

Selling the Family Silver: Alberta's Fiscal Management in the Era of Oil

by

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1. Introduction

Possessing a large stock of natural resource wealth can be as a blessing, as well as a curse. The inheritance of large stocks of oil and natural gas pose numerous challenges for the government of Alberta. Government revenue can be rapidly eroded due to external shocks in the world price of oil. Also, growth in other sectors may be compromised by high demand in the resource sector, and moreover, the resources are finite, raising questions on how to allocate resource wealth equitably amongst different generations. It is possible that one day the stocks of resources will run out; therefore, long term foresight in policy formulation today should address the financial situation of Albertans in the future. The widely criticized misuse of revenues from North Sea oil by the United Kingdom¹ supports an investigation into the use of revenues from non-renewable natural resources in order for Alberta to avoid making similar mistakes.

Fiscal policy at the provincial level is central to overcoming the challenges of resource wealth, and in determining the long run economic well being of Albertans. Decisions made to spend or save revenues involve tradeoffs between current and future rewards. As it stands, over the last twenty years the provincial government has saved only 2% of total resource revenues. Despite the large surpluses in recent years, deposits into the Heritage Fund have been minute, and the consequences of this are to be inherited by future generations.

Through empirical analysis, two separate yet similar investigations are made. Firstly, the alternative fiscal outcomes that would have arisen if the Alberta government had acted differently by having implemented savings rules in 1987 are evaluated. The 'Hartwick rule', and a 50% savings rule are hypothetically applied in comparison to the

¹ Solow (1991).

status quo. The Hartwick rule essentially prescribes that all resource revenues should be saved as opposed to spent. Resource revenues are removed from the General Revenue Fund (GRF) and instead deposited in the government's saving fund (i.e. the Heritage Fund (HF)). This approach permits the government to spend only what it earns in interest on savings and current tax revenues, thus, expenditures are reduced (or taxes increased) to avoid running a deficit. As an alternative to the Hartwick rule, a 50% savings rule is evaluated in the empirical data. Proposed by Kneebone (2006), it recommends that half of all resource revenues be allowed for spending, and the other half directed towards the HF. It allows for interest income from the HF to be transferred to the GRF.

Another alternative contemplated is the Norway model. It requires that all resource revenues are saved, and plans for a maximum of four percent withdrawal from the fund (which is the annual predicted investment income) annually if a budget deficit must be paid.² Although the Norway model is often mentioned as an alternative to the status quo,³ it is not used in the empirical analysis since it generally embodies the same characteristics of the Hartwick rule. In fact, the Norway model can be stricter than the Hartwick rule. This is in view of the fact that the Hartwick rule allows investment income to be transferred to government revenues, while the Norway model only transfers what is required to offset the deficit, which in many cases is less than the investment income.

The second investigation uses future projections to evaluate the long term consequences of the status quo, and the advantages for future available revenue under the Hartwick rule in the event of a windfall gain in resource revenues coupled with the eventual exhaustion of oil and gas in Alberta.

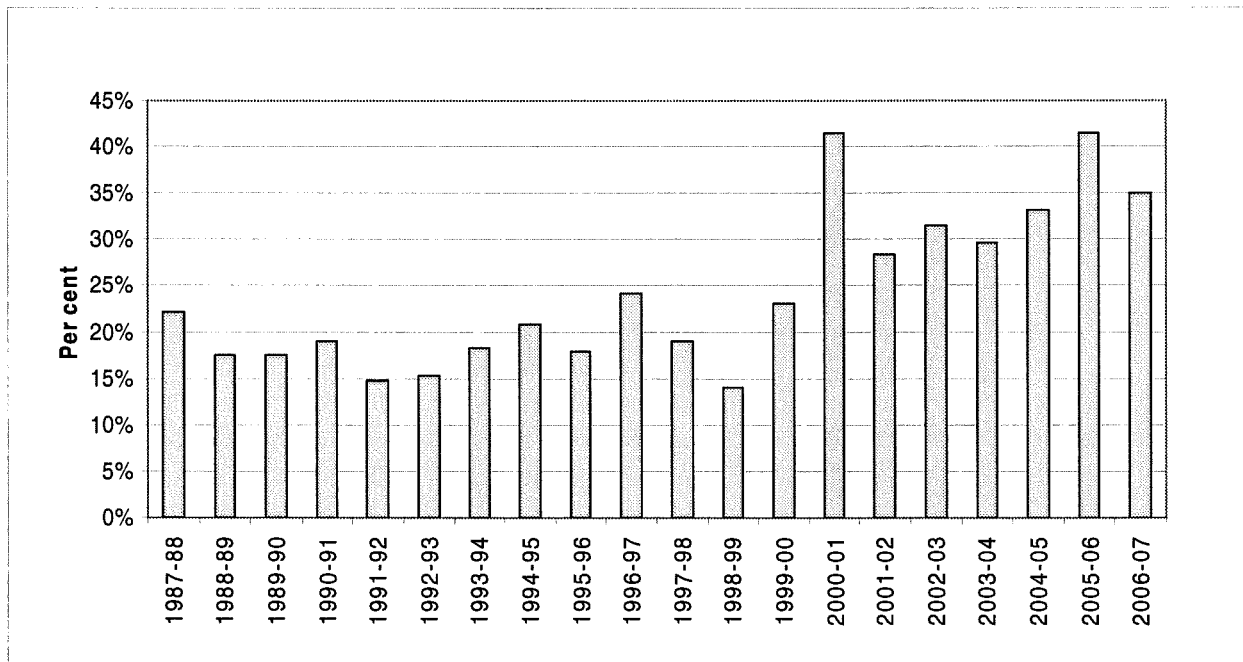
² See Davis et al. (2003).

³ See Scoffield (2006).

Comparisons among each approach focus on changes in the size of the Heritage Fund, annual investment income, and changes that must be made in spending or revenues to achieve final balance. The future projections focus simply on the state of the GRF with attention to feasible expense levels given differences in total revenue for each scenario. Data used for the analysis is drawn from Alberta General Revenue Fund records and the Alberta Heritage Savings Trust Fund (Heritage Fund) for the fiscal period of 1987 until 2006. Future projections are made using 2006 (and averages from 2002-2006) data as base figures. Further to the investigation, the fiscal state of affairs of the Alberta government must first be elaborated upon, plus its glaring limitations in regards to expenditures and resource revenue reliance exposed.

Savings rules, and the interest income that accrues on the principal of savings funds safeguard the source of revenue in the budget from worldwide shocks in the price of oil, which is known to be highly volatile. Over the last three fiscal years the government of Alberta has relied on resource revenues to supply roughly 35% of total revenues (see Figure 1.1). This leaves “oil-dependent economies at the mercy of sudden changes in the market price of oil” (Tijerina and Pagan, 153), as the majority of government revenue can be rapidly dissolved.

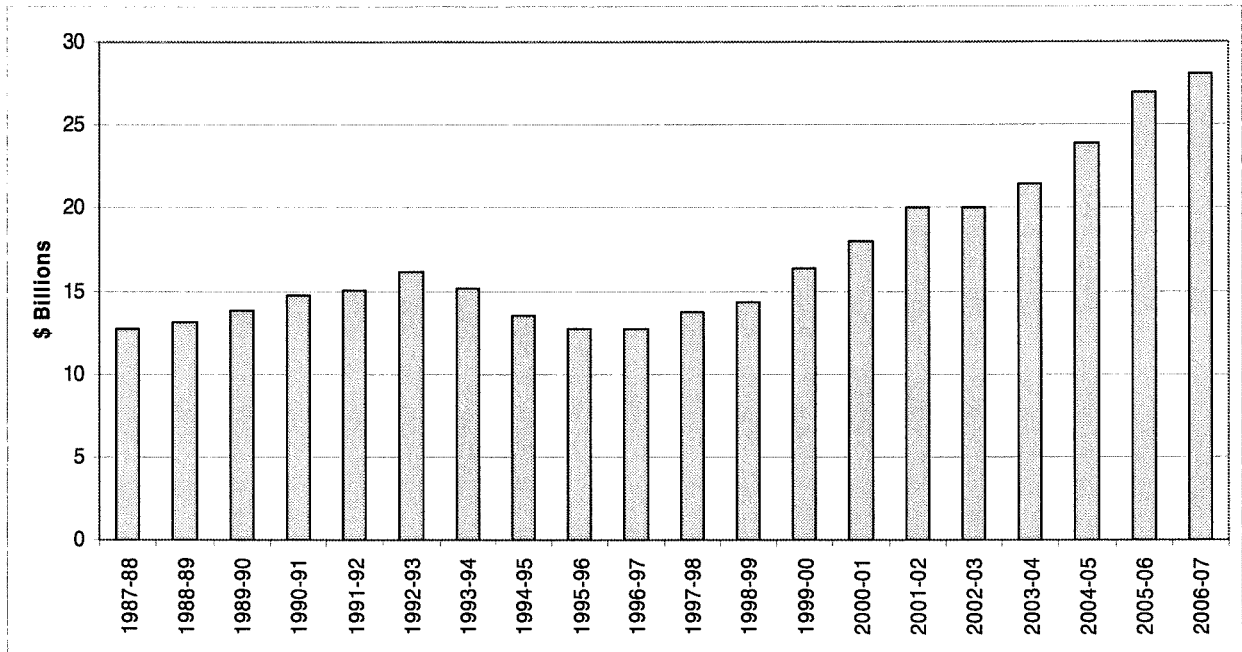
Figure 1.1 Share of Natural Resource Revenue in Total Revenue, Alberta Government GRF (1987-2006)



Source: Alberta Government Statistics (1987-2006).

A government's fiscal situation is further exacerbated when resource revenues are relied upon to support lofty program spending. Program expenses in Alberta have grown significantly since the turn of the century (see Figure 1.2). Expenditures have swelled from a low of \$12.7 billion in 1995-96 to \$27 billion in 2005-06, an increase of 113%.

Figure 1.2 Total Program Expenses in Alberta Government GRF (1987-2006)



Source: Alberta Government Statistics (1987-2006).

Increases in government expenditures tend to have a great amount of inertia, making the provincial government significantly dependent on the current stream of natural resource revenues. Together with the fact that resource revenues are highly volatile makes this a dangerous fiscal stance for the province. Notably, previous price shocks have seen the price of oil drop from US\$23 a barrel to US\$11.5 a barrel from the end of 1985 to 1986, a 50% reduction.⁴

Moreover, high spending in Alberta has some important consequences on inter-provincial migration. Saving resource revenues, as opposed to spending, reduces the migration distortion between provinces. At the moment, the payments towards program expenditure that come from natural resource revenues, and the low taxes in Alberta can act as a subsidy to move to the province.⁵ McMillan (2002) states that “resource revenues in their various forms will mask to Albertans the cost of public spending and, in

⁴ Tijerina and Pagan (2003).

⁵ See Boadway and Flatters (1982).

an environment of low taxes and comparable services, further public outlays (especially infrastructure ‘investments’ and other ‘one-time’ spending) will be appealing because ‘we have the money’” (p. 151).

The research findings demonstrate that an absence of savings rules have greatly depleted the potential value of the Heritage Fund, and set Alberta on an unsustainable path. As stated previously, the lack of prudence amongst fiscal planners is leading the province to an intensified dependence on current resource revenues, further exacerbating the fiscal stance of future generations to come.

Before proceeding to the findings of the research, Section 2 develops the definition for sustainability used throughout the paper. Section 3 discusses briefly the elements of the Hartwick Rule and the possible shortcomings in the methodology of using the Hartwick rule to the case of Alberta. Moreover, previous empirical applications of the rule are presented, and the empirical approach for Alberta is outlined. A brief historical overview of the Heritage fund and its operational management rules are detailed in Section 4. Subsequently, Section 5 presents the empirical results, and Section 6 states the conclusions.

2. Sustainability

There are many facets to the debate surrounding ‘sustainability’ as a tool for public policy. In fact, there is an inherent ethical undertone, which can give sustainability different meanings depending on one’s point of view. A relevant perspective in the economics literature is that advocated by John Rawls.

In Rawls’ *A Theory of Justice* (1971), he describes a hypothetical ‘original position’ where individuals in a society gather behind a ‘veil of ignorance’ to decide upon

a social contract or set of rules that ensure justice. Arrow (1973) extends this argument for social justice and applies it to the notion of intertemporal justice. In an intertemporal setting without population growth, the Rawlsian perspective suggests that the ethical treatment which should be given is that each generation over time should receive an equal, or rather non-declining level of utility. Thus, a hypothetical meeting of all generations to decide the intertemporal allocation of natural resources would likely result in an extraction schedule which is not “excessively conservationist (lest they turn out to be a member of an earlier generation) or excessively exploitive (lest they become a member of a later generation)” (Tietenberg 2004, 86). Most importantly, what would likely arise from such a meeting would be discussion of a criterion to guide decisions made by the first generation that will affect the well being of generations to follow. This is what ultimately leads to the use of sustainability as a possible solution to ensure intertemporal justice.

The two principal branches of sustainability theory are ‘ecological’ and ‘economics’ approaches. Ecologists, on one hand, argue that “a sustainable state is one in which the natural capital stock is non-declining throughout time” (Perman et al, 86). This depicts a world in which natural capital (i.e. fertile land, oil and gas, forests, fisheries, other stocks of biomass) remains constant or is increasing. Thus, non-renewable natural resources such as oil and gas, which exists in finite quantities and have no ability to reproduce, must be left untouched in order to fulfill an ecologist notion of sustainability.

The ecological stance on sustainability results in a cautious approach to policy which can affect the environment. “Ecologists have tended to give uncertainty [about the future] a more central role than have most economists” (Perman et al. 2003, 96).

Essentially, from the ecologists’ standpoint, economic development that may infringe

upon the environment must be cautiously approached as the future consequences which occur are uncertain. Protecting the “biological diversity...and preserving the resilience and dynamic ability of [environmental] systems to adapt to change” (Munasinghe 1993, 3) are the key characteristics of their stance.

On the other hand, the perspective taken in this paper is the economic perspective. It contends that “a sustainable state is one in which utility (or consumption) is non-declining throughout time” (Perman et al. 2003, 86) or also “a sustainable state is one in which resources are managed so as to maintain production opportunities in the future”(Perman et al. 2003, 86). Therefore, most neo-classical economists put less of a focus on the natural sciences, and instead concentrate on the role of utility, or opportunities over time.

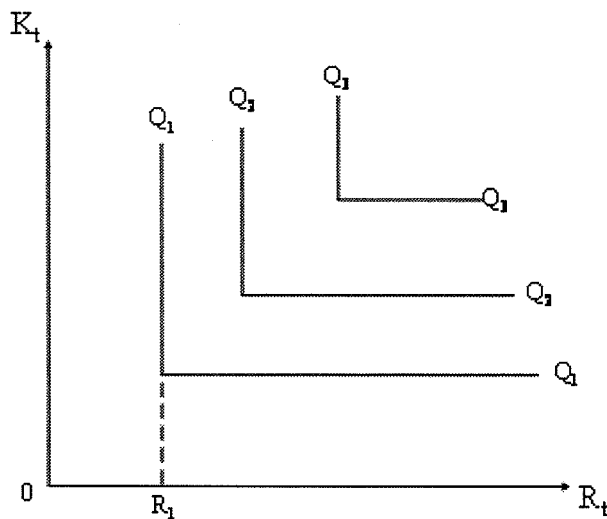
Economists view the ecological stance on sustainability as limiting. Solow (1986) argues that “we have no obligation to our successors to bequeath this or that resource. Our obligation refers to generalized productive capacity or, even wider, to certain standards of consumption and living possibilities over time” (p. 142). Since human interaction with the environment is necessary in the creation of most goods, Solow argues that the ecological approach is infeasible if sustainability is the obligation to leave the world as it was when we came.

Resources often have a characteristic known as ‘fungibility’. This is when one resource can replace, or rather, be the substitute for another. Ultimately, this is the crux of the difference between ecological and economic perspectives. Ecologists would in general, dismiss any mention of fungibility and insist on the inestimable value of the resource. Contrarily, economists insist that at the margin, most resources are in fact

substitutable with man-made capital (includes physical, human, and intellectual capital), albeit perhaps imperfectly.

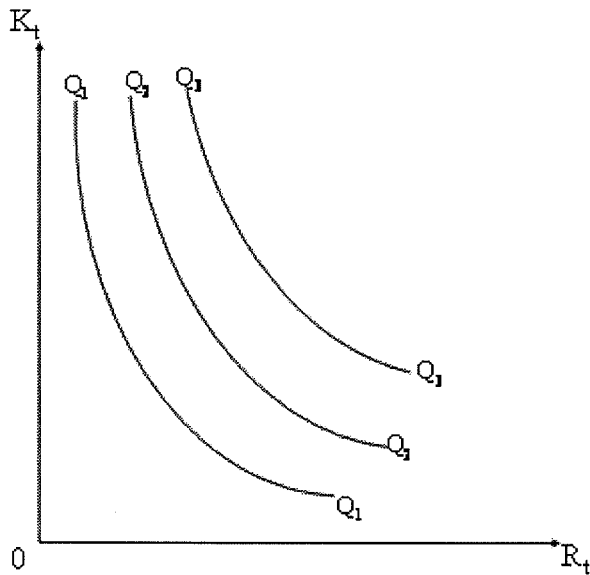
The alternate approaches develop criteria for sustainability that stem from how substitutable one form of capital is for the other. Economists fall into the category of 'weak' or 'very weak sustainability' and ecologists encompass what is referred to as 'strong sustainability'. Strong sustainability is when the elasticity of substitution between the two forms of capital (natural capital R_t , and man-made capital K_t) within the production function, is zero (see Figure 2.1). Contrarily, weak sustainability claims that natural and man-made capital are highly substitutable, and their production function has an elasticity of substitution greater than zero (see Figure 2.2, top of p. 10).

Figure 2.1 Ecologist Perspective, 'strong sustainability'



Source: Perman et al. (2003), *Natural Resource and Environmental Economics* (3rd Edition), Addison Wesley.

Figure 2.2 Economist Perspective, 'weak sustainability'



Source: Perman et al. (2003), *Natural Resource and Environmental Economics* (3rd Edition), Addison Wesley.

Markandya and Pedroso (2005) present empirical research that evaluates the elasticity of substitution between natural and man-made capital. Using nested CES functions (one, two, and three level cases), and placing natural resources in different places inside the function, they estimate the elasticity of substitution involving land resources to be in the range of one and higher. This result shows a reasonable degree of substitutability between natural and man-made capital, which “validates the use of a ‘Hartwick Rule’ of saving the rents from the exploitation of natural resources if we are to follow a maximum constant sustainable consumption path” (Markandya and Pedroso 2005, 9).

3. The Hartwick Rule: A Prescription

Hartwick (1977) shows in a continuous time setting that a constant consumption path over time could be achieved in an economy if the resource rents are invested rather

than consumed. The outcome of this proof consists of what is referred to as the “Hartwick Rule”. The rule can be used as a prescriptive ‘rule of thumb’ for sustainability in economies where non-renewable resources make up a significant portion of total output. In particular, Hartwick (1977) assumes that the production function of an economy takes a Cobb-Douglas form:

$$Y = f(R_t, K_t) = K_t^\alpha R_t^\beta; \text{ where } \alpha + \beta = 1, \text{ and } \alpha > \beta$$

The rule assumes that the population base of an economy is constant, the non-renewable resource is essential in production, and there is no exogenous technological change. It is important to note that the share of man-made capital in output (α) is greater than the share of the natural resource (β). In addition to these elements, the assumption is made that the utility function looks the same across all generations.⁶ Moreover, consumption is the only argument in the utility function (i.e. $U_t(c_t)$).

Underlying this rule is the fact that all resources must be extracted at an efficient rate. Therefore, Hotelling’s rule holds,⁷ which “is equivalent to assuming that the resource is extracted by perfectly competitive firms with perfect foresight, and that the economy as a whole is perfectly competitive” (Perman et al. 2003, 90). Whether or not the oil and gas deposits in Alberta are efficiently depleted is a separate debate than the purpose of this paper, and we therefore assume that efficiency is fulfilled.

⁶ This assumption is often questioned since each generation is likely to have different preferences than the generation that precedes them.

⁷ Hotelling’s rule, as defined in Solow (1986), he states that the shadow value of a unit of the unextracted natural resource should be increasing at each instant at a rate equal to the current marginal product of reproducible capital, p. 144.

An alternative way of looking at the Hartwick rule is to observe the value of the stock of total capital (natural plus man-made) and examine whether or not it remains constant over time. For an oil economy, the important characteristic is that over time the oil stock and the flow of the oil going into production are decreasing. Thus, to offset the decrease of the oil used in production, more man-made capital must be accumulated. This results in net investment equaling zero, i.e. the value of the oil being used up is offset by the increase in the value of man-made capital. Essentially, the constant consumption path that follows is like consuming the interest on the constant stock of wealth.⁸ This has led to a vast literature of research, which is elaborated upon after the shortcomings of the Hartwick rule for the case of Alberta are presented.

There are numerous criticisms as to how well the Hartwick rule applies to specific cases. Firstly, the rule makes the assumption that the population base remains constant throughout time. In contrast, the population base in Alberta has been growing by approximately 1.5% over the last ten years.⁹

Secondly, there is a considerable amount of literature which describes how the Hartwick rule applies to the case of a small open economy.¹⁰ The assumption of stationary technology “is violated when gains from trade are taken into account in a general equilibrium setting”(Asheim 1986, 395). Asheim argues that we must look at the application of the Hartwick rule from a broader perspective. This implies that net exporters of natural capital (i.e. oil) need not reinvest all of the rents. The responsibility to do so rests with the importer of the good. Statistics for Alberta from 2000 to 2005 show that on average about 80% of their crude oil and 79% of their natural gas extracted

⁸ See Perman et al. (2003), p. 90.

⁹ Statistics Canada (2007).

¹⁰ See Ashiem (1986).

was exported (see Appendix C).¹¹ Thus, arguably, Alberta may have a justification to save less than what is prescribed under the rule. Yet the degree to which this is acceptable is debatable.

Thirdly, another debatable assumption is that technological progress is not considered, and technology is assumed to remain constant throughout time. Weitzman and Lofgren (1997) argue that technological progress is the essence of economic growth, and when left out of a model it “is the most restrictive assumption”(p. 140). However, the model is not void of any role for technological progress, in fact the model “anticipates that technological progress will make future renewable substitute sources available”(Hartwick 1997, 55). Technological progress is endogenous and increases are viewed as additions to the level of human capital, which is a component of man-made capital.¹²

Notwithstanding the possible shortcomings in applying the rule to empirical data, numerous studies have been undertaken. Pearce and Atkinson (1993) tested net investment as a weak sustainability indicator using data from a range of countries. Net investment (Z) defines the difference between savings (S) and the sum of the depreciation in natural capital (δ_N) and depreciation in man-made capital (δ_M); i.e. $Z = S - (\delta_N + \delta_M)$. According to the Hartwick Rule, net investment should be zero if the country is on a sustainable path. If it is less than zero ($Z < 0$) it is non-sustainable, if it is greater than zero ($Z > 0$), the path is also sustainable, but they could be consuming more. The results find that countries such as Japan, Costa Rica, and the Netherlands have positive levels of net investment making their current paths sustainable. On the other hand, Mali and

¹¹ Source: Canadian Association of Petroleum Producers (Alberta Statistics, 1998-2005).

¹² See Hartwick (1997), p. 72.

Madagascar have negative levels of net investment, and thus their paths are not sustainable.

The majority of the empirical research to date has focused mainly upon the “greening” of national accounting practices and the use of net national product (NNP) as a revised measure of gross national product (GNP). “Green” NNP takes into account not only depreciation on man-made assets but also the economic depreciation of natural resource capital. Hartwick (1990) affirms that a true value of output must have GNP incorporate “priced resource input flows and these flows from capital stocks should be ‘off-set’ by deduction (or possibly supplements to) GNP to incorporate for declines (or possibly increases) in natural resource stocks”(p. 291). Although no formal structure for this type of accounting exists in Canada at a national or provincial level, Usher (1980) attempted to account for economic depreciation of oil in Canada. It was later proven that his procedure was incorrect since he took into account total rent when calculating economic depreciation, as opposed to Hotelling rent.¹³ Total rent tends to overestimate economic depreciation, and leads to empirical results indicating non-sustainable outcomes.

Vincent (1997) used a combination of methods in studying economic sustainability from resource depletion in Malaysia. His empirical research calculates sustainability estimates at a national and sub-national level. He used the net investment approach similar to Pearce and Atkinson and the net national product approach taking into account Hotelling rent as opposed to total rent in order to overcome previous methodical mistakes (the mistakes made by Usher and Pearce and Atkinson). To overcome this, Vincent converts total rent into Hotelling rent by using estimates of

¹³ Hotelling rent is $[P_t - MC(Q_t)] * Q_t$, the value of economic depreciation of a resource.

elasticity of the marginal cost curve and number of years remaining until the stock is exhausted. He concludes that the Malaysian economy grows sustainably at a national level, but not sustainably at a regional level.

A recent alternative approach to empirical research of the Hartwick rule was undertaken by Hamilton et al. (2005). The method chosen was a counterfactual simulation as to what the current wealth or well being of a country would be if they had hypothetically followed the Hartwick rule over the last thirty years, as opposed to the status quo. Using data on resource rents underlying the World Development Indicators, four estimates are made of what the produced capital stock would be following the Hartwick rule. The evidence shows that many countries such as Nigeria, Venezuela, and Trinidad and Tobago are not following the prescriptive rule, and are investing too little of their rents. Natural resource revenues are thus being spent, and the well being of future generations is being overlooked. The evidence predicts that levels of produced capital stock could be nearly five times higher than the actual stock if the Hartwick rule was followed. On the other hand, there are some countries who are investing too much in produced stock such as South Korea and Thailand, suggesting that previous generations' consumption level was too low, and too much consideration is given to generations to come.

These results lead us to consider how sustainable Alberta has been. Distinct from the previous approaches, Alberta is evaluated for its level of sustainability given public records of their fiscal budgets and the Heritage Fund. The amount of rents collected by the government should be a reflection of the total decrease in the value of the resource (equal to the Hotelling rent), and thus according to the Hartwick rule, should be entirely

invested or saved.¹⁴ This is due to the fact that the resource revenues they received are, generally speaking, equal to the Hotelling rent. The government currently collects revenues through the sale of leases and royalty taxes. The term “royalties”, contrary to its common representation as government revenue from resources, in fact, stands for total resource rent. In contrast, what the government imposes is a “royalty tax”, which captures only a certain proportion of total royalties. “Oil sands companies pay a 1% royalty [i.e. royalty tax] on gross revenues until all project costs are recovered. The royalty [tax] then increases but only to 25% of net revenue” (Taylor and Raynolds 2006, 1). This however, is not the only method which the government uses to capture royalties. Competitive auctions for permits to the land to exploit the resource are held annually.¹⁵ Assuming the agents which bid on permits are rational, and have full information, the auction should absorb the remaining rent. It is the combination of the tax and the auction which should theoretically allow the government to obtain the total resource rent.¹⁶

4. A Brief History of the Heritage Fund

The Alberta Heritage Savings Trust Fund has been in existence for a little more than 30 years. It was originally established on May 19, 1976 with three principal objectives: i) to save for the future, ii) to strengthen or diversify the economy, and, iii) to improve the quality of life of Albertans.¹⁷ Originally, 30 percent of natural resource revenues which accrued to the government of Alberta were allocated to the fund (see Appendix A: Heritage Fund Equity Value [1976-77 to 2006-07] for a complete financial

¹⁴ Hartwick and Olewiler (1998), page 273 discuss this in brief.

¹⁵ Alberta Government, Energy.

¹⁶ The Pembina Institute has been critical of the existing strategy to obtain resource revenues, and argues that the government has been receiving much less than it should. See Taylor and Raynolds (2006).

¹⁷ Excerpts from Alberta Government, Finance.

history of the fund). In the early 1980s when the price of oil began to fall, transfers out of the Heritage Fund into the government of Alberta's General Revenue Fund (GRF) quickly outweighed the transfers coming into the fund. Then, in 1987 transfers going into the fund stopped. In fact, there were no positive transfers from the GRF to the Heritage Fund from 1987 until 2005. Gross payout from the fund for that period of time amounted to roughly \$18 billion dollars. Notwithstanding this large outflow, the overall fund equity shrank by only \$1.2 billion, as most of the outflow was covered by investment income earned by the fund.

The investment portfolio of the fund is managed within the Finance Department of Alberta by the Investment Management Division. On average, for the last twenty years the average investment return on the portfolio has been 9.1 percent. Throughout its history the fund has generated over \$29 billion dollars in investment income. The current size of the fund is listed at \$16.3 billion dollars (February 2007), and the last few years have seen positive transfers into the fund as resource revenues have been steadily increasing.

The operational aspects of the fund detail its withdrawal or deposit rules. Decisions on how much to deposit or remove from the fund are made annually. The government does not follow an agreed upon guideline for deposits, and withdrawals are discretionary transfers to the budget made by the government.

5. Empirical Findings

From 1987-2006, two chief concepts are recorded and concurrently judged against the status quo. They are:

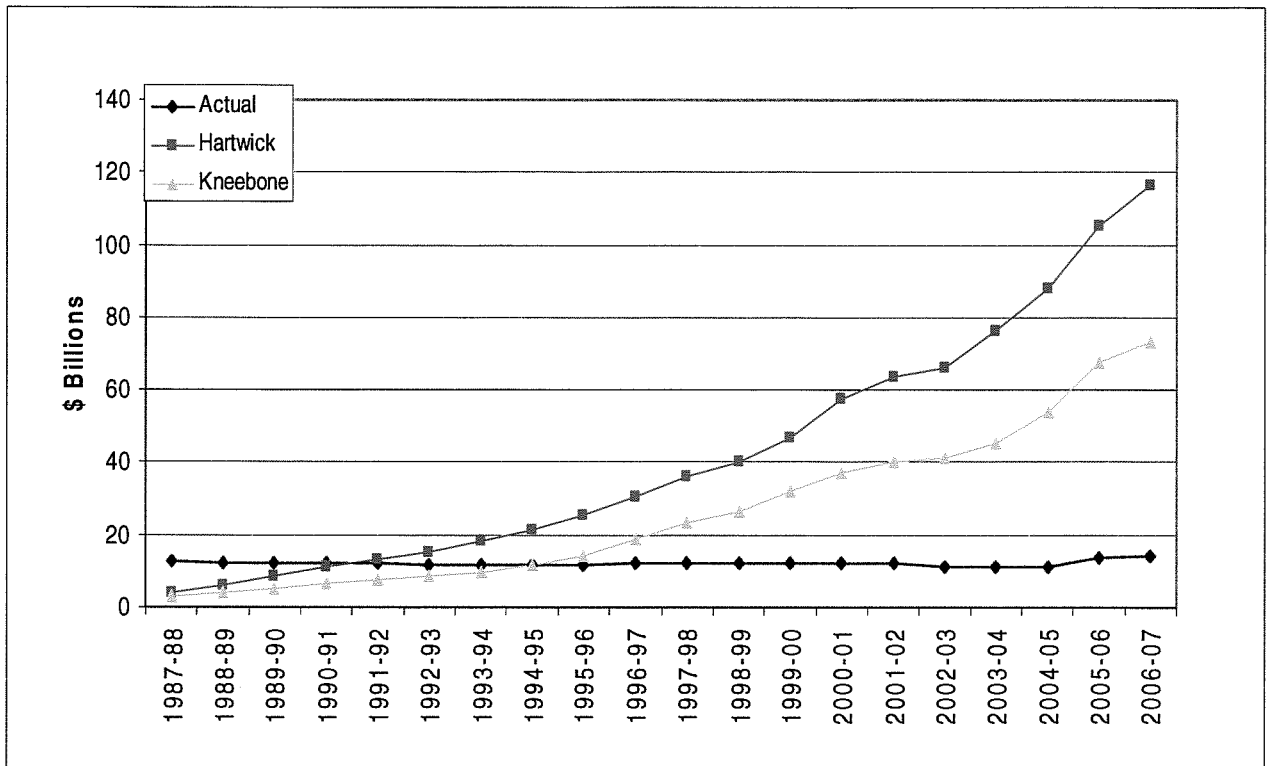
- i) The impact of the savings rule on the Heritage Fund; in terms of equity, annual income and transfers to the GRF;
- ii) The reduction of expenditures (or increases in tax revenue) necessary to achieve final balance under the Hartwick rule.

5.1 Savings Rules vs. Actual (1987-2006)

If the Alberta government had adhered to the Hartwick rule, we would expect that they would incur short term costs while inheriting long term gains. Naturally, the results reflect this hypothesis. Starting in 1987-88, if resource revenues had been removed from government revenue and transferred to the Heritage Fund, the size of the fund would have grown to \$117 billion, roughly seven times its current size in 2006-07 (see Figure 5.1.1). Moreover, the fund would have doubled its size by 1997, after only 10 years of prudence. Keep in mind that this is with the annual income earned by the fund flowing out to the GRF. Under Kneebone's 50% savings rule, the size of the Heritage Fund reaches a value of \$73.2 billion in 2006.

Note also that in the initial period the level of the fund for the Hartwick rule (and the Kneebone 50% rule) is lower than the actual scenario because all existing debt in 1987 (\$11.1 billion) is immediately paid off by a lump sum transfer from the HF. This is warranted because essentially, savings act to increase wealth, and debt acts as negative wealth. The sum of the two is net wealth, which is what the Hartwick rule is concerned with.

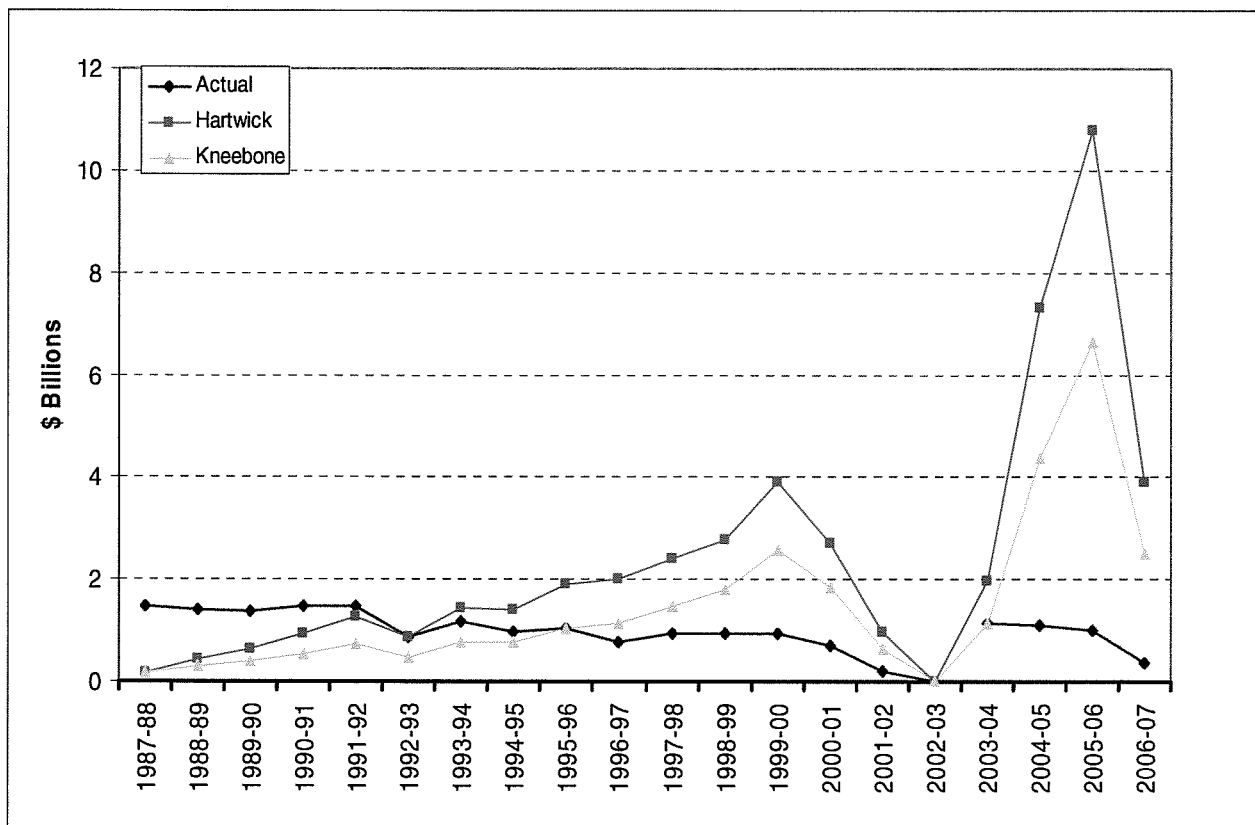
Figure 5.1.1 Heritage Fund Value 1987-2006 (Actual vs. Hartwick and Kneebone)



Source: Alberta Government Statistics (1987-2006) and author's calculations.

The transfers of investment income of the Heritage Fund into the GRF can be seen in Figure 5.1.2. Predictably, the Hartwick rule scenario would allow for the largest flow of income since the principal of the Heritage fund is the largest from 1991-92 onward. In the early part of the turn of century the fund earns small positive returns, and in 2002-03 the fund incurs large losses. However, when the fund recovers to earn positive returns, under the Hartwick rule it transfers a high of \$11 billion in investment income to the GRF in 2005-06.

Figure 5.1.2 Transfers from Heritage Fund into GRF 1987-2006 (Actual vs. Hartwick and Kneebone)



Source: Alberta Government Statistics (1987-2006) and author's calculations.

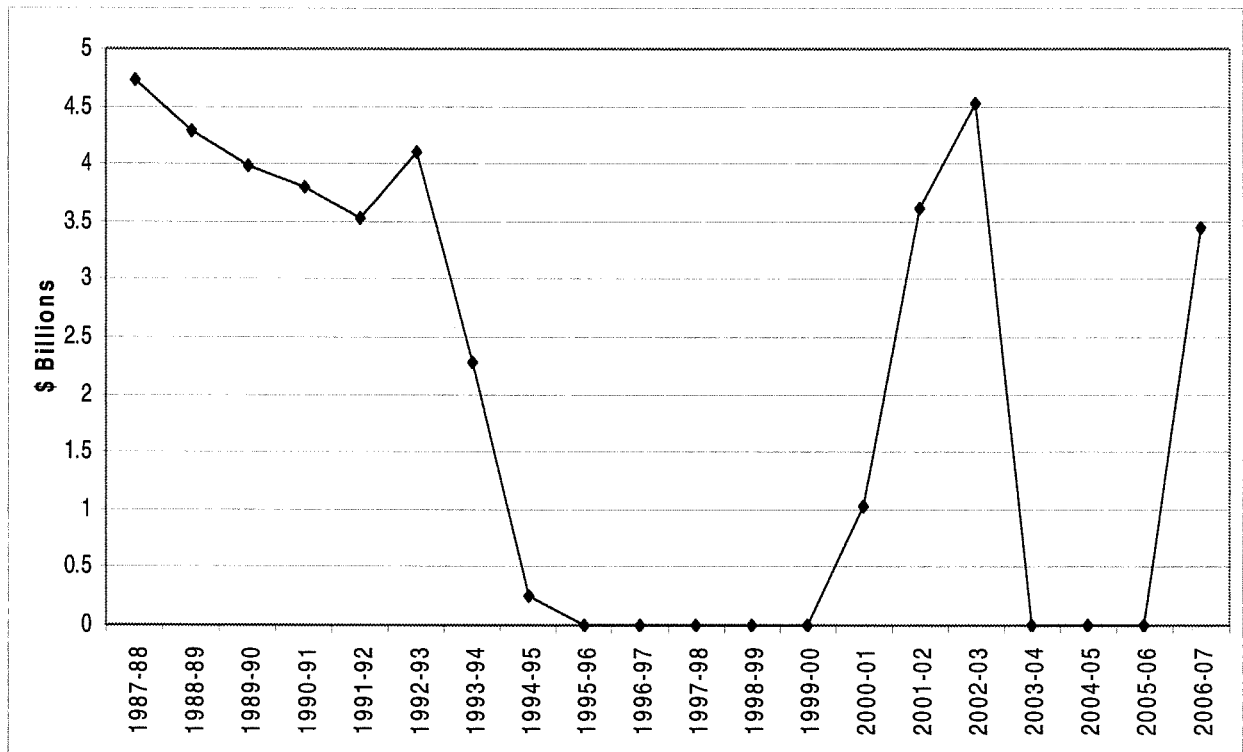
The final balance of the GRF is defined as revenues minus expenses (including annual debt payments). Under the Hartwick rule and the Kneebone 50% savings rule, it is assumed that the government is always in final balance. This is necessary since if the final balance is allowed to vary, and expenses follow the status quo, large debt will accrue simultaneous to growth in savings, which is inconsistent with the Hartwick Rule. This is achieved by reducing program expenses, or increasing tax revenues (i.e. non-resource).^{18,19} Correspondingly, under the Hartwick rule, the relevant question is how

¹⁸ Keep in mind that the overall debt level would be nil under the Hartwick rule (and the Kneebone savings rule) as it would be paid off via a lump sum transfer from the HF.

¹⁹ As pointed out by Dissou, Y., the consequences of the reduction in spending or increased taxes on other sectors is limited in a partial equilibrium setting. It is likely that the growth of other sectors will be hindered, yet this is difficult to quantify, and must therefore be kept in mind as a cost to the current prescription.

much expenditures or tax revenues must be altered in order to achieve a final balance? In fact, expenditures must be reduced, or likewise tax revenues increased, by roughly \$39.6 billion dollars in 12 over the last 20 years (see Figure 5.1.3). This amounts to roughly a 20% reduction relative to total program spending, and a 25% increase relative to overall tax revenue during these 12 years.

Figure 5.1.3 Reductions in Expenditures (Increases in Tax Revenue) under Hartwick Rule to achieve Final Balance (1987-2006)



Source: Alberta Government Statistics (1987-2006) and author's calculations.

A side by side comparison of the models demonstrates important results for each approach (see Table 5.1.1). In comparison to the status quo, the Hartwick rule allows for an increase in total income earned by the Heritage Fund of approximately \$30 billion dollars, given that equity of the fund becomes much larger under the Hartwick rule. The Kneebone 50% savings rule allows the revenue earned from the fund to increase by around \$21 billion.

Table 5.1.1 Summary of Important Model Results (1987-2006)

TOTAL (\$Billions)	Fund Equity (2006)	Transfers to GRF 1987- 2006	Net Income 1987-2006 (Loss)	Accumulated Debt (2006)
Actual	14.29	28.99	28.83	0.00
Hartwick	116.69	57.48	58.12	0.00
Kneebone	73.18	39.01	39.65	0.00

Source: Alberta Government Statistics (1987-2006) and author's calculations.

Bear in mind that since the principal in the HF under the Hartwick rule is the highest, the benefits will not be felt immediately but will impact the overall revenue in future budgets.

The next section seeks to simulate the benefits over a longer time horizon.

5.2 Future Scenarios: Long Term Sustainability (2007-2040)

Due to the relatively short time frame for the counterfactual analysis, an extension must be done in order to properly assess the sustainability of the hypothetical approaches. As stated at the outset of this paper, the underlying problem for fiscal planners is how to divide the resource wealth between existing generations and generations to come. Using the actions of the Alberta government over the last 20 years as a base, the business-as-usual (BAU) scenario depicts total revenue when no resource revenues are saved. In determining the long term consequences of each approach, the BAU scenario is compared with the Hartwick rule under a simulated rise and fall of future resource revenues. This is important to consider since non-renewable resource revenues are subject to large swings in prices, and are exhaustible.

In this section, the Hartwick rule scenario is disaggregated into two cases:

- i) Continuing from the results of the previous empirical section, where it was hypothetically implemented in 1987 (HR_1987), and;
- ii) If implemented at the outset of 2007 (HR_2007). In total, three alternative cases are examined:

Case 1 = BAU
Case 2 = Hartwick_2007
Case 3 = Hartwick_1987

The rise and fall of resource revenues are projected geometrically according to the quadratic formula below:

Resource Revenues_t = R₀*(at - bt²) ; where t=1.....33 (i.e. 2007-2040).

Each parameter within this formula must be selected by making assumptions, they are:

R₀= \$11364 million (forecasted 2006 resource revenue)

a = 1.285

b = 0.15

The parameters for 'a' and 'b' are calibrated to reproduce two stylized facts: first the initial growth rate in revenue matches the historically observed value (28.5% in 2005-06); and second, revenues peak in 2011 after which they decline. Note that sensitivity analysis could be performed to allow for different results from more prolonged or more abrupt peaks in projected resource revenues.

A number of further assumptions are made to carry out the projections. All of the other assumptions are listed in point form below:²⁰

1. Real rate of return on Heritage Fund equity of 4.5% (based on past performances, and; long term return to the fund = 6.7% - 2.2% [expected inflation]).²¹ Also, sensitivity analysis can be performed on the real rate of return for the HF.
2. The average of the 2002-2006 levels of non-resource tax revenues are used as a base for future projections, and they are projected to grow over time at a rate

²⁰ Note that although the Alberta government has an evaluation of the royalty regime underway, the consequences on future revenues are ignored for simplicity.

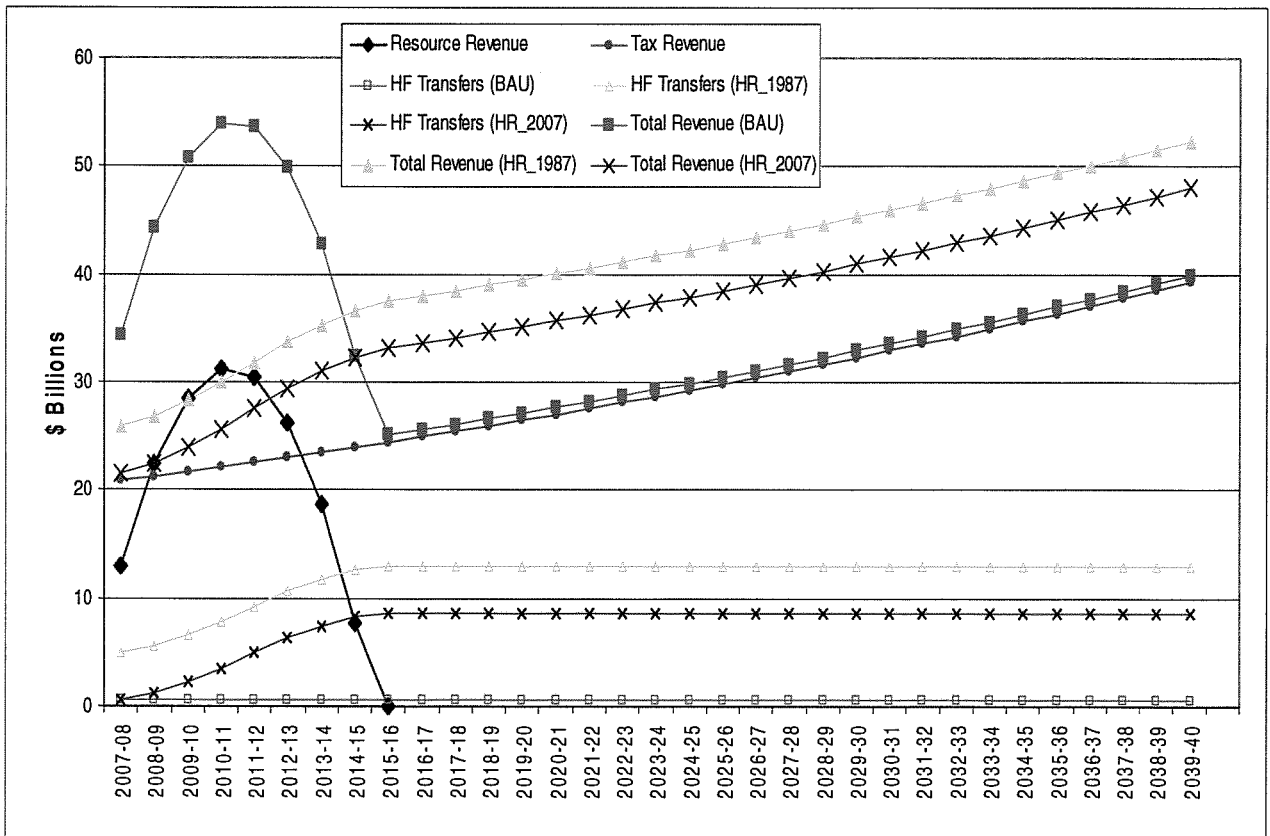
²¹ See Alberta, Finance.

equal to the population growth rate. The projections let tax revenues rise by 2% per year (the average population growth in Alberta from 2002-2006).²²

- Under BAU, all resource revenues are recorded as current income in the GRF (i.e. nothing is deposited in the HF).

In estimating the projections, rather than making arbitrary projections on expenditures, the results demonstrate the overall level of revenues available to spend for each scenario. Once resource revenues are exhausted, all that remains is the non-resource tax revenue and the investment income from the HF. Figure 5.2.1 presents the results from the projections.

Figure 5.2.1 Revenue Projections, Alberta Government GRF (2007-2040)



Source: Alberta Government Statistics (1987-2006) and author's calculations

²² See Statistics Canada (2007).

The total revenue lines represent the feasible level of expenses (without borrowing) under each scenario. Once resources are exhausted, the Hartwick rule scenarios allow for a higher level of spending in each period. These levels can be sustained due to the constant level of investment income flowing from the Heritage Fund to the GRF (represented by the HF Transfers lines). Essentially, these higher levels are realized because wealth from oil and gas is preserved. If the implementation of the Hartwick rule took place in 1987 (HR_1987), it would take seven years for total revenues to rise to the BAU level. Once resources are exhausted, its total revenue will be approximately \$12 billion higher than the BAU for every following year. If implementation of the rule occurred today (HR_2007), total revenues would take eight years until it reaches the BAU level and once resources are exhausted, total revenues will remain roughly \$8 billion higher than the BAU.

In concluding, empirical observations from future projections have demonstrated that the government of Alberta's current fiscal approach to resource revenues generates a level of total revenues over the long-run that is \$12 billion dollars lower annually in comparison to the Hartwick rule. The consequences for future generations from the BAU approach further exacerbates as the projections are made over longer time horizons.

6. Conclusion

In the section on sustainability, the general guidelines for sustainability in public policy are outlined. Subsequently, the Hartwick rule is counterfactually applied to Alberta's use of natural resource revenues over the last twenty years, and then projected

until 2040. The results make clear that by not saving its resource revenues, Alberta has veered from a sustainable path.

Since 1987, the government (and residents) of Alberta's decision not to save resource revenues has numerous negative consequences on current and future public accounts. The size of the Heritage Fund would increase to roughly \$110 billion in 2007, roughly seven times its current size. The income from the HF would approach the total amount of resource revenues which currently enter into the GRF. The benefits of preserving resource wealth are further portrayed by the projections made into the future.

Although previous decisions tended to ignore the well being of future generations, policy devoted towards sustainability can have a large impact on the source of government revenues and provide numerous spillover benefits. Missed opportunities would have aided the government to protect against volatile world energy prices, and ease migration pressures due to the skewed real benefits of Albertans from spending their resource wealth on public programs. Furthermore, what seems to be entrenching Alberta in an unsustainable position are large increases in program expenditures.

The opportunity for the province to implement a new savings plan seems to be slipping away, and the government needs to decide soon which path it takes. Whether or not the government is intent on learning from its previous mistakes is uncertain, and the annual benefit for Albertans in the future (and today) from preserving rather than spending resource wealth is at stake.

Appendix A: Heritage Fund History (1976-77 to 2006-07)

(\$Millions)

	Fund Equity (a)	Net Income (Loss)	Transfers from GRF	Transfers to GRF	Rate of Return
1976-77	2172	88	2120	-36	
1977-78	3210	194	931	-87	8.9%
1978-79	4431	294	1059	-132	9.2%
1979-80	5628	343	1332	-478	7.7%
1980-81	7570	724	1445	-227	12.9%
1981-82	9661	1007	1434	-350	13.3%
1982-83	11351	1482	1370	-1162	15.3%
1983-84	11739	1467	720	-1799	12.9%
1984-85	12247	1575	736	-1803	13.4%
1985-86	12692	1667	685	-1907	13.6%
1986-87	12681	1445	217	-1673	11.4%
1987-88	12552	1353	0	-1482	10.7%
1988-89	12397	1252	0	-1407	10.0%
1989-90	12263	1244	0	-1378	10.0%
1990-91	12113	1337	0	-1487	10.9%
1991-92	12029	1382	0	-1466	11.4%
1992-93	11945	785	0	-869	6.5%
1993-94	11874	1103	0	-1174	9.2%
1994-95	11825	914	0	-963	7.7%
1995-96	11825	1046	0	-1046	8.8%
1996-97	12001	932	0	-756	7.9%
1997-98	12026	947	0	-922	7.9%
1998-99	12026	932	0	-932	7.7%
1999-00	12256	1169	0	-939	9.7%
2000-01	12256	706	0	-706	5.8%
2001-02	12256	206	0	-206	1.7%
2002-03	11362	-894	0	0	-7.3%
2003-04	11362	1133	0	-1133	10.0%
2004-05	11362	1092	0	-1092	9.6%
2005-06	13494	1397	1750	-1015	12.3%
2006-07	14286	503	650	-361	3.7%
					Average
TOTAL	14286	28825	14449	-28988	9.1%

Source: Alberta Government Statistics and author's calculations

Annual Rate of Return % = net income year t / fund equity year t-1

Heritage Fund: Hartwick Rule 1987-2006 (\$Millions)

	Fund Equity (Hartwick)	Net Income (Loss)	Transfers from GRF	Transfers to GRF
1987-88	4202	1353	2626	168
1988-89	6287	419	2085	419
1989-90	8527	631	2240	631
1990-91	11215	930	2688	930
1991-92	13237	1280	2022	1280
1992-93	15420	864	2183	864
1993-94	18237	1424	2817	1424
1994-95	21615	1404	3378	1404
1995-96	25315	1912	3700	1912
1996-97	30505	1995	5190	1995
1997-98	35971	2407	5466	2407
1998-99	40300	2788	4329	2788
1999-00	47026	3917	6725	3917
2000-01	57612	2709	10586	2709
2001-02	63839	968	6227	968
2002-03	66312	-4657	7130	0
2003-04	76198	6613	9887	1956
2004-05	87907	7323	11708	7323
2005-06	105335	10808	17428	10808
2006-07	116689	3926	11354	3926
TOTAL	116689	58116	131819	57484

Source: Alberta Government Statistics and author's calculations

Heritage Fund: Kneebone 1987-2006 (\$Millions)

Year	Fund Equity (Kneebone)	Net Income (Loss)	Transfers from GRF	Transfers to GRF
1987-88	2889	168	1313	168
1988-89	3932	288	1043	288
1989-90	5052	395	1120	395
1990-91	6396	551	1344	551
1991-92	7407	730	1011	730
1992-93	8498	483	1092	483
1993-94	9907	785	1409	785
1994-95	11596	763	1689	763
1995-96	14409	1026	2814	1026
1996-97	18740	1136	4331	1136
1997-98	23278	1479	4538	1479
1998-99	26623	1804	3345	1804
1999-00	32019	2588	5396	2588
2000-01	37312	1844	5293	1844
2001-02	40425	627	3114	627
2002-03	41041	-2949	3565	0
2003-04	45459	4093	4418	1144
2004-05	54213	4369	8754	4369
2005-06	67499	6666	13286	6666
2006-07	73176	2516	5677	2516
TOTAL	73176	39646	86598	39014

Source: Alberta Government Statistics and author's calculations

Heritage Fund: Future Projections BAU 2007-2040 (\$Millions)

	Fund Equity (Actual)	Net Income (Loss)	Transfers from GRF	Transfers to GRF	Rate of Return
2007-08	14286	643	0	643	4.5%
2008-09	14286	643	0	643	4.5%
2009-10	14286	643	0	643	4.5%
2010-11	14286	643	0	643	4.5%
2011-12	14286	643	0	643	4.5%
2012-13	14286	643	0	643	4.5%
2013-14	14286	643	0	643	4.5%
2014-15	14286	643	0	643	4.5%
2015-16	14286	643	0	643	4.5%
2016-17	14286	643	0	643	4.5%
2017-18	14286	643	0	643	4.5%
2018-19	14286	643	0	643	4.5%
2019-20	14286	643	0	643	4.5%
2020-21	14286	643	0	643	4.5%
2021-22	14286	643	0	643	4.5%
2022-23	14286	643	0	643	4.5%
2023-24	14286	643	0	643	4.5%
2024-25	14286	643	0	643	4.5%
2025-26	14286	643	0	643	4.5%
2026-27	14286	643	0	643	4.5%
2027-28	14286	643	0	643	4.5%
2028-29	14286	643	0	643	4.5%
2029-30	14286	643	0	643	4.5%
2030-31	14286	643	0	643	4.5%
2031-32	14286	643	0	643	4.5%
2032-33	14286	643	0	643	4.5%
2033-34	14286	643	0	643	4.5%
2034-35	14286	643	0	643	4.5%
2035-36	14286	643	0	643	4.5%
2036-37	14286	643	0	643	4.5%
2037-38	14286	643	0	643	4.5%
2038-39	14286	643	0	643	4.5%
2039-40	14286	643	0	643	4.5%
TOTAL	14286	20572	0	20572	

Source: Alberta Government Statistics and author's calculations

Heritage Fund: Future Projections HR 1987 (2007-2040, \$Millions)

	Fund Equity (HR_1987)	Net Income (Loss)	Transfers from GRF	Transfers to GRF	Rate of Return
2007-08	129587	5251	12898	5251	4.5%
2008-09	151975	5831	22387	5831	4.5%
2009-10	180441	6839	28467	6839	4.5%
2010-11	211579	8120	31137	8120	4.5%
2011-12	241977	9521	30399	9521	4.5%
2012-13	268228	10889	26251	10889	4.5%
2013-14	286922	12070	18694	12070	4.5%
2014-15	294650	12911	7728	12911	4.5%
2015-16	294650	13259	0	13259	4.5%
2016-17	294650	13259	0	13259	4.5%
2017-18	294650	13259	0	13259	4.5%
2018-19	294650	13259	0	13259	4.5%
2019-20	294650	13259	0	13259	4.5%
2020-21	294650	13259	0	13259	4.5%
2021-22	294650	13259	0	13259	4.5%
2022-23	294650	13259	0	13259	4.5%
2023-24	294650	13259	0	13259	4.5%
2024-25	294650	13259	0	13259	4.5%
2025-26	294650	13259	0	13259	4.5%
2026-27	294650	13259	0	13259	4.5%
2027-28	294650	13259	0	13259	4.5%
2028-29	294650	13259	0	13259	4.5%
2029-30	294650	13259	0	13259	4.5%
2030-31	294650	13259	0	13259	4.5%
2031-32	294650	13259	0	13259	4.5%
2032-33	294650	13259	0	13259	4.5%
2033-34	294650	13259	0	13259	4.5%
2034-35	294650	13259	0	13259	4.5%
2035-36	294650	13259	0	13259	4.5%
2036-37	294650	13259	0	13259	4.5%
2037-38	294650	13259	0	13259	4.5%
2038-39	294650	13259	0	13259	4.5%
2039-40	294650	13259	0	13259	4.5%
TOTAL	295650	402914	177960	402914	

Source: Alberta Government Statistics and author's calculations

Heritage Fund: Future Projections HR_2007 (2007-2040, \$Millions)

	Fund Equity (HR_2007)	Net Income (Loss)	Transfers from GRF	Transfers to GRF	
2007-08	27184	643	12898	643	4.5%
2008-09	49571	1223	22387	1223	4.5%
2009-10	78038	2231	28467	2231	4.5%
2010-11	109175	3512	31137	3512	4.5%
2011-12	139574	4913	30399	4913	4.5%
2012-13	165825	6281	26251	6281	4.5%
2013-14	184519	7462	18694	7462	4.5%
2014-15	192246	8303	7728	8303	4.5%
2015-16	192246	8651	0	8651	4.5%
2016-17	192246	8651	0	8651	4.5%
2017-18	192246	8651	0	8651	4.5%
2018-19	192246	8651	0	8651	4.5%
2019-20	192246	8651	0	8651	4.5%
2020-21	192246	8651	0	8651	4.5%
2021-22	192246	8651	0	8651	4.5%
2022-23	192246	8651	0	8651	4.5%
2023-24	192246	8651	0	8651	4.5%
2024-25	192246	8651	0	8651	4.5%
2025-26	192246	8651	0	8651	4.5%
2026-27	192246	8651	0	8651	4.5%
2027-28	192246	8651	0	8651	4.5%
2028-29	192246	8651	0	8651	4.5%
2029-30	192246	8651	0	8651	4.5%
2030-31	192246	8651	0	8651	4.5%
2031-32	192246	8651	0	8651	4.5%
2032-33	192246	8651	0	8651	4.5%
2033-34	192246	8651	0	8651	4.5%
2034-35	192246	8651	0	8651	4.5%
2035-36	192246	8651	0	8651	4.5%
2036-37	192246	8651	0	8651	4.5%
2037-38	192246	8651	0	8651	4.5%
2038-39	192246	8651	0	8651	4.5%
2039-40	192246	8651	0	8651	4.5%
TOTAL	192246	250845	177960	250845	

Source: Alberta Government Statistics and author's calculations

Appendix B: Calculated Net Investment Figures for Alberta General Revenue Fund (\$Millions)

	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	Forecast	Estimate
Investment Income	1847	1834	1891	2125	2155	1711	1837	1567	1724	1616	1747	1610	1906	1353	788	-462	1838	1812	2106	1767
Transfers to GRF from HF	-1482	-1407	-1378	-1487	-1466	-869	-1174	-963	-1046	-756	-922	-932	-939	-706	-206	0	-1133	-1092	-1015	-361
Investment Income net of transfers	365	427	513	638	689	842	663	604	678	860	825	678	967	647	582	-462	705	720	1091	1406

Source: Alberta Government Statistics and author's calculations

Appendix HR: GRF Hartwick 1987-2007 (\$Millions)

REVENUE	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06 Forecast	2006-07 Estimate
Personal Income Tax	2236	2039	2536	2796	3057	2784	2877	3063	3177	3445	3877	4601	5100	3943	4183	4834	4613	4649	4577	5999
Corporate Income Tax	595	697	700	803	732	637	854	1073	1332	1407	1849	1659	1255	2023	2229	2019	1696	2364	2596	2227
Resource Revenue (Hartwick Savings Rule)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
School Tax Revenue	729	769	824	915	1027	1115	1168	1196	1205	1169	1212	1118	1128	1151	1094	1113	1178	1247	1284	1306
Other Tax revenue	553	679	683	878	1029	1055	1053	1126	1112	1157	1218	1178	1241	1386	1469	1633	1838	1918	1954	2014
Investment Income from HF	168	419	631	930	1280	864	1424	1404	1912	1995	2407	2788	3917	2709	968	0	6613	7323	10808	3926
Investment Income net of O&G	365	427	513	638	689	842	663	604	678	860	825	678	967	647	582	-462	705	720	1091	1406
Other own-source revenue	1407	1662	2022	1615	1566	2319	2710	2832	2431	2473	2890	2950	3183	3272	3672	4321	4122	4375	4359	4343
Total Own-Source Revenue	6053	6692	7909	8575	9380	9616	10749	11298	11847	12506	14278	14972	16791	15131	14197	13458	20765	22596	26669	21221
Federal Transfers	1912	2135	1943	2365	2150	2457	2090	1929	1748	1351	1183	1335	1640	1813	2264	2074	2926	3219	3363	3398
Total Revenue	11905	11900	12839	14185	13737	14271	15406	16164	15515	16652	17754	16819	20103	25527	21926	22662	25887	29328	34601	32408

EXPENSES

Total Program Expense	12698	13110	13840	14735	15052	16176	15123	13480	12681	12701	13773	14346	16356	17976	20071	20053	21480	23851	26966	28067
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Adjusted Debt servicing costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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Total Expense	12698	13110	13840	14735	15052	16176	15123	13480	12681	12701	13773	14346	16356	17976	20071	20053	21480	23851	26966	28067
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Final Balance (Hartwick)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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Accumulated Debt	11105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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Source: Alberta Government Statistics and author's calculations

Appendix KN: GRF Kneebone 1987-2006(\$Millions)

REVENUE	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	Forecast	Estimate
Personal Income Tax	2236	2039	2536	2796	3057	2784	2877	3063	3177	3445	3877	4601	5100	3943	4183	4834	4613	4649	4577	5999
Corporate Income Tax	595	697	700	803	732	637	854	1073	1332	1407	1849	1659	1255	2023	2229	2019	1696	2364	2596	2227
Resource Revenue (50% Savings Rule)	1313	1043	1120	1344	1011	1092	1409	1689	1393	2017	1889	1184	2325	5293	3114	3565	3838	4872	7181	5677
School Tax Revenue	729	769	824	915	1027	1115	1168	1196	1205	1169	1212	1118	1128	1151	1094	1113	1178	1247	1284	1306
Other Tax revenue	553	679	683	878	1029	1055	1053	1126	1112	1157	1218	1178	1241	1386	1469	1633	1838	1918	1954	2014
Investment Income net of O&G	365	427	513	638	689	842	663	604	678	860	825	678	967	647	582	-462	705	720	1091	1406
Investment Income from HF	168	288	395	551	730	483	785	763	1026	1136	1479	1804	2588	1844	627	0	1144	4369	6666	2516
Other own-source revenue	1407	1662	2022	1615	1566	2319	2710	2832	2431	2473	2890	2950	3183	3272	3672	4321	4122	4375	4359	4343
Total Own-Source Revenue	7366	7604	8793	9540	9841	10327	11518	12346	12354	13664	15239	15172	17787	19559	16970	17023	22083	24514	29708	25488
Federal Transfers	1912	2135	1943	2365	2150	2457	2090	1929	1748	1351	1183	1335	1640	1813	2264	2074	2926	3219	3363	3398
Total Revenue	9278	9739	10736	11905	11991	12784	13608	14275	14102	15015	16422	16507	19427	21372	19234	19097	25009	27733	33071	28886
Expenses																				
Total Program Expense	12698	13110	13640	14735	15052	16176	15123	13480	12681	12701	13773	14346	16356	17976	20071	20053	21480	23851	26966	28067

Appendix BAU: Future Projections GRF 2007-2040 (\$Millions)

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Projected Resource Revenues	12898	22387	28467	31137	30399	26251	18694	7728	0	0	0	0	0	0
Tax Revenue	20894	21312	21738	22173	22616	23068	23530	24000	24480	24970	25469	25979	26498	27028
Transfers from HF to GRF (BAU)	643	643	643	643	643	643	643	643	643	643	643	643	643	643
Total Revenue (BAU)	34435	44341	50847	53953	53658	49962	42866	32371	25123	25613	26112	26622	27141	27671

2021- 22	2022- 23	2023- 24	2024- 25	2025- 26	2026- 27	2027- 28	2028- 29	2029- 30	2030- 31	2031- 32	2032- 33	2033- 34	2034- 35	2035- 36	2036- 37	2037- 38	2038- 39	2039- 40
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0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

27569 28120 28683 29256 29841 30438 31047 31668 32301 32947 33606 34278 34964 35663 36376 37104 37846 38603 39375

643 643 643 643 643 643 643 643 643 643 643 643 643 643 643 643 643 643 2732

28212 28763 29325 29899 30484 31081 31690 32311 32944 33590 34249 34921 35607 36306 37019 37747 38489 39246 40018

Source: Alberta Government Statistics and author's calculations

Appendix HR_1987: Future Projections GRF 2007-2040 (\$Millions)

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Projected Resource Revenues	12898	22387	28467	31137	30399	26251	18694	7728	0	0	0	0	0	0	0	0
Tax Revenue	20894	21312	21738	22173	22616	23068	23530	24000	24480	24970	25469	25979	26498	27028	27569	28120
Transfers from HF to GRF (HR_1987)	4993	5574	6581	7862	9263	10631	11812	12654	13001	13001	13001	13001	13001	13001	13001	13001
Total Revenue (HR_1987)	25887	26885	28319	30034	31879	33699	35342	36654	37482	37971	38471	38980	39500	40029	40570	41121

	2023- 24	2024- 25	2025- 26	2026- 27	2027- 28	2028- 29	2029- 30	2030- 31	2031- 32	2032- 33	2033- 34	2034- 35	2035- 36	2036- 37	2037- 38	2038- 39	2039- 40
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	28683	29256	29841	30438	31047	31668	32301	32947	33606	34278	34964	35663	36376	37104	37846	38603	39375
	13001	13001	13001	13001	13001	13001	13001	13001	13001	13001	13001	13001	13001	13001	13001	13001	13001
	41684	42257	42843	43439	44048	44669	45302	45948	46607	47280	47965	48664	49378	50105	50847	51604	52376

Source: Alberta Government Statistics and author's calculations

Appendix HR 2007: Future Projections GRF 2007-2040 (\$Millions)

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Projected Resource Revenues	12898	22387	28467	31137	30399	26251	18694	7728	0	0	0	0	0	0	0	0
Tax Revenue	20894	21312	21738	22173	22616	23068	23530	24000	24480	24970	25469	25979	26498	27028	27569	28120
Transfers from HF to GRF (HR_2007)	643	1223	2231	3512	4913	6281	7462	8303	8651	8651	8651	8651	8651	8651	8651	8651
Total Revenue (HR_2007)	21537	22535	23968	25684	27529	29349	30992	32304	33131	33621	34120	34630	35149	35679	36220	36771

	2023- 24	2024- 25	2025- 26	2026- 27	2027- 28	2028- 29	2029- 30	2030- 31	2031- 32	2032- 33	2033- 34	2034- 35	2035- 36	2036- 37	2037- 38	2038- 39	2039- 40
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2868 3	2925 6	2984 1	3043 8	3104 7	3166 8	3230 1	3294 7	3360 6	3427 8	3496 4	3566 3	3637 6	3710 4	3784 6	3860 3	3937 5	
8651	8651	8651	8651	8651	8651	8651	8651	8651	8651	8651	8651	8651	8651	8651	8651	8651	
3733 4	3790 7	3849 2	3908 9	3969 8	4031 9	4095 2	4159 8	4225 7	4292 9	4361 5	4431 4	4502 7	4575 5	4649 7	4725 4	4802 6	

Source: Alberta Government Statistics and author's calculations

Appendix C Canadian Association of Petroleum Producers (Alberta Statistics)

Note: All currencies are in Canadian dollars unless stated otherwise.								
Note: * references those numbers not yet available ** Estimates								
Alberta:								
	1998	1999	2000	2001	2002	2003	2004	2005
Capital Spending (\$ billions)								
Conventional	10.4	8.5	12.9	14.7	11.7	15.5	18.5	24.9
Oil Sands	1.6	2.5	4.3	5.9	6.7	5.0	6.2	10.4
Total	11.9	11.0	17.2	20.6	18.4	20.5	24.7	35.3
	98/99	99/2000	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Payments to province (\$ billions) Royalties, fees & bonuses - Fiscal year	2.6	4.8	10.6	6.0	7.1	7.7	9.7	14.3
Wells Drilled								
Oil	1,391	1,751	3,198	2,558	2,645	3,022	2,563	3,221
Gas	4,033	5,622	7,353	8,789	6,949	9,942	12,276	13,268
Total (incl. Dry & Service)	8,175	9,444	13,543	14,975	12,989	17,873	19,365	21,599
Reserves at year-end								
Conventional oil (million barrels)	2,215	2,148	2,079	1,947	1,921	1,753	1,741	1,704
Oil Sands:								
Mining - Integrated Synthetic (million barrels)	2,847	5,034	5,011	4,919	4,881	5,213	5,294	6,125
Raw In-situ Bitumen (million barrels)	1,388	1,561	1,805	1,820	2,024	2,032	2,082	2,474
Natural Gas (trillion cubic feet)	47.8	46.6	44.8	45.2	44.5	42.5	41.7	40.9
Production								
Conventional oil (thousand barrels/d)	858	785	748	720	661	629	600	571
Mining - Integrated Synthetic (thousand barrels/d)	308	324	320	349	441	429	462	383
In-situ Bitumen (thousand barrels/d)	282	244	289	310	303	435	532	609
Pentanes plus/condensate (thousand barrels/d)	200	197	185	166	161	148	146	145
Crude oil & equivalents (thousand barrels/d)	1,649	1,550	1,541	1,544	1,566	1,640	1,740	1,709
Natural Gas (billion cubic feet/d)	13.3	13.7	13.8	13.6	13.4	13.1	13.2	13.3
Industry Revenues (\$ billions)	21.1	28.8	49.9	49.3	42.9	57.2	64.4	81.5
Employment								
Direct & Indirect	174,150	178,200	183,000	183,000	183,000	275,000	275,000	275,000
Exports								
Crude oil - volume (thousand barrels/d)	957	886	931	1006	983	1,016	1,105	1,093
Natural Gas (billion cubic feet/d)	7.6	8.2	8.5	8.9	8.9	8.4	8.5	7.1
Consumption:								
Crude oil & Products (thousand barrels/d)			250	244	231	246	263	272
Natural Gas (billion cubic feet/d)			2.2	2.0	2.1	2.3	2.3	2.2

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