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THE STOCK MARKET AND INVESTMENT

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ABSTRACT

Changes in real stock-market prices have a lot of explanatory value of the growth rate of U.S. aggregate business investment, especially for long samples that begin in 1891 or 1921. Moreover, for the period since 1921 where data on a q-type variable are available, the stock market dramatically outperforms q. The change in real stock prices also retains its predictive value in the presence of a cash-flow variable, such as after-tax corporate profits. Basically similar results apply to Canadian investment, except that the U.S. stock market turns out to have move preditive power than the Canadian market. I discuss some possible explanations for this puzzling finding, but none of the explanations seem all that convincing.

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A literature initiated by Tobin (1969) relates investment to q, which is the ratio of the market's valuation of capital to the long-run cost of acquiring new capital. An increase in the prospective return on capital or a decrease in the market's discount rate raises q and thereby increases investment. With a simple form of adjustment cost for changing the capital stock, the optimal amount of current investment depends only on the current value of q. But more generally—for example, with a time-to-build technology for the capital stock—current investment depends on current and lagged values of q (see Hayashi, 1982, and Abel and Blanchard, 1986).

The growth rate of investment relates to current and lagged values of proportionate changes in q. An important source of variation in the numerator of q—the market value of capital—is the change in stock-market prices. Therefore, q theory can rationalize a positive relation between investment and current and lagged changes in stock-market prices, as estimated by Fama (1981) and Barro (1989), among others.

As is well known (see, for example, Hayashi, 1982), the distinction between average and marginal q can cause difficulty in empirical implementations of the theory. For example, changes in relative prices—such as those for energy relative to other goods—may move the stock market in one direction and the incentive to invest in the other direction. That is, marginal q (associated with investment in the new capital, which is suited to the current configuration of relative prices) may rise (or fall), while average q (associated with the existing capital) may fall (or rise). Tax changes, especially when they treat old and new capital differently, can have similar effects. If the data refer to average q, as is typically the case, the theory will perform well only if the dominant disturbances relate to changes in the prospective returns on all forms of capital or to shifts in market discount rates.

The established empirical view (derived from results of von Furstenberg, 1977; Clark, 1979; and Summers, 1981, among others) is that measures of the market value of capital (q-type variables) have only limited explanatory power for investment. Furthermore, when measures of corporate profits or production or similar variables are considered, the statistical significance of the market-valuation variables tends to disappear. Of course, corporate profits and production are simultaneously determined with investment, and this simultaneity can account for the "explanatory value" of these variables. But the view in the empirical literature is that even predetermined values of variables like profits or production leave market-valuation measures with little predictive power for investment. I found this conclusion difficult to reconcile with the strong relations between investment (and other macroeconomic variables, such as GNP) and stock-market returns, as reported in Fama (1981) and Barro (1989). The explanation, discussed below, is that the stock market does much better than the measures of q that have been used in previous empirical studies of investment.

Results for U.S. Investment and *GNP*

Table 1 shows regressions with annual U.S. data for DI_t, the growth rate of real, non-residential, fixed, private, domestic investment. I do not consider broader definitions of investment--which would include expenditures on residential housing and other consumer durables, and perhaps outlays on human capital--since these flows do not relate directly to stock-market prices or other variables that measure the market value of business capital.

(Results for the corporate component of investment—which relates naturally to the stock market and to corporate profits—are basically similar to those for my broader concept of business investment.)

The investment variable consists of expenditures on capital goods, and is therefore gross of depreciation. In some models (where adjustment costs pertain to gross expenditures, rather than to net investment), it is gross investment that relates naturally to q-type variables. However, in other settings (where replacement expenditures do not entail any adjustment cost), it is net investment that would be associated with q. In any event, since available measures of depreciation are largely arbitrary, the choice of gross investment tends to be dictated on grounds of data availability.

The sample periods considered in Table 1, which exclude dates around World Wars I and II, are 1891-1914, 1921-40, 1948-87; 1921-40, 1948-87; and 1948-87. The variables considered are:

DI_t: Growth rate of investment (year t relative to year t-1).

$STOCK_t$: Growth rate for year t of the real stock-market price. For 1926-85 I used the value-weighted return on stocks (exclusive of dividends[1]) from the Center for Research in Securities Prices (CRSP) of the University of Chicago. For 1986-87 I used the returns based on the New York Stock Exchange

[1]From the standpoint of q theory, the change in investment depends on the change in the market value of capital. Therefore, it is appropriate to measure stock returns exclusive of dividends. Conceptually, it would also be desirable to adjust for retained earnings. However, the measurement of retained earnings is problematic since it requires an estimate of "depreciation."

index, as reported by DRI. For 1871-1925 I used the returns based on the Cowles Commission (1939) index for the value of all stocks. The inflation rate for the GNP deflator (year t relative to year $t-1$) was subtracted from the change in nominal stock prices to compute real changes. (Although the timing of inflation and stock returns is off slightly, I found that the adjustment of the nominal returns for inflation has, in any event, only a minor effect on the results.)

$DPROF_t$: The first difference of the ratio of after-tax corporate profits to *GNP* (the value for year t less that for year $t-1$). For 1929-87, corporate profits are the standard national accounts' numbers, which adjust for capital consumption and inventory revaluation. Numbers for 1919-28 (provided by Changyong Rhee) are after-tax corporate profits as reported in issues of Internal Revenue Service, *Statistics of Income.*

Dq_t: Growth rate of q (year t relative to year $t-1$), where q_t refers to the end of year t. (Thus, Dq_t lines up with $STOCK_t$.) The measure of q, constructed by Blanchard, Rhee, and Summers (1988) and provided by Changyong Rhee, is an estimate of the ratio of total market value of corporations (equity plus debt) to corporate capital stock at reproduction cost. The measures of capital stock include standard estimates of depreciation. The variable used makes no separate adjustment for taxes.

DY_t: Growth rate of real *GNP* (year t relative to year $t-1$).

Regressions 1 and 2 of Table 1 apply to the 1891-1914, 1921-40, 1948-87 sample, for which I lacked data on corporate profits and *q*. Regression 1 shows the substantial explanatory power of the one-year-lagged real stock-price change, $STOCK_{t-1}$, for the growth rate of investment, DI_t. The estimated coefficient on $STOCK_{t-1}$ is .57, s.e. = .05 (t-value = 12.5). With the lagged dependent variable, DI_{t-1}, also included as a regressor, the R^2 is .67. (Even without DI_{t-1}, the R^2 is .53.) The contemporaneous variable, $STOCK_t$, is insignificant in regression 2. Thus, the results suggest that some disturbance—such as a shift in the prospective real return on capital—shows up as a shift in stock-market valuation and, with about a one-year lag, as an increase in investment expenditures. (Lags of *STOCK* beyond the first are insignificant if added to regression 1.)

The use of nominal stock-price changes, rather than real changes, makes only a minor difference. For example, if the one-year lag of the nominal price change is substituted for the real change in regression 1, the estimated coefficient changes little and the R^2 falls from .67 to .65. The effect is minor because the nominal capital gain on stocks is so much more volatile than inflation. Over the period, 1891-1914, 1921-40, 1948-87, the standard deviation of the nominal capital gain is .19, while that for inflation is .04; hence, the correlation between the nominal and real capital gains on stocks turns out to be .975. Despite this high correlation, the results for investment indicate a clear preference for the real capital gain as an explanatory variable. If nominal and real gains are included simultaneously, the estimated coefficient of the lagged nominal gain is .01, s.e. = .23, while that on the lagged real gain is .56, s.e. = .23. Thus, as theory predicts, the data indicate that investment relates to the change in real market value, rather than nominal market value.

Regressions 3-9 of Table 1 deal with the period, 1921-40, 1948-87. Regression 3, which includes the one-year lag of the real stock-price change, is similar to regression 1. Regression 4 shows that—with the stock-market variable omitted—the variable Dq_{t-1} has some explanatory value for DI_t, although the R^2 is only .31. This finding is consistent with those reported in the empirical literature. Regression 5 shows that the stock-price change dominates the q variable—the estimated coefficient of Dq_{t-1}, -.03, s.e. = .08, is essentially zero, while that on $STOCK_{t-1}$ is about the same as that shown in regression 3.

These results are surprising in that q takes account of stock-market valuation, and also considers changes in the market value of corporate debt. In addition, the q variable allows in the denominator for changes in the stock of capital at reproduction cost. Thus, q measures total market value per unit of physical capital. (In contrast, even without changes in the market value of debt, stock-price indices err in not adjusting for retained earnings.)

Theoretically, the features that Dq adds to the change in real stock prices ought to matter for the relation between market valuation and investment. On the other hand, in terms of measurement, stock prices are much more accurate than the estimated changes in the market value of corporate debt or the computed changes in the quantity of corporate capital at reproduction cost (which involve rough estimates of depreciation). Moreover, despite the high variability of stock prices, it is not true that these changes dominate the sample variations in Dq. The results in Table 1 indicate that the differences between *STOCK* and *Dq* are important, and that the data clearly prefer *STOCK* to *Dq*.

It may be that *Dq* is the change in real stock prices plus a variable that is dominated by noise. In this case it would not be surprising that the stock-price change would perform much better than *Dq* in a relation for investment. It is also possible that the results mean that components of *Dq* other than the change in real stock prices—such as revaluations of corporate debt—do not matter for investment in the way that *q* theory would predict. This possibility is worth further investigation.

Regression 6 shows that, with the stock-market variable excluded, the lagged profit variable, $DPROF_{t-1}$, has significant explanatory power for DI_t (coefficient of 5.0, s.e. = 1.1), although the R^2 is only .34. With $STOCK_{t-1}$ also included in regression 7, $DPROF_{t-1}$ becomes less important (coefficient of 2.1, s.e. = 0.8), but is still significantly positive. However, the lagged stock-price change, $STOCK_{t-1}$, plays the main predictive role—the coefficient here is .48, s.e. = .05.[2]

Regression 8 adds contemporaneous values of the changes in stock prices and the profit ratio. The current stock-market variable, $STOCK_t$, is insignificant, but the current change in the profit ratio, $DPROF_t$, is highly significant (coefficient of 3.4, s.e. = 0.6). Even so, the lagged variables remain significant—the coefficient of $STOCK_{t-1}$ is now .31, s.e. = .05, while that on $DPROF_{t-1}$ is 2.1, s.e. = 0.6.

[2]The results for real versus nominal stock-price changes are similar to those for the longer sample. If the nominal variable is added to regression 3, its t-value is 0.1, while that on the real variable is 1.9. In regression 7, the respective t-values are 0.3 and 1.9.

I would interpret regression 8 by thinking again about an exogenous disturbance, such as a change in the prospective return on capital. The results suggest that this kind of shock has an immediate reflection in stock-market valuation and some contemporaneous effect on the ratio of corporate profits to *GNP*. The principal effect on investment expenditures and the larger impact on the profit ratio show up with a one-year lag. As would be expected, there is no lagged effect on stock prices—that is, the full adjustment of financial prices is contemporaneous with the disturbance.

Results for the 1948-87 sample (regressions 10-16 in Table 1) are basically similar to those for the period, 1921-40, 1948-87.[3] One difference is that the estimated coefficients on the lagged stock-market variable, $STOCK_{t-1}$, and the current change in the profit ratio, $DPROF_t$, are smaller than before.[4]

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[3]Again, the data indicate some preference for real stock-price changes over nominal changes. If the nominal variable is added to regression 10, its t-value is 0.3 while that for the real variable is 1.4. In regression 14 the respective t-values are 0.7 and 1.6.

[4]Changes in nominal interest rates—such as the commercial paper rate—are significant for DI_t over the 1948-87 period, but not for the longer samples. In the post-World War II period, the estimated coefficient of DR_{t-1} (where DR is the change in the nominal interest rate) is negative, while that of DR_t is positive. The lagged change in real stock prices, $STOCK_{t-1}$, is still significantly positive here. However, for a more recent sample—such as 1960-87—the inclusion of the interest-rate terms eliminates the statistical significance of $STOCK_{t-1}$. In contrast, for the longer samples (those starting in 1891 or 1921), the interest-rate variables are insignificant and have a negligible effect on the estimated coefficient and standard error for $STOCK_{t-1}$. I am unsure what effects are picked up in the recent period by the changes in nominal interest rates. However, the shifting role over time likely reflects the changing behavior of inflation. Notably, changes in nominal interest rates probably proxy mainly for shifts in expected inflation in the recent period, but mainly for variations in expected real interest rates in earlier periods.

Table 2 shows regressions with the dependent variable changed to the growth rate of real *GNP*. The results are basically similar to those shown in Table 1, although the estimated coefficients on *STOCK* and *DPROF* tend to be smaller in Table 2.[5] These results accord with the much greater volatility of investment than of *GNP*.

<u>Forecasts Associated with Stock-Market Crashes of 1987 and 1929</u>

Corresponding to the stock-market crash of October 1987, the rate of change of nominal stock prices for that month was -.247 (per month). For 1987 overall, the annual rate of change of real stock prices was -.032. Thus, if the October 1987 rate of change in stock prices had equaled the sample mean over 1948-87 of .0065 per month (and if inflation and the other changes in real stock prices remained as they were), the rate of change of real stock prices for 1987 would have been .222. In other words, the stock-market crash lowered the annual rate of change of real stock prices for 1987 by .254.

The decrease in real stock prices in 1987 corresponds to a reduced forecast of growth in investment and *GNP* for 1988. For example, using the

[5]Unlike for investment, the preference between real and nominal gains on stocks is less clear for *GNP*. If the nominal stock-price change is added to regression 1 (for the 1891-1914, 1921-40, 1948-87 sample), the t-value is 1.6, while that for the real change is 0.5. The results are similar for regression 3 (for the 1921-40, 1948-87 sample), where the respective t-values are 1.7 and 0.2. However, in regression 5, the t-values are each 0.9. For regression 7 (1948-87 sample), the t-value for the nominal variable is 1.0, while that for the real variable is 1.8. Similarly, in regression 9, the respective t-values are 1.1 and 1.9.

regressions for the 1891-1914, 1921-40, 1948-87 sample (Table 1, regression 1, and Table 2, regression 1), the stock-market crash implied that the forecasted annual growth rates for 1988 over 1987 fell from .123 to -.021 for investment, and from .059 to .021 for *GNP*. The sensitivity of these growth forecasts to the stock market is reduced if one uses estimates based on the 1948-87 sample. Using the regressions for this sample (Table 1, regression 14, and Table 2, regression 9), the projected growth rates for 1988 over 1987 fell from .066 to -.004 for investment, and from .049 to .023 for *GNP*. (I assumed here that corporate profits for 1987 were not altered along with the stock-market crash.) In any event, the crash corresponded to a revision from a forecast of a strong boom for 1988 to a prediction of below-average growth.

The actual economic performance for 1988 turned out to be strong; growth rates for 1988 over 1987 were .079 for investment and .035 for *GNP*. Table 3 compares these outcomes with forecasts based on regressions from the various samples covered in Tables 1 and 2. Although the actual growth rates exceed the projected values in each case, the gap is never statistically significant at the 5% level. Thus, while the stock market did not predict well for 1988, one cannot conclude with any confidence from this observation that the economy has shifted to a new regime where the stock market is generally unreliable. In other words, given the typical margin of error for the sample, the incorrect forecasts for 1988 are not all that unusual.

The last two cases in Table 3 consider the forecasts for 1930-32 that would have emerged after the stock-market crash of 1929. In this case, regressions for the growth of investment and *GNP* were estimated (based on lagged growth and the lagged real return on stocks) over the sample, 1891-1914, 1921-29. While the plunge in stock prices accurately predicted a decline in economic activity after 1929, the forecasts substantially understate the extent of the decline in this case.[6] For *GNP* growth, the gap between forecasted and actual values for 1930-32 is statistically significant at the 5% level (F^3_{30} = 9.8), while for investment growth the gap is not significant (F^3_{30} = 2.1).

Putting 1987 and 1929 together, there is no indication that stock-market crashes are systematically ignored in terms of the response of economic activity. In the recent case, the economy did better than stock-market-based predictions would have said, while in the earlier case, the reverse applied. One likely possibility is that stock-market crashes occur at times when economic conditions are volatile, so that forecast errors are higher than usual. But, in terms of the forecast mean, there is no reason to think that economic activity relates differently to stock returns at times of stock-market crashes than at other times.

Results with Monthly Stock-Price Changes

Table 4 shows results for the annual growth of investment and *GNP* over the long-term sample (1891-1914, 1921-40, 1948-87), using monthly changes in real stock prices as regressors. Each monthly term is the logarithm of stock prices at the end of the month less the logarithm of stock prices at the end of the previous month. To get a rough estimate of the change in real stock prices, I subtracted the inflation rate for the year (expressed on a monthly

[6]The "forecasts" for 1931 and 1932 were based on the actual values of lagged growth and lagged stock returns for 1930 and 1931. Thus, the calculated values are not true forecasts. However, the computations are appropriate for seeing whether the data for 1930-32 satisfy the same relationship as those for the prior years.

basis), calculated from the annual *GNP* deflator. In other words, the inflation rate used is the same for all 12 months within a given year.[7]

The regression for investment shows that this year's growth rate (annual average of investment for year t relative to that for year $t-1$) relates especially to real stock-price changes between May and December of the previous year.[8] Estimated coefficients for monthly stock-price changes in the current year turn out to be insignificant, as do those for changes prior to December of two years' previous. The standard error of each coefficient on monthly stock-price movements is fairly high (about 0.2), which allows for a good deal of random variation in point estimates from month to month. Nevertheless, there is some indication of a distributed lag pattern for the coefficients that rises between December and September of the previous year

[7]The results are similar if changes in nominal stock prices are used instead of changes in real stock prices, although the fit for investment is somewhat better with the real prices. (The fit for *GNP* is virtually identical with real or nominal prices.) It would be possible to use monthly inflation rates for the *CPI* back to 1913 or for wholesale prices for the entire sample, although the accuracy of the earlier data are unclear. (Even at recent times the "monthly" figures do not always refer to prices sampled within the indicated month.) I think that the results would not change much with a shift to monthly inflation numbers, because the main function of the adjustment for inflation is to capture the secular changes in the inflation rate. The inflation rates calculated from the annual *GNP* deflator are satisfactory in this respect.

[8]For samples prior to World War II, the data on investment and *GNP* are available only on an annual basis. Therefore, I related annual growth rates of investment and *GNP* to a distributed lag of monthly stock returns. Even for the post-World War II period, my experience is that little additional information obtains by using quarterly, rather than annual, values of the national accounts' variables. Much of the true underlying information comes from annual data and the quarterly observations also bring in important variations due to seasonals.

and then gradually diminishes to reach close to zero within about 15 months. The results for *GNP*, also shown in Table 4, reveal a similar pattern.

A Comparison of Results for Canada and the United States

Table 5 shows regression results for the growth rate of investment (real, non-residential, fixed, private, domestic) in Canada for the period, 1928-40, 1948-87. (The main national accounts' data for Canada begin in 1926, although some data are available earlier.) The growth rate of real stock prices for Canada is based on the Toronto 300 composite index.

Regressions 1-4—which use data on investment, real stock prices, and after-tax corporate profits as a ratio to *GNP*—are comparable to results reported before for the United States. Regression 1 shows the explanatory power of lagged changes in real stock prices for the growth of investment. The main difference from the U.S. case is that the R^2 of .61 is somewhat lower. (Over the period 1928-40, 1948-87, the R^2 for a parallel U.S. regression is .72.) Regression 3 shows that, as with the United States, the lagged change in the corporate profit ratio has some additional explanatory power for the growth of investment. In Regression 4, the contemporaneous stock return is again insignificant for the growth of investment. The current change in the corporate profits ratio is significant, but—unlike for the United States—the lagged value has a larger coefficient (and greater t-value) than the contemporaneous value.

It is often argued that the U.S. economy has a large, perhaps dominant, influence on the Canadian economy. Therefore, it is natural to consider U.S. variables as regressors for Canadian investment growth. Regression 5 adds the U.S. lagged variables that I used before to explain U.S. investment growth—DI_{t-1}, $STOCK_{t-1}$, and $DPROF_{t-1}$—to an equation for Canadian investment growth. This equation also includes the Canadian lagged variables as regressors—that is, the same set of variables included in regression 3 of table 5. The striking result in regression 5 is that the lagged change in U.S. stock prices is significant (.43, s.e. = .14), while the lagged change in Canadian stock prices is insignificant (-.13, s.e. = .16).[9] That is, changes in U.S. stock prices predict growth in Canadian investment, but—holding fixed the behavior of the U.S. stock market—the change in Canadian stock prices has no predictive value for growth in Canadian investment. The apparent predictive role for the Canadian stock market in regressions 1, 3, and 4 of Table 5 can be attributed to the strong positive correlation (.87) between the changes in Canadian and U.S. real stock prices over the sample period.

Instead of entering the three lagged U.S. variables separately, one can combine them into the implied forecast for U.S. investment growth. The variable $\hat{DI}_t$ in regression 6 of Table 5 is the fitted value from a regression (over the sample 1928-40, 1948-87) of U.S. investment growth on a constant and the U.S. values of DI_{t-1}, $STOCK_{t-1}$, and $DPROF_{t-1}$. Note that the fit of regression 6 is virtually the same as that in regression 5. Therefore, the usual likelihood-ratio test accepts the hypothesis that the U.S. variables matter for Canadian investment growth only to the extent that these variables predict U.S. investment growth.

[9]The Canadian variables turn out to have little influence on the growth of U.S. investment. In particular, the types of results reported for the United States in Table 1 are not substantially affected if Canadian variables are entered as additional regressors.

Regression 7 in Table 5 shows that the conclusion about the insignificance of Canadian stock-price changes for Canadian investment growth still holds if one includes the contemporaneous values, $STOCK_t$ or $DPROF_t$, for Canada. Regressions 8 and 9 shows that the same conclusion also applies if one replaces the forecasted value of U.S. investment growth, $\hat{DI}_t$, with the actual value, DI_t.

The results about the connection between Canadian investment and the Canadian and U.S. stock markets are less clear if one limits attention to the post-World War II period. With only the lagged Canadian variables included, the coefficient of $STOCK_{t-1}$ for the 1948-87 sample is .14, s.e. = .07, which is much smaller than the value (.33, s.e. = .08) shown in regression 3 of Table 5. With the lagged U.S. values also entered, the coefficient of $STOCK_{t-1}$ for Canada again becomes insignificant—the estimate is -.05, s.e. = .15, which is similar to the value (-.13, s.e. = .16) shown in regression 5. However, while the coefficient of $STOCK_{t-1}$ for the United States is positive, it is now statistically insignificant—the estimated value is .23, s.e. = .16. Thus, the results for the 1948-87 period are consistent with the idea that Canadian investment relates more to the U.S. stock market than to the Canadian market. But the results also indicate that Canadian investment is only weakly related to developments on either stock market over this period. The main evidence for a link between the U.S. stock market and Canadian investment comes when the data from 1928-40 are added to the sample (as in Table 5). Thus, the behavior during the depressed 1930s is playing a major role in the findings.

It is not surprising that the U.S. economy would have a significant influence on Canadian investment. For example, a boom in the United States could raise the return on Canadian capital and thereby stimulate Canadian investment. But, in this story, the U.S. boom would also raise the market value of Canadian capital—that is, Canadian stock prices and q would rise. If these market values were held fixed, it is unclear why U.S. events would influence Canadian investment. Therefore, assuming that the Canadian stock market is a good measure of the market value of capital in Canada, the results shown in Table 5 (regressions 5-9) are puzzling.

One possibility is that the stock-price index that I used—the Toronto 300 composite—is not a very good measure of the market value of capital located in Canada. I have, however, been assured by some Canadian researchers that this measure is the best available broad index of Canadian stock-market prices.

Another consideration is that much of Canadian domestic investment is carried out by U.S. firms. The shares in these firms are typically traded on the U.S. stock market, rather than the Canadian market. Thus, to the extent that Canadian investment is carried out by foreigners (specifically, Americans), there is a good reason that Canadian investment would not relate to the Canadian stock market. But, it must be the case overall that the Canadian stock market is more accurate than the U.S. market as an indicator of the value of capital in place in Canada. Thus, I am skeptical that this element accounts for the results in Table 5.

A familiar problem with the empirical implementation of q theory is the distinction between marginal and average q, with the theory relating more to the former and the data to the latter. This distinction would be particularly helpful if I were trying to explain why neither Canadian nor U.S. stock prices did very well in predicting Canadian investment. However, the main puzzle is why the U.S. stock market does as well as it does in predicting Canadian investment, especially over the sample, 1928-40, 1948-87.

The general problems with using average q to proxy for marginal q would apply to both the U.S. and Canadian stock markets. But one reason why this element might matter more for Canada is that Canadian production and investment are more related to natural resources, specifically to energy, than are U.S. production and investment. Since the distinction between marginal and average q is particularly important when there are variations in the relative price of energy, it is conceivable that the U.S. stock market is better than the Canadian stock market as a proxy for marginal q (averaged over industries) in Canada. Therefore, an argument along these lines might explain why Canadian investment relates more to the U.S. stock market than to the Canadian market. One reason for skepticism, however, is that the strongest role for the U.S. stock market in the Canadian investment equation emerges when the period 1928-40 is also included. This period, which substantially predates the times of oil shocks, is not one where the natural resource story is likely to be compelling.

Summary of Major Findings

Many empirical studies have related business investment to q, which is the ratio of the market's evaluation of capital to the long-run cost of acquiring new capital. A typical finding in this literature is that q-measures have only limited predictive value for investment. In contrast, I find for the United States—especially for long samples that begin in 1891 or 1921--that lagged changes in real stock-market prices have a lot of explanatory value for the growth rate of investment. Moreover, for the period since 1921 where data on a q-type variable are also available, the stock-market variable dramatically outperforms q. This result arises even though the change in the q measure approximates the change in real stock prices plus other variables that ought to matter for investment. One plausible interpretation of these results is that the other components of q are measured inaccurately, relative to stock-market prices.

Even in the presence of cash-flow variables, such as contemporaneous and lagged values of after-tax corporate profits, the stock-market variable (but not q) retains significant predictive power for investment. An overall interpretation of these results is that an exogenous disturbance (such as an increase in the prospective rate of return on capital) shows up contemporaneously as an increase in stock prices and corporate profits, and with a lag of a year or more as an expansion of investment expenditures and a further increase in profits.

I examined the stock-market crashes of 1929 and 1987. In the former case, subsequent investment spending (for 1930-32) performed worse than the stock market would have predicted, while in the latter case, the subsequent spending (for 1988) was surprisingly strong. Nevertheless, one cannot conclude with any confidence that the relation between stock prices and investment (or *GNP*) is systematically different in the context of stock-market crashes than at other times.

For Canada since 1928, a simple relation between investment and stock-price changes (and corporate profits) looks similar to that for the United States. However, when the interaction between the two countries is considered, it turns out that the U.S. stock market has more predictive power than the Canadian market for Canadian investment. I discuss some possible explanations for this puzzling finding, but none of the explanations seem all that convincing.

Table 1

Results for U.S. Investment Growth

Sample	No.	Const.	DI_{t-1}	$STOCK_{t-1}$	$DPROF_{t-1}$	Dq_{t-1}	$STOCK_t$	$DPROF_t$	Dq_t	R^2	$\hat{\sigma}$	DW
1891-1914, 1921-1940, 1948-87	(1)	-.007 (.009)	.393 (.066)	.566 (.045)						.67	.081	1.5
	(2)	-.007 (.010)	.388 (.068)	.564 (.046)			-.015 (.047)			.67	.081	1.5
1921-40, 1948-87	(3)	-.011 (.011)	.414 (.073)	.546 (.051)						.69	.083	1.5
	(4)	.014 (.016)	.016 (.126)			.415 (.096)				.31	.124	1.6
	(5)	-.012 (.011)	.438 (.099)	.562 (.067)		-.031 (.084)				.69	.083	1.5
	(6)	.025 (.016)	-.084 (.135)		4.98 (1.08)					.34	.122	1.8
	(7)	-.004 (.011)	.243 (.094)	.485 (.054)	2.07 (0.77)					.73	.078	1.5
	(8)	.006 (.009)	.229 (.074)	.313 (.051)	2.08 (0.60)		-.053 (.042)	3.41[illegible] (0.57)		.84	.062	1.7
	(9)	.006 (.009)	.266 (.084)	.331 (.073)	2.22 (0.62)	-.067 (.065)	-.070 (.056)	3.35 (0.58)	.023 (.077)	.84	.062	1.7

Table 1. continued

Sample	No.	Const.	DI_{t-1}	$STOCK_{t-1}$	$DPROF_{t-1}$	Dq_{t-1}	$STOCK_t$	$DPROF_t$	Dq_t	R^2	$\hat{\sigma}$	DW
1948-87	(10)	.010 (.010)	.347 (.134)	.298 (.058)						.42	.053	1.9
	(11)	.031 (.011)	.064 (.135)			.275 (.073)				.28	.059	2.0
	(12)	.014 (.011)	.304 (.145)	.253 (.082)		.072 (.093)				.43	.053	1.9
	(13)	.033 (.012)	-.026 (.154)		3.42 (1.49)					.13	.065	2.0
	(14)	.013 (.012)	.271 (.136)	.276 (.057)	2.18 (1.20)					.47	.052	1.9
	(15)	.021 (.010)	.226 (.135)	.248 (.054)	1.92 (1.15)		-.130 (.050)	1.46 (1.18)		.57	.048	1.9
	(16)	.023 (.011)	.234 (.144)	.208 (.082)	2.00 (1.28)	.022 (.096)	-.163 (.075)	1.29 (1.36)	.077 (.117)	.57	.049	1.8

Notes: Standard errors of coefficients are in parentheses, $\hat{\sigma}$ is the standard error of estimate, DW is the Durbin-Watson Statistic. The dependent variable is $\log(I_t/I_{t-1})$, where I_t is real, non-residential, fixed, private domestic investment (1982 base). Data are from U.S. Department of Commerce (1987) and *U.S. Survey of Current Business*, July 1988. DI_{t-1} is a lag of the dependent variable. $STOCK_t$ is the change in real stock-market prices, as discussed in the text. $DPROF_t$ is the first difference of the ratio of after-tax corporate profits to *GNP*, as discussed in the text. Dq_t is $\log(q_t/q_{t-1})$, where q_t—discussed in the text—is the ratio of market value of corporations to the corporate capital stock at estimated reproduction cost.

Table 2

Results for U.S. *GNP* Growth

Sample	No.	Const.	DY_{t-1}	$STOCK_{t-1}$	$DPROF_{t-1}$	$STOCK_t$	$DPROF_t$	R^2	$\hat{\sigma}$	DW
1891-1914, 1921-1940, 1948-87	(1)	.0174 (.0039)	.277 (.074)	.148 (.016)				.56	.029	1.7
	(2)	.0156 (.0040)	.304 (.075)	.150 (.016)		.028 (.017)		.57	.029	1.8
1921-40, 1948-87	(3)	.0140 (.0046)	.326 (.084)	.150 (.019)				.59	.031	1.6
	(4)	.0270 (.0062)	.086 (.131)		1.32 (0.34)			.32	.039	1.9
	(5)	.0200 (.0045)	.137 (.093)	.135 (.018)	0.88 (0.25)			.67	.028	1.3
	(6)	.0206 (.0043)	.128 (.086)	.103 (.020)	0.94 (0.23)	.020 (.017)	0.66 (0.24)	.73	.026	1.6
1948-87	(7)	.0246 (.0049)	.127 (.118)	.104 (.020)				.42	.021	1.5
	(8)	.0293 (.0063)	.081 (.153)		0.65 (0.59)			.04	.027	2.0
	(9)	.0251 (.0050)	.110 (.119)	.103 (.021)	0.44 (0.47)			.43	.021	1.6
	(10)	.0222 (.0053)	.236 (.138)	.095 (.021)	0.19 (0.48)	-.011 (.021)	1.04 (0.57)	.49	.020	1.7

Notes to Table 2: The dependent variable is $\log(Y_t/Y_{t-1})$, where Y_t is real *GNP* (1982 base). Data since 1929 are from U.S. Department of Commerce (1986) and *U.S. Survey of Current Business*, July 1988. Earlier data are from Romer (1987, 1988). DY_{t-1} is a lag of the dependent variable. For other notes, see Table 1.

Table 3

Forecasts Associated with Stock-Market Crashes of 1987 and 1929

No.	Dep. Var.	Regression, Sample	Forecast Year	Forecast	Actual	t or F [5% value]
(1)	*DI*	Table 1 (1) 1891-1914, 1921-40, 1948-87	1988	-.021	.079	t_{81} = 1.24 [1.99]
(2)	*DY*	Table 2 (1) 1891-1914, 1921-40, 1948-87	1988	.021	.035	t_{81} = 0.49 [1.99]
(3)	*DI*	Table 1 (7) 1921-40, 1948-87	1988	-.028	.079	t_{56} = 1.35 [2.00]
(4)	*DY*	Table 2 (5) 1921-40, 1948-87	1988	.015	.035	t_{56} = 0.72 [2.00]
(5)	*DI*	Table 1 (14) 1948-87	1988	-.004	.079	t_{36} = 1.59 [2.03]
(6)	*DY*	Table 2 (9) 1948-87	1988	.023	.035	t_{36} = 0.59 [2.03]
(7)	*DI*	$DI_t \rightarrow DI_{t-1}, STOCK_{t-1}$ 1891-1914, 1921-29	1930 1931 1932	-.07 -.23 -.36	-.19 -.44 -.51	F^3_{30} = 2.08 [2.92]
(8)	*DY*	$DY_t \rightarrow DY_{t-1}, STOCK_{t-1}$ 1891-1914, 1921-29	1930 1931 1932	.012 -.011 -.028	-.099 -.089 -.144	F^3_{30} = 9.82 [2.92]

Notes: *DI* is the growth rate of investment and *DY* is the growth rate of *GNP*. The results for (1)-(6) refer to the indicated regressions from Tables 1 and 2. Results for (7) and (8) come from regressions over the period 1891-1914, 1921-29 for investment growth and GNP growth, respectively, with the lagged dependent variable and the lag of the growth in real stock prices as regressors. See Tables 1 and 2 for definitions of variables.

Table 4

Results with Monthly Stock-Price Changes

Dependent Variable	*DI*	*DY*
Constant	.006 (.012)	.0234 (.0048)
Lagged Dep. Var.	.228 (.099)	.167 (.103)
Real Stock-Price Changes:		
December (-1)	.60 (.28)	.268 (.094)
November (-1)	.54 (.21)	.144 (.070)
October (-1)	.67 (.20)	.265 (.065)
September (-1)	.89 (.21)	.290 (.068)
August (-1)	.51 (.19)	.094 (.060)
July (-1)	.19 (.22)	.055 (.073)
June (-1)	.68 (.22)	.040 (.073)
May (-1)	.45 (.23)	.047 (.077)
April (-1)	.43 (.23)	.213 (.073)
March (-1)	.26 (.24)	.104 (.078)
February (-1)	.49 (.31)	.137 (.098)
January (-1)	.11 (.23)	.033 (.076)
December (-2)	.46 (.29)	.057 (.098)
November (-2)	.19 (.22)	-.062 (.074)
October (-2)	.16 (.20)	.058 (.067)
R^2	.74	.70
$\hat{\sigma}$	.079	.026
DW	1.7	1.8

Notes: Standard errors are in parentheses. The dependent variables are *DI*, the growth of investment, and *DY*, the growth of *GNP*. The sample periods are 1891-1914, 1921-40, 1948-87. Each regression includes a constant, the lagged dependent variable, and 15 monthly lagged values of changes in real stock prices. See the text for definition of the monthly stock-price change.

Table 5

Results for Canadian Investment Growth

No.	Const.	DI_{t-1}	$STOCK_{t-1}$	$DPROF_{t-1}$	$STOCK_t$	$DPROF_t$	DI_{t-1} (U.S.)	$STOCK_{t-1}$ (U.S.)	$DPROF_{t-1}$ (U.S.)	$\hat{DI}_t$ (U.S.)	DI_t (U.S.)	R^2	$\hat{\sigma}$	DW
(1)	.009 (.015)	.510 (.087)	.472 (.076)									.61	.106	1.7
(2)	.020 (.015)	.378 (.094)		6.76 (1.16)								.59	.109	2.0
(3)	.014 (.013)	.412 (.082)	.329 (.077)	4.37 (1.15)								.70	.094	2.1
(4)	.013 (.013)	.476 (.083)	.254 (.080)	4.41 (1.12)	-.016 (.079)	2.62 (1.20)						.73	.091	2.0
(5)	.007 (.013)	.249 (.113)	-.126 (.158)	4.30 (1.30)			.307 (.165)	.434 (.140)	1.14 (1.39)			.79	.081	1.7
(6)	.011 (.011)	.242 (.080)	-.035 (.107)	3.94 (0.99)						.75 (.17)		.78	.081	1.7
(7)	.011 (.012)	.294 (.090)	-.034 (.107)	4.03 (1.01)	.004 (.070)	1.30 (1.13)				.67 (.19)		.79	.081	1.7
(8)	.009 (.011)	.333 (.066)	.061 (.077)	2.94 (0.93)							.61 (.11)	.82	.074	2.3
(9)	.009 (.011)	.340 (.075)	.061 (.078)	2.99 (0.98)	.002 (.066)	0.21 (1.12)					.60 (.13)	.82	.075	2.3

Notes to Table 5: The sample period is 1928-40, 1948-87. The dependent variable is $\log(I_t/I_{t-1})$, where I_t is real, fixed, non-residential, private domestic investment for Canada (1981 base). Other Canadian variables correspond to the U.S. counterparts in Table 1. Sources of data on national accounts' variables for Canada are Statistics Canada (1983, 1988) and Bank of Canada, ***Monthly Review***. Data on stock prices are from the Toronto Stock Exchange and from recent issues of Bank of Canada, ***Monthly Review***. The variables marked (U.S.) pertain to the United States, and correspond to those used in Table 1. $\hat{DI}_t$ is the fitted value from a regression for 1928-40, 1948-87 of U.S. investment growth, DI_t, on a constant and the U.S. values of DI_{t-1}, $STOCK_{t-1}$, and $DPROF_{t-1}$. For other definitions, see Table 1.

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