العنوان:	The Macroeconomic Effects of Natural Resource Expotts : A Statistical Study of Alberta, Canada
المصدر:	مجلة العلوم الإدارية
الناشر:	جامعة الملك سعود - كلية العلوم الإدارية
المؤلف الرئيسي:	Tamaschke, Rick
المجلد/العدد:	مج13, ع2
محكمة:	نعم
التاريخ الميلادي:	1988
الصفحات:	101 - 120
رقم MD:	661111
نوع المحتوى:	بحوث ومقالات
قواعد المعلومات:	EcoLink
مواضيع:	المحاسبة المالية، السلاسل الزمنية
رابط:	http://search.mandumah.com/Record/661111

J.Admve.Sci., King Saud Univ., Vol. **13**(2), pp. 101-120 (1408/1988)

The Macroeconomic Effects of Natural Resource Exports : A Statistical Study of Alberta, Canada *

Rick Tamaschke
Assistant Professor, Department of Economics, University of Queensland, Australia

This paper is concerned with special conditions and problems facing the development of resource-dependent economies. It provides a statistical analysis of Alberta, which is Canada's major oil producer.

Single and simultaneous equation models are used to test the hypothesis that exports acted as an "Engine of Growth" in the Albertan economy over the period 1961-1982.

the results show that economic growth in Alberta over the period of study was closely related to export growth and that there was little evidence of diversification about the resource-export base. Also exports do not seem to have responded to service sector growth. These results seem to be consistent with those related to the oil-producing countries of the Middle-East.

There has been growing concern recently about the economic growth prospects of Western Canada, which consists of the provinces of Alberta, British Columbia, Manitoba and Saskatchewan. This has occurred in the face declining resource-export growth[1] and rising unemployment and prompted the Economic Council of Canada to examine the growth prospects of these regions. The Council's findings, as well as the debate they generated, shed a good deal of light on the special conditions and problems facing the development of resource-

* Work on this study was begun while the author was at the University of Alberta on sabbatical leave. The author is grateful to his Canadian colleagues for their encouragement, particularly Professor E. Shaffer who has also kindly kept the author supplied with the appropriate Albertan data.

1. Often the term resources is used to refer to mineral resources only as for exmaple in Gregory (1983). The definition used here encompasses all natural-resource exploitation and is therefore much wider.

dependent economies.[2] However, there has as yet been no detailed statistical analysis of the major issues raised (notably the question of a suitable economic development framework and the role of the service sector) which could also be of interest to other resource-dependent economies, such as the oil producers of North Africa and the Middle East. This paper is directed at the deficiency in the literature and provides a statistical analysis of Alberta, which is Canada's major oil producer. The paper is divided into four sections. Section I briefly considers the main characteristics of the Albertan economy with the aim of placing the analysis of this paper into perspective. Section II examines the Economic Council of Canada's suggestions regarding an appropriate export-led growth framework for the development of the resource-dependent economies of Western Canada. Sections III and IV then assess the relevance of the Council's suggestions econometrically (using single and simultaneous equation models), essentially by considering the extent to which exports acted as an "engine of growth" in the Albertan economy over the period 1961-1982. Finally Section V summarises the paper's main conclusions and attempts to shed some light on the Province's growth prospects, including the role of the service sector.

I

The Canadian province of Alberta is situated to the east of the Rocky Mountains, between British Columbia in the west, Saskatchewan in the east and the United States of America in the south. The Province covers an area of some 661,000 square kilometres, which is about 7 percent of the Canadian land mass.[3] Table I gives details of provincial population and shows the relativities between Alberta and the remainder of Canada. Perusal of Table 1 shows that the Province's population increased by almost 70 percent during the intercensal period 1961-1981 which was a little more than twice the Canadian national average increase. Much of Alberta's population increase was through immigration from Central and Eastern Canada.[4] The Province was fortunate to have been blessed with a rich natural resource base, notably substantial oil and natural gas reserves, but also with the means to produce many other natural resource-related products including wheat and cattle; the Province also gains from its natural assets through tourism (largely on account of the magnificant Rocky Mountains).[5] The exploitation of these natural assets has provided the Province with considerable wealth. Table 2 presents some statistics on the growth of real income; once again information on the other Provinces is also presented for

2. See Economic Council of Canada (1984). This document formed the basis for discussion at a special "Western Transition" conference at the University of Alberta in November 1984. Papers presented at this conference appear in Canadian Public Policy (1985).
3. On this see Statistics Canada (various issues).
4. On this see Economic Council of Canada (1984).
5. On this see Economic Council of Canada (1984).

comparative purposes. Perusal of Table 2 shows that real incomes rose markedly over the period to 1981 but that was followed by a significant decrease in 1982, hence much of the concern about future growth prospects. By 1982 real income per capita was clearly highest in Alberta and during the 1970s the increase in real GDP per capita was well above the Canadian national average. This was particularly remarkable considering the large population growth during that period; the statistics show that real GDP actually increased by just under 100 percent, which was over twice the national average increase. As Alberta is Canada's major oil producer, this is of course in keeping with the OPEC oil price shocks of the 1970s. Table 3 provides some data on provincial oil production and Alberta's dominance will be readily apparent.

Table 1. Selected national and provincial census population statistics Canada 1961 and 1981

Province	1961 Census		1981 Census		Percent increase 1961-to 1981	Provincial population growth relative to national growth
	Persons ('000)	Percent national total	Persons ('000)	Percent national total		
Alberta	1.332	7.3	2.237	9.2	67.9	2.03
British Columbia	1.629	8.9	2.744	11.3	68.4	2.04
Manitoba	922	5.1	1.020	4.2	11.3	0.34
Saskatchewan	925	5.1	968	4.0	4.6	0.14
Other Provinces	13.430	73.6	17.367	71.3	29.3	0.87
Canada	18.238	100.0	24.342	100.0	33.5	1.00

Source: Economic Council of Canada (1984) and Statistics Canada (14).

Table 2. Real gross domestic product per capita Canada, selected periods (1971 Canadan Dollars)

Year	Alberta	British Columbia	Manitoba	Saskatchewan	Canada
1961	3026	2886	2374	2121	2627
1971	4532	4153	3577	3450	3859
1981	6488	5404	4558	4454	4993
1982	5986	4970	4387	3454	4706

Source: Economic Council of Canada (1984).

Table 3. Oil production in Alberta and Western Canada selected periods (millions of cubic metres)

Year	Alberta	Saskatchewan	Total	Alberta percent of Total
1961	25.1	8.9	34.8	71.8
1971	59.3	14.1	78.2	75.8
1981	64.2	7.4	74.1	86.6
1982	62.6	8.1	73.3	85.4

Source: Economic Council of Canada (1984).
Note: Includes synthetic and experimental oil.

Table 4 provides some details of the structure of provincial output and employment over the intercensal period 1961-1981. Table 4 shows that the share of the so-called "productive" sector (natural resource, manufacturing and construction) has declined as a provider of employment. The largest component in this area is in natural resources. Manufacturing's share in employment is quite small (effectively remaining static over the twenty year period) and construction increased its share only slightly. The service, or "non-productive" sector, increased its employment share significantly over the period.(6) This is particularly so in the field of community, personal, financial and business services. A contrasting picture is shown by the output statistics. The Alberta Bureau of Statistics provides two sets of figures for the value of financial services. According to one definition, resource royalties are included amongst "finance" (Column 2 in Table 4) and according to the other they are not (Column 3). If the first approach is used, the share of the service sector ramained almost constant over the 20 year period and the resource sector increased its share slightly; the output tendencies of manufacturing and construction are similar to the picture painted by the employment figures. If on the other hand, royalties are excluded from "finance", the output share of the service sector actually declined over the period. However as the employment performance of the service sector looks impressive compared with the " productive" sector, some commentators have been extolling the virtues of the service sector; they look increasingly towards services to generate employment sufficiently to fill the gap left by declining resource-export growth.(7) Their argument is based on service sector productivity growth to increase demand for services directly and also indirectly by making the output of the "productive" sector (especially the export industries) more competitive on account of cheaper services. the prospects for this approach will be examined in Sections III to V of this paper.

6. These groups follow Economic Council of Canada (1984). "Natural resources" include primary products and minerals. "Services" include: transport, communications and other utilities; wholesale and retail trade; finance, insurance and real estate; community, business and personal services; public administration and defence.
7. On this see Economic Council of Canada (1984).

Table 4. Distribution of employment and output in various industries Alberta 1961-1981 (Percent)

Industry	Employment	Output(1)	Output(2)
Natural resource			
1961	26.0	21.3	24.6
1981	13.7	24.3	33.8
Manufacturing			
1961	8.8	10.0	10.0
1981	9.0	8.1	8.1
Construction			
1961	7.8	7.8	7.8
1981	10.8	8.1	8.1
Services			
1961	57.3 (14.6)	59.9 (27.6)	57.6 (25.4)
1981	66.5 (33.7)	60.0 (36.2)	50.5 (26.7)
Total			
1961	100.0	100.0	100.0
1981	100.0	100.0	100.0

Alberta Bureau of Statistics (1) and Economic Council of Canada (1984).

Notes: *1.* Output(1)= Resource royalties included under Services
Output(2)= Resource royalties included under Natural Resource.

2. Figures in parenthesis refer to the shares of community, personal,property, business and financial services.

Table 5 provides some statistics on export's share in GDP. Perhaps not surprisingly (in view of the Province's comparatively small population and resources' significant share in output), exports form a sizeable proportion of GDP and in fact increased their share in GDP significantly over the period. Overall export's share averaged some 40 per cent of GDP. In the case of Alberta virtually all exports are relateable to natural resource exploitation.[8] It can also be argued that the export shares of Table 5 understate the contribution of exports to the economy because investment in the export sector (which is reflected in increased production only after some gestation period) and various indirect effects (or induced activity in other sectors of the economy) are excluded.[9] This aspect will be discussed further later in this paper.

8. In the sense of primary products per se (including minerals) and the output of forward linkage processes which include services. It is acknowledged that it may sometimes be difficult to determine where forward linkage processes end and where secondary manufacturing begins. On forward linkages see footnote 13.

9. The natural resource contribution also encompasses purely domestic activities, that is consump- =

Table 5. Exports' share in gross domestic product Alberta 1961-1982

Year	Percent	Year	Percent
1961	33.3	1972	37.6
1962	33.8	1973	40.7
1963	34.8	1974	51.8
1964	36.0	1975	49.0
1965	35.5	1976	45.2
1966	35.5	1977	45.6
1967	35.1	1978	45.6
1968	34.4	1979	48.5
1969	33.9	1980	51.1
1970	35.2	1981	48.6
1971	35.8	1982	48.9

Source: Alberta Bureau of Statistics (1).

II

A major issue confronting the economic policy maker is the question of an approprite framework within which policy can be formulated and its implications evaluated. The Economic Council of Canada suggested two broad alternatives for the economic analysis of Alberta (and Western Canada), called "Resource Growth and Retrenchment" and "Resource Growth and Evolution".[10] So far the Council has hedged its bets as to whether "Retrenchment" or "Evolution" applies to Western Canada.

According to the "Resource Growth and Retrenchment" view, the prosperity of the natural resource-oriented economies of Western Canada with their limited populations (and domestic markets) and their comparative advantage in resource-intensive commodities, would depend on the ability to export natural resources. If resource-export growth slackens off or declines, the economy would do likewise and real income per head could be maintained only if the population contracted through emigration. The decline in the size of the population to sustain growth in real income per head is what is meant by "Retrenchment". The prosperity of the economy depends on a whole host of resource-linked factors, including rising export prices, the ability to expand the output of the existing resource industires, the ability to establish new resource export industries and so on. And if the economic policy objective is a growing population and rising real incomes per capita, then the real value of natural resource

= tion of resources on the domestic market which is not linked to export activity in any (ie. neither directly nor indirectly). Given the limited nature of the Albertan domestic market the scope for this contribution is comparatively small, hence the emphasis on exports.

10. On this see Economic Council of Canada (1984).

exports must continue to grow. According to the "Retrenchment" view, resource-based growth (whether through renewable or non-renewable resources) has some inherent weaknesses which lead to its ultimate downfall. In short, the economy must eventually contract, which suggests that in the longer term rising real incomes per head can be sustained only by a shrinking population, hence "Retrenchment".

By way of contrast the supporters of the "Resource Growth and Evolution" school believe that exports of natural resources provide the economy with its start and that growth can eventually be sustained by developing other exports, import substitiution and/or through adequate growth in the non-tradeables sector of the economy. Natural-resource exports remain important to this approach but are not considered vital for maintaining growth in real incomes in the longer term, even when the population is growing. In fact population growth, rising real incomes and a shift in the patterns of demand (and production) play key roles in the economy becoming increasingly less dependent on the performance of its natural-resource industries.

Despite the seemingly different emphasis on the ultimate role of natural resources in the economy, the "Retrenchment" and "Evolution" schools have a good deal in common as those familar with the extensive (particularly recent) literature on the "staple theory" will be aware.[11] In its modern form staple theory is in fact the Robertsonian "exports as an engine of growth" framework adapted to the special case where there exists a comparative advantage in resource-intensive exports (consisting of agricultural products, minerals and services, such as certain kinds of tourism etc.) and a limited domestic market. And as we shall see below, "Retrenchment" and "Evolution" are in fact particular cases of this framework. First, it wil be useful to summarize this special (staples) version of the "exports as an engine of growth" model to help place the various points into context.

Briefly, according to this model, exports (in our case of natural resource-intensive commodities) contribute to economic growth directly (through direct contributions to GDP) and indirectly per medium of spread (or carry over) effects over a period of time. These spread effects take the form of Hirschman-

11. For an extensive literature survey and outline of the staple theory see Tamaschke (1980). A detailed study of this reference, and of the many references cited in it, will show that "staple theory" evolved primarily from the historical studies of the Canadian economic historian Harold Innis. Innis' approach was descriptive and made no attempt to develop an explicit framework for the study of resource-dependent economies. This work was later combined with a considerable body of regional science and economic development literature and attained its complete modern form (in which it is a special case of the Robertsonian (1938) "engine of growth" hypothesis) only as recently as the late 1970s. Unfortunately. despite these developments, even now when some economic historians use the term "staple theory" they have the earlier literature (of some 20 years ago) in mind and this tends to cause a good deal of confusion.

type linkages[12] (essenatially multiplier-accelerator mechanisms) and can stimulate activity in consumer goods industries, in industries producing inputs for the export sector and also in industries which process the basic resource products in some way before export; these spread effects can then generate additional spread effects and so on. Through these mechanisms activity can be induced in other sectors of the economy (private and public) such manufacturing, consturction, transport and communications, and other services. In addition to the "chain reaction" resulting from production in the export industries over time, the impact of new investment in these industries, which will be reflected in increased export production only after some gestation period, must not be overlooked; this investment can of course generate spread effects of its own. Overall then these relationships suggest that natural-resource exploitation can have spin-off effects throughout the economy involving both domestic and foreign mechanisms (including the balance of trade, exchange rates, capital flows immigration, the evolution of tariffs and so on). Provided that investment oppurtunities generated by the export sector are accepted, this framework postulates that growth will be a process of diversification about a natural-resource base. Should growth be sustained long enough, this process may ultimately result in a domestic market which is sufficiently large to enable manufacturing industry to exploit the economies of scale required for viable large scale import substitution and also enhance the export of manufactured goods.[13] Before this "end phase" is reached however, the rate of economic growth would be dependent primarily upon the performance of the natural-resource industries and would rise or fall (and at times even stagnate) with export activity. That account must be taken of export's direct and indirect contributions, which accrue through time, must be stressed.

A close examination of the above framework suggests that both the "Retrenchment" and "Evolution" schools of thought are embraced by it. Seen in this light, "Retrenchment" focuses on the period before the "end phase" and is pessimistic about the economy's ability to cast aside the shackles of the resource industries. On the other hand, the "Evolution" view seems more optimistic about the outcome and emphasizes policy formulations consistent with reaching the model's "end phase", namely a significant domestic market and a viable manufacturing sector. Whether the ultimate outcome is "Retrenchment" or "Evolution" depends very much on the nature of the resource endowments and the scope for, and exploitation of, investment oppurtunities (both privately and publicly) to bring about the process of diversification about the natural-resource base.

---

12. Following Hirschman (1958). Hirschman focused attention on backward and forward linkages (effects on the input producing and processing industries respectively) although he was not primarily concerned with exports. Watkins (1963) extended Hirschman's concepts to include a final demand linkage (ie - the effects on consumer goods industries).
13. It follows that by this time comparative advantage would have changed.

As we have seen, so far the Economic Council of Canada has hedged its bets as to whether "Retrenchment" or "Evolution" applies to Alberta (and Western Canada generally). However, as these are special cases of the Robertsonian framework, the estimated coefficients of regression equations directed at testing the extent to which exports acted as an "engine of growth" should do much to resolve this issue. This will be discussed further in the following sections.

III

The analysis of Section II showed that the postulated relationship between export growth and GDP is central to the "exports as an engine of growth" model. As we saw, theoretically exports can contribute to the growth of GDP directly and indirectly per medium of spread or carry over effects, which take time. The theory does not specify the length of the time lags involved but then again, so far as the author is aware, it has this in common with all economic theories postulating time lags between variables. With time lags in mind, the analytical tool used here is the dynamic (or lagged) regression relationship, using appropriate annual data from the period 1961-1982. We saw in Section II that the equations should attempt to capture:

(i) The "real income chain" (flowing from increased export production and export price rises, relative to domestic and import prices).

(ii) The "export sector investment chain".

If the economy is heavily reliant on the export sector, investment expectations (and the supply of funds) could reasonably be expected to be sensitive to variations in the volume of export earnings and export price fluctuations. Following Tamaschke (1980), the equations were calculated from variables in natural log difference (virtually percentage change) form, i.e. $Log_eX_t - Log_eX_{t-1}$, in an attempt to allow for acceleration effects, import substitution and diversification about the export base.[14]

The equations presented in this section were estimated by ordinary least squares. The lag structures of the equations were estimated using the Koyck (1954) geometrically declining weight approach in all cases where the preliminary calculations suggested that the current period had the largest weight; the "freeweight" version was used whenever this assumption was not justified. The equations were tested for multicollinearity and these tests gave no cause for concern. Tests for serial correlation were also performed and the test statistics are presented with the equations.

---

14. For further discussion see Tamaschke (1980). On the use of log. differences in respect to technological changes see Solow (1980).

Equation (1) provides a relationship between changes in GDP and changes in export earnings at current prices; "export earnings" obviously include both export production effects and export price effects, which are essential elements in the two "chains" outlined earlier through which GDP growth can theoretically be determined (directly and indirectly) in an economy heavily reliant on its natural-resource export sector.[15] In the koyck scheme, the lagged export effects are represented by the lagged dependent variable.

$$G'_t = 0.02 + 0.44X'_t + 0.33G'_{t-1} \qquad \text{——(1)}$$

$$(1.93)^{**} \quad (9.76)^{*} \quad (4.05)^{*}$$

$$n = 21 \quad R^2 = 0.90 \quad F = 81.00^{*} \quad h = -1.26$$

G = GDP

X = Exports

′ Indicates that variables are in natural logarithmic difference form

n = Number of observations

h = Durbin's h statistic

Values in parenthesis are t statistics

* = Significant at at least the 5 percent level

** = Significant at the 10 percent level

Equation (1) supports the view that there was a strong relationship between exports and GDP during the period 1961-1982. Of course equation (1) is in current prices and the explanatory power of the equation might simply be a reflection of inflationary effects. To remove the infaltionary effects, the relationship was reestimated in real terms but with allowances for the real income effects of changes in the terms of trade[16]; the result is given as equation (2):

$$GR'_t = 0.01 + 0.46XR'_t + 0.21GR'_{t-1} \qquad \text{——(2)}$$

$$(1.79)^{**} \quad (10.77)^{*} \quad (2.39)^{*}$$

$$n = 21 \quad R^2 = 0.87 \quad F = 60.23^{*} \quad h = -0.06$$

GR′ = Real GDP

XR′ = Real exports

15. GDP is at market prices; equations using GDP at factor cost yield almost indentical results. In addition to the Albertan variables, various relative measures (ie. Alberta relative to Canada) were also tried with no significant impact on the results presented in this paper. In keeping with common practice, the two tail test has been used to determine the significance of results, although a priori theoretical considerations suggest that one tail tests could have been justified. In view of the limited sample size, the "h" statistic is given for what it is worth.

16. This follows from the arguments expressed on p.10 in relation to the "real income chain". For the purposes of these regressions the series were deflated by a weighted index of domestic and =

Equation (2) suggests that the constant price relationship between exports and GDP is very strong thus supporting the results of equation (1). The resutls suggest that the current period effect (mainly the export component effect in GDP) outweighed the lagged effects (the spread effects proper) by a ratio of about two to one. This would seem to suggest that comparatively little diversification took place during the period. At the same time the small value of the intercept term (which is barely significant at the 10 percent level) would further seem to suggest that there would have been little or no growth in the Albertan economy without resource-export growth. Equations (3) and (4) show that much the same results hold when GDP per capita is used.

$$G/P'_t = \underset{(0.97)}{0.01} + \underset{(10.05)^*}{0.46X'_t} + \underset{(3.13)^*}{0.26G/P'_{t-1}} \qquad \text{——— (3)}$$

$n = 21 \quad R^2 = 0.90 \quad F = 80.92^* \quad h = -1.05$

G/P = GDP per capita

$$GR/P'_t = \underset{(0.51)}{0.005} + \underset{(10.95)^*}{0.44XR'_t} + \underset{(2.02)^{**}}{0.19GR/P'_{t-1}} \qquad \text{——— (4)}$$

$n = 21 \quad R^2 = 0.88 \quad F = 66.07^* \quad h = -1.17$

The similarity of the results obtained from the GDP and GDP per capita analyses could further suggest that population growth was sensitive to export growth during the period. As we saw in Section II, population growth (primarily through immigration) is actually part of the staples version of the "exports as an engine of growth" model. To examine the above proposition further, equations (5) and (6) analyse the relationship between the export sector and population growth. [17]

$$POPN'_t = \underset{(0.32)}{0.001} - \underset{(-1.01)}{0.01X'_t} + \underset{(2.89)^*}{0.03X'_{t-1}} + \underset{(7.54)^*}{0.86POPN'_{t-1}} - \qquad \text{——— (5)}$$

$n = 20 \quad R^2 = 0.81 \quad F = 22.74^* \quad h = -0.54$

$$POPN'_t = \underset{(0.61)}{0.002} - \underset{(-0.92)}{0.01XR'_t} + \underset{(2.20)^*}{0.02XR'_{t-1}} + \underset{(7.05)^*}{0.88POPN'_{t-1}} - \qquad \text{——— (6)}$$

$n = 20 \quad R^2 = 0.78 \quad F = 18.91^* \quad h = -1.02$

POPN = Population

= import prices to capture the gains in real income due to export price changes relative to other prices. Subsidiary calculations using other methods of deflation of any kind has its hazards, hence the approach of stating both current price and real results. On the question of deflation of variables for regression analysis see Belsey (1979).

17. On immigration see Section II and Tamaschke (1980). The population equations span the period 1962-1982 because of signs of structured instability in 1961; obviously it was impossible to estimate the earlier equation structure from one observation.

Equations (5) and (6) would in fact seem to lend support to the view that population growth in Alberta was strongly realted to events in the export industires with significant lags of one year and longer.

Sectoral Results[18]

Services

We saw earlier (in Section II) that it has been suggested that the service sector might expand sufficiently to compensate the dampening effects of declining resource-export growth. It is therefore important to examine the relationship between service-sector and export-sector growth with a view to shedding some light on this scenario. Following the two approaches of the Alberta Bureau of Statistics with respect to the treatment of resource royalties (on this see Section I), two sets of equations are presented. For equations (7) and (8) royalties are included amongst services; in equations (9) and (10) they are not. In both cases the first equation is in current, and the second in constant, prices.

$$SV'_t = 0.016 + 0.20X'_t + 0.67SV'_{t-1} \qquad \text{——(7)}$$
$$(1.23) \quad (5.47)^{*} \quad (7.85)^{*}$$
$$n = 21 \quad R^2 = 0.87 \quad F = 60.45^{*} \quad h = -1.37$$

SV = Service sector output including royalties

$$SVR'_t = 0.014 + 0.21XR'_t + 0.78SVR'_{t-1} \qquad \text{——(8)}$$
$$(0.99) \quad (4.81)^{*} \quad (8.65)^{*}$$
$$n = 21 \quad R^2 = 0.85 \quad F = 51.00^{*} \quad h = -1.16$$

$$SV(-R)'_t = 0.03 + 0.07X'_t + 0.15X'_{t-1} + 0.48SV(-R)'_{t-1} \qquad \text{——(9)}$$
$$(2.14)^{**} \quad (1.55) \quad (2.78)^{*} \quad (3.77)^{*}$$
$$n = 21 \quad R^2 = 0.76 \quad F = 17.94^{*} \quad h = -1.37$$

SV(-R) = Service sector output less resource royalties

18. For what it is worth, the sectoral output results are supported by some tentative sectoral investment results which are available from the author on request.

$$SV(-R)'_t = 0.03 + 0.06XR'_t + 0.16XR'_{t-1} + 0.62SVR(-R)'_{t-1} \quad \text{——— (10)}$$

$$(1.84)^{**} \quad (1.11) \quad (2.82)^{*} \quad (5.01)^{*}$$

$$n = 21 \quad R^2 = 0.74 \quad F = 16.13^{*} \quad h = 0.95$$

Although the lag structure of equations (7) and (8) differs slightly from equations (9) and (10), the resutls support the view that there was a strong lagged positive relationship between export growth and service sector output growth.[19] Moreover, inspection of the intercept terms, would also seem to suggest that there would have been little growth in services without export growth. This would imply that service sector growth would decline substantially in the face of reduced export growth. The simultaneous equation model in Section IV will examine the extent to which service sector growth contributed to export growth.

Manufacturing

Equation (11) (current prices) and equation (12) (constant prices) examine the relationship between export growth and manufacturing output growth:

$$MFG'_t = 0.03 + 0.32X'_t + 0.26MFG'_{t-1} \quad \text{——— (11)}$$

$$(1.12) \quad (2.29)^{*} \quad (0.23)$$

$$n = 21 \quad R^2 = 0.43 \quad F = 6.79^{*} \quad h = -0.96$$

MFG = Manufacturing output

$$MFGR'_t = 0.04 + 0.33XR'_t + 0.40MFGR'_{t-1} \quad \text{——— (12)}$$

$$(1.23) \quad (2.75)^{*} \quad (1.77)^{**}$$

$$n = 21 \quad R^2 = 0.42 \quad F = 6.52 \quad h = -1.03$$

Equations (11) and (12) would support the view that there was a significant relationship between export growth and manufacturing. However this is not nearly as strong as for services. This lends further support to the earlier finding that there was little diversification about the export base during the period.

19. Thus in keeping with the results of equations (1) and (2), the reduction in explanatory power is only very minor and suggests that the relationship is "real". In the absence of detailed sectoral deflators, deflation in the sectoral constant price equations concentrated on exports. Experimental regressions using a number of proxies for the sectoral price deflators support the view that exports and real sectoral production were related along the lines suggested by the equations stated in the text.

Construction

Equations (13) and (14) examine the relationship between exports and construction.

$$CON'_t = \underset{(1.40)}{0.06} + \underset{(0.24)}{0.04X'_t} + \underset{(2.29)^{*}}{0.43X'_{t-1}} + \underset{(0.23)}{0.05CON'_{t-1}} \qquad \text{——— (13)}$$

$n = 21 \quad R^2 = 0.31 \quad F = 2.55^{**} \quad h = -1.35$

CON = Construction output

$$CONR'_t = \underset{(1.96)^{**}}{0.08} + \underset{(0.32)}{0.06XR'_t} + \underset{(2.46)^{*}}{0.50XR'_{t-1}} + \underset{(0.62)}{0.12CONR'_{t-1}} \qquad \text{——— (14)}$$

$n = 21 \quad R^2 = 0.32 \quad F = 2.67^{**} \quad h = 0.46$

Equations (13) and (14) suggest a positive statistical relationship between the export sector and consturction; once again however the result is a poor one compared with some of the other resutls. Combined with the manufacturing results, equations (13) and (14) seem to suggest that the key components of the "productive" sector did little to respond to the stimulus of the resource-export sector.

To summarize, the resutls of the equations suggest that:

(i) There was a strong positive relationship between export growth and both GDP and population growth.
(ii) Growth of service sector output is very sensitive to export growth.
(iii) Growth of manufacturing and construction, though positively related to export growth, is not nearly as responsive as is the service sector.

IV

So far the analysis of this paper has examined the relationship between exports and economic growth with single equation methods. The direction of causation was assumed to be from the former to the latter which might be unacceptable to some economists. Thus some might argue that exports and GDP might be related by a "feedback" effect via activity outside Alberta, particularly in the other Canadian provinces. Thus increased income in Alberta would result

in increased demand for imports and increased exports and income elsewhere. This could in turn stimulate the demand for imports and lead to increased demand for Albertan exports. In addition, following the views presented earlier in this paper (in Section I) about the role of the service sector growth could have stimulated export growth. As the data are annual, it is theoretically possible for these mechanisms to occur in the current period. as a result, the relationship between exports and GDP will be analysed with a simultaneous equation model, which makes allowances for a possible "feedback" mechanism and interaction between the export and service sectors.

The model consists of four equations. The first equation examines the central "exports as an engine of growth" relationship developed in Section III. The second equation examines the relationship between exports, current and lagged imports and services as well as export prices. If there is feedback, we would expect a significant positive impact of the import variables on exports. Significant positive values for the service sector coefficients would provide support for the view that service sector output growth contributed to export growth. The third equation examines the relationship between imports and GDP. and finally the fourth equation completes the model and examines the relationship between export growth and service sector growth as developed in Section III. In all cases, the lagged dependent variable allows for lagged effects.

The model

$$G'_t = \alpha_c + \alpha_1 X'_t + \alpha_2 G'_{t-1} + \epsilon_{t1}$$

$$X'_t = \beta_c + \beta_1 M'_t + \beta_2 M'_{t-1} + \beta_3 P'_{xt} + \beta_4 SV(-R)'_t + \beta_5 SV(-R)'_{t-1} + \beta_6 X'_{t-1} + \epsilon_{t2}$$

$$M'_t = \gamma_c + \gamma_1 G'_t + \gamma_2 G'_{t-1} + \gamma_3 G'_{t-2} + \gamma_4 M'_{t-1} + \epsilon_{t3}$$

$$SV(-R)'_t = \delta_c + \delta_1 X'_t + \delta_2 X'_{t-1} + \delta_3 SV(-R)'_{t-1} + \epsilon_{t4}$$

Endogenous Variables

M'_t where M = imports into Alberta

X'_t where X = Albertan exports

G'_t where G = Albertan GDP

$SV(-R)'_t$ where SV(-R) = Output of the service sector excluding resource royalties

Predetermined Variables

X'_{t-1}

G'_{t-1}, G'_t $P'_{xt} = \text{In}\,(P_{xt}/P_{xt-1})$ where P_x = index of export prices

M'_{t-1},

$SV(-R)'_{t-1}$

As the equations are either overidentified or just identified, they were estimated by two stage least squares. Despite the broad agreement between the current price and real resutls in Section III, the model was nevertheless estimated in current prices and constant prices and both sets of resutls strongly supported one another. The current price results are given below as equations (15), (16), (17), and (18).[20]

$$G'_t = \underset{(2.06)^{**}}{0.03} + \underset{(8.95)^{*}}{0.43X'_t} + \underset{(3.78)^{*}}{0.32G'_{t-1}} \qquad \text{——— (15)}$$

$$n = 21 \qquad R^2 = 0.90 \qquad h = 0.77$$

$$X'_t = \underset{(2.18)^{**}}{0.16} - \underset{(-0.40)}{0.24M'_t} + \underset{(0.76)}{0.19M'_{t-1}} + \underset{(7.37)^{*}}{0.78P_{xt}} + \underset{(0.33)}{0.91SV(-R)'_t}$$

$$\underset{(-1.16)}{-1.45SV(-R)'_{t-1}} - \underset{(-0.62)}{0.24X'_{t-1}} \qquad \text{——— (16)}$$

$$n = 21 \qquad R^2 = 0.95 \qquad h = 1.05$$

$$M'_t = \underset{(0.60)}{0.03} + \underset{(3.14)^{*}}{1.05G'_t} \underset{(-1.08)}{- 0.48G'_{t-1}} + \underset{(0.77)}{0.23G'_{t-2}} \underset{(-0.11)}{- 0.04M'_{t-1}}$$

$$n = 21 \qquad R^2 = 0.57 \quad h = -0.99 \qquad \text{——— (17)}$$

$$SV(-R)'_t = \underset{(2.51)^{*}}{0.04} + \underset{(1.13)}{0.06X'_t} + \underset{(2.93)^{*}}{0.16X'_{t-1}} + \underset{(3.16)^{*}}{0.43SV(-R)'_{t-1}} \qquad \text{———(18)}$$

$$n = 21 \qquad R^2 = 0.73 \qquad h = 1.25$$

20. The constant price results are available from the author on request. The values for R and h are given for what they are worth. As the nature of the sampling distributions of the coefficients in "small samples" is unknown, standard errors were also calculated using the sample size as the devisor. The results stated as significant in the text are "significant" according to both criteria.

The main findings of this analysis are that:

(i) A comparison of equations (1) and (15) suggests that the nature of the export/GDP relationship is very similar irrespective of which estimation method is used.

(ii) Equation (16) would support the view that "feedback" was absent during the period 1961-1982; all of the import coefficients in the equation are generally negative and would seem to be not significant.

(iii) Equation (16) would also suggest that service sector growth did not lead to an expansion of the Province's exports; all of the coefficients would seem to be not significant. However export prices would seem to be a highly significant determinant of changes in exports.

(iv) Equation (17) would support the view that there was a significant relationship between imports and GDP in the Albertan economy during the period.

(v) Equation (18) strongly supports the single equation exports/service sector results of Section III.

To sum up, the simultaneous equation results seem to lend strong support to the single equation results obtained in Section III.

V

Despite its limitations this paper has some important findings:

(1) The statistical results, combined with the qualitative evidence assembled in Section I, support the view that economic growth in Alberta over the period 1961-1982 was closely related to export growth.

(2) The results would also seem to suggest that there was little evidence of diversification about the resource-export base during the period, hence little progress was made along the path towards "Evolution". In fact the responses shown by the manufacturing and construction sectors were disappointing compared with the other results of this paper. If this pattern continues, the outcome for Alberta could ultimately well be "Retrenchment".

(3) The service sector was very sensitive to resource-export growth. These results suggest service-sector growth will decline with reduced resource-export growth. As much of the employment growth in the service sector was in community and personal services, the finding that population growth during the period was also sensitive to developments in the export sector provides further cause for concern.

(4) Export do not seem to have responded to service sector growth. Thus overall the results would seem to suggest that it would take a major change from past performance for the service sector to grow autonomously at sufficiently fast a rate to make any significant immediate impact on the dampening effects of reduced resource-export growth. Any service sector-led growth scenario would therefore need to be viewed as part of a longer term development strategy.

(5) The kinds of results obtained for the Albertan economy over the period 1961-82 seem remarkably consistent with the results of an earlier study into the effects of oil exports in North African and the Middle Eastern countries.[21] This could suggest that political and ethnic differences played only a secondary role compared with the economic forces present in oil economies.

21. On this see Metwally and Tamaschke (1980).

References

Alberta Bureau of Statistics (1970-1982). *Alberta Economic Accounts.* Canada.

Belsey, D.A. (1979). Specification with Deflated Variables and Spurious Specious Correlation, *Econometrica,* Vol. **40**,215-223.

Canadian Public Policy (1985). Vol.**11**, Supplement. Canada.

Cargill, T.F. and R.A. Meyer (1981) Some Time Frequency Domain Distributed Lag Estimation: A Comparative Monte Carlo Study. *Econometrica*, Vol. **42**, 332-337.

Economic Council of Canada (1984) *Western Transition.* Ottawa, Canada Government Publishing Centre. Canada.

Gregory, R.G. (1983) Some Implications of the Growth of the Mineral Sector, *Australian Journal of Agricultural Econ..* , Vol. **20**, 54-63. Australia.

Hirschman, A.O. (1958). *The Strategy of Economic Development.* Yale University Press. U.S.A.

Johnston, J. (1984). *Econometric Methods.* 3rd ed., McGraw-Hill, London.

Koyck, L.M. (1954). Distributed lags and Investment Analysis. Amsterdam, North Holland.

Metwally, M.M and **H.U. Tamaschke.** (1980). Oil Exports and Economic Growth in the Middle East, *Kyklos,* Vol. **33**, 240-261.

Robertson, D.H. (1938). The Future of International Trade, *Economic Journal*, Vol. **XLVIII**, 18-35.

Shaffer, E. (1980). Class and Oil in Alberta, in P.Nore and T. Turner (eds.),*Oil and Class Struggle.* Zed Press. London.

Solow, R.W. (1957). Technical Change and the Aggregate Production Function, *Review of Economics and Statistics,* Vol. **39**, August.

Statistics Canada. *Canadian Year Book* (various issues), Canada.

Tamaschke, H.U. (1976). An Econometric Study of the Staple theory of Economic Growth in the Context of the Australian Economy. *Economic Analysis and Policy,* Vol. **6.**Australia.

———— (1980). *Exports and Economic Growth: Case Studies of the Staple Theory.* J.K. Publishers. London.

Vickery, E. (1974) Exports and North American Economic Growth: 'Structuralist' and Staples Models in Historical Perspective, *Canadian Journal of Economics*, Vol. **VII.**

Watkins, M.H. (1963). A Staple Theory of Economic Growth, *Canadian Journal of Economics and Political Science,* V.**XXIX**. Canada.

الآثـار الاقتصـادية الكلية لصادرات الموارد الطبيعية: دراسة إحصائية لإقليم ألبرتا في كندا

ريك تامشكي

أستاذ مساعد، قسم الاقتصاد، جامعة كوينزلاند، استراليا.

يهدف هذا البحث إلى دراسة المشكلات الخاصة والأوضاع المتعلقة بالتنمية الاقتصـادية في الـدول التي تعتمد على المصادر الطبيعية ويغطي التحليل الإحصائي إقليم ألبرتا الذي يعد أكبر منتج للنفط في كندا.

ويستخـدم البـاحث نماذج قياسية فردية وآنية لاختبـار نظرية «التجارة الخارجية كعجلة للنمو الاقتصادي». وقد أوضحت النتائج الاحصائية أن اقتصـاد ألبرتا خلال الفترة ١٩٦١ ـ ١٩٨٢م قد اعتمد اعتمادا كبيرا على صادرات النفط وأنه لم يكن هناك تغيرا واضحا في درجة تنويع مصادر الدخل خلال هذه الفترة. كما أن الاقتصاد لم يستجب لنمو قطاع الخدمات بالطريقة التي تمكن هذا القطاع من القيام بدور قيادي في حالة كساد القطاع النفطي.