NATURAL RESOURCE REVENUES AND EQUALIZATION:

A PARTIAL OVERVIEW OF SELECTED ISSUES

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Introduction

The perspective adopted in this paper is unabashedly one inspired much more by natural resource economics than by public economics. The focus is clearly on the insights that the economic analysis of the exploitation of both renewable and non-renewable natural resources has to offer for enhancing our appreciation of the potential role and treatment of provincial resource revenues in Canada's fiscal equalization system.

Section I outlines key factors that differentiate renewable and non-renewable resources from an economics perspective. The basic idea developed here deals with the fact that renewable resources are characterized by the existence of a replenishment process, while no such process exists for non-renewable resources. As we will see in this section, this difference has important consequences for the nature and sustainability of net benefits that can be derived from the exploitation of these two types of natural resources. Section II uses the conclusions reached in the previous section to explore what needs to happen to the economic rents generated by non-renewable resource exploitation to yield sustained flows of economic benefits once economic or physical exhaustion has occurred. In light of this information, some implications for the equalization treatment of natural resource revenues accruing to provincial governments are then discussed.

Section III provides some information on the volatility of key non-renewable natural resource prices and addresses implications of this volatility for provincial government revenues and equalization payments. Strategies used by provincial governments to collect the economic rents generated by the exploitation of renewable and non-renewable resources – and their

consequences for fiscal equalization – are briefly addressed in section IV. The paper concludes with an overview of a number of proposals outlined in the literature on the treatment, for purposes of fiscal equalization, of the resource revenues collected by provincial governments.

I. Renewable and Non-Renewable Natural Resources

In some fundamental way, economic differences between renewable and non-renewable natural resources have to do with the length of their replenishment cycles. Stocks of renewable resources will typically replenish themselves within periods of time that are relevant to human activity patterns. The hydrologic cycle, for example, is such that water reservoirs and head ponds will be regularly refilled by precipitation (including spring thaws). Such processes, of course, are not deterministic so that the subsequent replenishment is not exactly equal to the stock drawdown. Nonetheless, the basic idea remains that production activities reduce the stock of a renewable natural resource, but that there is also a process (due to nature, but also possibly human-assisted – think of forest management as an example of the latter) whereby additional units of the resource are added to the remaining stock within a time frame to which humans can relate.

In the case of hydro-electricity, one might think of the relevant replenishment cycle as being approximately one year in length (longer, of course, if one seeks to account for periodic droughts). Forestry activities would be characterized by much longer replenishment cycles – measured in decades, but still time periods that "mean" something to humans and human activity patterns. (In this context, it is possible to think of agriculture simply as forestry with replenishment cycles measured in months!)

The returns to activities linked to the replenishment of renewable resources, if human-assisted, must compensate, among other things, for the length of this cycle – a straightforward time value of money concept: an initial investment in seedlings, for example, will only yield financial returns some decades later. But "nature" also contributes something to this process – and this "something" creates value. Nutrients from the soil, water, and solar energy combine to yield physical growth in trees. For some period of time and (for simplicity) given a felled timber price, the value of standing timber grows over time. The decision to harvest will be triggered by the opportunity cost of the site: will more value be created by allowing the standing timber to continue to grow, or by cutting it and re-starting the replenishment process by planting new seedlings? Neither nature nor anyone else requires a payment to bring forward this underlying physical growth – an economic rent is thus being generated.

In the case of hydro-electricity, there is clearly a need to compensate those building and operating generation facilities to secure their effort, and the water itself may well have alternative uses that should be factored into the decision-making process. However, as Bernard *et al.* (1984), Zuker and Jenkins (1984), and many others have argued, the economic rent that can be created by using water to generate electricity is most frequently linked to the fact that hydro-electricity is a much cheaper method of generation than is the next-cheapest alternative. This is a kind of Ricardian/quality-differential rent – a return that is not necessary to induce the entrepreneur to construct and operate the hydro-electricity-generating facility. In the case of both forestry and hydro-electricity (and for renewable resources in general), it is also clear that site-specific factors can generate Ricardian-type rents at any point in time: for example, some hydro sites are of better quality than others and can thus generate a uniform commodity (electricity) at lower per-unit costs.

All else being equal, this pattern of rents can be re-created in each replenishment cycle by the steady-state exploitation of renewable resources. Reality is quite clearly more complicated that this simple exposition. But the key point remains: the natural dimensions of the replenishment cycle are at the heart of rent generation in the case of renewable resources. As such, one can think of repeated replenishment cycles giving rise, at least potentially, to ongoing streams of economic rents from the exploitation of renewable natural resources.[1]

The case of non-renewable resources is quite different from that described above. Here, the replenishment cycle is either effectively non-existent (the case for most minerals) or so long as to be measured in geological time, and thus of no relevance to human activity patterns – as for coal, crude oil, and natural gas. For all intents and purposes, therefore, it is reasonable to assume that there is no (natural) replenishment process for non-renewable resources – that there are finite stocks of these resources present in the Earth's crust. That the sizes of these stocks are not known with certainty adds an element of risk to the analysis, but does not take away from the fact that nature will not (and cannot be assisted to) create additional physical units of non-renewable resources within time frames to which humans can relate in their decision-making processes.[2]

One of the standard theoretical approaches to the economics of non-renewable natural resources was first developed by Harold Hotelling. A key assumption of this family of models is that all units of the ***known*** stock of a non-renewable resource can be produced at a constant marginal extraction cost (which is inferior to the resource's choke price – the price at which the quantity demanded falls to zero). Under standard conditions, this type of model will yield

[1] A complication concerns the fact that some renewable resources are in fact *exhaustible*. Fish stocks are probably the example that would most readily come to mind for many Canadians. This issue will be addressed in the next section of the paper.

[2] An aspect ignored in this discussion is the fact that some non-renewable resources are *recyclable* (think of copper, for example). While this affects the determination of the economic rent that can be generated, the basic story remains as long as flow consumption levels exceed flow volumes recycled, and thus that virgin ore production still occurs. For a more detailed discussion, see Tietenberg (2003, chapter 9). For the purposes of this paper, it is important to note that non-renewable energy resources (coal, crude oil, natural gas, uranium) are ***NOT*** recyclable.

physical exhaustion of the resource in question: *all* units will be extracted. But since there is no replenishment process, every unit consumed at any point in time reduces consumption possibilities in all later time periods and moves the date of physical exhaustion closer to the present. Consumption in the present thus leads to foregone benefits in the future, and by extension foregone consumption in the present leads to additional benefits realized in the future. It is in that sense that stocks of unproduced non-renewable resources are assets: units of these resources "in the ground" are worth something now because their extraction in the future will yield benefits.

Resource owners/producers face an intertemporal allocation problem: should they produce an additional unit of the resource now and forego production of the same unit at a later point in time, or should they leave that unit of the resource "in the ground" and produce it later? Basically, this amounts to a portfolio choice for the owners/producers: at every point in time, do they want to hold their wealth in the form of units of the resource in the ground, or would they rather produce units of the resource and invest the net proceeds (the difference between the market price and the constant marginal extraction cost for each unit produced) in a financial instrument of comparable riskiness (the next best alternative means of holding wealth)? In other words, is wealth to be held "in the ground" or "in the bank"? Therefore, to induce owners/producers to delay production, units of resources in the ground must earn a rate of return. This is where Hotelling's well-known "r-percent rule" comes from: in equilibrium, the price of a unit of resource in the ground (equal to the market price net of the constant marginal extraction cost) must grow at the rate of interest earned by an equally risky financial instrument.

Note that the growing price of a unit of resources in the ground is necessary to induce the owner/producer to delay production, but that it is not necessary to compensate for the cost of

extraction. Therefore, economic rents are being generated. Recall that every unit of this non-renewable resource is of the same quality: the marginal cost of extraction is constant across all units. Therefore, there are no Ricardian-type rents being earned here. Instead, all rents are due to the fact that the resource is intertemporally scarce: there is a known fixed stock to be produced and consumed over time, and eventually this resource will be physically exhausted. This is in sharp contrast to the case of renewable resources where the replenishment cycle can yield – at least potentially – an ever-repeating (under steady-state exploitation) pattern of production and consumption, thus giving rise to ongoing streams of economic rents.

An obvious extension is to relax the homogeneous-quality assumption and instead allow the marginal extraction cost to rise as extraction of the known stock proceeds. This will lead to a situation where cumulative extraction will eventually be such that the marginal extraction cost will exceed the market price, and further extraction will not be economically warranted. In that case, the known stock is not physically exhausted; rather it is *economically* exhausted. In equilibrium, as time and extraction proceed, the quality of the units of resources left in the ground falls in the sense that their marginal extraction cost rises. Current extraction imposes an externality on future extraction: the marginal extraction cost is higher in the future as a result of current production – the so-called degradation effect or charge.

In this case, the economic rent generated by units of resources in the ground can be broken into two components: the standard capital gain discussed earlier (the Hotelling-type scarcity rent), plus the extent to which the degradation charge is reduced by the fact that these units of resources have yet to be produced (Bohi and Toman 1984, p.15). The idea is that any unit of a non-renewable resource left in the ground at time t defers some part of the increase in the marginal extraction cost of future extraction, all else held equal. This is akin to a Ricardian-

type of economic rent since the degradation charge is due to progressively lower-quality resources being extracted. It can be shown that the sum of these two rent components will fall over time (as extraction proceeds), and reach zero precisely when economic exhaustion is reached, since for that last unit produced the marginal cost of extraction will be equal to the market price.

Now, let there be a perfect substitute for the non-renewable resource that is available in infinite supply at a constant marginal cost. As a result, it can no longer be argued that the non-renewable resource is intertemporally scarce, and thus no Hotelling-type scarcity rent will be generated by its exploitation (Hartwick 1982). However, to the extent that the marginal extraction cost of the non-renewable resource grows with cumulative extraction, the same type of Ricardian/quality-differential rents discussed in the previous paragraph will also be generated here. As in the previous case, per-unit economic rents will fall with cumulative extraction and reach a value of zero exactly when economic exhaustion occurs. This time, however, economic exhaustion of the non-renewable resource will occur when its rising marginal extraction cost reaches the marginal cost of the perfect substitute.

A simple, but theoretically rather challenging, step now suggests itself: what if different-quality deposits of a non-renewable resource were exploited at the same time? In that case, not only would marginal extraction costs rise over time for each deposit, but at any point in time deposits with different marginal extraction costs would be in production. In a static sense, this is similar to the case of quality variations across hydro-electric sites, and would thus yield variations in Ricardian rents per unit of production being generated by these deposits. From a dynamic perspective, each deposit would yield flows of the Ricardian-type rents discussed in the

previous paragraph and reach economic exhaustion at a time/cumulative extraction determined, in part, by its specific cost conditions.

As far as equalization is concerned, however, this type of situation could have important implications. Assume, for simplicity, that provincial fiscal regimes seek to capture the economic rents generated by resource exploitation. Differences in marginal extraction costs thus mean that the revenue-generating potential for provincial treasuries varies across deposits of any given non-renewable resource (and also across smaller production units, such as individual wells). Provincial fiscal regimes would reflect these differences by allowing tax/royalty rates to vary across deposits: lower rates for higher cost deposits; higher rates for lower cost deposits, all else equal.[3]

In this context, any kind of approach that seeks to measure a province's fiscal capacity for natural resource tax bases through the use of cross-province (or even within-province) averages of tax rates will thus provide increasingly inaccurate representations of these fiscal capacities as the degree of heterogeneity across deposits increases.[4] This follows from the fact that the more heterogeneous the deposits, the wider would be the range of tax/royalty rates and the less representative of the rate distribution as a whole would be the cross-province average. In addition, such an approach would create equalization-induced incentives for provinces to adopt policies that discourage the development and production of relatively high cost resource deposits.[5] This is because deposits whose costs would warrant below-average tax/rate royalty rates would nonetheless be deemed to be of average fiscal capacity. As a result, such deposits

[3] It is perhaps not surprising (but nonetheless comforting) to note that this pattern of tax/royalty rates is quite consistent with the oil and gas fiscal regimes of Western Canadian provinces, as described in Department of Energy, Government of Alberta (2003).

[4] Note that this applies to both renewable and non-renewable resources, as long as there are quality variations across sites/deposits.

[5] Please note that much more could be said (and, indeed, has already been said by others) on the issue of equalization-induced disincentives to development. Given the time constraints, I chose to focus this paper on the issues raised in the *Letter of Agreement* dated July 4 last.

would be "over-valued" by the equalization system, thus creating incentives for provinces to prevent their development and production in order to curtail "losses" on the equalization front.

It is clear, however, that an approach to the equalization of natural resource revenues based on the *actual* revenues collected by provincial governments would alleviate these problems. Such an approach would implicitly use the entire distribution of tax/royalty rates in effect, thus allowing the heterogeneity of deposits to be more accurately reflected in the calculation of each province's fiscal capacity. By extension, equalization-induced disincentives to the development of high cost resource deposits would also be attenuated, since there would no longer be a tendency for the equalization system to overvalue the fiscal capacity of such deposits.

We could make the basic framework of analysis even more complicated by assuming that the sizes of the endowments of non-renewable resources are not known with certainty, and thus that exploration activities must be undertaken to find units of the non-replenishable stocks. The introduction of this – and other – forms of risk makes the analytics less tractable and the theoretical concept of economic rent even more difficult to measure empirically, among other things. Nonetheless, the basic points highlighted above remain valid: stocks of non-renewable resources are assets which generate economic rents of the Hotelling variety, or of the Ricardian variety, or of both types simultaneously. Even in cases when physical exhaustion does not occur, once economic exhaustion is reached, the remaining stocks of non-renewable resources will no longer be sources of economic rents. As noted above, a key difference between renewable and non-renewable resources rests with the fact that it is possible for the former to yield ongoing streams of economic rents in steady-state production, while the latter will cease to generate economic rents once the value of the resources "in the ground" reaches zero, even if physical exhaustion does not occur.

II. Resource Revenue Savings Behaviour

Through a relatively straightforward extension of the arguments presented in the previous section, it can be shown that the steady-state (constant-stock) exploitation of a renewable resource can lead to a sustained constant per capita (aggregate) consumption level in a model of a simple competitive economy experiencing neither population growth nor technological progress. However, as noted earlier, given the absence of a replenishment process for non-renewable resources, constant-stock exploitation strategies for such resources do not exist. Therefore, ***must*** a competitive economy characterized by the exploitation of non-renewable resources yield a decreasing per capital aggregate consumption level over time as extraction proceeds and the march toward economic or physical exhaustion continues? In a seminal paper, Hartwick (1977) demonstrates that the answer to this question is: no.

In the context, again, of a competitive economy with zero population growth and no technological progress, Hartwick develops a stylized model which he uses to demonstrate that if all of the economic rents generated by the exploitation of a non-renewable resource were to be invested in physical capital, the flow of benefits generated by this reproducible capital would be able to sustain a constant per capita aggregate consumption level.[6] The key insight provided in this paper is that a stock of assets "held" in the form of a non-renewable resource can be transformed into an alternative type of asset, which can then be used to sustain a constant per capita consumption path. For this to be true, the net benefits generated by non-renewable resource exploitation must not be used to fund current consumption, but must be invested in a

[6] There are only real assets in Hartwick (1977), but the same kind of argument could be made to apply to financial assets in a more complicated model.

form of capital that can be accumulated. The reproducible nature of this form of capital then acts to replicate, in some way, the replenishment process characteristic of renewable resources.

In Canada, the Alberta Heritage Savings Trust Fund (whose establishment, one might add, pre-dates the publication of Hartwick's seminal paper!) comes closest to embodying the ideas outlined above. A portion of non-renewable resource revenues collected by the Province of Alberta was to be transferred from the government's general revenues to the Fund, where these would be invested in revenue-yielding instruments "for the benefit of future generations of provincial residents" (Scarfe and Powrie 1980, p.166). The Trust Fund – established in 1976 – received contributions from the provincial government for the next dozen years or so. However, no new injections of funds have been made since 1987. One could argue that the Alberta government anticipated the theoretical argument later made by Hartwick: future generations of Albertans can benefit from today's production and sale of a finite stock of non-renewable resources if (some of) the economic rents generated by these activities are saved and invested in alternative forms of capital that will yield sustained flows of benefits over time.

For our purposes, it is important to note that in a subsequent paper Hartwick (1978) demonstrates that the same type of argument can be made about reductions in the net stock of a *renewable* resource. The economic rents generated by renewable resource production that leads to a reduction in the underlying net stock of the resource must be invested in reproducible capital if a constant per capital consumption path is to be sustained over time.[7] The transformation of these net benefits into reproducible capital acts, in some sense, to supplement the replenishment process that characterizes renewable resources.

[7] This argument can be extended to deal with the case of the production of a renewable resource to the point of exhaustion: as with non-renewable resources, all economic rents thus generated would need to be invested in an alternative form of capital for per capita consumption levels to be maintained.

What does all of this imply for the treatment of natural resource revenues in fiscal equalization? To assess alternative answers to this question, let's adopt a simple frame of reference: the object of fiscal equalization is to equalize provincial government revenues that give rise to net fiscal benefits.[8] Let's also assume that provincial governments seek to capture the economic rents generated from the production and sale of natural resources located within their boundaries. From that perspective, then the arguments outlined earlier provide, at least at a theoretical level, some justification for treating government revenues from non-renewable resources differently from such revenues generated through the production and sale of renewable resources. To the extent that a steady-state approach is assumed used to manage renewable resource exploitation, then *all* government revenues from renewable resources should be available for current spending and thus give rise to net fiscal benefits. On the other hand, if a steady-state approach were to be used to guide provincial governments' treatment of their revenues derived from non-renewable resource exploitation, then all of these revenues would be invested in a reproducible form of capital and only the flow of benefits resulting from this investment would give rise to net fiscal benefits. Therefore, based on the frame of reference adopted above, only these flow revenues (and not the investment flows that ultimately give rise to them) should be made subject to equalization. Indeed, only through such differentiated treatment of the resource revenue flows themselves would fiscal equalization target the sources of net fiscal benefits linked to natural resource exploitation.

Arguments for a similar type of differentiated treatment of provincial renewable and non-renewable resource revenues within the Canadian fiscal equalization system have previously been made in Parliamentary Task Force on Federal-Provincial Fiscal Arrangements (1981),

[8] This is a simplified representation of the "broad-based horizontal equity" approach to fiscal equalization outlined in Economic Council of Canada (1982), Boadway *et al.* (1983), among others.

Economic Council of Canada (1982), and Hobson (2002), among others. However, not all contributors to the analysis of this dimension of public policy are in agreement on this issue. For example, the Standing Senate Committee on National Finance (2002) recently pronounced itself opposed to any such differentiated treatment being extended to natural resource revenues within Canada's fiscal equalization system.

Nonetheless, it seems quite clear that the *theory-based* arguments in favour of the kind differentiated treatment described about are quite compelling, and would be consistent with an approach to equalization that incorporated a broad-based view of horizontal equity (basically, one that addresses ***all*** inter-provincial differences in net fiscal benefits). In practice, an important argument ***against*** such an approach is that the (theoretically necessary) investment of provincial non-renewable resource revenues in reproducible forms of capital has but rarely occurred. As noted earlier, the main example of such a savings/investment vehicle has been the Alberta Heritage Savings Trust Fund (AHSTF), and even there it has been almost 20 years since the Government of Alberta last "saved" some of its non-renewable resource revenues by transferring them to this Fund.[9] No other province has set up anything remotely comparable to the AHSTF, and so the savings/investment behaviour dictated by the theoretical treatment provided above simply does not appear to have been forthcoming to any significant degree in nine provinces.

In general, therefore, it seems reasonable to conclude that ***all*** flows of provincial non-renewable resource revenues have been used by provincial governments to generate net fiscal benefits for their residents, at least for the last two decades. This makes it difficult, from a public policy perspective, to justify treating provincial non-renewable resource revenues differently from renewable resource revenues for fiscal equalization purposes. It should be noted, however, that the absence of differential treatment across resource revenues of the type outlined above

[9] Note, however, that Alberta has recently created a number of "endowment" and similar types of funds.

will, in itself, provide a disincentive for equalization-receiving provinces to save and invest some of their non-renewable resource revenues. Take the current equalization arrangements as an example. All else held equal, under these arrangements equalization payments to a given "have not" province would be the same whether its government chose to spend all of its non-renewable resource revenues in the same fiscal year as these are earned, or whether it opted to invest all of its non-renewable resource revenues and spend only the annual returns from such cumulated investments in any given fiscal year. For some years at least, a savings-induced reduction in the means to generate current net fiscal benefits for the residents of the province in question would not be compensated by an increase in equalization payments. For a given level of spending, this clearly provides an incentive for the provincial government to spend rather than save its non-renewable resource revenues. To my knowledge, the empirical significance of this equalization-driven incentive to spend all provincial non-renewable resource revenues as these are realized has never been formally assessed.

Another argument against differentiated treatment rests with the fact that government revenues, once realized, are completely fungible. Let's assume, for the sake of argument, that the equalization system were modified to allow the different treatments of non-renewable and of renewable resource revenues outlined above: provincial non-renewable resource revenues invested through an AHSTF-type vehicle would be excluded in the calculation of equalization payments. The government of an equalization-receiving province could, at least potentially, choose to prevent higher non-renewable resource revenues from reducing its equalization entitlements by transferring all of the increased revenues to a "non-renewable resource trust fund". That same government could simultaneously choose to deliver to the province's residents the level of net fiscal benefits associated with the full spending of all its non-renewable resource

revenues simply by running an offsetting budget deficit. There is no *net* change in the government's asset and liability position: an increase in the value of the trust fund is exactly offset by an increase in the non-consolidated public debt. The consolidated debt remains exactly the same, *excluding the effects on equalization payments*. However, in the hypothetical system assumed to prevail, equalization payments to this province would be *higher* if it chose the deficit-financing strategy, all else held equal. Differential treatment of provincial natural resource revenues within the equalization system makes it possible for the government of a "have not" province to increase its equalization payments simply by effecting a change in accounting practices. It strikes me that, from a public policy perspective, this would not be a desirable characteristic for any system of fiscal equalization actually implemented.

Mintz and Poschmann (2004) have argued that a way of dealing with this problem is to include deficits incurred by any provincial government as sources of funds available to generate net fiscal benefits for the residents of that province. As the title of their paper suggests, the idea would be to "follow the cash" and adjust equalization payments *downward* to reflect the fact that flow borrowings by provincial governments are used to generate net fiscal benefits in the same fiscal year.[10] Apart from the "mechanical" problems of identifying a means of incorporating "provincial budget deficits" in the equalization formula (add a 34th "tax base"?), difficult political issues would be created by such a modification. I can't imagine any federal government relishing the task of informing the government of a "have not" province that it would receive lower equalization payments this fiscal year because it ran a budget deficit! The ensuing uproar over the "clawback" of non-existent revenues would create a difficult political situation for the

[10] To be fair to Mintz and Poschmann (2004), one of their main concerns is to ensure that the equalization system *as a whole* not provide additional incentives for provincial governments to run budget deficits.

federal government, thus ensuring – in my view – that the notion of incorporating provincial budget deficits in the equalization formula is almost certainly a non-starter.

III. Volatility of Natural Resource Prices

Plourde and Watkins (1998, p.246) compared the volatility over the 1982-1994 period of the prices of numerous international commodities (including a number of internationally traded non-ferrous minerals, precious metals, and agricultural commodities) and concluded that "crude oil is in the upper range of all measures of price volatility studied". In the post-1994 period, industry analysts have suggested that, if anything, crude oil prices appear to have increased in volatility. On a similar note, since the late 1990's North American natural gas prices are also perceived as being generally higher and more volatile than in previous decades. All of this would suggest that the evolution of energy prices in Canada could have important implications for fiscal equalization, depending on the extent to which energy revenues are included in the equalization system.

But how does the volatility of energy prices compare to that of other key economic variables? To address this question, I decided to use the Canada-US exchange rate (represented as the price of foreign exchange – PFX, measured in units of Canadian currency per US dollar) – as the yardstick against which to compare the volatility of energy prices. The rationale here is simply that exchange rates are usually considered difficult to forecast because of their inherent volatility – a "volatile" key economic price is thus being compared to "volatile" energy prices.

Monthly observations for the exchange rate, the price of Canadian par crude oil, and Alberta's reference price for natural gas were obtained for the period extending from January

1976 to April 2005.[11] For each series, monthly rates of change were obtained by subtracting the natural logarithm of prices recorded in adjacent months: $PDOT_t = \ln(P_t) - \ln(P_{t-1})$. The resulting time series are depicted in Figure 1. These series tell a rather striking story: monthly rates of changes in PFX, represented by the thicker line, are clearly much "smaller" than those for both crude oil and natural gas prices. While the upward trends in crude oil and natural gas price levels are much more pronounced than for PFX during the sample period, what is also noteworthy is that monthly energy price reductions are also proportionately larger (in absolute value) than for PFX.

The descriptive statistics reported in Table 1 lend additional support to the conclusion that energy prices are more volatile than the Canada-US exchange rate. Average rates of energy price changes are systematically "larger" and characterized by larger variances than average rates of change in PFX. Absolute values of these growth rates are also larger, on average, for energy prices than for PFX. These results hold true for the sample period as a whole and for each 10-year (or so) sub-sample.[12] Further, since the beginning of 1986 (and the onset of price deregulation for crude oil and natural gas in Canada), more than 90% of all monthly changes in PFX have been less than 2% in absolute value and there have no observed monthly changes greater than 6%. In the case of crude oil, fewer than 20% of all monthly price changes have been less than 2% in absolute value and more than 40% of all recorded changes during the same period have been greater than 6%. The story is quite similar for natural gas: fewer than 30% of

[11] Note that the reference price is used by the Government of Alberta in the calculation of royalty payments owed to the province by natural gas producers.

[12] While the 10-year sub-samples are arbitrary, they also correspond rather closely to distinct periods in the evolution of energy prices. Between 1976 and 1985, field prices of crude oil and natural gas were regulated by the Canadian government. Energy price deregulation in Canada and the United States was largely complete when a sustained drop in world oil prices began in 1986. A gradual recovery in energy prices began in the second half of the 1990s and eventually led to the high (in nominal terms) prices of crude oil and natural gas observed since the turn of the century.

monthly price changes since January 1986 have been less than 2% in absolute value, while more than 35% of these changes have exceeded 6% in absolute value terms.

For the purposes of this paper, we need to consider whether this volatility in energy prices translates into volatile provincial government revenues and through this affect Canada's fiscal equalization system. Figures 2 to 6 present some useful information on this score for the period 1981 to 2002 (the last year for which data were available at the time of writing). Each figure shows nominal per capita revenues accruing to provincial governments from the application of a specific tax instrument: direct taxes on corporate and government business enterprises (summarized as "corporate income tax", or CIT); personal income taxes (PIT); retail sales taxes; and taxes on natural resources (royalties plus miscellaneous taxes on natural resources). Note that all four are measures of important tax bases used in the calculation of equalization payments.

All of the data series used to construct these figures were obtained from CANSIM, Statistics Canada's electronic database.[13] A subset of three provinces was selected in an effort to present a range of possible situations in the context of fiscal equalization: from Alberta – a "have" province with high natural resource revenues, to Ontario – a "have" province with low natural resource revenues, to New Brunswick – a "have not" province with low resource revenues.[14]

Figure 3 and 4 suggest that, for all provinces considered and for Canada as a whole, per capita PIT and sales tax revenues accruing to provincial governments rose rather steadily between 1981 and 2002. There are very few sudden departures from trends, which suggests that

[13] Note that the information on provincial government revenues is that reported in Statistics Canada's *Provincial Economic Accounts*, publication no. 13-213.
[14] It would be instructive to expand this analysis to include other provinces; the case of Saskatchewan – (often) a "have not" province with significant resource revenues – might be particularly interesting to consider.

it would very unlikely for the underlying tax bases to create a lot of volatility in equalization payments in most standard applications of a "representative tax system" (RTS) approach to fiscal equalization. In the case of provincial CIT revenues, growth patterns are less smooth (especially in Alberta), but per capita revenues from this source are typically smaller than for the sources considered in Figures 3 and 4. Note that the most volatile per capita provincial CIT revenues occur in Alberta, the province with the largest oil and gas production industry. It would be important here to study more carefully the evolution of CIT rates to determine how much of this volatility was due to changes in rates as opposed to changes in the underlying tax base (and in the various factors influencing this base). Nonetheless, the result remind us that provincial resource revenues (here specifically those linked to oil and gas production) can potentially be indirect causes of volatility in equalization payments.

Figures 5 and 6 tell a different story. First, the profoundly uneven distribution of natural resource revenues across provinces is clearly evident: over the sample period, per capita provincial natural resource revenues in Alberta were about six times the Canadian average and about 16 times that realized in the other nine provinces. All in all, more than 60% of all provincial natural resource revenues between 1981 and 2002 accrued to the Government of Alberta. Second, given that almost all of Alberta's resource revenues are linked to oil and gas production activities, Figures 5 and 6 also highlight the scope for energy revenues to affect equalization payments.

Figure 5 also shows why provincial energy revenues are a potentially important source of volatility in equalization payments. For example, between 1985 and 1986, at a time when world oil prices fell dramatically, per capita provincial natural resource revenues in Alberta dropped by about 40%, from $2140 to $1205. The opposite occurred in 2000 when North American natural

gas prices reached values well above their historical range: per capita resource revenues in Alberta more than doubled in a single year, rising to $3042 from $1376 in 1999.[15] Note as well what happens when Alberta's resource revenues are excluded in the calculation of the Canada-wide average (Figure 6): the evolution of per capita provincial revenues from that source now follows a relatively smooth path between 1981 and 2002. Taking Alberta out of this calculation means a reduction in both the absolute and the relative importance of energy revenues in overall provincial resource revenues, which in itself contributes to this smoother path. By extension, this means that the greater the share of total provincial energy revenues included in the equalization formula, the more likely is it that that volatility of equalization payments will rise.

IV. Rent Capture Strategies of Provincial Governments[16]

A sustained (and mostly implicit) assumption made in this paper is that the objective of provincial governments is to design and deploy revenue-generating instruments that seek to capture for their residents the economic rents generated by the exploitation of renewable and non-renewable resources within areas under their jurisdiction. This is a difficult task, not only because translating the concept of "economic rent" into something that can be measured using available data is a challenge in itself, but also because the operating environment of resource industries (particularly, but not exclusively, those dealing with non-renewable resources) is characterized by significant degrees of risk and uncertainty that need to be reflected in the "calculation" of rents. In turn, this creates differences between *ex ante* and *ex post* measures of rents, where the former refers to measures based on information available at the onset of

[15] The price of Canadian par crude oil was $37.65 per barrel in December 1985; it fell to less than $17 by July 1986. During 1999, Alberta's reference price for natural gas averaged $2.35 per gigajoule; in 2000, the corresponding value was $4.27.

[16] Note that this section contains no discussion of the effectiveness of rent capture strategies in forestry and mining, which can be explained by my lack of familiarity with the literature in these areas.

activities when the future values of the variables determining rents are not known with certainty. *Ex post* rents, on the other hand, are calculated after the fact, when the values of all the relevant variables are known with certainty.

Given these difficulties, it is perhaps not surprising that assessments of the degree of success that government policies have at capturing economic rents are relatively sparse. As far as Alberta's oil and gas resources are concerned, it seems that the only systematic studies of government rent capture ever undertaken (and published) were completed more than two decades ago. Watkins (1975) and Watkins and Kirkby (1981) examine the degree of success of the province's system of royalties and bonus bids in capturing economic rents during the 1960s and 1970s. The evidence provided in these studies suggests that for the cases examined, this system was successful in capturing a high proportion of *ex ante* rents, but much less successful in capturing a significant share of *ex post* rents: most of the changes in rents unanticipated at the beginning of operations accrued to producers. Although prices, cost conditions, and the provincial fiscal regimes applicable to oil and gas production have all changed dramatically since the beginning of the 1980s, very little research seems to have been done to assess the effectiveness of the producing provinces' subsequent rent capture strategies.[17]

In a series of contributions, Helliwell *et al.* (1989, for example) examined the generation, distribution, and dissipation of economic rents from the exploitation of the Western Canadian oil and gas deposits. Their key conclusion was that the dissipation of economic rents was almost exclusively linked to the under-pricing of crude oil and natural gas that characterized Canada's regulated pricing system – a factor that ceased to be relevant with the deregulation of Canadian crude oil and natural gas prices in the second half of the 1980s. The work of Helliwell *et al.*,

[17] A compendium of the oil and gas fiscal regimes of the western provinces and territories in effect as of late 2003 is provided in Department of Energy, Government of Alberta (2003). It does not include, however, descriptions of bonus bids and land tenure systems.

however, provides very little insight into the effectiveness of the provincial fiscal regimes in capturing economic rents for the residents of the producing provinces.

Studies have also been undertaken into the strategies adopted by provincial governments to capture the rents potentially generated by hydro-electric sites. Bernard *et al.* (1984) and Zuker and Jenkins (1984) are key examples of this kind of work and both deal with all relevant provincial jurisdictions in Canada. More recently, FCPP (2004) outlines the results of a 1994 study aimed at assessing the extent of hydro-electric rent dissipation in Manitoba. The conclusions reached in all these studies are strikingly similar: provincial governments have not sought to capture all available hydro-electric rents, but instead have allowed electricity to remain under-priced, thus letting some of the rents be captured by electricity consumers and allowing the rest to be dissipated.

Evidence that a portion of hydro-electric rents have been dissipated as a result of provincial government policy decisions has led to suggestions that measures of *potential* hydro rents be incorporated into the fiscal equalization system since these provided more accurate measures of the fiscal capacity of provinces. Economic Council of Canada (1982) and Royal Commission on the Economic Union and Development Prospects for Canada (1985), for example, indicate that such an approach would be desirable.[18] Both also note, however, that it would be premature to move to such a treatment of hydro rents in fiscal equalization since much work needed to be done to develop the kinds of instruments required to provide the necessary approximations to the underlying measures of economic rents. The fact that we have not made much progress down this path is confirmed by Expert Panel on Equalization and Territorial Formula Financing (2005a, p.25) where exactly the same point is made two decades or so later.

[18] Economic Council of Canada (1982) explicitly refers to a 1982 version of Zuker and Jenkins (1984). A version of Bernard *et al*. (1984) circulated in discussion paper form beginning in 1982.

The information provided in this section suggests that while the notion of relying on measures of potential resource rents for equalization purposes might be quite interesting, a few factors indicate that it is still quite a ways from being in position to be considered seriously. In particular, discussions of rent dissipation have tended to focus on hydro-electricity generation. However, as we have seen earlier, the evidence on the effectiveness of provincial resource rent capture strategies in general is rather dated and overall quite sparse.

As far as oil and gas is concerned, Watkins and Kirkby (1981) raise some questions as to the effectiveness for capturing *ex post* rents of Alberta's system of royalties and bonus bids in effect in the late 1970s.The intervening years do not appear to have yielded published research results that challenge the validity of this conclusion for more contemporary versions of the province's rent collection regime. Until such results are available, it would appear inappropriate to focus only on potential hydro-electric rents as targets for inclusion in fiscal equalization calculations. Finally, as noted earlier, the tools needed to derive approximations to the value of these potential rents are not currently available. And it seems quite reasonable to think that their development and implementation for equalization purposes would be time-consuming, technically challenging, and likely to prove quite controversial, given the observed large degree of heterogeneity across deposits for most natural resources.

V. Resource Revenues in Equalization: Brief Overview of Selected Proposals

This section provides a brief overview of a number of proposals dealing with the treatment of resource revenues in equalization. All in all, twelve different proposals are considered, and there is no claim that this list is exhaustive. As Table 2 indicates, the focus is on six different aspects of the proposed treatment of provincial resource revenues – aspects

particularly relevant to assessing the overall role of these revenues in fiscal equalization. Since some the details and subtleties of the proposed treatments will not be adequately reflected in this kind of overview, interested readers are invited to consult the original contributions to get the full flavour of the various proposals.

The six aspects summarized in Table 2 can be described as follows:

- Are all of the provinces included in the determination of the revenues / tax bases eligible for equalization? Basically, is the proposed treatment akin to a 10-province / national standard approach or is it more selective, like the current five-province standard?
- What measures of revenues enter the equalization formula, or how are the relevant tax bases calculated? The options here are: using the revenues actually received by each province; using measures of fiscal capacity based on average tax rates; using measures of potential economic rents, as opposed to revenues collected.
- Are revenues from renewable resources to be treated differently than those from non-renewable resources?
- Are provincial non-renewable resource revenues transferred to an AHSTF-type "trust fund" to be excluded from the revenues deemed eligible for equalization?
- What proportion of provincial resource revenues are to be subject to equalization?
- What overall approach to equalization is used? Three options are considered: the "one-tier, gross" approach includes resource revenues as separate tax bases, but does not treat these tax bases any differently, "have not" provinces receive equalization payments, but "have" provinces do not contribute directly; the "two-

tier, net" approach separates resource-related tax bases from all others, and provides for a different equalization treatment of the two groups, a net approach is used within the resource-revenues tier (resource-rich provinces contribute directly and resource-poor provinces share these total contributions, but there are usually restrictions on the entitlements from this tier that are driven by outcomes in the non-resource-related tier); in a "sharing pool, net" approach, resource revenues are treated outside of formal equalization system itself, and contributions from all provinces are pooled and re-distributed.

As Table 2 shows, all proposals considered support a 10-province or nation-wide approach. Note that some of this support is "implicit" (*e.g.,* Gainer and Powrie (1975)) because the proposals were outlined in the context of the all-province type of approach in effect at the time of writing. Nonetheless, the notion of excluding some provinces from the determination of relevant average tax rates or tax bases, as embodied in the current five-province standard, finds no support amongst the authors of any of these twelve proposals.

All of the proposed "two-tier" and "sharing pool" approaches are built on the notion that measures of revenues actually received by the provinces will drive the equalization/revenue-sharing arrangements. There is some limited support (Economic Council of Canada (1982) and Feehan (2004)) for focusing on potential rents, as opposed to revenue measures, for equalization purposes. By and large, however, proposals articulated around a "one-tier" system retained the notion of representative/average tax rates and bases as in integral component of fiscal equalization.

In general, there is strong support among the proposals considered for the equal treatment of revenues from all natural resources, be they renewable or non-renewable. Two types of

exceptions to this approach should be noted. First, Standing Committee Senate Committee on National Finance (2002) seems to endorse the full inclusion of revenues from renewable resources (the text is not very clear on this point), but clearly favours including only a portion of non-renewable resource revenues, with that portion being less than the 70% currently provided under the so-called generic solution. Boessenkool (2001) and Martin (2001), on the other hand, support the outright exclusion from equalization of provincial revenues collected from some or all non-renewable resource industries.

The treatment of resource revenue transfers to trust funds is simply not addressed in a number of proposals. However, in those where it is explicitly mentioned, only in Feehan (2004) is there opposition to the idea of excluding these revenue flows from equalization.

Courchene (2004) discusses another type of exclusion for a portion of provincial resource revenues, namely to net out from these revenues amounts equal to the expenditures by provincial governments on infrastructure (and similar items) necessary for resource developments to occur. After all, the argument goes, these amounts are no longer available to generate net fiscal benefits for residents and so should not factor into equalization calculations. While appealing, this argument seems less than convincing. If provincial government expenditures on infrastructure are necessary to ensure that specific resource developments proceed and serve no other purpose, then it is hard to make a case that it is spending on public goods. Instead, it seems much more akin to project expenditures that would otherwise need to be undertaken by the developer. Provincial governments can certainly decide to subsidize private expenditures, but it is not clear to me why the cost to provincial treasuries of doing so should be reduced by excluding an offsetting amount of resource revenues from equalization. On the other hand, if the relevant infrastructure serves not only specific resource developments but also a broader range of needs,

then it is more akin to a public good: a source of net fiscal benefits for residents. In that case, excluding an offsetting amount of resource revenues from equalization would appear, quite simply, to run counter to the underlying objectives of the program.

An examination of the approaches where both renewable and non-renewable resource revenues are included in the equalization calculations reveals a near unanimity on the notion that this inclusion should extend only a portion of such revenues. Hobson (2002), for example, suggests that this portion be equal to 70%. However, most of the approaches considered suggest that somewhere between 20% and 30% of provincial resource revenues be subject to equalization.

What arguments are offered to support such choices? Economic Council of Canada (1982) points out that to equalize all net fiscal benefit differentials across provinces would require all resource revenues to be subject to equalization. A number of contributors suggest that this full inclusion of resource revenues would run counter, at least in spirit, to the *Constitution Act 1982* (and its predecessor, the *British North America Act*) which vests the province with ownership rights in, and thus control over, natural resources located within their boundaries. Gainer and Powrie (1975) and later Hobson (2002) invoke constitutional provisions to argue that provincial resource revenues should be treated as if these had accrued to private (corporate) owners, and thus that a portion equal to the federal corporate income tax rate – assumed to be 30% - should be transferred by the provinces to the federal treasury. The remaining 70% of the resource revenues collected by each province should be subject to equalization.

Other contributors take the constitutional argument in a different direction, and begin with the premise that property rights to resources should be thought of as vesting in the *residents* of the provinces. Based on this, Parliamentary Task Force on Federal-Provincial Fiscal

Arrangements (1981) then concludes that the share of revenues subject to equalization should be equal to the proportion that would have been collected by each province had these revenues been earned by residents and treated as taxable income. The relevant proportion is thus the provincial (marginal) personal income tax rate (or the corporate income tax rate, or some weighted average of the two).

Economic Council of Canada (1982), among others, begins with the same underlying premise, but reaches a different conclusion as to the portion of provincial resource revenues that should be included in equalization calculations. It is argued that, for consistency with the "narrow-based" view of horizontal equity, residents of different provinces that are equally well off after provincial fiscal actions should also be equally well of after federal fiscal actions. Since provincial resource revenues are assumed to be distributed to residents (and not to corporations), then the narrow-based view of horizontal equity would suggest that these revenues be treated as income and thus considered as taxable income by the federal government. As a result, the appropriate proportion of provincial resource revenues to be subject to equalization is given by the federal (marginal) personal income tax rate.

Other contributors (such as Royal Commission (1985) and Feehan (1984)) make practical arguments (*e.g.*, politically acceptable / good compromise) in support of an inclusion rate between 25% and 30%. In the end, as noted earlier, a clear majority of proposals incorporate an inclusion rate of somewhere between 20% and 30% of provincial resource revenues for fiscal equalization purposes.

Most of the proposed approaches were developed in the context of a one-tier approach to equalization: resource revenues are to be treated like all other tax bases. The idea of treating resource revenues separately from other types of revenues has been incorporated in two-tier

systems (of the contributions considered in this section, Courchene and Copplestone (1980) provide the most detailed description of such an approach) and within the context of a sharing pool for resource revenues outside of the equalization system (as in Helliwell and Scott (1981)).

An appealing property of such two-tier systems and sharing pools is that these directly address the double asymmetry that any approach to fiscal equalization must contend with in Canada: the resources are where the people (and the bulk of the economic activity) are not. As noted earlier, provincial resource revenues are very unevenly distributed, with the 10% of Canadians living in Alberta collecting more than 60% of the Canadian total. However, more than one-third of Canadians live in Ontario, where in excess of 40% of the country's GDP originates. In a 10-province, "gross" equalization system, an increase in natural gas prices, for example, which raises royalty revenues in Alberta, would yield additional equalization payments to "have not" provinces – and a large proportion of these additional liabilities (or reductions in net fiscal benefits delivered by the federal government – and hence not subject to compensating changes in equalization payments) would be borne by federal taxpayers in Ontario. Why should additional net fiscal benefits available to Alberta residents create an equalization-induced liability for the residents of Ontario?

This issue does not arise in "net" systems, such as those proposed by Courchene and Copplestone (1980) and Helliwell and Scott (1981). In these cases, a portion of resource revenues would be contributed by all provinces and then be shared by all provinces according to a set rule, usually something like each province's population. The increase in natural gas royalties discussed in the previous paragraph would lead Alberta to increase its flow of contributions to fund equalization (or revenue sharing), and all the provinces would share in these additional revenues according to their population share (for example). Thus, additional

resource revenues in Alberta would not yield additional equalization-induced liabilities for Ontarians.

This is indeed an attractive property of "net" systems. An important drawback, however, is that contrary to "gross" systems, these cannot be implemented solely through actions undertaken by the federal government – "net" systems require the active support and participation of all provinces, especially *resource-rich* provinces. Alberta, for example would have to willingly make a portion of its resource revenues available for equalization or revenue-sharing. Royal Commission on the Economic Union and the Development Prospects for Canada (1985, p.195) noted that there was no evidence that provinces were willing to play the kind of cross-province redistributive role associated with two-tier equalization systems and revenue sharing pools. The intervening two decades do not appear to have perceptibly altered this situation.

Figure 1.
Monthly Rates of Price Change, Jan-76 to Apr-05
(sources: Statistics Canada, NRCan, Alberta Department of Energy)

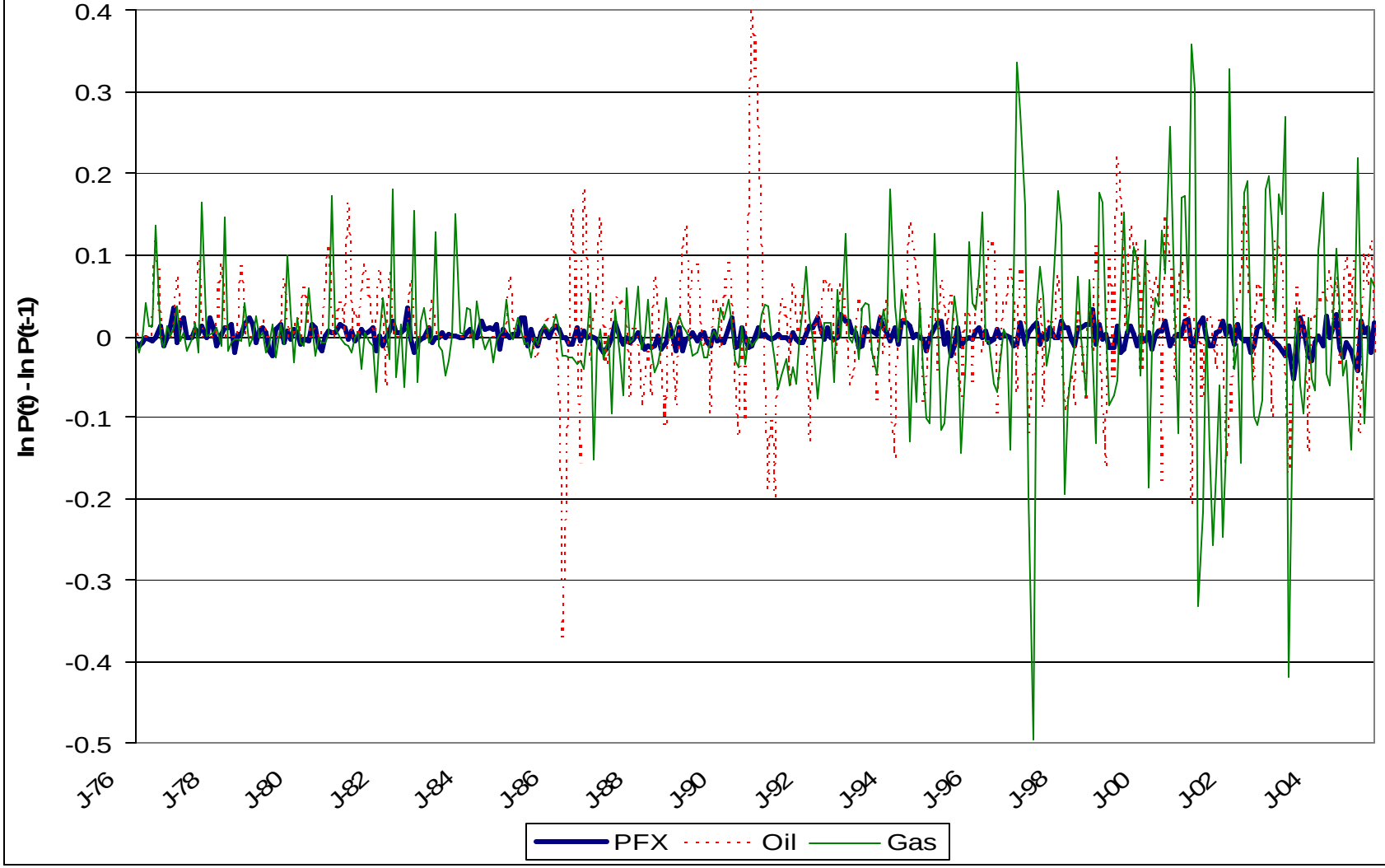

TABLE 1
Summary Statistics: Monthly Rates of Price Changes and Their Absolute Values
Canada-US Exhange Rate, Canadian Crude Oil and Natural Gas Prices

	Monthly Rates of Price Changes			**Absolute Values of Monthly Rates of Price Changes**	
	Average	***Median***	***Variance***	***Average***	***Median***
01/1976 – 04/2005					
Exchange Rate – PFX	0.00056	0.00051	0.00015	0.00950	0.00822
Crude Oil	0.00594	0	0.00539	0.04846	0.03319
Natural Gas	0.00649	0	0.00846	0.05651	0.02879
01/1976 – 12/1985					
Exchange Rate – PFX	0.00266	0.00312	0.00011	0.00864	0.00742
Crude Oil	0.01271	0	0.00105	0.01483	0
Natural Gas	0.01011	0.00035	0.00205	0.02585	0.01333
01/1986 – 12/1995					
Exchange Rate – PFX	-0.00015	0.03041	0.00011	0.00837	0.08704
Crude Oil	-0.00344	0.04082	0.00852	0.06499	0.21729
Natural Gas	-0.00430	0.05326	0.00264	0.03674	0.62052
01/1996 – 05/2005					
Exchange Rate – PFX	-0.00092	0.00026	0.00022	0.01163	0.01040
Crude Oil	0.00874	0.01762	0.00665	0.06676	0.05514
Natural Gas	0.01416	0.01044	0.02153	0.11054	0.07939

NOTES:

- Monthly data for the Canada-US exchange rate obtained from Statistics Canada, Canadian dollars per unit of US currency; crude oil prices (Canadian par at Edmonton) taken from a website maintained by Natural Resources Canada's Oil Division, current dollars per barrel; natural gas prices (Alberta reference price) obtained from Alberta's Department of Energy, current dollars per gigajoule.
- Monthly rates of price changes are calculated as: $PDOT_t = \ln(P_t) - \ln(P_{t-1})$.

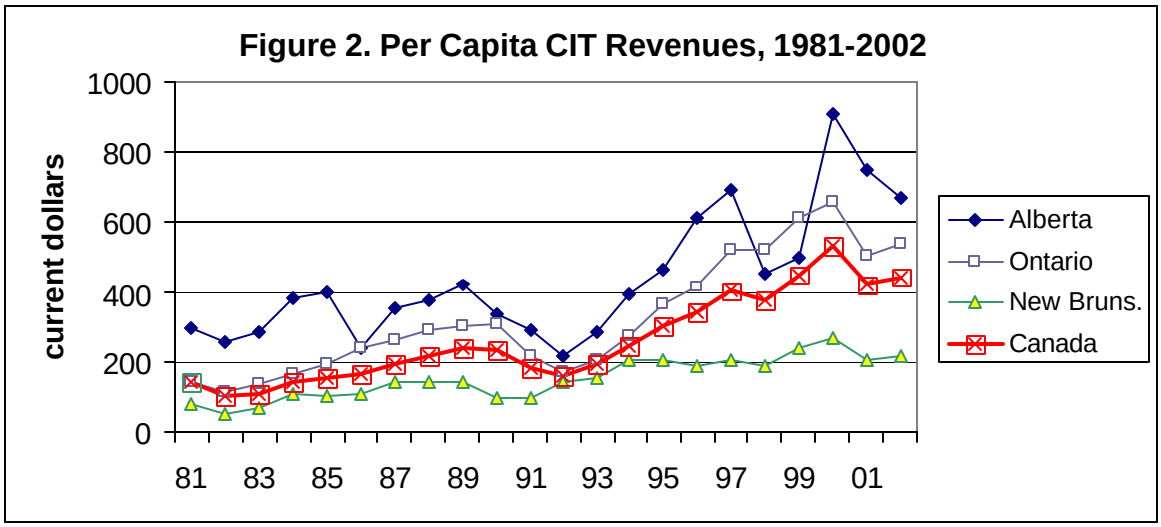
Figure 2. Per Capita CIT Revenues, 1981-2002
current dollars
1000
800
600
400
200
0
81
83
85
87
89
91
93
95
97
99
01
Alberta
Ontario
New Bruns.
Canada

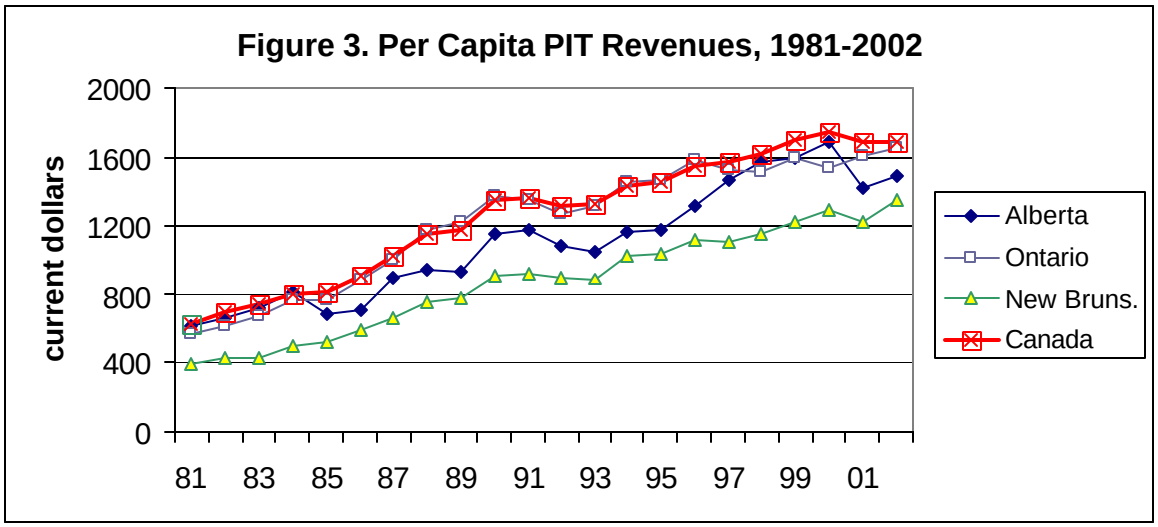
Figure 3. Per Capita PIT Revenues, 1981-2002
current dollars
2000
1600
1200
800
400
0
81
83
85
87
89
91
93
95
97
99
01
Alberta
Ontario
New Bruns.
Canada

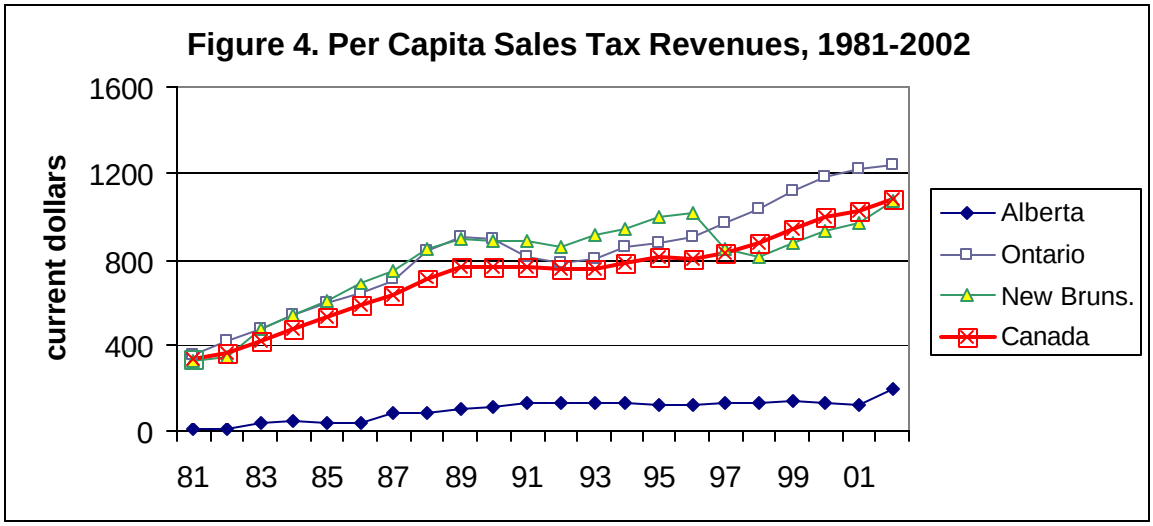
Figure 4. Per Capita Sales Tax Revenues, 1981-2002
current dollars
1600
1200
800
400
0
81
83
85
87
89
91
93
95
97
99
01
Alberta
Ontario
New Bruns.
Canada

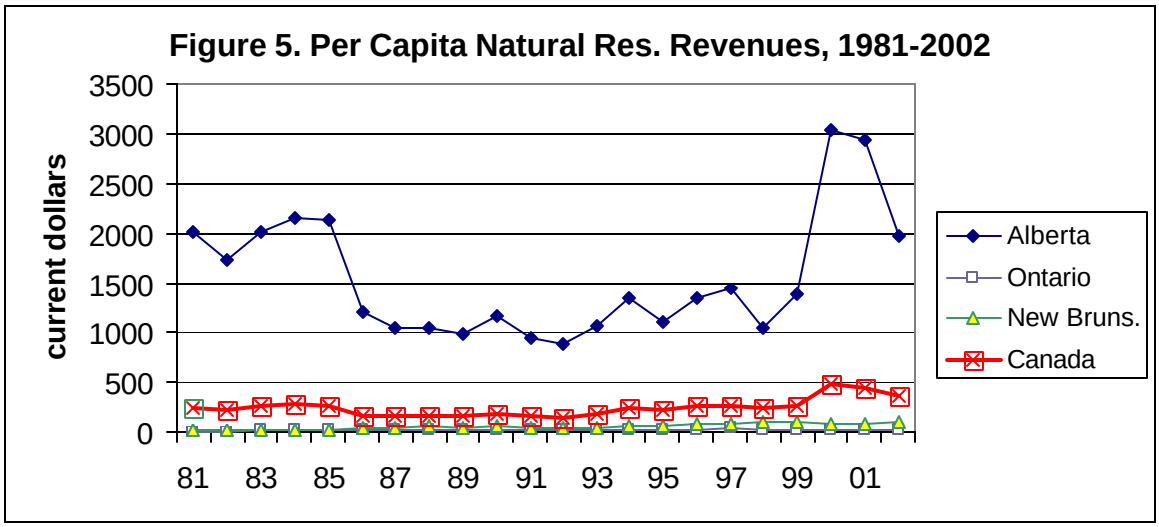
Figure 5. Per Capita Natural Res. Revenues, 1981-2002
current dollars
3500
3000
2500
2000
1500
1000
500
0
81
83
85
87
89
91
93
95
97
99
01
Alberta
Ontario
New Bruns.
Canada

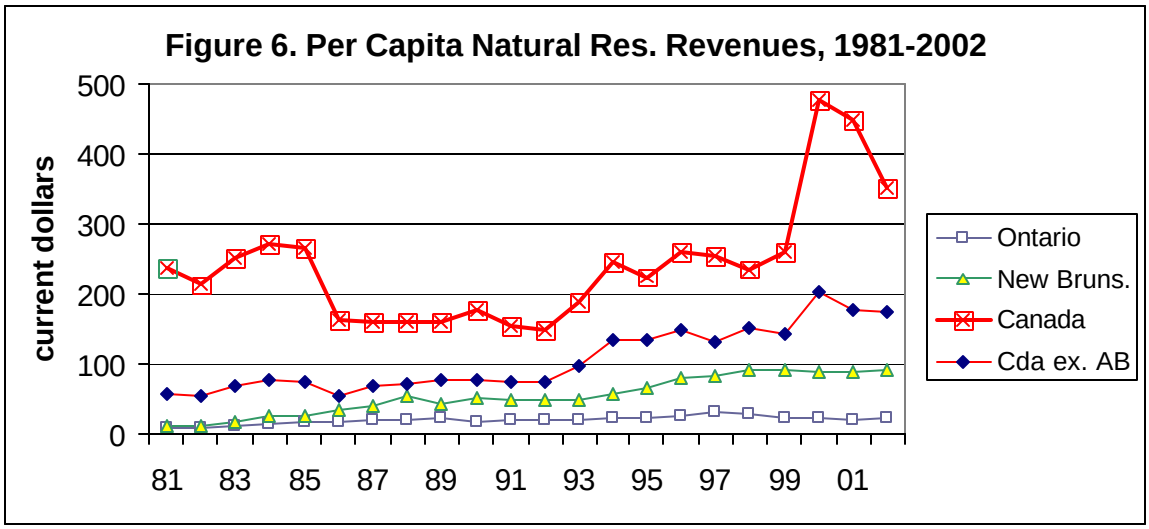
Figure 6. Per Capita Natural Res. Revenues, 1981-2002
current dollars
500
400
300
200
100
0
81
83
85
87
89
91
93
95
97
99
01
Ontario
New Bruns.
Canada
Cda ex. AB

TABLE 2
Overview of Selected Proposed Equalization Treatment of Provincial Natural Resource Revenues

Author(s)	*10-province approach?*	*Average tax rates? Potential tax rates? Actual revenues?*	*Different treatments for renewable & non-renewable resources?*	*Exclude "trust fund" contributions?*	*Proportion of provincial resource revenues included*	*One-tier? Two-Tier? Sharing pool?*
Gainer and Powrie (1975)	yes (implicit)	actual revenues	? no (Powrie (1981)	?	70%	two-tier (net)
Courchene and Copplestone (1980)	yes	actual revenues	no	?	100%, but capped	two-tier (net)
Parliamentary Task Force… (1981)	yes (implicit)	average rates (?)	no	yes	provincial PIT/CIT rates ~ 20%	one-tier (gross)
Helliwell and Scott (1981)	yes	actual revenues	no	no (?)	25%	sharing pool (net)
Economic Council of Canada (1982)	yes (implicit)	potential rates	no	yes	federal PIT rate ~ 25%	one-tier (gross)
Boadway, Flatters , and LeBlanc (1983)	yes	actual revenues	no	?	federal PIT rate ~ 25%	two-tier (?) (net)
Royal Commission… (1985)	yes	average rates (?)	no	yes	25-30%	one-tier (gross)
Boessenkool (2001)	yes	average rates	non-renewable : out renewable : in	not applicable	100% (renewable)	one-tier (gross)

TABLE 2 (continued)
Overview of Selected Proposed Equalization Treatment of Provincial Natural Resource Revenues

Author(s)	*10-province approach?*	*Average tax rates? Potential tax rates? Actual revenues?*	*Different treatments for renewable & non-renewable resources?*	*Exclude "trust fund" contributions?*	*Proportion of provincial. resource revenues included?*	*One-tier? Two-Tier? Sharing pool?*
Martin (2001)	yes	average rates	oil & gas: out all others: in	not applicable	oil & gas: 0% others: 100%	one-tier (gross)
Hobson (2002)	yes	average rates	no	yes	70%	one-tier (gross)
Standing Senate Committee on National Finance (2002)	yes	average rates (?)	yes	no (?)	renew: 100% non-re: <70%	one-tier (gross)
Feehan (2004)	yes	potential rates	no	no	25%	one-tier (gross)

NOTE : ***The contents of Table 2 are subject to revision.***

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