Policy Shift: The Free Trade Agreement, Energy, and the Staples Thesis

by

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Abstract

This paper studies the impact of the 1988 Free Trade Agreement (FTA) between Canada and the United States on Canada's energy industry. It characterizes the adoption of the FTA as a policy shift from interventionism to a hands-off approach. The policy shift appears to have significantly enhanced energy industry profitability. I come to this conclusion after testing for a structural break in energy sector rents. I then examine the indirect benefits, or linkages, from the energy industry to other sectors. I find that these linkages weaken with the onset of the FTA. Throughout the paper, a theme develops on the trade-offs inherent to energy policy. Policy-induced increases in energy income generally weaken linkages, and policy which strengthens linkages generally reduces energy income. Balancing this trade-off is the policy maker's challenge. The pre-FTA and post-FTA policies skewed this balance in opposite directions. I propose policy which attempts to balance energy sector income and its linkages to other sectors.

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1 Introduction

2008 represents a milestone year for both Canada's economy and energy industry. Twenty years have passed since the ratification of the Free Trade Agreement (FTA)[1] with the United States. In this time, commodity prices have gone from record lows to today's record highs. Of particular interest to Canada's energy sector is the price of a barrel of oil, which, has surpassed the record prices of the 1970s in real terms. Oil prices in the 1970s precipitated government intervention, which culminated in the 1980 National Energy Program (NEP). The policy embraced economic nationalism over continentalism in the energy industry. It unleashed a constitutional battle between Western provinces and the federal government and was dismantled by the following government. Less than eight years after the NEP came into effect, Canada shifted to the continental energy policy of the FTA. This paper characterizes the FTA as a "hands-off" policy relative to interventionist policies of the 1970s and 1980s.

Oil prices were relatively low following the FTA's ratification up until the onset of the 21st Century. Since then, increased demand in the developing world, Middle Eastern wars, and declining conventional supplies, have all contributed to today's record prices. Canada's energy abundance has led its Prime Minister, Stephen Harper, to declare Canada "an energy superpower." The current government continually endorses the FTA's hands-off policy approach, but this position will come under attack. Record oil prices will lead to increased calls for government intervention, since the balance between energy producing regions and regions without energy has shifted. While writing this paper, the Deputy Leader of the Official Opposition in Parliament, Michael Ignatieff, is reported to be developing policy which will promote greater East-West energy linkages. Such policies may be warranted, but stand in clear opposition to the hands-off policy of the FTA. They also counter the private sector's plans to con-

[1]Now known as the North American Free Trade Agreement (NAFTA) after the inclusion of Mexico in 1993, which changes little for the energy trade between Canada and the US. For this reason, I will refer to the FTA, and not NAFTA, throughout the paper.

struct North-South pipelines from the oilsands to the United States.[2] North-South pipelines provide a greater market for Canada's energy resources, but the benefits to Canada depend on the quality of the resource. It appears that new pipeline proposals will primarily transport bitumen,[3] which sells for roughly half the price of synthetic crude oil. By exporting bitumen, Canadians relinquish a large amount of economic rents. Economic rents provide indirect benefits to other economic sectors. A body of literature known as the staples thesis describes these indirect benefits, or linkages, fostered by resource production. Linkage formation tends to increase the wealth of an economy and increase its level of diversification. Keay (2007) finds Canada's 20th Century economic performance to be consistent with the staples thesis. This paper adopts his methodology in empirically testing the impact of the FTA on the energy sector and the linkages from it to other sectors.

The paper proceeds as follows: first, I discuss the evolution of Canada's energy policy in the context of the staples thesis. Next, I review relevant academic papers, commentary, and studies. I then introduce preliminary data which shows an acceleration of energy exports to the US with the onset of the FTA. Section 3 contains my empirical tests' methodology and results. The shift from interventionism to a hands-off policy impacted energy income positively, at the expense of weakened linkages. My findings highlight the policy trade-off between linkage strength and energy income. The pre-FTA interventionism and post-FTA hands-off approach failed in balancing these. My conclusions suggest policy options to restore the balance.

2 Historical Outline and Literature Review

2.1 The Staples Thesis and Energy Policy since the 1950s

This section reconciles the staples thesis with Canadian energy policy in the latter half of the 20th Century. The major policy decisions of the 1950s came about follow-

[2] See Jaremko, "1M barrels a day..."

[3] A heavy oil which is upgraded to synthetic crude oil prior to refining into final products such as gasoline and jet fuel.

ing the discovery of large crude oil reserves in 1947, and mostly concerned pipeline regulation. After the establishment of a pipeline network, the National Oil Policy began in 1961. It became obsolete with the oil price shocks of the 1970s, which led to increased intervention and ultimately, the NEP in 1980. The ratification of the FTA in 1988, three years after the NEP's termination, signaled a policy shift from interventionism to a hands-off approach. I will explore the economic development implications of the above policies in the context of the staples thesis.

The Innis-Mackintosh staples thesis describes the economic contributions made by resource industries. Innis and Mackintosh applied it to Canada's pre-Confederation fishing and fur trade industries. Watkins (1963) revitalized its application to Canada's economy. Export demand drives resource industry expansion, which provides both direct and indirect benefits to the economy. Industry expansion directly increases employment, investment, output, and resource rents. It also spills over to other industries through indirect linkages. The staples thesis describes how the three main indirect linkages promote diversification away from staple production. Firstly, forward linkages represent resource production's impact on investment in resource processing, or value-added industries. The strength of these forward linkages depends on transportation costs, transaction costs, and trade policy. Domestic sale of resources theoretically reduces transportation and transaction costs for domestic manufacturers relative to those in competitor countries. Secondly, backward linkages occur as the resource industry increases the demand for domestically produced machinery, equipment, and other capital. They also reflect the resource industry's demands for services from engineers, bankers, lawyers, transport firms, communication firms, etc. Lastly, final demand linkages develop as workers and investors in the resource sector use their returns from labour and capital to purchase final consumption goods and services. They demand manufactured consumption goods, retailing services, housing, transportation infrastructure, professional services from lawyers, doctors, and bankers, etc. If linkages form, production in the resource sector should chronologi-

cally lead production in other sectors.

Policy to promote these linkages will have two opposite effects: the first on energy income, and the other on linkage strength. Energy income refers to the total income from energy production available to spill over into other sectors. Policy which reduces energy income exerts downward pressure on linkage levels, but this can be offset by increases in linkage strength. Linkage strength represents the linkages per dollar of energy income. A policy which reduces energy income may actually increase aggregate linkages if linkage strength increases sufficiently enough. For example, increased capital intensity in energy production results in greater rent leakage out of Canada, since capital owners are more likely than workers to be foreign. Policy could respond by limiting foreign capital, and this would induce the two opposite effects described above. It would reduce energy income since it increases the cost of capital. This will exert downward pressure on linkage levels. However, the policy would increase linkage strength, since relatively more resource income will stay in Canada, and thus be available for linkage creation. Aggregate linkages will increase if greater linkage strength offsets lower energy income.

The development of Canada's oil and gas industry following 1947 sparked some of the country's largest policy debates as politicians haggled over the approval of pipelines. Expansion of the industry required transporting the oil and gas to markets beyond Alberta. At the time, most observers would look at a map and see unrestricted international trade in oil and gas as the optimal strategy. However, McDougall (1982) discusses the US reluctance to make their fuel available to eastern Canadian consumers. In 1948, Canada's Minister of Trade, C.D. Howe, saw a possible US oil embargo as a calamity. The US also limited market access for Canadian producers, and when US markets were available to Canadian production, the approval of Canadian pipelines with export capacity generated large controversy. Economic nationalists argued that resources should be used to meet Canadian needs only. This attitude existed despite what Aitken (1959a) describes as the ingredients for expansion

in the oil and gas industry following 1947. They were primarily American capital, entrepreneurship, and technology. The literature finds a further paradox: exports were a necessary condition for domestic oil and gas consumption. Without export service, domestic pipelines became prohibitively expensive. As a result, the eventual pipelines included export service.

Including export components not only made oil pipelines feasible, they likely enhanced staples-led growth through a large impact on energy income. The Interprovincial Pipeline began transporting Alberta's oil in 1950 to an American port on Lake Superior. The pipeline was extended to Sarnia, Ontario, in 1953. Also in 1953, the TransMountain oil pipeline was completed to Vancouver with export components to the northwest US states. Export components were justified by the increasing returns to scale inherent in pipeline construction. Also, further expansion of the industry depended on reaching US markets, since Canadian oil met domestic requirements throughout western Canada and southern Ontario by 1954. Without access to US oil markets, energy income may have stagnated, thus limiting the spill-over benefits to other Canadian industries. In this case, energy income's effects on linkages likely offset any decline in linkage strength.

Natural gas policy in the 1950s also sought the spoils described by the staples thesis, but through stronger forward linkages. Aitken distinguishes oil from gas in that oil was primarily used for motive power, whereas natural gas was an important manufacturing input. For this reason, export restrictions to the United States were policy goals. Such goals even had the support of producing provinces. The Alberta government's 1949 Dinning Commission proposed preferential treatment for Canadian consumers. Nonetheless, natural gas exports to the United States expanded in the early 1950s. By 1953, C.D. Howe intervened to prohibit Canadian natural gas exports. Howe's ultimate goal seemed to be the construction of a pipeline to Central Canada before the development of what one must conclude were more lucrative markets in the United States. The eventual proposal, which he brought to Parliament in

1956, produced one of the most contentious debates on record and ultimately led to the Liberal party's defeat in the 1957 and 1958 elections. The TransCanada pipeline was to be built exclusively in Canada, but by an American company, with Canadian government financial support. The Conservative opposition opposed not the federal subsidies, nor the all-Canadian construction of the line. They opposed the American involvement. A consensus seemed to exist that preferential domestic access, through pipeline routes, to natural gas was good public policy. Forward linkages would be promoted through the existence of a secure supply of an industrial input, natural gas. Without the pipeline, industrial users were subject to potentially more expensive and volatile supplies induced by US protectionism. However, if eastern Canada's natural gas market was less lucrative than the U.S. market, Howe's policies may have harmed the natural gas industry, thus decreasing energy income. To minimize this effect, "surplus" policies allowed the export of gas supplies which were beyond Canadian requirements. Ultimately, the TransCanada pipeline was built against incredible opposition. Its potential strengthening of forward linkages may have driven Howe to see the project through.

Thirteen years after 1947, data on oil and natural gas production shows the rapid transformation of the industry. Between 1950 and 1960, annual oil production in Canada increased from 30 million barrels to 190 million barrels, and annual natural gas production increased from 70 mcf to 500 mcf. The four major pipelines approved in the 1950s included export service, but the US remained reluctant to accept oil imports. In 1958, Aitken predicted the US market to remain an "unreliable foundation for Canadian oil development," due to its protectionist policies. The Royal Commission on Energy, or Borden Commission, acknowledged this challenge. It convened in the aftermath of the pipeline debate and Liberal defeat to Diefenbaker's Conservatives. Its main recommendation was to expand energy exports to the United States. A further problem for Canada's oil and gas industry was that oil from Alberta suffered a cost disadvantage relative to foreign oil in central Canada. To spur industry

development, the federal government introduced the National Oil Policy in 1961. It implicitly subsidized western producers by guaranteeing a market west of the Ottawa River. The market east of the Ottawa River was open to cheaper imports from Venezuela and the Middle East. The rationale for the Ottawa Valley Line was to promote development in the western Canadian oil industry. It benefited energy income, but through artificial forward linkages. These linkages actually hurt Ontario's energy users, since they paid a premium for Albertan oil. For this reason, policy sought increased energy exports to enhance energy income. The aid to producers stemmed from the inability to overcome protectionist barriers in the US market.

With the first OPEC shock in 1973, the positions reversed. Western Canadian oil was sold in central Canada at a price lower than the world price. 1973 may not have marked increasing government intervention in the petroleum industry, but it marked a shift in the direction of intervention. No longer did Ottawa support the producing provinces, they now asked for support from the producing provinces. During the oil shocks, desire for "energy security" and "self-sufficiency" became widespread. Both the United States and Canadian governments exercised a large amount of price control in the markets. Canada embarked on a "single price" policy, which controlled the price of Alberta oil and gas, taxed exports, and used the tax proceeds to subsidize imported oil in eastern Canada. The policies were designed to reduce the volatility in energy prices faced by Canadians, and obviously benefited those in the eastern population centers relative to those in the energy producing provinces. They culminated with the NEP in 1980, a collection of energy policies based on three goals:

1. Security of supply

2. "Fairness" in energy pricing and revenue sharing

3. 50 percent domestic ownership of the Canadian oil and gas industry

Goal 1, security of supply translated into export restrictions, which essentially subsidized the domestic purchase of oil and gas. Such policies, in the form of export taxes

or quantity restrictions, may advantage domestic manufacturers, thus promoting the strength of forward linkages. However, this policy may have negatively impacted energy income, potentially harming aggregate linkages. Goal 2, fairness in energy pricing meant controlling the price Canada's oil producers could charge domestic consumers. Again, this had the potential to promote linkage strength, but its harm to energy income may have decreased aggregate linkage levels. Fairness in revenue sharing meant a greater share of royalties paid to the federal government at the expense of provincial governments. The impact from Goal 3, foreign capital restrictions, was discussed earlier. The policies designed to meet the three goals all entailed a stark trade-off between linkage strength and energy income. Not surprisingly, the NEP sparked a large constitutional battle between Alberta and the federal government. In 1984, Brian Mulroney's Progressive Conservatives capitalized on this discontent to win the 1984 federal election. With their Western Accord of 1985, they curtailed the interventionist policies of the NEP. The Western Accord would soon cede to the FTA's sweeping deregulation of Canada's energy industry.

Many bill the FTA's energy chapter as a trade-off between security of supply for the United States and security of market for Canada. The security of access to the US market may have increased energy income for Canada's energy producers, thus positively influencing linkage levels. However, it may have reduced linkage strength through a number of channels. Policies which discriminate against American consumers or investors violate the FTA. Limits on consumer discrimination may weaken forward linkages to domestic secondary processors. The inability to discriminate against foreign investors may decrease domestic rent capture, and thus linkage strength. Additionally, the FTA's removal of tariffs on America's manufactured goods likely weakened backward and final demand linkages between Canada's energy and manufacturing industries. However, lower tariffs also decrease the cost of foreign capital goods, which may have increased energy income. Again, each policy trades off linkage strength with energy income. The interventionist years took an extreme ori-

entation toward linkage strength, whereas the hands-off approach adopted an extreme orientation toward energy income.

2.2 Literature Review

This section combines academic journal articles and book chapters which have relevance to the energy industry's spill-over benefits. The first examples analyze energy's importance as a manufacturing input. Several researchers model the effects of energy price shocks on manufacturers. With particular application to forward linkages, some authors characterize optimal North American energy trade. A pair of strong papers examine the FTA's impact on Canada's industrial structure. Many authors also analyze the FTA's policy implications for energy. A recent article on the perception of the Canadian dollar as a commodity currency leads into the resource curse literature. Finally, empirical work showing resource industries' benefits to Canada contrasts this literature.

The costs of energy to manufacturers represent a small proportion of their total costs. On average, during the 1970s, authors find energy to account for 2% of manufacturers' costs.[4] When disaggregating to the industry level, 1974 estimates ranged from below 0.5% to above 6.5%. Forward linkages may offer a substantial competitive advantage to industries in the upper band of this range. These advantages have likely diminished if technological change has reduced energy use since the 1970s.

The OPEC energy price shock of 1973 seems to have motivated research modeling similar shocks. Denny, May, and Pinto (1978) simulate energy price shocks of 50% on the Canadian economy over a dataset from 1949 to 1970. Holding output constant, energy use decreases 19% and average costs and marginal costs rise less than 1%. Alternatively, Fuss (1977) finds a tripling of the energy price to increase average manufacturing costs in Canada by 10%. These results show firms' flexibity in adjusting to energy price shocks. With greater input substitutability, forward linkages

[4]See Powrie (1976), Ellison (1978), and Denny, May, and Pinto (1978).

between energy and manufacturers may be weak. For this reason, my empirical section characterizes linkages to the manufacturing sector as exclusively backward and final demand linkages.

The profit maximizing result of oil and gas trade in a frictionless trading market seems to be one where Canada's western producers supply western North America, and America's southern producers and foreign suppliers supply eastern North America. Waverman (1972) characterizes a continental natural gas market as optimal relative to the more nationalist market achieved by the TransCanada pipeline and its accompanying policies. He finds higher costs to Eastern Canadian consumers associated with West-East natural gas flows. Not surprisingly, he characterizes the restrictions to trade as inefficient. His model estimates the gains to regional producers and consumers as a result of the policy. It finds that trade restrictions increased the actual cost of natural gas to Canadian consumers. Embracing a continental gas market would encourage industry expansion in Alberta, and Waverman implies that it would not weaken forward linkages since he finds Canadian consumers to be paying too much. However, these conclusions are sensitive to the degree of US natural gas export restrictions or the ability of Canada's natural gas users to acquire other foreign gas. Along the same continentalist vein, Powrie and Gainer (1976) note the higher prices available to Alberta's oil producers in Chicago. They find \$0.25 and \$0.65 per barrel export taxes as the requirements to make, respectively, Sarnia and Montreal competitive destinations for Albertan oil. Imposing such export taxes may strengthen forward linkages, but would inhibit energy income.

Studies have found a significant impact from the FTA on Canada's industrial structure, and also indicate an impact on linkage formation. Trefler (2004) provides a very good overview of the agreement and finds significant distributional effects between industries. Employment fell dramatically in several industries, while productivity increased across the board, as theory would predict. Trefler finds the magnitude of these changes to be remarkable given the duty-free nature of Canada-US trading prior

to the FTA. His findings indicate an industrial shift. More significant to this paper is the potential for the FTA to have brought about a shift in linkage formation. Lileeva (2008) presents results implying this shift. Both Canadian and U.S. tariff cuts led to closures of non-exporting plants, but benefited high-productivity and exporting plants. If I find evidence of weakened backward and final demand linkages, this offers an explanation. The FTA reduced domestic producers' advantage in meeting the capital and consumer demand spill-overs from the energy sector.

Many authors, such as Leeson (1988), argue that Canada abdicated its policy options for energy with the FTA. However, Plourde (1991) finds that it does not prohibit price controls or productions taxes as long as they apply to both American and Canadian consumers and investors. Essentially, the FTA's energy chapter requires equal treatment between domestic and foreign energy consumers and investors.[5] Despite the restrictions on enacting national oil and gas policies, McDougall (1991) argues that the FTA does not hinder the Canadian government's ability to direct energy transmission systems. The National Energy Board (NEB) still retains the power to approve pipelines. They make decisions based on their perceptions of each proposal's net benefits. The conclusions of this paper dissent against recent NEB decisions.

Issa, Lafrance, and Murray (2008) find a structural break in the relationship between energy prices and Canada's currency. Using a dataset from 1973 to 2005, they find a negative coefficient on energy prices prior to 1993. Following 1993, the impact of energy prices on the currency became positive. This finding supports today's general perception of the Canadian dollar as a commodity currency. The authors note that the structural break corresponds with fairly complete energy sector deregulation and Canada's embrace of free trade. When performing tests on the strength of

[5]In this vein, it prohibits previous National Energy Board powers which benefited Canadian electricity users. Interested readers can reference Blue (1988) and Dillon (1988) for a discussion of the FTA's potential negative impact on Canada's economy due to a loss of comparative advantage in electricity access. Wylie (1989) shows hydroelectricity to influence Canadian industrial development as far back as the early 20th Century. This paper does not analyze electricity generation, despite the FTA's potential impact on linkages to domestic electricity users. Oil and gas production differs substantially from electricity generation. Combining data from these two sectors may obscure important variations in each.

linkages before and after the FTA, I will consider their findings. If I find weakened linkages following the FTA, they may reflect the new relationship between energy prices and Canada's currency. If energy prices drive energy output expansions, the resulting currency appreciation will offset potential linkages to Canada's industries which compete with international products.

A controversial, but oft-cited idea in recent literature concerns the notion of a "resource curse." It contradicts the staples thesis' beneficial description of resources. Sachs and Warner (2001) find a statistically significant negative relationship between economic growth and natural resource exports. They explain this by showing a positive relationship between price levels and resource abundance. Increased price levels harm the competitiveness of export sectors, thus hindering export-led growth. It appears that countries in the Middle East, Sub-Saharan Africa, and East Asia influence the results. The economic conditions in these countries do not compare to Canada's. Moreover, their conclusions ignore the potential indirect benefits described by the staples thesis. Keay (2007) incorporates these indirect benefits into his analysis and shows that a "resource curse" does not apply to Canada's 20th Century economic development. In fact, he finds resource industries to positively affect Canada's national income and level of diversification, without decreasing economic growth.

Keay (2007) finds evidence of forward, backward, and final demand linkages from resource sectors to other sectors of the Canadian economy over the 20th Century. He includes forestry, fishing, energy, and mining, in his resource sector classification. His evidence indicates that from 1900 to 1999, resource industries comprised a leading sector for the Canadian economy. Increases in resource sector value added are shown to chronologically precede decreases in input prices, increases in manufacturing value added, and increases in service sector value added. These results establish the relevance of the staples thesis to 20th Century economic development in Canada. My testing for the energy sector employs the same methodology, but on a smaller data set. I will discuss this methodology in detail in Section 3. Keay's evidence implies

that, historically, resource production spilled over into other areas of the economy. This situation appears to have counteracted the pitfalls of resource production found by Sachs and Warner.

Keay (2008) uses the same methodology to test the resource sector's linkages to "New Economy" sectors, such as high tech manufacturing and service provision. His data spans 1970 to 2005. Again, he finds significant linkages between resource sectors and the new economy sectors. They show the continued relevance of the staples thesis. Resources remain important to the Canadian economy beyond the direct benefits they provide. Moreover, this conclusion depends energy production. With energy production excluded, the evidence of linkage formation weakens substantially. Given these results, one might expect my testing to find energy to be a leading sector over this period. Interestingly, Copithorne (1979) made the same prediction in the 1970s. He downplays the staples thesis' continued importance to Canada, expect with respect to oil and gas. Copithorne also offers an interesting historical perspective on Alberta's oil and gas exports. As the energy industry expanded, Alberta's government was bitterly opposed to sending unprocessed oil and gas to Sarnia. A serious diversification policy in the 1970s reflected this strategy. The policy promoted investment in energy processing, plastics, and chemical production. Such policies seem to have lost influence since that decade, especially since the FTA. My testing will establish the relevance of the staples thesis in the post-FTA years. If my empirical results no longer conform to the staples thesis, they will lend some validity to fears of a Canadian resource curse.

In summary, the FTA seems likely to have enhanced energy income. However, this likely came at the expense of linkage strength, thus opening the door to a potential resource curse. Section 3.1 tests for the impact of the FTA on energy income. Sections 3.2 and 3.3 examine the impact of the FTA on linkage strength. Prior to presenting the results, I discuss some preliminary data.

2.3 Energy Data

This section presents data on Canada's energy industry and its exports to the US. Figure 1 shows the direct economic contribution from Canada's primary energy production.[6] With the 1973 OPEC shock, energy's contribution to the Canadian economy began accelerating. Energy value added as a proportion of GDP peaked at 6% in 1984. It plummeted below 3% in the late 1980s after a crash in world oil prices. Since then, energy's significance in the Canadian economy has trended upwards. The recent increase in energy's direct impact counters a downward trend seen throughout the 20th Century in Canada's resource industries. Section 3.1 empirically tests how policy and energy prices affected the relationship seen in Figure 1.

Please See Page 43 for Figure 1

The FTA promised Canada stable access to US energy markets and the data shows delivery of this promise. The perceived benefit of the FTA contrasted sharply with the previous desire for energy self-sufficiency embodied in the NEP. Figure 2 illustrates the potential effects of these two policies. Beginning in 1980, energy exports to the US as a proportion of Canadian GDP began a cyclical decline.[7] Following the FTA, the cycle began a strong upward trend which continued into the 20th Century.

Please See Page 43 for Figure 2

Figure 3 emphasizes the importance of the US to Canada's energy sector. It deflates the value of energy exports to the US by an energy price index. The result reflects the volume of energy exports. Since the FTA, the volume of energy exports to the US accelerated dramatically. My empirical tests will determine the impact of increased energy exports on energy income and linkage strength.

Please See Page 44 for Figure 3

[6] I define primary products as oil, gas, coal, and other bituminous substances. I use an HP filter to capture the Long Run Cycles in all figures.

[7] Energy exports to the US in figures 2 and 3 include both the primary products, and secondary products, which are defined by the petroleum and coal product classification.

3 Empirical Tests

I empirically test the following hypotheses:

1. The FTA positively affected the energy industry's profitability.

2. The FTA weakened backward and final demand linkages from the energy industry to other sectors of the economy.

3. The FTA weakened the specific forward linkage from primary energy extraction to secondary energy processing.

To test the first hypothesis, I perform a Chow test on energy resource rent data. The Chow test will identify whether or not a structural break exists in the data after the FTA's ratification. I test the second hypothesis using Granger causality tests. They will identify the statistical relationship between past changes in the energy industry's value added and current changes in domestic resource-intensive input prices, manufacturing value added, and service sector value added. The third test uses the same methodology as the second. It tests for chronological relationships between the energy industry's value added, and value added in the petroleum, chemical, and plastics industries. The first and second tests' data spans 1971 to 2005. The third test covers 1971 to 2003. Using this data range also allows comparability with Keay (2008). More importantly, I begin my analysis in the 1970s, as the Canadian energy industry became competitive on the world market in this decade. I transform all data by taking the natural logarithm and then the first difference, which calculates each variable's growth rate. I do this to ensure stationarity,[8] and because it puts the data into a relevant form for my testing. I am interested in how changes in one variable influenced changes in other variables. The following three subsections elaborate on the methodology of each test and present their results.

[8]This transformation makes all data series stationary at the 99% confidence level using Phillips-Perron and Dickey-Fuller tests.

3.1 Testing for a Structural Break

My evidence suggests that the energy industry's economic health improved after the FTA. To proxy economic health, I use data on the energy industry's resource rents. Resource rents are the extra returns to labour and capital from resource production. They arise due to the exhaustible nature of resources, which creates excess returns beyond the average industry's returns. The existence of rents drives economic activity. I calculate resource rents using the method in Keay (2007).[9]

Equations 1 and 2, shown below, represent the linear regression models which I test for structural breaks using Chow tests. The null hypotheses are that the coefficients from these energy rent models did not change following the FTA. Basically, the Chow test runs two regressions: one prior to the FTA and the other following the FTA.[10] It then determines the statistical significance of the difference between the coefficients.

$$\Delta Rent_t = \beta_0 + \beta_1 Time + \epsilon 1_t \tag{1}$$

$$\Delta Rent_t = \eta_0 + \eta_1 Time + \eta_2 \Delta Oil_t + \eta_3 \Delta USGDP_t + \epsilon 2_t \tag{2}$$

Where: $\Delta Rent_t$ represents the annual growth rate of real rents accruing to the fuel extraction, petroleum and natural gas extraction, coal extraction, and petroleum and coal product manufacturing classifications. Time is simply a time trend. ΔOil_t represents the annual growth rate of the real West Texas Intermediate crude oil price. Lastly, $\Delta USGDP_t$ covers the annual growth rate of real US GDP. ϵ represents an error term. I deflate the rent and oil variables by the Canadian GDP deflator.

Figures 4 and 5 illustrate what can be expected from the Chow test on equation

[9] By strict definition, this calculation reflects excess energy industry returns rather than rents since it ignores the extra risk premium on labour and capital employed in the energy sector. Nonetheless, this measure of rents reflects economic health and is relevant for my purposes. Lloyd-Smith (2007) finds this method's estimates for Alberta's oil and gas industry to be comparable to those used by Statistics Canada and various other researchers. As a final note, calculating the risk premiums constitutes an MA essay itself.

[10] When running a series of Chow tests on equation 1 using break years between 1980 and 1995, I find similarly strong evidence of structural breaks in 1989, 1990, 1992, and 1993. I chose 1989 for my testing given that the FTA came into effect then. Changing the break year does not change any conclusions.

1. The solid and fluctuating line in Figure 4 uses an HP filter to illustrate the cyclical component of energy rent levels. It shows the long run cycle of resource rents to peak in 1982, and subsequently decline until 1991. This is not surprising given the OPEC price shocks of the 1970s and the easing of supply pressures in the mid-1980s. Since 1991, the level of resource rents advanced steadily. One can infer the growth rates of resource rents from Figure 4, but I also present them in Figure 5. It shows a steady decline in the rent growth cycle prior to the FTA. After the FTA, the cycle increased before beginning a slight decline around 2000.

Please See Page 44 for Figure 4

Please See Page 45 for Figure 5

The Chow test on equation 1 shows evidence of greater energy industry health following the ratification of the FTA. Table 1 presents its test statistic and p-value. I can conclude at a 0.01 level of significance that some variable(s) other than a time trend and constant induced a structural break in the rent generating model. In other words, statistically significant evidence suggests that the growth in energy rents changed substantially following the FTA. The fourth column in Table 1 shows the mean of the residuals from the model following the FTA. It indicates that the model underestimated rent growth by an average of 3.1% following the FTA. This finding does not necessarily indicate that the FTA increased the energy industry's rent generating capacity. The FTA could be a plausible explanation, but before making such a conclusion, I adjust the model by adding relevant control variables.

The most pressing adjustment is to control for energy prices. I control for the effects of energy prices on rents by including the West Texas Intermediate (WTI) crude oil price in the model. I also included US GDP to control for energy demand fluctuations. Equation 2 shows the expanded model. The oil price variable will almost certainly be a positive and significant driver of rents. Prices for natural gas, petroleum, and other grades of oil likely influence rents as well, but since they gener-

Table 1: Chow Tests for a 1989 Structural Break

Test	**Hypothesis**	**Chow Statistic**	**P-value**	**Mean of Residuals from 1989-2005**
1	$\beta_{0P}=\beta_{0F}$ & $\beta_{1P}=\beta_{1F}$	7.19	0.003***	0.031
2	$\eta_{0P}=\eta_{0F}$ & $\eta_{1P}=\eta_{1F}$ & $\eta_{2P}=\eta_{2F}$ & $\eta_{3P}=\eta_{2F}$	3.32	0.025**	0.019
3	$\eta_{0P}=\eta_{0F}$	0.84	0.366	n/a
4	$\eta_{1P}=\eta_{1F}$	4.65	0.040**	n/a
5	$\eta_{2P}=\eta_{2F}$	0.04	0.848	n/a
6	$\eta_{3P}=\eta_{3F}$	0.88	0.358	n/a

P denotes the pre-FTA years, 1971-1988. F denotes the post-FTA years, 1989-2005. *** Denotes a significant test statistic at the 0.01 level; **Denotes a significant test statistic at the 0.05 level.

ally fluctuate with oil prices, they should not change the model significantly.[11]

After expanding the model to equation 2, one might expect to no longer find the previous evidence of a structural break in equation 1. Figure 6 shows the close relationship between energy rents and oil prices, notwithstanding the oil price spike of 1979. In the post-FTA years, rent increases seem to reflect oil price increases.

Please See Page 45 for Figure 6

However, even after controlling for oil prices and US GDP, it appears that the economic health of the energy industry underwent a statistically significant positive change following the FTA. Test 2 on Table 1 shows the results of a Chow test on equation 2.[12] It allows me to reject the hypothesis that all four coefficients in equa-

[11]Replacing the growth in the oil price by the growth of an energy price index produces the same conclusions.

[12]The conclusions presented here are sensitive to adjustments in the model, but such adjustments render the model economically unsound. I discuss their shortcomings in the appendix, Section A.1.

Table 2: Coefficient Estimates and p-values for Equation 2

Period	Time	ΔOil	$\Delta USGDP$	Constant	R^2
1971-2005	-0.003	0.521	1.085	0.055	0.55
	(0.047)**	(0.001)***	(0.207)	(0.278)	
1971-1988	-0.015	0.446	0.703	0.166	0.71
	(0.000)***	(0.037)**	(0.568)	(0.019)**	
1989-2005	-0.005	0.402	2.996	0.065	0.42
	(0.215)	(0.003)***	(0.177)	(0.516)	

P-values are calculated using Newey-West standard errors.

tion 2 remained the same after the FTA. On average, the model under-predicts the growth in rent by 1.9% following the FTA. The decline in the growth rate of energy rents seen in figure 5 and subsequent reversal following the FTA *cannot* be attributed to oil prices since the model controls for them. Nor can it be attributed to increased growth in US GDP, since I also control for this. Strong evidence suggests that some variable not in the model enhnanced the rent generating capacity of the energy industry following the FTA. The following paragraphs examine the potential variables behind the structural break.

Tests 3 to 6 check for structural breaks on the individual coefficient estimates. They do not directly reveal the factors behind the overall structural break, since they only find the coefficient on the time trend to undergo a statistically significant structural break. If they found the coefficients on oil prices or US GDP to change significantly with the onset of the FTA, this would simplify the analysis. Table 2 shows equation 2's coefficient estimates and p-values for the whole dataset, the pre-FTA years, and the post-FTA years.

As discussed, prior to the FTA, Canada's oil prices were subject to a number of controls. They generally mirrored world prices, but were held below them during the OPEC price shocks. Since the FTA, relatively negligible controls have been in place. For this reason, one might expect the coefficient on the change in oil prices, η_2,

to increase with the onset of the FTA. However, Test 5 shows that the relationship between oil prices and rents does not change significantly.

The coefficient on the change in US GDP, η_3, may also increase given the change in treatment afforded to US consumers with the FTA. Export taxes in the 1970s and the NEP in the early 1980s disrupted Canada's oil and gas producers' access to US markets, potentially hindering the relationship between US demand and energy rents. I am unable to reject Test 6's null hypothesis that η_3, the coefficient on US GDP, remains the same before and after the FTA. However, as Table 2 shows, its magnitude substantially increases. This indicates that the US market has increased its importance to the energy sector's health. The data presented in Section 2.3 reflects this finding.

The weak evidence of a stronger relationship between rents and US GDP only partly explains equation 2's structural break. Test 4 shows a significant structural break on the time variable. I can rationalize this result by comparing the coefficients from estimates before and after the FTA. Table 2 shows that prior to the FTA, the simple passage of time exerted a negative, statistically significant influence on the growth in rents. After the FTA, the time variable is no longer statistically significant. Some factor, which was positive for the energy industry's health, emerged around the time of the FTA. I present two plausible explanations.

The first is the growing viability of the oilsands. Since I have controlled for oil prices, increased viability due to market conditions cannot be behind the structural break. However, supply-side developments, such as technology breakthroughs, tax rates, or capital costs may have induced the structural break. Technology changes have occurred in recent years, but they do not seem to be of the magnitude necessary to induce a structural break.[13] Alberta's favourable royalty regime does not seem to

[13]Suncor began commercial oilsands extraction in 1967. Today's infamously large dump trucks and excavators replaced the original bucket-wheel, dragline, and conveyor belt technology. This represents an improvement at the margin, but does not seem substantial enough to induce a structural break. The development in the 1980s and subsequent viability of the Steam Assisted Gravity Drainage technique will potentially enhance post-FTA rents, but its application does not seem to have expanded substantially until only recently.

be behind this either as I have tested the tax rates.[14] Low interest rates in the late 20th Century and early 21st Century may have promoted energy industry expansion, especially for relatively capital-intensive oilsands production. However, these effects would only influence the latter years of the dataset. For now, a policy shift seems the most plausible explanation.

For the energy industry, the FTA represented a dramatic policy shift from the interventionism of the 1970s and 1980s. The following quotes extend Section 2.1's discussion of the shift. On March 14, 1973, federal Energy Minister Donald Macdonald stated, "The market should govern the price of (natural) gas." Prime Minister Pierre Trudeau made a similar statement on May 7: "There is no government policy that the people of Ontario should have low gas(oline) prices." Four months later, on September 5, Trudeau stated, "The prices of petroleum have reached the point where immediate measures are required to stabilize the actions of the marketplace." World oil supply conditions of the 1970s made Canada's energy industry the constant target of governments.[15]

A steady increase of adverse policy for the energy industry occurred throughout most of the pre-FTA period. As policies moved towards interventionism, they seem to have driven a wedge into the relationship between rents, prices, and demand. The significant and negative coefficient on the time trend reflects this wedge. Following the FTA, the coefficient on time becomes statistically insignificant. This implies a removal of the policy wedge in the FTA era. I will not credit the FTA for removing this wedge, as policy makers still have options to intervene in the energy industry. They have just chosen not to use them since the FTA's ratification. Their hands-off approach appears to have contributed to post-1988 energy industry income. If the following sections do not find evidence of reduced linkage strength with the onset of the FTA, I can conclude that this approach has been positive for Canada's economy.

[14]The results from adding tax rates, pipeline capacity, and reserves to equation 2 are discussed in the appendix, section A.1.

[15]The Alberta government also targeted the energy industry by increasing royalty rates in the 1970s.

However, if the linkages show signs of weakening, policy makers face difficult choices in trading off energy industry income with linkage strength. The pressure to return to heavy pre-FTA interventionism may be high given today's oil prices.

3.2 Testing for Backward and Final Demand Linkages

My evidence suggests that linkages from the energy sector to other areas of the economy weakened with the onset of the FTA. This section specifically tests for backward and final demand linkages between the energy industry, the non-resource intensive manufacturing sector, and the service sector.[16] A statistically significant relationship between changes in past energy value added and current changes in manufacturing value added indicates the existence of backward and final demand linkages.[17] The tests also reflect forward linkages, but in a weaker sense. For example, refining industries receive spill-over benefits through forward linkages. These benefits will spill over into the manufacturing and service sectors. I test the strength of the linkages between 1970 and 2005, prior to the FTA, and after the FTA. The tests unequivocally reveal a weakened linkage from the energy industry to the service industry. I also find evidence of a weakened linkage from the energy industry to manufacturing industry, but this result depends on the tests' construction.

To test for the linkages consistent with the staples thesis, I utilize vector autoregressive (VAR) systems. These will identify chronological relationships between the energy industry, non-resource intensive manufacturing industry, service industry, and domestic energy prices. I have estimated the parameters from the following four

[16]The service sector refers to all economic activities not included in the resource sector, resource-intensive and non-resource intensive manufacturing sectors, and agriculture sector. Resource intensive manufacturing refers to all manufacturing activities directly associated with energy, fishing, forestry, and mining. Non-resource intensive manufacturing refers to the opposite. As an example, refineries would count as resource-intensive manufacturing.

[17]Value added equals the value of economic output minus the material inputs used to create that output. It is divided between labour and capital. It provides a good measure of an industry's economic health.

equation VAR system[18]:

$$\Delta Ener_t = \beta_1 + \beta_2 \Delta Ener_{t-1} + \beta_3 \Delta Manu_{t-1} + \beta_4 \Delta Serv_{t-1} + \beta_5 \Delta EnPr_{t-1} + \epsilon 1_t \quad (3)$$

$$\Delta Manu_t = \alpha_1 + \alpha_2 \Delta Ener_{t-1} + \alpha_3 \Delta Manu_{t-1} + \alpha_4 \Delta Serv_{t-1} + \alpha_5 \Delta EnPr_{t-1} + \epsilon 2_t \quad (4)$$

$$\Delta Serv_t = \gamma_1 + \gamma_2 \Delta Ener_{t-1} + \gamma_3 \Delta Manu_{t-1} + \gamma_4 \Delta Serv_{t-1} + \gamma_5 \Delta EnPr_{t-1} + \epsilon 3_t \quad (5)$$

$$\Delta Pr_t = \eta_1 + \eta_2 \Delta Ener_{t-1} + \eta_3 \Delta Manu_{t-1} + \eta_4 \Delta Serv_{t-1} + \eta_5 \Delta EnPr_{t-1} + \epsilon 4_t \quad (6)$$

Where: $\Delta Ener$ = real percentage change in primary energy industry value added, where primary is defined as in Section 2.3; $\Delta Manu$ = real percentage change in non-resource intensive manufacturing value added; $\Delta Serv$ = real percentage change in value added in the service industry; $\Delta EnPr$ = real percentage change in a Canadian energy price index. By choosing this measure, I essentially control for energy prices. This separates the effects of energy industry output expansions and energy price expansions. All variables are deflated by the Canadian GDP deflator. I use the GDP deflator and not sector specific price indices as I wish to test for linkages due to income changes, rather than output volume changes.[19] I also include a constant in the system to capture movements in sector output not related to past movements of other sectors.

Table 3 reports the results from estimating the VAR system. As evident, the estimations cover different periods. The first spans the complete data set, the second covers 1972 to 1989, and the final estimation reflects the years following the FTA. I chose 1990 as the break year so that all lagged values for the post-FTA estimation were generated during the FTA's existence.

[18]I impose one lag on the model. The Akaike and Schwarz criteria indicate economically unsatisfactory optimal lag lengths. They usually indicate zero as the optimal number of lags. This indicates that current value added in one industry determines current value added in another industry. This makes little sense as there should be no fundamental economic relationship without lags. Ideally, I would use shorter frequency data, but using monthly data is infeasible in this case. Annual data, with lags should still identify linkages. A one year lag comes close in its test statistic to the test statistic from zero lags, and both criteria indicate a one year lag as the optimal lag length when testing the levels. I do not perform Granger causality tests on the levels, due to their non-stationarity. Moreover, I wish to test how growth in one industry affects growth in other industries. It is possible to include more than one lag, but the parameter estimates remain similar.

[19]Whereas Keay (2008) deflates each industry by its sector specific price index.

Table 3: Testing for Linkages with Energy Prices

Dependent Variables		Independent Variables					
		$\Delta Ener_{t-1}$	$\Delta Manu_{t-1}$	$\Delta Serv_{t-1}$	$\Delta EnPr_{t-1}$	Cons	R^2
$\Delta Ener_t$	'71-'05	0.172	-0.328	-1.383	0.110	0.089	0.05
		(0.492)	(0.541)	(0.396)	(0.669)	(0.139)	
	'71-'89	0.664	-0.875	-1.772	-0.655	0.112	0.21
		(0.079*)	(0.288)	(0.492)	(0.158)	(0.307)	
	'90-'05	-0.579	0.331	-1.543	0.270	0.084	0.21
		(0.053*)	(0.582)	(0.409)	(0.268)	(0.134)	
$\Delta Manu_t$	'71-'05	0.025	0.232	-0.767	-0.012	0.038	0.11
		(0.764)	(0.191)	(0.154)	(0.885)	(0.057*)	
	'71-'89	-0.018	0.377	-0.808	0.111	0.044	0.20
		(0.878)	(0.138)	(0.310)	(0.437)	(0.190)	
	'90-'05	-0.016	0.170	-0.894	0.003	0.035	0.10
		(0.902)	(0.517)	(0.275)	(0.976)	(0.148)	
$\Delta Serv_t$	'71-'05	0.045	0.077	0.433	-.046	0.016	0.40
		(0.032**)	(0.085*)	(0.001***)	(0.030**)	(0.002***)	
	'71-'89	0.059	0.035	0.267	-0.075	0.024	0.35
		(0.048**)	(0.590)	(0.189)	(0.041**)	(0.006***)	
	'90-'05	0.024	0.106	0.522	-0.033	0.012	0.44
		(0.455)	(0.101*)	(0.009***)	(0.206)	(0.049**)	
$\Delta EnPr_t$	'71-'05	0.046	- 0.435	-0.075	0.000	0.043	0.02
		(0.860)	(0.432)	(0.964)	(0.999)	(0.489)	
	'71-'89	0.273	-0.949	-2.382	-0.435	0.124	0.14
		(0.436)	(0.213)	(0.319)	(0.311)	(0.223)	
	'90-'05	-0.119	-0.207	2.902	0.061	-0.023	0.10
		(0.769)	(0.799)	(0.252)	(0.852)	(0.761)	

For all tables, coefficient estimates are the numbers without brackets, and p-values are the numbers in brackets. *s denote the level of statistical significance: ***0.01, **0.05, *0.10.

The results in Table 3 show a weakened linkage from the energy industry to service sector with the onset of the FTA. Prior to the FTA, I can conclude at the 0.05 significance level that changes in energy sector value added Granger caused changes in service sector value added. After the FTA, this linkages loses its statistical significance. The results cast doubt on the validity of the staples thesis in the post-FTA era, since the service sector dominates the Canadian economy in terms of output. It

appears that the energy sector no longer leads Canada's largest sector. This may reflect factors such as globalization, but services remain difficult to import. The policy shift to the FTA likely contributed to the weakened linkages. A potential increase in rent leakage brought about by the FTA would reduce the proportion of energy income available for domestic spill-over, thus weakening linkages. Section 3.3 implies that rent leakage increased with the FTA.

The Granger causality tests also find a decline in the statistical significance of energy prices on the service sector. Prior to the FTA, energy prices have a negative and statistically significant relationship with service sector value added. The oil price shocks of the 1970s sparked efforts to decrease energy use in cars, buildings, and commercial vehicles. The loss of statistical significance for energy prices following the FTA may reflect these efforts.

Table 3 shows that in the post-FTA period, manufacturing assumed energy's role as a leading sector for the service industry. Prior to the FTA, I do not find a statistically significant relationship between the manufacturing sector and the service sector. After the FTA, I can conclude at the 0.11 significance level that changes in manufacturing value added led changes in service sector value added. This may reflect Lileeva's finding of the FTA's positive impact on high productivity exporting industries.

The statistically significant negative coefficient estimate for β_2 appears odd, but changes in energy value added became highly cyclical in the post-FTA years. High growth years were generally followed by negative growth years, and vice versa. This does not seem to result in larger standard errors for the estimates of α_2 and γ_2 in the post-FTA dataset relative to those in the pre-FTA dataset.

Finally, I do not find any evidence of a linkage from the energy industry to manufacturing industry. One might conclude that this reflects the concentration of energy production in western Canada, and the concentration of manufacturing in eastern Canada. Despite the geographical differences, the absence of any statistical signif-

icance seems surprising, given Keay's results. For this reason, I replace the energy price index in equations 3 to 6 with a composite raw material price index, which includes energy, forestry, fishing, and minerals. Its changes closely mirror those of the energy price index. Since mineral costs either cover or proxy a large proportion of manufacturers' input costs, the raw material index will act as a stronger control in equation 4. The previous results for equation 4 may be inaccurate if increases in real energy sector value added coincided with increases in mineral prices. Table 4 presents the coefficient estimates and p-values from the adjusted model. I will reconcile these results with the conclusions from the initial VAR system.

The results in Table 4 show a linkage from the energy sector to the manufacturing sector to weaken following the FTA. Prior to the FTA, changes in energy sector value added Granger caused changes in manufacturing sector value added at a 0.11 level of significance. This relationship loses its statistical significance after the FTA. Part of the weakening may reflect Asia's increased prominence in manufacturing. However, access to cheaper capital and consumer goods from the US likely played a larger role than Asia. Lileeva's finding of a negative impact from the FTA on Canada's non-exporting industries reflects this.

Over the full data set, from 1972-2005, both the energy industry and manufacturing industry are found to be leaders of the service industry. The energy industry's leadership is more significant, despite its smaller coefficient. The smaller coefficient reflects the small size of the energy industry relative to the manufacturing industry. Prior to the FTA, energy is found to be a significant leader of the service sector at a 0.02 level of significance, whereas manufacturing does not seem significant. Following the FTA, the energy industry's level of significance declines to 0.09, whereas the manufacturing industry becomes more significant. This reversal is not as strong as that in Table 3, but it supports the same conclusions. With the onset of the FTA, linkages from the energy sector to the service sector weakened. The manufacturing sector appears to have picked up some of this slack, possibly through the increase in

Table 4: Testing for Linkages with Raw Material Prices

Dependent Variables		Independent Variables					
		$\Delta Ener_{t-1}$	$\Delta Manu_{t-1}$	$\Delta Serv_{t-1}$	ΔPr_{t-1}	Cons	R^2
$\Delta Ener_t$	'72-'05	-0.109	-0.036	-2.24	0.503	0.115	0.10
		(0.647)	(0.943)	(0.151)	(0.276)	(0.050**)	
	'72-'89	0.103	-0.108	-2.17	0.334	0.122	0.16
		(0.757)	(0.887)	(0.389)	(0.622)	(0.268)	
	'90-'05	-0.751	0.49	-2.22	0.935	0.108	0.32
		(0.011**)	(0.378)	(0.209)	(0.060*)	(0.042**)	
$\Delta Manu_t$	'72-'05	0.083	0.162	-0.718	-0.134	0.036	0.13
		(0.300)	(0.339)	(0.171)	(0.372)	(0.065*)	
	'72-'89	0.155	0.138	-0.720	-0.293	0.043	0.25
		(0.106*)	(0.528)	(0.321)	(0.133)	(0.175)	
	'90-'05	-0.079	0.221	-1.23	0.157	0.044	0.15
		(0.566)	(0.395)	(0.133)	(0.496)	(0.081*)	
$\Delta Serv_t$	'72-'05	0.058	0.075	0.405	-0.136	0.016	0.52
		(0.002***)	(0.053*)	(0.001***)	(0.000***)	(0.000***)	
	'72-'89	0.057	0.059	0.291	-0.150	0.022	0.52
		(0.017**)	(0.283)	(0.108)	(0.002***)	(0.005***)	
	'90-'05	0.051	0.083	0.451	-0.117	0.013	0.49
		(0.086*)	(0.141)	(0.012**)	(0.019**)	(0.016**)	
ΔPr_t	'72-'05	-0.059	0.041	-0.243	0.219	0.022	0.03
		(0.645)	(0.878)	(0.772)	(0.377)	(0.475)	
	'72-'89	-0.063	0.141	-0.287	0.239	0.020	0.03
		(0.711)	(0.720)	(0.826)	(0.495)	(0.719)	
	'90-'05	-0.024	-0.119	-0.041	0.179	0.020	0.04
		(0.907)	(0.764)	(0.974)	(0.611)	(0.601)	

high productivity exports found by Lileeva. However, recent currency appreciations have likely harmed the competitiveness of these exports. The currency appreciation appears to reflect oil prices, which will stimulate energy activity, especially in the oilsands. Unfortunately, the post-FTA weakening of the energy sector's linkage to the manufacturing sector implies that Canada's manufacturers will be missing out on opportunities for backward linkages to the oilsands' capital projects. Without these backward linkages, the costs of currency appreciation to exporting manufacturers will not be offset by gains to Canada's manufacturers serving the domestic

market. Strengthening these linkages likely requires Canada's manufacturers to shift their focus from the US to western Canada. This paper does not propose policy to address this systemic issue.

Tables 3 and 4 show energy output to no longer produce their historical spill-over benefits to other sectors after the FTA. Record breaking oil prices and a dollar at parity will pressure politicians into action. The job of the policy maker becomes critical, since energy policy will create winners and losers. Section 3.1 showed the FTA's hands-off approach to positively impact energy income. This section shows a weakening of linkages coincident with the hands-off approach. The most alarming result is the weakening linkage from the energy industry to the service sector. The service sector makes up most of Canada's economy, which has recently been dubbed "a nation of corner stores."[20] On aggregate, this has been true over the 20th Century, but Keay (2007) shows the strong foundation to the corner store, built by leadership from the resource sector. Without this leadership, Canadians risk the foundation of their economic prosperity. Policy to correct this threat will be successful if it reinvigorates Canada's historical linkages. Such policy will harm energy income, but its success paradoxically depends on striking the right balance between a prosperous energy industry and strong linkages. The conquer and divide politics of the NEP struck a skewed balance against energy income, and the FTA seems to have fared no better in its neglect of linkages.

3.3 Testing for Secondary Processing Linkages

This section implicitly tests for a relative acceleration of primary energy exports following the FTA. I test the forward linkages from primary energy production to secondary energy processing industries, and analyze the effects of the FTA on them. The results show weakened forward linkages to secondary processing since the FTA.

[20]Terence Matthews, Chairman of Mitel Networks Corp. made this statement in the *Globe and Mail* on May 22, 2008. Interestingly the article exempts the "booming resource sector" from this categorization.

This implies that Canada's energy processors no longer have an advantage relative to foreign processors, which may result in substantial rent leakage.

Canadians have feared the label of "hewers of wood and drawers of water." Newspaper and magazine columns often lament Canada's inability to transform primary energy products into more valuable commodities. Doing so through domestic secondary processing represents a forward linkage, which will also create backward and final demand linkages. However, increasing domestic secondary processing through policy entails a trade-off. Limiting raw resource exports will reduce energy sector activity and thus backward and final demand linkages. However, the benefits from secondary processing policies will dominate this negative effect if the resource in question receives significantly higher rents after secondary processing. Bitumen illustrates this point. Transforming bitumen into synthetic crude oil (upgrading) gives oilsands output a greater market, and thus significantly higher prices. Legislating that all upgrading take place in Canada will increase forward linkages to secondary processing industries. The economic rents from processing may spill over into other sectors through backward and final demand linkages. Domestic refining also creates forward linkages to other sectors by providing feedstock to industries producing goods such as fertilizers, plastics, and other petrochemicals. It makes these sectors more competitive, thus enhancing the economy's degree of diversification. However, domestic upgrading laws may decrease the demand for bitumen. This will reduce the amount of bitumen production and could offset the gains from legislation. Even with this in mind, the results in this section provide an impetus for domestic upgrading policies.

This section mimics Section 3.2 in its testing. It examines linkages between primary energy commodities, refined petroleum, plastics, and chemicals. I use Statistics Canada Manufacturing Value Added data. The refined petroleum and plastics classifications are self explanatory. The chemical classification includes all manners of chemicals, fertilizers, synthetic resins, paint, pharmaceuticals, adhesives, etc. Finally,

I use annual data which ranges from 1970 to 2003.[21] I test the following VAR system:

$$\Delta En_t = \beta_1 \Delta En_{t-1} + \beta_2 \Delta Pet_{t-1} + \beta_3 \Delta Chm_{t-1} + \beta_4 \Delta Pl_{t-1} + \beta_5 \Delta EP_{t-1} + \epsilon_t \quad (7)$$

$$\Delta Pet_t = \alpha_1 \Delta En_{t-1} + \alpha_2 \Delta Pet_{t-1} + \alpha_3 \Delta Chm_{t-1} + \alpha_4 \Delta Pl_{t-1} + \alpha_5 \Delta EP_{t-1} + \epsilon_t \quad (8)$$

$$\Delta Chm_t = \gamma_1 \Delta En_{t-1} + \gamma_2 \Delta Pet_{t-1} + \gamma_3 \Delta Chm_{t-1} + \gamma_4 \Delta Pl_{t-1} + \gamma_5 \Delta EP_{t-1} + \epsilon_t \quad (9)$$

$$\Delta Pl_t = \eta_1 \Delta En_{t-1} + \eta_2 \Delta Pet_{t-1} + \eta_3 \Delta Chm_{t-1} + \eta_4 \Delta Pl_{t-1} + \eta_5 \Delta EP_{t-1} + \epsilon_t \quad (10)$$

Where: ΔEn = real percentage change in primary energy industry value added, where primary is defined as in Section 2.3; ΔPet = real percentage change in petroleum and coal product refining value added; ΔChm = real percentage change in chemical industry value added; ΔPl = real percentage change in plastic industry value added; and ΔEP = real percentage change in a Canadian energy price index.[22] I also include a constant in the model to capture movements in one sector not related to other sectors, but do not list it in the above equations.

Granger causality tests find evidence of weakened linkages from the energy sector to its secondary processing sectors. Table 5 shows the VAR coefficient estimates and p-values from equations 7 to 10. It appears that linkages from primary energy production to petroleum processing and chemical production weaken with the onset of the FTA. These findings reflect both increased volatility in the linkages and a weakening of their magnitude. I do not analyze the estimates from equation 10, since I do not find evidence of forward linkages from the energy sector to plastics sector over any data range.

Equation 7's coefficient estimates in the post-FTA period may appear odd to the reader. Changes in petroleum value added exert a statistically significant negative effect on changes in energy sector value added. This contradicts the logical leadership hierarchy from primary to secondary industries, but may simply reflect the correla-

[21] Using monthly data is preferable, since the linkages from energy extraction to refining are very direct. Oil is extracted and then refined into final fuel products over a short time frame. In fact, both the Schwarz and Akaike criteria consistently cite 0 lags as optimal for the explanatory variables in the VAR system of equations 7-10. They show 1 lag to be the next best alternative. The yearly dataset, while not ideal, remains a valid test for linkages.

[22] I discuss the results of replacing this by an idiosyncratic index in the appendix, Section A.2.

Table 5: Testing for Secondary Processing Linkages with Energy Prices[z]

Dependent Variables	Period	Independent Variables ΔEn_{t-1}	ΔPet_{t-1}	ΔChm_{t-1}	ΔPl_{t-1}	ΔEP_{t-1}	R^2
ΔEn_t	'71-'03	0.219	-0.134	0.367	-0.295	0.103	0.07
		(0.328)	(0.367)	(0.446)	(0.528)	(0.765)	
	'71-'89	0.397	0.145	0.024	-0.370	-0.401	0.12
		(0.237)	(0.659)	(0.981)	(0.635)	(0.578)	
	'90-'03	-0.362	-0.239	0.472	-0.051	0.345	0.32
		(0.209)	(0.047**)	(0.265)	(0.936)	(0.267)	
ΔPet_t	'71-'03	0.368	-0.364	-1.121	1.019	0.242	0.28
		(0.195)	(0.053*)	(0.066*)	(0.086*)	(0.579)	
	'71-'89	0.580	-0.297	-1.070	0.482	-0.535	0.27
		(0.104*)	(0.385)	(0.310)	(0.552)	(0.477)	
	'90-'03	0.421	-0.304	-1.088	1.549	0.370	0.38
		(0.464)	(0.204)	(0.198)	(0.220)	(0.550)	
ΔChm_t	'71-'03	0.177	-0.042	0.035	0.235	-0.298	0.22
		(0.072*)	(0.521)	(0.867)	(0.252)	(0.048**)	
	'71-'89	0.188	-0.131	-0.391	0.523	-0.328	0.52
		(0.049**)	(0.159)	(0.173)	(0.018**)	(0.110*)	
	'90-'03	0.228	0.044	0.048	0.235	-0.338	0.20
		(0.247)	(0.589)	(0.870)	(0.587)	(0.112*)	
ΔPls_t	'71-'03	0.047	-0.075	-0.240	0.479	-0.179	0.23
		(0.623)	(0.240)	(0.248)	(0.038**)	(0.227)	
	'71-'89	0.135	-0.095	-0.659	0.569	-0.409	0.43
		(0.284)	(0.436)	(0.082)	(0.051*)	(0.130)	
	'90-'03	-0.062	-0.024	-0.047	0.504	-0.107	0.19
		(0.692)	(0.714)	(0.840)	(0.144)	(0.527)	
ΔEP_t	'71-'03	0.160	-0.091	0.322	-0.177	0.233	0.13
		(0.301)	(0.372)	(0.332)	(0.582)	(0.326)	
	'71-'89	0.118	-0.021	0.421	-0.285	0.394	0.30
		(0.489)	(0.895)	(0.413)	(0.471)	(0.283)	
	'90-'03	-0.046	-0.112	0.217	0.366	0.060	0.10
		(0.895)	(0.434)	(0.667)	(0.628)	(0.871)	

z: While a constant is in the model, I do not include its coefficient estimates or p-values. The constant is only found to be statistically significant at the 0.20 level twice. I find evidence of positive constants, with p-values of 0.029 and 0.004 for equations 8 and 9, respectively, during the pre-FTA years.

tion between raw energy extraction and petroleum refining. Moreover, the negative, but statistically insignificant, coefficient on lagged energy reiterates the volatile post-FTA energy growth trend discussed in Section 3.2. High growth in one year tended to follow negative growth in the previous year, and vice versa. I cautiously consider the further results with equation 7 in mind.

Prior to the FTA, I find evidence of a linkage from energy extraction to petroleum processing, which weakens with the onset of the FTA. Since I do not find evidence of bi-directionality,[23] I can conclude at a 0.11 level of significance that changes in primary energy production Granger caused changes in secondary petroleum processing prior to the FTA. After the FTA, the relationship loses its statistical significance, which largely stems from an increased standard error. The coefficient estimate for lagged energy, α_1, remains positive, which should be expected. This finding reduces my apprehension of the odd results in equation 7, and allows me to draw conclusions from equation 8. Forward linkages between primary energy extraction and secondary processing appear to weaken with the onset of the FTA. The policy shift from pre-FTA intervention to a post-FTA hands-off approach may explain this finding. I will expand on this point after presenting the results for the chemical sector.

I find a weakened forward linkage from the energy sector to chemical sector with the onset of the FTA. The linkages will depend on quantity effects and will likely be offset by price effects. Prior to the FTA, I can conclude at the 0.05 significance level that changes in energy sector value added Granger caused changes in chemical sector value added. After the FTA, this relationship loses it statistical significance, but the coefficient on lagged energy, γ_1, is larger than in the pre-FTA period. Once again, increased volatility seems to weaken the linkages from primary production to secondary processing. The volatility seen in the parameter estimates will increase risk, thus reducing the incentive to invest in secondary processing capacity. Table 5 also

[23]Bi-directionality refers to finding statistically significant relationships between two variables when one is lagged and the other is not, and vice versa. In this case, statistically significant estimates for both β_2 and α_1 would imply bi-directionality.

shows, unsurprisingly, that changes in the energy price index correspond negatively and significantly to the chemical sector output. Before the FTA, increases in energy prices seem to offset the spill-over benefits from increased energy production. After the FTA, energy prices exert an almost identical negative effect, but I do not find evidence of forward linkages. The existence of domestic energy production no longer appears to cushion the impact of energy prices on secondary processing industries. Some explanation must reconcile the weakened forward linkages to chemical production and petroleum refining.

The policy shift from pre-FTA interventionism to the post-FTA hands-off approach seems the most likely explanation. The extension of the Interprovincial pipeline to Montreal in 1976 created linkage opportunities, which were realized by implicitly subsidizing eastern Canadian energy users through export taxes. The NEP went further by directly subsidizing eastern Canadian petroleum refineries with the proceeds from oil and gas export taxes. The policy shift to the FTA ended the flow of subsidized energy to Canada's main petroleum refining and chemical producing regions. Without subsidized energy products, one would expect linkages to weaken, which the Granger causality tests verify. The weakening reflects increased volatility, and not magnitude, in the relationship between primary production and secondary processing. It appears that the interventionist policies of the pre-FTA period promoted a relatively stable energy supply environment for secondary processors. Following the FTA, secondary processors lost their federal government support. This also applies to the Alberta government's policies, which promoted linkages from primary production to secondary processing. Its diversification strategy in the 1970s supported petroleum, chemical, and plastic industrial development. With the crash in oil prices in the mid-1980s, the support for secondary processing declined. Processing raw resources domestically enhances rent capture. The weakened linkages from the energy sector to the service sector found in Section 3.2 may reflect a less profitable secondary processing sector, and thus lower rent capture in the post-FTA period.

The above discussion reiterates that policy matters, especially when it comes to forming linkages. It also shows the dangers of using policy, such as energy intervention, as means to electoral ends. The means of the 1970s and 1980s strengthened linkages, but to the significant detriment of Canada's energy industry. In fact, linkage creation may have only been a residual effect from political motives. On the other hand, the hands-off policy embodied by the FTA significantly enhanced the energy sector's prosperity, at the expense of linkage formation. Without linkage formation, an economy will not transform into the diversified and prosperous economy described by Innis, Mackintosh, Watkins, and Keay. To achieve this goal, policy makers and politicians will have to fill the policy void left by the FTA. Temptations will be strong to revert to the extremes of the NEP, but doing so would get it wrong once again.

4 Conclusion

Canada's energy industry increased its dependence on the United States with the onset of 1988's FTA. The hands-off policies associated with the FTA increased energy sector income. However, the staples thesis appears to be losing its relevance. My testing finds that Canada's historical staples-led linkages no longer hold for energy. Canadians forego opportunities for economic prosperity without strong linkages between sectors. The weakening of linkages from primary energy production to secondary processing becomes especially troubling as the energy industry extracts lower value resources, such as bitumen. Lower quality, less marketable resources will accrue less resource rent, thus limiting the backward and final demand linkages to other sectors. At no time in recent Canadian history has the title of "hewers of wood and drawers of water" been more alarming.

Many policy choices could enhance linkage strength from the energy industry to other sectors. Policy makers could tax bitumen at a higher rate than synthetic crude oil, thus encouraging more domestic upgrading. They could alternatively offer tax incentives to oil companies upgrading bitumen in Canada. These policies would be

unlikely to harm energy income substantially, but may not be enough to strengthen linkages. Policy could also forbid foreign workers from constructing oilsands plants, which will reduce energy sector income, but stem the flow of leaked rents from Canada. Discriminating against foreign investors in the oilsands will also reduce rent leakage, but will also have a similar effect on energy income. Striking the right balance between energy income and linkage strength will always remain a challenge.

Another challenge may come from changes forced upon Canada by the US. Canada's secure access to the US market may come under threat with American policy to reduce carbon emissions. Presumptive Democratic presidential nominee Barack Obama has talked openly of penalizing "dirty" fuel sources from the oilsands. US mayors and states are adopting similar proposals. Canada still benefits greatly from its energy trade to the US. However, the industry will face great pain if the US turns its back on what will become Canada's main energy export. Sweeping greenhouse gas and environmental impact mitigation in the oilsands will mitigate this threat. Such policy is unlikely, so diversifying Canada's energy customers would be wise. Policy makers could fast-track a pipeline of synthetic crude oil to the Pacific Coast in British Columbia. Clauses in the FTA constrain the amount of diversification, so policy makers must be prepared and open for renegotiations.

The evidence of weakened linkages from 1990 to 2005 can only worsen given recent developments. This June, Shell canceled a planned bitumen upgrader in Sarnia. Their decision fits into a developing theme, where bitumen will be extracted and piped to American processing plants. Given the Sarnia cancellation, tens of billions of dollars worth of planned bitumen upgrader investment in Alberta no longer remains a sure bet. If upgraders are deemed unviable in Sarnia, they are unlikely to be viable in Alberta's over-heated cost environment.[24] A growing list of firms planning bitumen processing in the United States, such as Shell, EnCana, Husky, Marathon, BP, Exxon, and Conoco, have shown that the returns to bitumen upgrading are higher

[24]During the summer of 2007, industrial construction managers in Alberta consistently cited annual cost inflation of 20%.

there. The recently approved Keystone pipeline will provide bitumen to these companies. This will increase primary energy activity, but the potential rents from synthetic crude oil will flow freely from Canada in pipelines operated by the ironically named TransCanada Corporation. At the NEB hearings for the Keystone pipeline, Mike McCracken, a veteran economist in Ottawa, and founder of Infometrica, a private economic research firm, estimated that its approval would cost Canada 18,000 jobs. It appears that the NEB discarded this testimony in its eventual approval. While there no longer remains a chronological relationship between energy output, and the output of other sectors, there does appear to be a chronological relationship between NEB decisions and refinery cancellations. If continued, Canada's new bitumen staple opens the door to a made-in-Canada resource curse.

Nearly a half century ago, perhaps with C.D. Howe on his mind, Professor Hugh Aitken noted the existence of "strategic decisions in the process of economic growth to promote the creation, integration, and welfare of a national economy." Legislating against continued raw resource exports, such as bitumen, may fit this description and counteract the detrimental trends found in sections 3.2 and 3.3. McDougall (1991) finds that policy makers have substantial power in directing new energy transmission systems. The NEB can reverse their recent course and mandate that no bitumen leave Canada until it is upgraded. Such a policy fits this paper's theme of a double-edged sword. It would hamper development in the oilsands, where firms are struggling to construct bitumen upgraders in a construction environment past full employment. The reduction in industry activity would temporarily reduce the level of overall linkages, but the long-term revitalization of linkages will likely overcome this negative effect. There are significant profits to be made by transforming bitumen into synthetic crude oil, and the technology is available. If given the rules, firms will comply. The rules will attract investment dollars into Canada, which will directly benefit the Canadian economy. The rents from synthetic crude oil will be distributed to Canadian labour and higher royalties will be paid by capital. These payments will spill over into

manufacturing and service sectors. Such a policy takes true national leadership and will work to restore the energy industry as a leader for Canada's economy. It will be sure to generate outright hostility between provinces and American displeasure, but seeing it through could put Canada on a path to 21st Century staples-led prosperity.

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A Appendix

A.1 Adjustments to Equation 2

First, the conclusions I present depend on correcting for heteroscedasticity and autocorrelation using Newey-West standard errors. This correction is appropriate, but I mention it since Chow tests using an uncorrected covariance matrix do not find evidence of a structural break. Secondly, Chow tests using levels do not find a structural break. Such tests suffer from problems of non-stationarity, thus violating the OLS assumptions. Moreover, the post-FTA regression on the levels produces economically flawed results, with the oil price as a negative and insignificant driver of rents. Thirdly, adding more variables to the model also removes evidence of an overall structural break. For example, I included three potentially important variables: pipeline capacity, tax rates, and reserves.[25] None of the variables are significant over any of the periods tested. Nor do they drastically alter the coefficient estimates already in equation 2. For this reason, including them in equation 2 would result in an over-specified model.

The conclusions also change if I remove either the constant or time trend from the model. Given the results in Table 2, this would result in an under-specified model. Under-specification creates biased coefficient estimates and misleading standard error estimates. Moreover, removing the constant from equation 1 nullifies evidence of a structural break. This result contradicts the clear shift in rent growth seen in Figure 5. Figure 5 shows that a constant matters to equation 1. Table 2 shows that it still matters in equation 2, since it remains significant after controlling for oil prices and US GDP.

Finally, removing the time trend from the model also gives misleading results. Table 2 shows the time trend to be statistically significant prior to the FTA. By removing it, the model incorrectly shifts its explanatory power to the other independent variables and the error term. In summary, there are many adjustments one can make to the model. The discussion above shows the errors inherent in particular adjustments.

A.2 Substituting Canada's Idiosyncratic Energy Prices into Equations 7-10

The conclusions in Section 3.3 strengthen if I replace changes in the Canadian energy price index in equation 7 to 10 by changes in an idiosyncratic energy price index. The idiosyncratic energy price index represents Canada's energy price movements which are independent of those in the United States. Keay (2000) discuses its construction. The coefficient estimates remain similar to those in Table 5, but prior to the FTA, I can now conclude that changes in energy sector value added Granger

[25] To proxy these, I include the average annual change in export volume to the United States, the change in the average tax rate for the oil and gas sector, and the change in the real value of Canada's oil and gas reserves, respectively.

caused changes in petroleum processing value added at a 0.03 level of significance. After the FTA, the linkage from primary to secondary petroleum processing loses its statistical significance, as I find a p-value of 0.38. The results for the chemical sector are not as strong as those in Table 5, but they still show evidence of weakening linkages from primary energy production. For descriptive purposes, I could divide forward linkages into two channels. The direct linkage from primary production to secondary processing found in Section 3.3 represents the first channel. The second channel represents the forward linkage where increases in energy value added should precede decreases in idiosyncratic energy prices. I do not find evidence of this second channel. The results are available on request: stratton.pj@gmail.com.

Figure 1

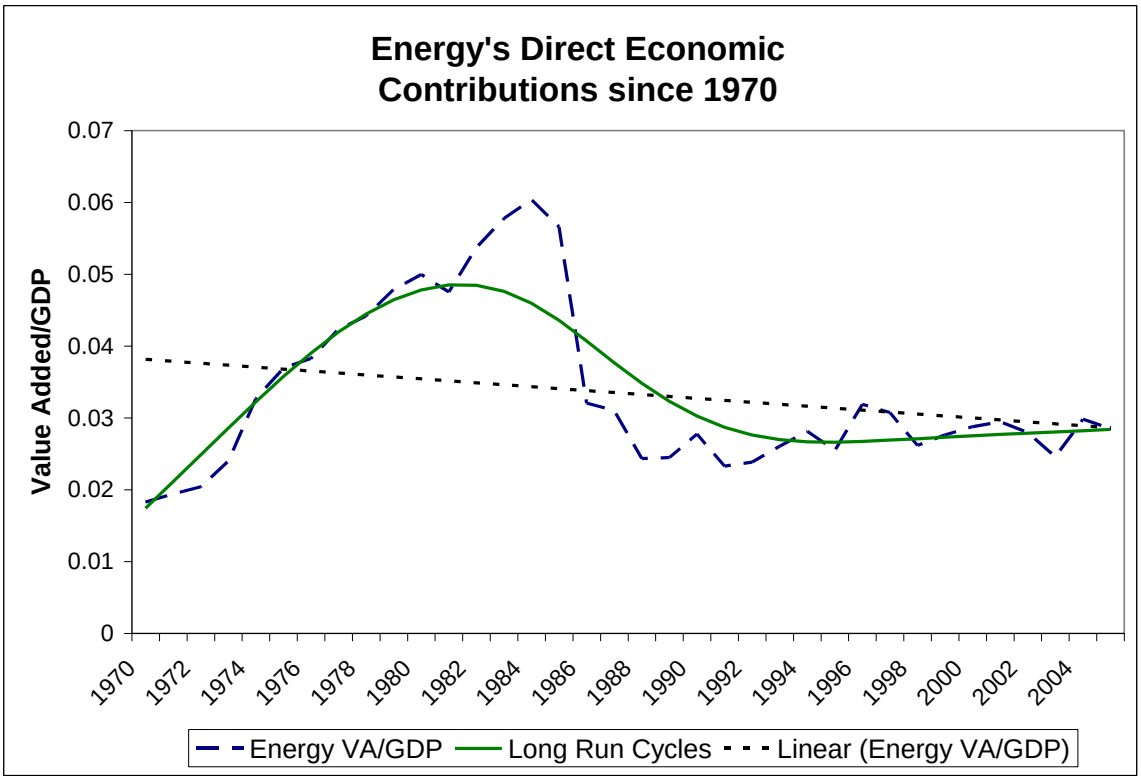

Figure 2

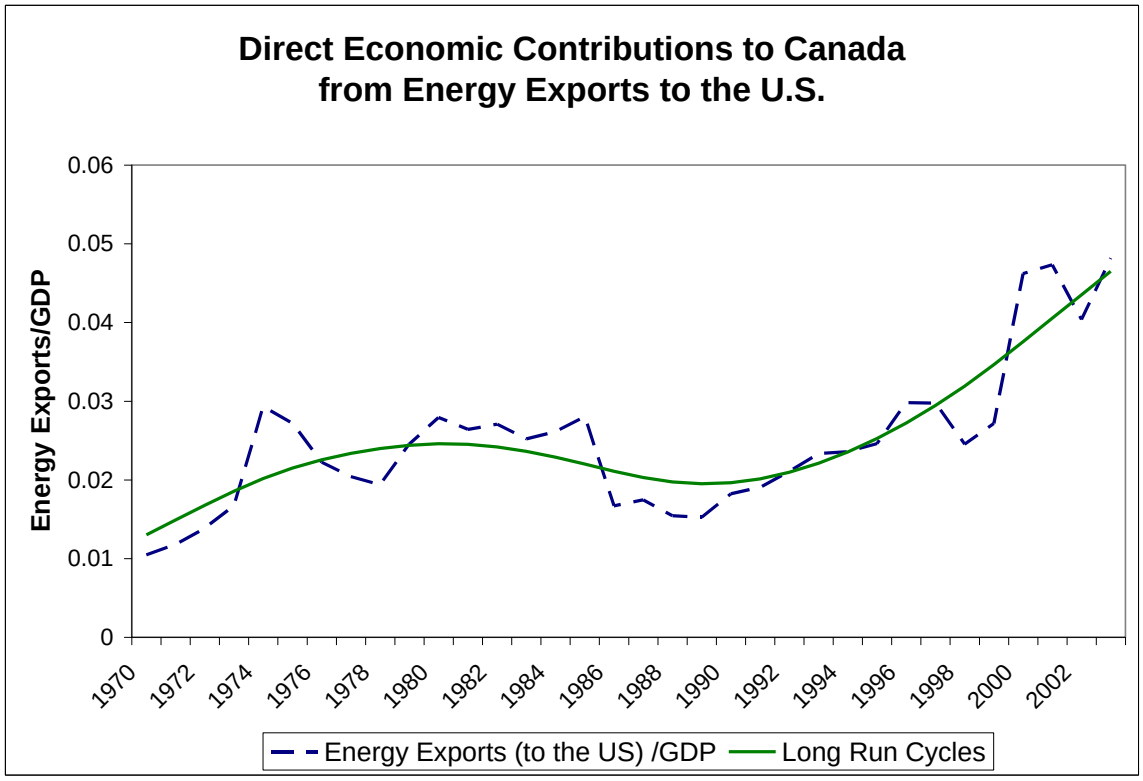

Figure 3

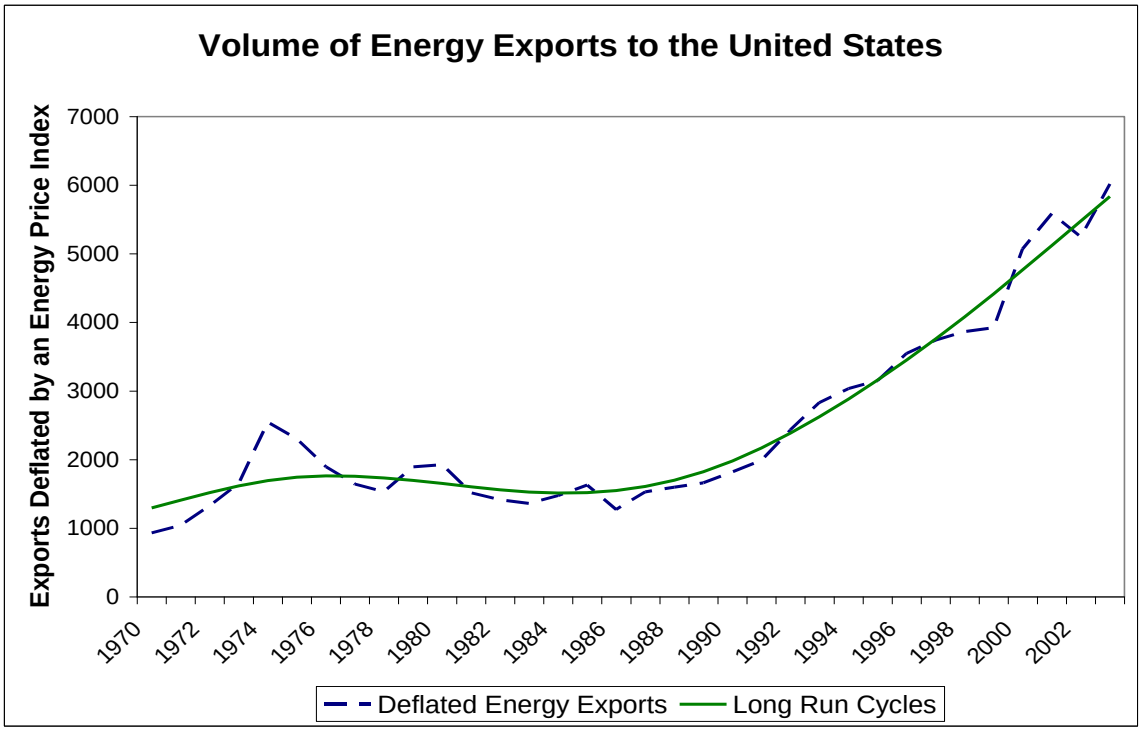

Figure 4

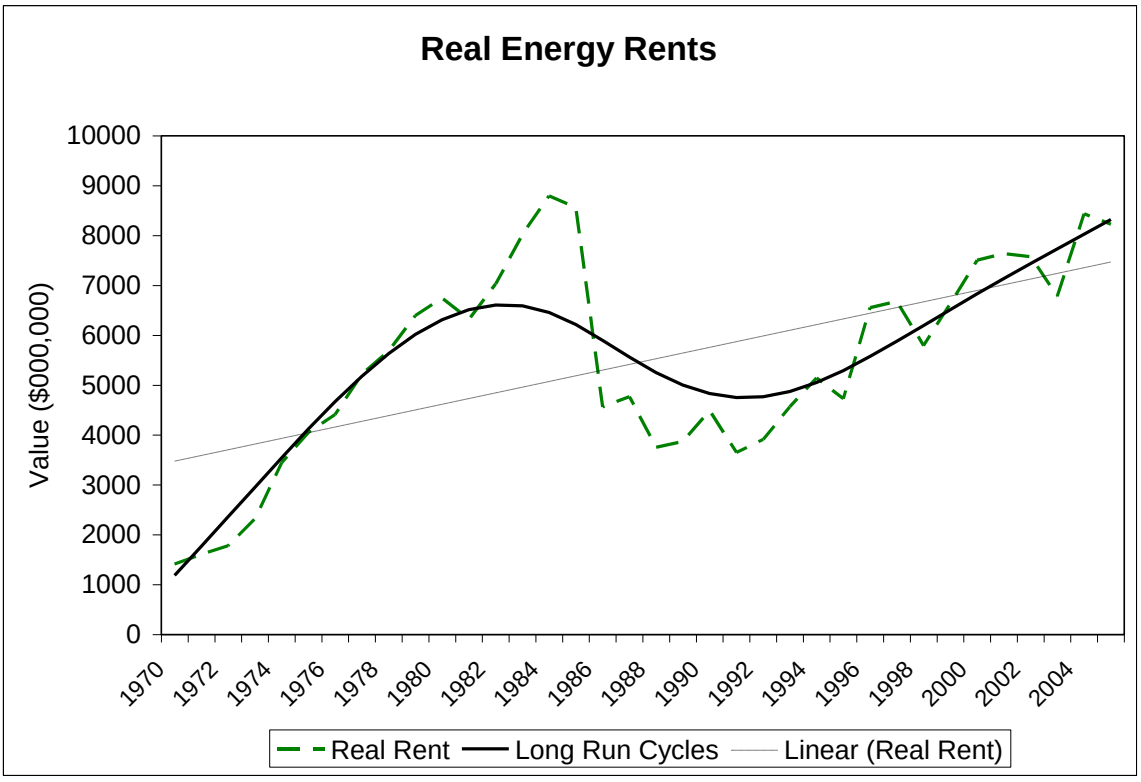

Figure 5

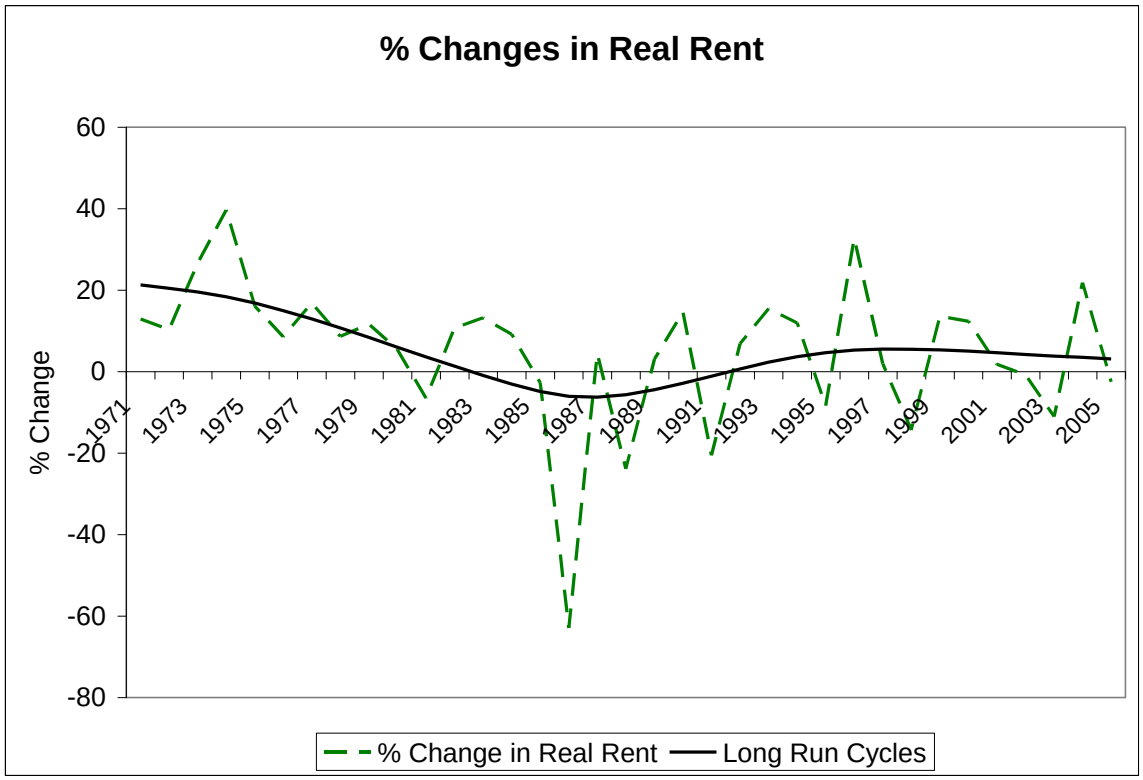

Figure 6