Investment Tax Credit Effects on the United States and Canada, 1968-1985

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Abstract

A micro approach of matched pairs (U.S. and Canadian firms) was utilized to ascertain investment tax credit impacts, differentiating between "tax credit" and "non-tax credit" firms. Univariate tests were used to measure the significance of the investment rates between the matched pairs over the period 1968-1985. This research found little evidence that the investment tax credit was an effective stimulus for capital investment.

1. Introduction

Effective January 1, 1986 the Tax Reform Act of 1986 (U. S. Congress, 1986) repealed the investment tax credit (hereafter ITC) in the United States. The ITC was one of the most controversial incentives introduced into the U.S. tax system. It has been suspended, reactivated, repealed, restored, and repealed again since 1962. According to Truitt and Lathen (1983) no tax provision in the history of the U.S. taxation can rival the ITC for addition to and removal from the tax code. Canada, following the U.S. lead, incorporated the ITC into Canada's Income Tax Act in 1975 (Canada, 1972) (Also see Harris, 1986).

The justification for repeal of the ITC in the United States was in apparent contradiction to many research studies over the years. Studies in neoclassical economic theory of capital accumulation (Hall and Jorgenson, 1967, 1971; Jorgenson, 1963, 1965; Jorgenson and Siebert, 1968; and Jorgenson and Stephenson, 1967) have concluded that the ITC was a positive economic stimulus to investment. Investment studies using q-theory (Chappel and Cheng, 1982; Salinger and Summers, 1983, Summers, 1981; Tobin and Brainard, 1977; and von Furstenburg, 1980) generally concur. Accounting studies (Ayres, 1987, Maloney, 1986; Stout, 1977; and Wunder, 1978) have also found a positive correlations between the ITC and investment, at least within some industries. Nonetheless, Congress repealed the ITC on the grounds that it was inequitable and inefficient. Congress believed that windfall subsidies would be lessened by repealing the ITC and thus "causing investment...decisions to be chosen more on the basis of their economic merits, and less on the value of the tax benefits associated with them" (Federal Tax Guide, 1986).

However, the ITC debate continues today, four years after its repeal. Shoven (1990) most recently labelled the ITC as the most effective policy for lowering the cost of capital and stimulating investment. But, in the same symposium, Harrison (1990) strongly disagreed.

This study provides little evidence to suggest that the ITC was an effective stimulus for capital investment. In contrast to most other research concerning this subject, this study follows a micro approach to evaluate the effects of the ITC on investment.(1) A matched pairs design was used to measure differences between U.S. and Canadian investment rates. U.S. firms enjoyed the ITC benefit during the entire test period, except for 1970, but Canadian firms enjoyed the benefit only after 1974. The research results of this study are contrary to previous ITC research and consistent with congressional reasoning for repeal of the ITC.

2. Legislative History

A comparative chronology of the ITC in the U.S. and Canada from 1962 to 1986 is given in Table 1. The first ITC legislation in the United States was enacted in 1962. It allowed for a 7 percent tax credit against the purchases of equipment designated as section 38 property. From the time of its inception until its most recent repeal in 1986, the U.S. ITC incurred several changes, including the broadening of the types of property qualifying under section 38 and an increase in the tax credit rate to a maximum of 10 percent.

Canada followed the U.S. lead and legislated its own ITC in 1975. From its inception until 1986, it too experienced significant change by broadening its qualifying property base, instituting a diversified tax credit rate

TABLE 1

A COMPARATIVE CHRONOLOGY OF THE INVESTMENT TAX CREDIT IN THE UNITED STATES AND CANADA, 1962-1986

UNITED STATES		CANADA	
1/1/62	7% ITC on Section 38 property subject to specified limitations		
1/1/64	Depreciable basis of assets no longer reduced by amount of ITC claimed		
10/1/66	ITC suspended		
3/9/67	ITC reactivated with allowable annual claims increased		
4/18/69	ITC repealed		
8/15/71	ITC restored with longer carryforward period and a larger value of used property qualifying for the ITC		
1/21/75	ITC raised to 10% with limit on used property again raised		
		6/23/75	5% ITC on new "qualifying" property subject to specified limitations
		4/1/77	Increased and diversified ITC rates by geographic and targeted regions and expanded eligible property
1/1/78	Definition of Section 38 property expanded and annual limits of ITC claims increased for 1979, 1980, and 1981		
		1/17/78	Further increased and diversified ITC rates and further expanded eligible property
		0/20/80	Further expanded eligible property
1/1/81	Changed method of ITC computation which effectively increased rates on certain properties and increased qualifying value of used property		
1/1/82	Required reduction of depreciable basis of property by ½ of ITC claimed		
		4/19/83	Increased allowable annual claims, expanded eligible property, initiated carryovers for unused credits, and allowed for refunds of a portion of unused credits
		After 10/83	Increased ITC rates
1/1/86	ITC was repealed		

system based on geographical location, and increasing rates.

The U.S. and Canadian ITC's differ in several respects.(2) First, whereas the U.S. credit applied to the purchase of machinery and equipment only, the Canadian credit was allowed against some buildings. Second, The U.S. ITC rate ranged from 6 percent to 10 percent. The Canadian ITC rate ranged from 5 percent to 50 percent. However, the differences in rates in the sample used in this study are not as wide as they appear. The 50 percent rates applied to firms located in sparsely populated northern Canada and were the exception rather than the rule.

3. Econometric Capital Investment Models

Two widely accepted models of investment behavior are Jorgenson's (1963) neoclassical model and Tobin's (1969) q-model. The neoclassical model is derived from the notion of optimal capital accumulation. Proponents of the notion of optimal capital accumulation maintain that firms constantly adjust their capital stocks to maximize firm wealth. The model is a static model which posits that the new optimal capital stock level is determined by expectations about future output and the cost of capital.(3) However, empirically, future expectation cannot be operationalized. Jorgenson sidesteps this problem by basing future expectations on past experience lagged over several periods.

The q-model, like the neoclassical model, believes that the investment behavior of firms depends on future expectations. However, it differs from the neoclassical model in several respects. The q-model is not a static model but is a dynamic model with the goal of measuring an optimal rate of investment instead of an optimal stock of capital. Additionally, the q-model uses public market data to measure future expectations and, accordingly, allows the market to assess the future. The "q" measure is the ratio of the market value of an additional unit of capital to its replacement cost (MV/RC). If the ratio is greater than unity, there is a supposed incentive to invest because the replacement cost of a unit of capital is less than its market value, indicating that the market value of the firm will increase with additional investment. However, the market value and/or replacement cost of many assets (or "a unit of capital") cannot be determined and therefore, marginal "q" is generally replaced with average "q" (market value of the firm/replacement cost of the firm) for empirical models.

While the above two models differ in approach, they generally rely on the same underlying assumptions to validate their models mathematically and/or intuitively.(4) Both models believe that future expectations are perfect (e.g. future profitability and future costs of capital). Other expectations include: a homogeneous production function with constant returns to scale,(5) perfect capital markets,(6) and perfect substitutability between capital and labor.(7)

4. Methodology

Unlike the neoclassical and q models, the outcomes associated with this research do not rely directly on underlying assumptions about production functions, homogeneity of capital, or market conditions. Moreover, most prior studies used aggregate level analysis which could only predict average effects. This research considered firm specific data. Previous research, particularly the neoclassical studies, covered the post World War II growth years of the 1950's and 1960's. A correlation between the ITC and investment growth may have been confounded by favorable economic conditions. The time period and sample selection may, at least in part, be responsible for the significance of the ITC in neoclassical studies. This research covers a more current time period including the recessionary periods of 1974-75 and 1981-82. This research also includes five sectors of the economy. In addition, the methodology compares firms which enjoyed the ITC benefit with those which did not.

4.1 Research Design

The primary source of data was the annual industrial U.S. and Canadian files of Standard and Poor's COMPUSTAT data base. Other sources were 10K filings and annual reports. Because of incomplete data, use of a random sample was not possible for this study. As a result, the potential for bias was controlled for by matching firms on confounding factors.

Three confounding variables were considered in this study. They are: 1) industry, 2) firm size, and 3) "q." Five different industries were observed in this study.(8) Differing industries have differing capital intensifications. Consequently, differing capital needs result in differing degrees of incentive that the ITC can provide. Therefore, firms were matched within the same industry classifications.

Firm size may also affect the rate of investment. For example, large firms may have greater cash flow with which to invest and lower debt costs. In addition, it has been shown that large firms will not always choose to minimize taxes (Zimmerman, 1983). There are several variables which could proxy for firm size. They are 1) number of employees, 2) total assets, and 3) net sales. The number of employees was not used as a size variable because many firms report this statistic in terms of full-time equivalents. The methodology used to calculate full-time equivalents allows for diverse results and consequently, low comparability across firms. Total assets or net sales could serve equally as well as surrogates for size.(9)

Total assets was chosen over sales as the size variable

for several reasons. First, the ITC is credited against assets. Therefore, if firms are matched on equal assets, a closer match on the potential ITC benefit may be expected. Second, sales are reported at retail values which may contain pricing biases. Pricing strategies may cause some firms, even within the same industry, to maintain low price mark-ups in relation to competitors in order to penetrate markets, eliminate excess inventories, or to guarantee market share. Thus, equal sales dollars between matched pairs may coincide with unequal outputs of product, and thus confound the ITC incentive for investment. Third, the profitability aspect of sales, as a matching variable, will likely be impounded in the q-ratio (the third matching variable). Fourth, although sales represents dollars of equal value (all from the same year) in contrast to assets (composed of purchases from several years), the potential for matching unequal dollar values using assets is likely mitigated because firms were matched on the average assets over the eighteen year sample period (after eliminating firms with significant merger activity).

"Q" served as a proxy for the incentive to invest. There is general agreement that "q" is a measure of profitability determined by the market (Tobin and Brainard, 1977). It should also be noted that most investment models use measures of profit (i.e. output, sales, return on assets) as determinants of investment. Moreover, the profitability measures were generally the most significant variables in these models. Therefore, "q" as a profitability measure, which has also proven to positively correlate with investment, should act as a suitable proxy for incentive to invest. Since "q", the remaining confounding factor, is a proxy for an investment incentive, it is conceptualized that it will embody most remaining confounding factors.

4.2 Sample Selection

The size of the sample was dependent upon the availability of data for Canadian firms. The U.S. COMPUSTAT file contained data on 2355 firms and the Canadian file contained data on 210 firms. It would be more definitive to measure the trend in investment in relation to the ITC beginning with a period several years before the first ITC legislation. Unfortunately, much data on Canadian firms in the early 1960's was missing and data before 1960 was nonexistent. For matching purposes, it was essential that needed data was available for each year in the test period. There appeared to be a longer lag for reporting Canadian data, and therefore, in the interest of including as many firms as possible with complete data, the most recent year included was 1985.

Five major industries which were the major beneficiaries of the Canadian ITC were identified for this research.(10) Within these industries, total assets were averaged over the test period, 1968-1985 for firms with complete data. Canadian dollars for total assets were first converted to U.S. dollars using the appropriate exchange rate. The results yielded sample sizes of 153 U.S. firms and 36 Canadian firms.

All firms involved in significant merger activity were dropped from the sample. A significant merger was defined as one in which the merger caused the assets to rise by more than twice the previous five-year average. After dropping firms involved in significant merger activity there were 132 U.S. firms and 26 Canadian firms.

After separating by industry group, the firms were matched on assets and "q".(11) The q-ratios were calculated closely following the procedure used by Salinger and Summers (1983).(12) The resulting matches yielded the U.S. and Canadian firms shown on Table 2. Table 2 also indicates the standard industrial classifications (SIC) codes, average total assets and average "q". The extreme right side of Table 2 shows the measure of closeness of the matches in ratio form. The ratios are computed by dividing the U.S. average total assets and "q" by the Canadian average total assets and "q", respectively.

5. Analysis

If the ITC significantly affected the investment rate of the sample firms, ceteris paribus, then the investment rate of U.S. firms should have been greater than the investment rate of Canadian firms during the years 1968-1969 and 1971-1974, when the U.S. had the ITC in effect but Canada did not.(13) Conversely, for 1970 and the years 1975-1985 the investment rates of the two countries should not have been significantly different, ceteris paribus. Additionally, if the ITC significantly affected investment, then Canada should have experienced greater investment rates in the latter part of the test period in contrast to the earlier years of the test period. By comparison, the U.S. should not have experienced such an increase in investment rates. Two tests were used to test for differences in investment rates between the U.S. and Canada. They were: the Wilcoxon Signed Ranks Test, and the Mann-Whitney Test.

The Wilcoxon test is the counterpart of the paired t-test used for parametric data. This test was performed on the differences (U.S. value minus Canadian value) of investment rates for each year in the sample period.

The Mann-Whitney test was used to test for a significant change in investment rates between the earlier and latter years of the test period. For this test, the test period was divided into two periods: 1968-1974 against 1975-1985. Each difference of the 26 matched pairs was tested independently. If the differences of group two (in which the U.S. and Canada had the ITC for all years) were less than the differences of group one, then this would lead to the conclusion that ITC legislation had a positive effect. The Mann-Whitney test was also used to test the sample aggregately.

TABLE 2

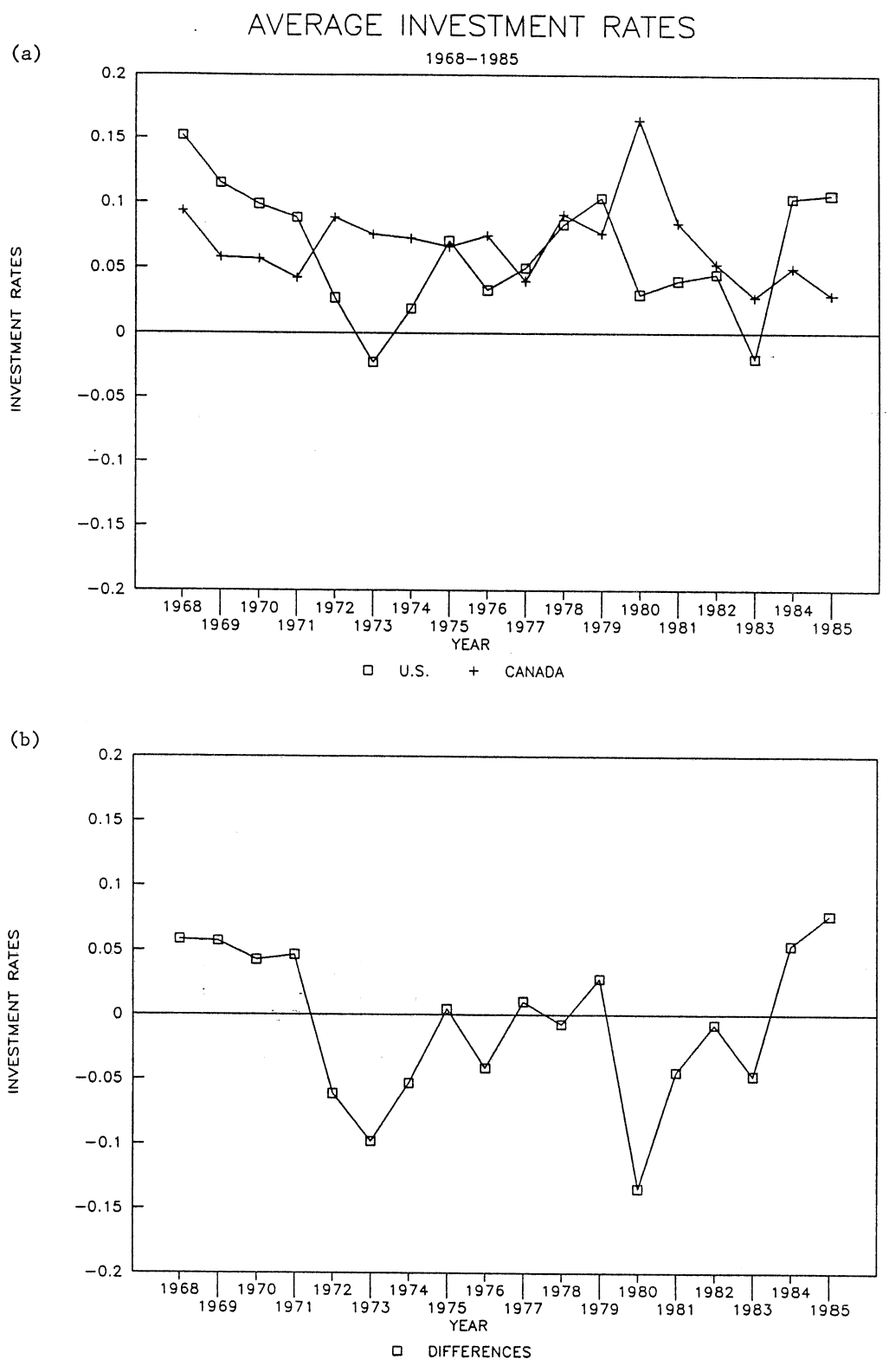
SAMPLE FIRMS

	UNITED STATES				CANADA					
n[1]	SIC[2]	Name	Ave Total Assets[3]	q	SIC[2]	Name	Ave Total Assets[3]	q	Total Assets[4]	q[4]
1	1040	Homestake Mining	266.71	1.84	1031	Pine Point Mines Ltd.	70.66	1.62	3.77	1.14
2	1040	Benquet Corporation	190.42	.95	1040	Kerr Addison Mines Ltd.	167.05	1.26	1.14	.75
3	1040	Callahan Mining Corporation	36.23	2.46	1040	Sigma Mines (Quebec) Ltd.	18.38	2.21	1.97	1.11
4	1021	Atlas Cons Mining & Development	243.08	1.39	1040	United Keno Hill Mines Ltd.	16.33	1.42	14.89	.98
5	1311	Wichita Industries	8.85	2.27	1311	National Petroleum Corp. Ltd.	2.61	2.30	3.39	.99
6	1381	Zapata Corporation	811.38	.77	1311	Pancanadian Petroleum Ltd.	782.11	1.65	1.04	.47
7	2010	Geo. A. Hormel & Co.	289.17	.74	2010	Canada Packers	328.61	.68	.88	1.09
8	2010	Rymer Co.	62.29	.79	2010	Schneider Corp.	59.38	.61	1.05	1.30
9	2030	Connelly Containers Inc.	14.06	.78	2041	Dover Industries Ltd.	15.16	.63	.93	1.24
10	2250	Alba-Waldensian Inc.	20.96	.53	2050	Corporate Foods Limited	20.38	.61	1.03	.87
11	2063	Holly Sugar Corp.	133.58	.61	2062	Redpath Industries Ltd.	144.50	.72	.92	.85
12	2048	Scope Industries Ind.	26.23	1.02	2070	Canbra Foods, Ltd.	27.00	1.00	.97	1.02
13	2030	United Foods Inc.	74.43	.64	2082	Canada Malting Co. Ltd.	73.94	.50	1.01	1.28
14	2065	Hershey Foods Corp.	521.74	1.03	2082	Labatt (John) Ltd.	554.88	.77	.94	1.34
15	2300	Hartmarx Corp.	369.32	.77	2082	Molson Cos. Ltd.	482.11	.89	.77	.87
16	2065	Tootsie Roll Industries Inc.	32.17	1.11	2085	Bright (T.G.) & Co. Ltd.	16.61	.92	1.94	1.21
17	2099	Chock-Full-O-Nuts Corp.	40.35	1.09	2085	Corby (H.) Distillery	42.83	.97	.94	1.12
18	2010	Seaboard Corp.	113.91	.53	2299	National Sea Prods. Ltd.	112.66	.51	1.01	1.04
19	2300	Phillips-Van Heusen	193.31	.56	2200	Celanease Canada	203.72	.44	.95	1.27
20	2250	Champion Products Inc.	42.15	.59	2200	Consoltex Canada	45.22	.41	.93	1.44
21	2250	Adams-Millis Corp.	43.90	.76	2270	New Harding Group	46.72	.73	.94	1.04
22	2400	Pope & Talbot Inc.	124.83	.72	2400	Weldwood of Canada Ltd.	203.94	.62	.61	1.16
23	4700	Airborne Freight Corp.	65.15	1.85	4131	Greyhound Lines of Canada Ltd.	69.00	1.72	.94	1.08
24	4511	Worldcorp Inc.	294.47	.86	4400	Algoma Central Railway	139.33	.56	2.11	1.54
25	4211	Consolidated Freightways Inc.	571.91	.88	4610	Interprovincial Pipe Line	723.00	1.02	.79	.88
26	4700	Hudson General Corp.	52.08	.84	4610	Trans Mountain Pipe Line	78.00	.90	.67	.93

[1]Sample match number.
[2]COMPUSTAT standard industrial classification code.
[3]In millions of dollars.
[4]U.S. value divided by Canadian value.

Note: Nos. 1-4 are mining firms, Nos. 5-6 are oil and gas firms, Nos. 7-21 are manufacturing and procession firms, No. 22 is a timber firm, and Nos. 23-26 are transportation firms.

FIGURE 1


AVERAGE INVESTMENT RATES
(a)
1968–1985
INVESTMENT RATES
0.2
0.15
0.1
0.05
0
−0.05
−0.1
−0.15
−0.2
1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
YEAR
U.S. + CANADA
(b)
INVESTMENT RATES
0.2
0.15
0.1
0.05
0
−0.05
−0.1
−0.15
−0.2
1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
YEAR
DIFFERENCES

6. Results

Figure 1 graphically displays the average investment rates of the sample firms. Panel (a) contrasts the average investment rates of the two countries. Several of the years indicate differences as hypothesized. The U.S. investment rates are greater than Canadian investment rates during the years 1968, 1969, and 1971, as hypothesized. However, Canadian investments rates were greater than U.S. rates during 1972, 1973, and 1974, when the U.S. had the ITC but Canada did not. After 1974 the investment rates were not hypothesized to be significantly different, which appears to be the case from 1975 through 1979 and again in 1982.

The contrasts can be viewed alternatively in panel (b) where only the differences (U.S. investment rate minus Canadian investment rate) are displayed. For years where the differences are greater than zero, the U.S. average investment rates were greater than the Canadian average investment rates. Conversely, where the differences are less than zero, the U.S. average investment rates were less than the Canadian average investment rates.

Table 3 displays the p-values for tests performed using the Wilcoxon Signed Ranks Test on the investment rate differences. For the years 1968-1969 and 1971-1974 a one-tailed test was used to ascertain if the U.S. investment rates were greater than the Canadian investment rates. In only one year, 1969, did the U.S. sample have a significantly higher average investment rate than the Canadian sample, the time when the U.S. alone enjoyed the ITC benefit. The 1969 result may have occurred because of the impending repeal of the ITC, which was expected to be permanent. Perhaps the incentive in 1969 was more the result of the threat of losing the benefit than it was the benefit itself. In the remaining

TABLE 3

WILCOXON TESTS

Tests of Differences
(by year)

Year	p-value
1968	.13
1969	.008*
1970	.12
1971	.33
1972	.72
1973	.79
1974	.71
1975	.81
1976	.04**
1977	.32
1978	.64
1979	.44
1980	.08**
1981	.04**
1982	.76
1983	.57
1984	.40
1985	.02*

*U.S. investment rate significantly greater than Canadian investment rate at the .10 level or greater.

**U.S. investment rate significantly less than Canadian investment rate at the .10 level or greater.

years of the period, no significant differences were found in the investment rates of the two countries. This is contrary to what was hypothesized, except for 1970.

For the years 1975-1985, the investment rates were tested for significance using a two-tailed test. If a significant difference was found, then that particular year was tested again to see in which direction the significance occurred. Significant differences were found in four of the eleven years: 1976, 1980, 1981, and 1985. In the first three of these years, the Canadian firms had greater investment rates than the U.S. firms. For 1985, the U.S. firms had the significantly higher rate. By 1985, tax reform was a much-debated topic with the repeal of the ITC likely. United States firms may have accelerated the timing of investments in 1985 to take advantage of the ITC before its repeal in 1986.

Table 4 displays the results of the Mann-Whitney tests.(14) Each matched pair was tested independently. The Mann-Whitney test measured differences between the two periods. If the point estimate of the median of the two periods was positive (see sign of point estimate on Table 4), this would indicate that period 1 was greater than period 2; and if the point estimate was negative, then period 2 had the greater values. The test was also run on all firms aggregately.

If the ITC had a strong influence on investment, absent confounding factors, the differences in investment rates should have been greater than period 1 (sign of the point estimate should be positive). Individually, 15 of the 26 matched pairs indicated that the group 1 differences were greater than the group 2 differences but only four (matches 10, 16, 19, and 26) were significant. Two of the eleven negative point estimates are significant (matches 1 and 9). Aggregately, group 1 values of all firms are greater than group 2 values but not significantly (p-value = .48).(15)

7. Limitations

In spite of the fact that the U.S. and Canadian economies are similar and in spite of the fact that the two countries were matched on the most likely confounding variables, there may have been differences between the two countries not accounted for in the analysis. Possibly the investment decision criteria was different in Canada from the U.S. in some way. The statutory ITC rates of the two countries were similar but not equal for any of the years of the test period, which may have introduced bias in the results not accounted for.(16)

TABLE 4

MANN-WHITNEY TESTS

Tests of Differences

Match No.	p-value	Sign of Point Estimate	Match No.	p-value	Sign of Point Estimate
1	.10	-	14	.12	-
2	.85	-	15	.78	-
3	.58	-	16	.01	+
4	.27	+	17	.12	+
5	.41	-	18	.36	-
6	.52	+	19	.05	+
7	.92	+	20	.36	-
8	.27	+	21	.92	+
9	.02	-	22	.99	+
10	.01	+	23	.41	+
11	.27	+	24	.46	-
12	.92	+	25	.71	-
13	.65	+	26	.04	+
All firms	.48	+			

The entire sample of firms for this study were drawn from the U.S. and Canadian industrial COMPUSTAT files. Accordingly, the firms were large publicly held firms listed on U.S. and Canadian stock exchanges. It is unknown whether small firms reacted similarly to the ITC as did the firms in this study.

The influence of the ITC as an investment stimulus may have been mitigated for firms which leased a substantial portion of their assets. It is uncertain what the lease effect may have been, but lessors may have passed the ITC on to lessees. Whether this practice was consistently done is unknown.

Finally, the power of the tests is rather low. Assessing the impact of a broad-based subsidy such as the ITC is a difficult task because of the variety of events that can impact investment. More sophisticated models can achieve greater testing power, however, this has been done at the cost of applying assumptions somewhat removed from reality. This study is not intended to be the final definitive work in this area but rather it adds another "piece of the puzzle" to further our understanding of the entire picture regarding investment behavior.

8. Summary and Conclusions

The ITC has been a tax incentive enacted to encourage business investment in the U.S. an Canada. It has been used in the U.S. from 1962 to 1985 with a brief suspension and a repeal during the 1967-1971 period. Canada has had the ITC since 1975. Tax policy research has traditionally been found within the domain of economic research. However, most economic research in the area of investment and tax incentives has dealt with aggregate data bases. This research took a micro-level approach with accounting financial statement data serving as determinants of the rate of investment.

U.S. firms were matched against Canadian firms because U.S. firms enjoyed the ITC during most of the test period but Canadian firms have had the benefit only since 1975. The firms were matched on industry type, assets, and "q." By matching on confounding factors affecting investment it was hypothesized that, ceteris paribus, U.S. firms would demonstrate higher average rates of investment than Canadian firms during the 1968-69 and 1971-74 period. In contrast, it was hypothesized that the average investment rates of U.S. and Canadian firms would not differ significantly in 1970 and during the 1975-1985 period.

Based on the results of this research, it is difficult to project conclusive general findings in favor of the significance of the ITC in investment decisions. During the 1968-1974 period, only in 1969 did the average U.S. rate of investment significantly exceed that of Canada. Excluding 1969, the average investment rates between the two countries were not significantly different. Therefore, it appears that, ceteris paribus, the ITC did not significantly alter investment behavior.

During the 1975-1985 period, Canadian firms outperformed the U.S. firms in several years. The evidence suggests, ceteris paribus that the ITC did stimulate average Canadian investment relative to average U.S. investment. After 1981 the investment rates were not significantly different until 1985 when the U.S. investment rates exceeded Canadian rates. The 1982-84 period was an economic recessionary period and this may have accounted for the Canadian slowdown. The U.S. firms may have accelerated investment in 1985 in advance of the expected ITC repeal of 1986.

In summary, this research finds little evidence to support the effectiveness of the ITC with regard to influencing investment in firms. Perhaps congressional assessment of the ITC was correct and perhaps the 1986 ITC repeal was an appropriate step. The ITC may possibly have been a windfall subsidy for capital investment.

Despite the fact that much research has been done in the area of investment incentives, the effect of the ITC has long been questioned. This research adds knowledge to provide additional understanding of the effects of the ITC, but it does not propose or conclude how to create and enforce a more effective tax incentive for investment. Hopefully, additional future research will uncover methods that can be utilized to formulate a more effective tax incentive for investment in synchronization with public policy goals.

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Endnotes

1. The few other micro studies include Ayres (1987), Salinger and Summers (1983, and von Furstenburg, et al. (1980).
2. The potential effects of these differences are addressed in the limitations section and note 16.
3. Jorgenson was the first to develop the empirical version of this model. See Jorgenson (1965) and Jorgenson and Stephenson (1967) for a full description of the model.
4. The neoclassical model is a theoretical model which must rely on production constraints and homogeneity assumptions to mathematically derive an empirically valid model (Jorgenson, 1965; and Jorgenson and Stephenson, 1967). The q-model must intuitively rely on the same assumptions for average "q" to equal marginal "q" (Tobin and Brainard, 1977).
5. A production function with constant returns to scale means that if inputs are increased by some proportion, then output

will increase by the same proportion. this implies that the value of all firms will be proportional to the size of their capital stocks and the behavior of all firms can be represented by a single representative firm.

6. The primary tenets of perfect capital markets affecting investment models are: firms can borrow up to the limit of its resources at the market rate of interest, no individual borrower is wealthy enough to affect market interest rates, and all assets are infinitely divisible (so that a marginal unit of capital exists).
7. The perfect substitution effect assumes that each unit of labor input can be replaced by one unit of capital. Without this assumption, the expected profitability of adding additional capital is clouded by wage prices.
8. The five industry classifications were defined by specified ranges of standard industrial classifications (SIC) reported by Standard and Poor's COMPUSTAT data base. The industries and corresponding SIC ranges are: Mining (SIC 1000-1211), Oil and Gas (SIC 1311-1382), Manufacturing and Processing (SIC 2000-2300), Timber (SIC 2400), and Transportation (SIC 4011-4700).
9. Pearson correlations were completed for total assets and net sales of the sample firms to see if the two variables were correlated. If any correlation existed, either variable could serve as a size variable. The correlation procedure was completed for each year independently for U.S. firms and for Canadian firms. With three exceptions, all years showed correlations between total assets and net sales of .62 or higher
10. See note 8.
11. To formulate matches more closely on average assets and "q", the firms were placed within a range of SIC groups. As a result, not all firms were matched on a four digit SIC number. Six firms were matched on a four digit classification, one firm was matched on a three digit classification, eleven firms were matched on a two digit classification, and eight firms were matched on a one digit classification. (See Table 2.)
12. The primary difference between the procedure used in this study and the procedure used by Salinger and Summers is that in this study, replacement cost of assets was determined using straight-line depreciation instead of declining balance depreciation. The replacement cost estimates were validated by testing for differences of estimated replacement costs from reported replacement costs published in annual reports (FASB 33) and 10K filings (ASR 190) for a sample of firms during the period 1976-1985. The Wilcoxon Signed Ranks Test indicated that the estimated and reported replacement costs were not significantly different.
13. Investment rate is defined as $(GPPE_t - GPPE_{t-1})/GPPE_t$ where GPPE is gross property, plant and equipment reported on the balance sheet. The capital investment variable is in ration form to allow for currency valuation differences between the countries and to allow for dollar value differences over time.
14. The Mann-Whitney test will be valid if the investment rates are not correlated over time. Ordinary least squares regression was used to test for autocorrelation among the investment rates. A separate regression was run for each U.S. firm, each Canadian firm, and each difference for the test period. The model regressed the investment rates on a constant term with a residual (no independent variables were included in the model). No significant autocorrelation was found in any of the regressions using the Durbin-Watson test statistic.
15. The aggregate test was done by averaging the investment rates across firms for each year and running one test on the averages.
16. The ITC rates for the U.S. sample firms ranged from 6 to 10 percent depending on the year and option chosen. The ITC rates for the Canadian sample firms ranged from 5 to 7 percent depending on the year. The higher Canadian ITC rates referred to earlier did not affect this sample because these rates applied to operations in northern Canada. None of the Canadian firms in the sample were headquartered in the high ITC regions.

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