol or wind turbine industry) and related basic development of research capabilities.) Most other policy studies that concentrate on structural change would also focus on how to promote the new labour “skills” that will be required to both produce the new kinds of capital but also to use it. This omission is a large “hole” in past policy development for Climate Change, and its absence adds to the competitiveness costs that could otherwise be mitigated.
- There is an extensive literature on the potential for countries or jurisdictions that take unilateral action to undertake compensatory trade or tax equivalent action to compensate for the undue advantage of “non parties”. I take this to be an interesting but unresolved discussion with proponents of action tending to assert that there are no fundamental differences between Climate protocols and the World Trade Organization rules, while trade experts (Hufbuaer) suggesting that this is a mine field, where researchers should be wary of assuming there is agreement..
- Finally, as Canadian monetary policy includes a flexible exchange rate commitment, it should be recognized that any relatively high structural costs imposed on domestic production should be mitigated by a depreciating value of the currency. At least transitionally, this should constitute an important mitigating

offset for trade sensitive industries at the expense of industries whose demand is principally domestic in origin. Longer run effects on aggregate and sector performance are disputable.

3 Multilateral or “Global” Action

A much more reasonable view of the future than one which assumes Canada alone acts is one in which there is substantial “global” action. Reasonably, one should anticipate that commitments of the “industrial” countries will be proportionately the same, or if not extended to such a wide group, that commitments would be proportional within major trading blocs. Potentially, global action could be widespread but the “breadth” of coverage is likely only to emerge over a prolonged period of time.

In cases where there is widespread action, the relative cost problem of energy-intensive and trade exposed Canadian sectors is reduced if not eliminated. But global markets for the commodities produced by these industries will be reduced compared to a unilateral action case. One US study suggests that effects on energy-intensive producers would be cut in half compared to the unilateral action case.⁴ I surmise that effects on other sectors of the economy would be more severe since reduced world real income should impact all other industries through generalized trade effects (reduced exports). Put simply, the unilateral vs. global cases may largely be a matter of deciding which sectors are adversely affected. In a unilateral case, I surmise that the chemicals industry would be relatively hard hit compared to effects on leather goods or operators of restaurants, who would be adversely affected but only slightly. In a global action case, the negative effects on the chemicals industry would be reduced (compared to the unilateral case) with negative effects for leather and restaurants increased. That is, a narrower range of effects (mostly negative) would more likely result.

Global or multi-country models will be needed to develop analyses of this kind. Several considerations suggest a wide range of possibilities, however that may or may not be well-addressed by available models.

- In a “global” action scenario, there will be a continuing major commitment across the world to develop solutions that lower energy intensity. They should emerge more quickly and be less costly than in a scenario where only one or a few countries are acting. Put simply, the net costs of action in Canada should be lower given a global search for answers. Whether this would be a positive or negative for development of Canadian industries providing solutions is problematic. On the

⁴ Richard D. Morgenstern, Joseph E. Aldy, Evan M. Herrnstadt, Mun Ho, and William A. Pizer. “Competitiveness Impacts of Carbon Dioxide Pricing Policies on Manufacturing”, **Assessing U.S. Climate Policy Options: A report summarizing work at RFF as part of the inter-industry U.S. Climate Policy Forum, Resources for the Future**, November 2007, p. 97.

one hand, there will be more competition for such domestic industries, but on the other hand, there will be a larger market and collaboration opportunities for domestic industries.

- A global or at least widespread reduction in emissions implies a sharp reduction (from the BAU case) in world demand for energy. Other things equal, this suggests there would be a sharp reduction in world oil, gas and other energy prices, to act as a partial offset to actions taken under agreed policies. It is not immediately clear that this has been examined. It will be a particularly acute problem to consider in circumstances where, for example, major commitments are undertaken by industrial countries with an anticipation of later action by emerging major economies. In the interim, already strained economic relations between China, India (Brazil?) and the industrialized countries would be made more acute.
- Industry specific assessments are likely to be important to these studies. Consider for example that for the US, action on coal-fired plants would constitute a major contribution to any economy-wide emission reduction target. This suggests the possibility of weaker actions on other sectors of the economy than would be required for Canada to meet a proportionate overall reduction in emissions. Modelling this would require detailed, industry specific assumptions for industries in each of the two economies.

4 Accounting for the Economic Effects of Reduced Emissions and GHG Stocks

Changes to emission levels alter the stock of pollutants with local area impacts and global Greenhouse Gasses. There are direct economic benefits to each of these, but analyses of competitiveness ignore them, apart from general references to long-term benefits. But impacts should have clear sectoral effects and in this sense, this feedback from the environment to the economy is part of the competitiveness story.

It may be argued that effects associated with reduced GHG are long-term and would be hard to identify sectorally, but local-area impacts have obvious short-term effects with sectoral implications. Consider, for example, that local area impacts (acidification) associated with coal-fired electric power generation have direct effects on agricultural, forestry, and possibly fisheries productivity. More broadly, health benefits associated with reduced emissions have economic effects, possibly with obvious sectoral implications. Reduced morbidity and mortality imply positive effects for the size of the labour force. Through effects on compensation rates, this suggests the possibility of relatively strong positive effects for labour-intensity sectors in the economy. Of course, there should be negative effects for producers of health care and operators of funeral homes. This noted, under certain circumstances of an ageing population, this would be a small negative in an otherwise rapidly growing area of demand growth.

Note that recognition of the local area and global effects have implications for the unilateral vs. global competitiveness study. That is, one may conveniently ignore the feedback to the economy of reduced GHG in a unilateral impact study since reductions of stocks would be negligible. But local area impacts would be meaningful in this instance. Under circumstances of global action, local-area impacts would be increased (cross-border considerations), and one would also add in the effects of reduced GHG stocks. There should be sectoral effects here too, but an organized translation of scientific knowledge into effects on economic sectors does not appear to be readily available.

5 Trade Exposure by Province and Sector Profitability

Review of data and analytical approaches - forthcoming

C. Sonnen
May 2, 2008