Financial Market Imperfection, Overinvestment and Speculative Precaution

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Abstract

This paper uses panel data to assess the investment-cash flow sensitivity of non financial firms, as a function of their degree of financial health. The splitting criterion used to categorize firms is a financial stress indicator, the Z-score, which is a contemporaneous indicator inversely related to their probability of financial failure. Based on this criterion, empirical evidence suggests that the most investment-cash-flow-sensitive firms are those displaying the lowest average Z-score. The paper also shows that, in this class of firms, investment seems to be partly driven by a precautionary motive.

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"There is no necessity to hold idle cash to bridge over intervals if it can be obtained without difficulty at the moment when it is actually required"
J.M. Keynes (The General Theory of employment interest and money).

1 Introduction

The investment decisions of firms with different financial profiles may qualitatively (and quantitatively) differ. The fact that, for some firms, investment is sensitive to variations in the abundance of internal funds or liquidity (e.g. cash flow) has been repeatedly discussed in the literature (Fazzari, Hubbard and Petersen, 1988; Whited 1992). Recent findings suggest that investment spending is sensitive to internal funds for firms identified as financially constrained. They also emphasize the fact that these results seem to crucially depend upon the splitting criterion chosen to discriminate firms identified as financially constrained from those that are not (Kaplan and Zingales 1995, 2000).

In this paper, I use panel data to assess the sensitivity of investment to cash flow for non financial firms, depending on their degree of financial health. The contribution of this paper comes from the choice of the splitting criterion for firms' degree of financial health. This criterion is based on a contemporaneous measure of the probability of financial distress (the Z-score) of the firm. Based on the Z-score, the empirical evidence suggests that the highest investment-cash-flow-sensitive firms are those displaying the lowest Z-score. The paper also suggests that, in this class of firms, investment seems to be partly driven by a precautionary motive. While this last finding can be explained by financial market imperfection stemming from informational problems, another explanation can also be provided by the risk-sharing nature of lender-borrower relationships.

Theoretically, an investment should only be sensitive to the profitability of its associated project. Usually, the classical approach relates investment to a measure of this profitability, such as Tobin's q. However, empirical evidence seems to suggest that in-

vestment is also related to some financial variables, such as cash flow. Then, to account for this extra-sensitivity, it is common to introduce some financial market imperfection -hence departing from the classical framework. In the literature, asymmetric information models are often used to explain the investment-cash flow sensitivity. These models support the view that financially constrained firms have a greater investment-cash flow sensitivity. It is generally argued that financing constraints arising from informational problems or agency costs preclude some firms from reaching their desired (first best) level of investment. Financially constrained firms are thus presumed to underinvest because internal funds are partially depleted and external funds are available only at a prohibitive price (or not at all).

However, the asymmetric information explanation implies that some firms expecting future financial distress cannot necessarily borrow more in advance if they are already constrained. Yet, one might think that these firms could still hold cash to cushion any severe future constraint: cash flow would then be held as a precautionary buffer as suggested by Schnure (1998). The lender might agree with this precautionary motive since that could provide some financial protection to the borrower (Sigouin 2003) and to the long-term relationship in which he is involved with the lender. This feature is not fully taken into account by the asymmetric information framework. Furthermore, a firm that is not financially constrained but is expecting to be restricted in the near future would be willing to increase its borrowing in the short run, before being restricted. As far as the precautionary motive is concerned, it could be the case that firms would like to *increase* their investment/borrowing level before facing a severe borrowing limit, rather than underinvest as assumed in the asymmetric information framework.

An alternative approach emphasizes the role of risk sharing and limited commitment between the financial intermediary and the firm. Marcet and Marimon (1992) show that the limited commitment framework has more pervasive effects on investment spending than an asymmetric information set up. This approach assumes that the financial rela-

tionship between a borrower and its creditor can be unilaterally terminated at any time (Kehoe and Levine, 1993). Consequently, when there is risk sharing, endogenous financing constraints arising from limited commitment can potentially lead to *overinvestment* as well as underinvestment.

This property arises in some limited commitment models but not all. For example, this is not the case in Hart and Moore (1994) or in Albuquerque and Hopenhayn (1997). In these models, investment takes place only in the first period. Kiyotaki and Moore (1997) and Hart and Moore (1994) are based on anonymous debt contracts and do not allow for long-term relationships. In Sigouin (2003), however, it is shown that a limited commitment model where investment decisions occur each period, and where the relationship lasts ad infinitum, a self-enforcing financial contract can arise endogenously. Because the model assumes a stochastic environment (in contrast to Kyiotaki and Moore 1997, Hart and Moore 1994), it is possible to evaluate the impact of "unexpected but rationally anticipated" fluctuations in the availability of internal funds. The major finding is that an entrepreneur can, in fact, overborrow at the end of economic upturns, in order to take advantage of the still low cost of external funds.

The fact that investment is not only related to Tobin's q but is also sensitive to cash flow and other financial variables has been recently challenged. Using conventional splitting criteria (e.g. size, age, dividend payout ratio), Whited and Erickson (2000) show that when estimating investment with a strictly measured expected-profitability variable (as the Tobin's q), cash flow and other financial factors become not significant. This is the case regardless of the financial situation of the firm. Similarly, Gomes (2001) shows that when using a more refined measure of profitability, i.e. a variable incorporating financial constraints, cash flow is no longer a significant explanatory variable of investment. Nevertheless, as pointed out by Whited and Erickson (2000), this does not necessarily rule out the idea that investment might also be partly driven by financial considerations. Instead, it means that the measure of the profitability of the firm could incorporate the influ-

ence of financial factors, leading to a non-significant role for those factors in explaining investment.

The approach of Whited and Erikson (2000) or Gomes (2001) is convenient to characterize the determinants of investment. However, it is less appropriate for isolating the role of firms' financial health in investment decision. Indeed, a pure empirical measure of expected profitability should incorporate financial constraints as one of its components, but such a measure would not necessarily be tractable to study the effect of financial variables on investment. Hence, in this paper, I use a pseudo-measure of a firm's profitability, i.e. the conventional measure of profitability: the Tobin's q. The aim of this work is to extract the role of intertemporal financing for investment, by showing how overinvestment is linked to what Kaplan and Zingales (1995, 2000) call "excessive conservatism", or precaution.

The next section discusses the conventional approach used to emphasize the investment-cash flow sensitivity among different types of firms. It also describes the different splitting criteria used to classify firms as financially constrained or healthy. The third section describes evidence of the firms'excessive conservatism. The fourth section proposes an alternative splitting criterion, based on the Z-score, that helps to explain the excessive conservatism underlined in previous studies. Since the criterion is based on expectations about the financial conditions that the firms will face, it allows for a different interpretation of the investment cash-flow sensitivity based on a risk-sharing argument. The last section concludes with some macroeconomic implications of the results.

2 The Investment-Cash Flow Sensitivity: A Short Overview

A usual result in the literature is that there is some investment-cash flow sensitivity, and that the sensitivity seems more pronounced for financially constrained firms.

Fazzari, Hubbard and Petersen (1988) show that the firms' financial structure does matter for investment decisions. For some firms, external funds do not provide a perfect substitute for internal capital. They show that the conventional representative firm approach might apply to mature companies, but financial factors play an important role for other firms. Using Value Line data for 421 manufacturing firms, they analyze differences in investment among firms with a sample splitting criterion based on the dividend-income ratio as a proxy for earnings retention practices. The relevance of this criterion comes from the fact that retained earnings are the main source of internal finance and net funds regardless of firm size. The retention ratio decreases monotonically with asset size, from 80 percent for small firms to 50 percent for large firms. They use the following reduced-form investment equations:

$$(I/K)_{i,t} = f(X/K)_{i,t} + g(CF/K)_{i,t} + u_{i,t}$$

where i = firm class, I = investment in plant and equipment, K = beginning-of-period capital stock, X = vector of variables controlling for investment opportunities, and CF = cash flow.

Given their splitting criterion, they find that investment by firms with a low dividend-income ratio is sensitive to fluctuations in cash flow. While firms with a low dividend-income ratio are smaller on average, this does not mean that firm size is always a factor. When the sample is split according to size (average capital stock), Fazzari et al. (1988) find that small firms have a relatively low cash flow coefficient. Furthermore, the cash flow effect holds for every class of dividend-income ratio; however the cash flow effect is stronger for the lowest dividend-income ratio class.

The conclusion reached by Fazzari et al. (1988), that financial factors matter in the investment decision process, especially for financially constrained firms (identified as the low dividend-income firms), is quite robust. It does support both the limited commitment and the asymmetric information approaches since it is empirical evidence of investment-cash flow sensitivity. This empirical evidence is repeatedly confirmed in the

literature. For example, Mills, Morling, and Tease (1995) find similar evidence regarding financial factor effects on investment. Using different splitting criteria, they find that small firms, particularly highly leveraged firms and firms with high retention ratios have a high investment-cash flow sensitivity. They estimate:

$$I_{i,t}/K_{i,t-1} =$$
$$\alpha + \beta_1 q_{i,t-1} + \beta_2(CF_{i,t}/K_{i,t-1}) + \beta_3(L_{i,t-1}/K_{i,t-2}) + \beta_4(D_{i,t-1}/K_{i,t-2}) + \beta_5(S_{i,t}/K_{i,t-1})$$

where q = the conventional Tobin's q, L = stock of liquid financial assets, D = stock of outstanding debt, and S = sales (the last three being measured at the end of previous period).

One could think that these results are attributable to the fact that the proxy variable constructed for the Tobin's q does not completely capture investment opportunities, making cash flow spuriously significant. Yet Fazzari et al. (1988) attempt to control for that problem, as do Gilchrist and Himmelberg (1995, 1998). Following Abel and Blanchard (1986), Gilchrist and Himmelberg (1995) estimate a set of vector autoregressive forecasting equations to build a proxy for the expected value of marginal q conditional on observed fundamentals: a "fundamental q ". This allows for the isolation of the role of cash flow as a forecasting variable from its role as an explanatory variable of investment. Even when controlling for this, the empirical evidence of Fazzari et al. (1988) still holds true. Using Compustat data, Gilchrist and Himmelberg (1995) confirm that financial factors matter for all firms and that the investment-cash flow sensitivity is strong for firms identified as financially constrained; although the fundamental q is strongly significant for unconstrained firms. For constrained firms, the use of the fundamental q seems superfluous since the investment-cash flow sensitivity is almost the same as when using more conventionnal measures of q. Actually, the use of conventional measures of q underestimates the difference in investment-cash flow sensitivity among firm classes.

When using the same criterion as in Fazzari et al. (1988) to identify financially constrained firms (the dividend payout ratio), Gilchrist and Himmelberg (1995) find con-

tradicting results. This suggests that both the choice of the splitting criterion and the choice of firm's profitability measure matter. When considering firm size, CP ratings, and bond ratings, the majority of these splitting criteria reveal the investment-cash flow sensitivity of financially constrained firms. Consequently, they infer that the empirical evidence supports the asymmetric information approach.

3 The Precautionary Motive

The fact that financially constrained firms display an investment sensitivity to cash flow can be related to the informational problem framework as well as the limited commitment one. But some limited commitment models result in financially constrained firms overinvesting in anticipation of further constraints, leading to a different investment sensitivity explanation. Puzzling empirical evidence actually suggests that some investment-cash flow sensitive firms *smooth* their investment.

The first disturbing finding is that, in some studies, cash flow matters, but in a nonlinear manner. As repeatedly shown (e.g. Fazzari et al. 1988, Devereux and Schiantarelli 1989), the timing of the cash flow effect is more complex than suggested by the asymmetric information framework. As pointed out by Devereux and Schiantarelli (1989), the asymmetric information models "do not yield an investment equation that explains how financial factors and *expectations* about firm's prospects jointly determine investment". In addition to the fact that the cash flow *dynamic* effect is not captured, Devereux and Schiantarelli (1989) also report that the cash flow effect seems to matter more than just for strictly financially constrained firms. They assert that cash flow fluctuations might play a role for all firms, and not just those with currently depleted internal funds or an incapacity to issue new shares. With a splitting criterion based on firm size, they show that the investment-cash flow sensitivity is actually greater for large firms.

Kaplan and Zingales (1995, 2000) also cast doubt about a monotonic relationship

between the investment-cash flow sensitivity and the firm's category. They find that the less financially constrained firms can actually hold more internal funds and exhibit a significantly higher investment-cash flow sensitivity. One possible explanation given by the authors for the low investment sensitivity of financially constrained firms relies on capital adjustment costs. When a financially constrained firm experiences a jump in cash flow, it invests more. But because capital adjustment costs forced the firm to invest prior to the increase in liquidity, the investment reaction is dampened. If the firm had not been constrained during a downturn, it would have invested more. In addition, if firms with very scarce cash flow positions are included in the analysis, then it is obviously possible to find their investment being unrelated to cash flow because of their extreme financial distress.

To classify firms according to their relative degree of financing constraints, Kaplan and Zingales (1995) use qualitative information from annual reports, as well as quantitative informations about the firms' financial statements and notes both retreived from Compustat. Given that their results contradict previous studies, they conclude that the observed investment-cash flow sensitivity depends crucially on the splitting criterion used. The relationship is not necessarily monotonic since unconstrained firms can also be cash flow sensitive depending on the criterion used. They insist that their paradoxical results should command criticism when examining the influence of financial factors. If the least constrained firms are in fact somehow intertemporaly constrained, then the splitting criterion must take this into account and be designed accordingly. This also suggests that designing a criterion truly able to separate firms depending on their degree of current and expected degree of financial constraint, as the paper shows, is useful for determining the degree of non-linearity in the investment-cash flow relationship.

With respect to the two issues described above, Fazzari et. al. (1999) explain that firms with large amounts of cash balances and unused lines of credit may be *expecting* future financial constraints. This coincides with the Kaplan and Zingales (2000) view of

an excessive conservatism of managers. Gertler and Gilchrist (1993) mention that bank lending to large firms *rises* following a tight monetary policy. They interpret this as evidence of smoothing behaviour: large firms borrow more to cushion themselves from expected declines in sales revenue in the wake of tighter monetary conditions. Empirical evidence shows that there is a slightly positive response of business loans, lasting almost one year, after an interest rate increase (Bernanke, Gertler, Gilchrist 1996, Losier 2000). Thurlow (1994), with a VAR analysis, shows that the immediate response to a monetary tightening is an increase in lending and inventory stocks, a result consistent with the findings of Gertler and Gilchrist (1994). Refering to these authors, Losier (2000) mentions that this could come from the fact that lenders are willing to provide more funds in an effort to prevent premature bankruptcies, an intertemporal interpretation consistent with limited commitment models à la Thomas and Worrall[1].

Gertler and Gilchrist (1994) assert that overinvestment by large firms seems to be attributable to the fact that they are persistently piling up inventories at the onset of monetary policy tightenings (for Romers dates, see Romer and Romer 1988, 1992). The view of a desired inventory build up for precautionary motives vis-à-vis expected credit limitations is also advocated by Thurlow (1994). In this paper the author notes that, an undesired inventory build up due to real rigidities is not supported by the facts, does not explain the increase in sales prior to a downturn, and does not generate asymmetric responses [2].

If, for some firms, investment is sensitive to expected cash flow, then, when such firms anticipate lower future inflows they should hold higher internal funds in advance whenever

[1] In VAR studies, the trough in output generally precedes that in business credit, while the increase in business credit demand coincides with the rise in inventories. I thank Scott Hendry for mentionning these facts.

[2] In order to account for this increasing investment, Thurlow (1994) assumes the existence of credit lines and time-consuming reorganization of credit by commercial banks. The limited commitment approach offers a different explanation by making the creditor actually willing to increase lending.

it is possible to do so. When a firm is so severely constrained that it cannot borrow but experiences scarce cash flow, it might use internal funds to smooth investment. The fact that future inflows might explain current cash flow positions is supported by the evidence of Opler et al. (1999). Net working capital is a proxy for money expected to be received by the firm within the year. Opler et al. (1999) present evidence that net working capital is negatively related to cash flow. Firms have target cash flow levels. By estimating

$$\Delta(CF/A)_t = \alpha + \beta\Delta(CF/A)_{t-1} + \epsilon_t$$

where A = assets. Using Compustat data, Opler et al. (1999) find cash flow to be mean reverting. Firms try to stabilize their cash flow around a target value with the average holdings being greater in volatile industries. They also find that the short run impact of cash flow on investment is small. These findings suggest that cash flow helps the firm in the continuation of its investment projects. They report that firms with excess cash in one year experience a fall in operating cash flow the next year. When a firm expects to be financially constrained it accumulates cash to be able to finance investment despite the expected decrease in future cash flow. They argue that this evidence is consistent with a dominant precautionary demand for liquid assets. While the results confirm that investment and cash flow are dynamically related, Opler et al. (1999) find no evidence that informational problems or agency costs would have an impact on the firm's propensity to spend excess cash.

In fact, the most important result is that excess cash seems to be held in advance to cushion decreases in operative cash flows. This might be paralleled with overborrowing and an increase of investment in inventory stocks prior to downturns. In Opler et al. (1999) the propensity to use excess cash for capital expenditures is far from significant. As such, cash hoarding could be due to risk aversion, i.e. a cash in advance motive driven by a form of liquidity preference.

The idea of treating cash flow as an independent variable to disentangle its effect on investment is also pursued by Schnure (1998) with the same conclusions. Schnure

(1998) develops a model of the firm's decision over cash flow given a probability of being credit constrained in the future. Using Compustat data it is suggested that informational problems or agency costs do not concern the majority of firms. Schnure (1998) advocates the existence of precautionary cash balances regardless of the firms' size[3]. (In the United States, the high cash holders operate in the riskiest sectors, precisely where precaution matters[4]). While investment is positively correlated to past cash flow (Fazzari et. al. 1988, Devereux and Schiantarelli 1989), Schnure (1998) finds that current cash flow is strongly negatively related to future capital expenditures, especially for high cash flow holders. This is consistent with the findings of Opler et al. (1999).

4 A splitting criterion based on the Z-score

This paper uses panel data to assess the investment-cash flow sensitivity of non-financial firms, depending on their degree of financial health. The splitting criterion used to categorize firms is a financial stress indicator which consists of a contemporaneous measure reflecting their probability of financial distress (the Z-score). Like any splitting criterion (e.g. dividend-payout ratio), the Z-score is unable to make investment-cash-flow causation definite, nor does it help distinguish between the demand and supply aspects of cash-flow –although we are more interested in demand aspects. It is precisely for these reasons that it is useful to investigate alternative splitting criteria. I choose the Z-score for its forward looking nature which enables us to investigate how precautionary motives relate to investment.

[3] In the case of the most liquid firms cash comes from stock issuance.

[4] I thank Eric Santor for mentionning that, obviously, other motives might exist.

4.1 Average Investment, Inventories, Cash Flow and Sales

The first experiment aims at computing the average investment, inventories, cash flow and sales, taking into account the financial situation of the firms. For that purpose, I use Research Insight data[5] from 1980 to 1998, I retrieve yearly financial data for over 16000 firms. After cleaning the dataset and transforming the variables, I can compute the average ratios of investment, inventories, cash flow and sales to total assets for a subsample of 2999 firms. For that experiment, I exclude firms that were started after 1980, and firms for which these variables were not jointly available for at least fifteen consecutive years.

To account for the "excessive conservatism" argument, I use the Z-score as the splitting criterion. The Z-score relates the probability of bankruptcy of a firm with its working capital, total assets, earnings before interest and taxes, sales and other financial variables[6]. Hence, by construction, the Z-score does not rely directly on investment or cash flow, which permits its direct use for investment's regressions[7]. There are a lot of financial stress prediction models available in the literature (e.g. Theodossiou 1993), but it is beyond the scope of this paper to construct a financial stress variable. Since Research Insight readily provides such a variable for each firm in the sample, it is directly used in the regressions. Altman's Z-score indicates the nature of the future financial constraints that a firm is expected to face. In that respect, it is an appropriate criterion to investigate the existence of precautionary investment in firms that are expecting financial troubles, regardless of their size, age, dividend payout ratio, or rating.

In this first experiment, firms are classified in three categories. For each year, each firm is assigned either a high probability of bankruptcy or a low probability of bankruptcy,

[5]Research Insight is a product of Standard and Poors similar to Compustat. The main difference is that Research Insight does not only include a data set but also a software enabling data retrieving.

[6]For more details regarding the rigorous computation of the Z-score see Altman et al. 1977, and Altman 1983.

[7]Regarding identification problems, the Z-score is still not perfect.

depending on its Z-score. When, for a specific year, a firm has a Z-score below 1.81, the threshold identified in Altman et al. (1977), it is classified as a troubled firm with high probability of bankruptcy. Above this threshold, the firm is classified as a healthy firm with a low probability of bankruptcy. The final category contains firms going bankrupt during the period[8].

The computation of the above mentioned ratios for the three categories reveals that firms with a high Z-score for a given year have relatively higher average cash flow, sales and inventories ratios than their troubled or bankrupt counterparts. However, the inventory ratio differential between bankrupt and healthy firms seems smaller than the one between troubled and healthy firms. This seems to be also the case for cash flow ratio differential. More importantly, the average ratio of investment to total assets for each category indicates that firms having a high probability of bankruptcy in a given year do not necessarily invest less than firms in the healthy set (see Appendix A). Actually, between 1980 and 1989, and after 1997 the reverse holds true. The case appears even stronger for bankrupt firms.

These descriptive, albeit simple, statistics, confirm the idea that there may be a case for a precautionary motive when investing. These statistics are also consistent with the more conventional idea that troubled firms are financially distressed because of this over-investment pattern. Nevertheless, assessing investment behaviour by considering splitting criteria such as the probability of bankruptcy embeded in the Z-score could yield encouraging results.

[8]I thank Eric Santor for mentionning that the threshold identified in Altman et al. (1977) is only a substitute for the threshold that could have been associated with the dataset. However, estimating a new measure of the Z-score is beyond the scope of this study.

4.2 Cash Flow Hoarding

Schnure (1998) or Opler et al. (1999) describe some cash flow hoarding behaviour in their studies. They relate this behaviour to the financial constraints firms are facing. The common argument is that cash flow helps firms in the continuation of their investment projects. To illustrate this property I run several experiments involving cash flow. In these experiments I split firms according to their average Z-score throughout the 1980-1998 period. Note that the categorization is ad hoc in the sense that its only objective is to show how firms behaviour evolves depending on their average Z-score. In the experiments, I estimate cash flow equations using regressors similar to those of Schnure (1998) and Opler et al. (1999). The primary objective is to check the existence of cash flow hoarding. In the first experiment I split firms in seven categories, from an average Z-score of 1.5 to an average of 5. Each category corresponds to an increment of 0.5 in the average Z-score. When regressing cash flow on past cash flow, investment and debt, and adjusting for firms clustering, the overall fit is significant ($Wald\ chi2(3) = 1005.18,\ Prob > chi2 = .000$). Apart from the constant ($z = -31.37$), the most significant regressor is past cash flow ($z = 17.26$), as expected (see Table 1). As Schnure (1998) and Opler et al. (1999), I find that past cash flow is always a strongly significant regressor, regardless the firm class. Firms seem to display a hoarding behaviour consistent with the precautionary argument suggested by Kaplan and Zingales (1995, 2000) or Devereux and Schiantarelli (1989). Furthermore, in the model, investment has a strong coefficient and debt has a negative coefficient. If firms are hoarding cash flow for continuing their investment projects, their ability to do so is negatively impacted by their debt level. The higher this level, the harder it is for firms to maintain their buffer. When running the regression on subsamples of firms, the picture is the same. However, low average Z-score firms debt is relatively less significant, reinforcing the explanatory power of lagged cash flow (and investment). Finally, note that investment is usually the most volatile regressor, and lagged cash flow is always significant. All categories display a significant fit, and the coefficient on cash

Table 1: Cash Flow Hoarding (dependent variable: cash flow/total asset)

Z-score	Lagged Cash Flow	Investment	Debt	Constant
All firms	**.319**	**1.5**	**-.942**	**-1.498**
9047 firms	**(.000)**	**(.000)**	**(.000)**	**(.000)**
[1.5,2]	.307	1.677	-.288	-1.814
603 firms	(.000)	(.000)	(.277)	(.000)
[2,2.5]	.276	1.915	-.662	-1.783
703 firms	(.000)	(.001)	(.001)	(.000)
[2.5,3]	.331	1.315	-.702	-1.56
833 firms	(.000)	(.046)	(.000)	(.000)
[3,3.5]	.306	1.545	-.737	-1.628
1223 firms	(.000)	(.001)	(.000)	(.000)
[3.5,4]	.255	3.43	-.550	-1.924
1057 firms	(.000)	(.000)	(.047)	(.000)
[4,4.5]	.404	1.661	-.678	-1.320
857 firms	(.000)	(.000)	(.005)	(.000)
[4.5,5]	.449	1.651	-.504	-1.222
730 firms	(.000)	(.000)	(.004)	(.000)

Z-score = average Z-score, Cash Flow = log(cash flow/(total asset-cash flow))), Investment = (capital expenditures/total asset), Debt = total debt/total asset
(P values in parentheses)

Table 2: Net Working Capital versus past Cash Flow (dependent variable: change in cash flow)

Z-score	Lagged Cash FLow	Net Working Capital	Constant
All firms	**-.231**	**-.0001**	**.0046**
10008 firms	**(.003)**	**(.000)**	**(.000)**
[1.5,2]	-.181	-.0002	-.003
720 firms	(.104)	(.000)	(.0236)
[2,20]	-.374	-.0001	.008
8115 firms	(.000)	(.000)	(.000)

Cash Flow = (cash flow / total asset) - (previous cash flow / previous total asset), Net Working Capital = working capital - cash flow

flow and other variables does not change much, as suggested by the Chow tests.

Schnure (1998) mentions that net working capital should be a significant and negative regressor of cash flow changes, since it is a proxy for the expected liquid inflows. Since many studies describe a mean reverting property of cash flow consistent with the idea of excessive conservatism, cash flow levels would tend to be maintained through time. To confirm this view, I run a second experiment regressing differenced cash flow on its lag and net working capital -again adjusting for firms clustering. This specification fits the data reasonably well ($Wald\ Chi2 = 30.65,\ Prob > Chi2 = .000$) and all variables are significant. As expected, net working capital has a negative coefficient (see Table 2). It is also the most significant regressor ($z = -6.97$ compared to -3.02 for past differenced cash flow and 3.81 for the constant). The mean reversion of cash flow is captured by the negative sign of past differenced cash flow, and this variable displays a strong coefficient. When running the regression on two subsamples of firms, firms with low average Z-score

Table 3: Cash Flow Hoarding and Debt (dependent variable: cash flow)

Z-score	Lagged Cash Flow	Debt	Net Working Capital	Constant
All firms	**.320**	**-.166**	**-.0002**	**.089**
10164 firms	**(.000)**	**(.000)**	**(.000)**	**(.000)**
[1.5,2.5]	.243	-.240	-.0003	.117
1624 firms	(.000)	(.048)	(.000)	(.004)
[2.5,3.5]	.164	-.121	-.0005	.102
2321 firms	(.000)	(.000)	(.000)	(.000)
[3.5,5]	.296	-.084	-.0002	.082
2773 firms	(.001)	(.002)	(.000)	(.000)

Cash Flow = cash flow / total asset

$[1.5, 2]$ and firms with higher average Z-score $[2, 20]$, the model remains significant and Chow tests suggest no significant difference in the coefficients. However, note that low Z-score firms seem to display a relatively greater significance in net working capital. Higher Z-score firms would have a stronger and more significant past differenced cash flow coefficient, a fact that could be explained by their better *ability* to preserve their cash reserves.

The result regarding net working working capital can be also obtained by regressing cash flow on lagged cash flow, debt and net working capital. This specification is not rejected ($Wald\ Chi2 = 71.19,\ Prob > Chi2 = .000$) and all the coefficients are significant (see Table 3). In this model, net working capital is the most significant variable ($z = -6.68$ compared to 5.31 for lagged cash flow and -4.21 for debt) with the constant ($z = 10.18$). It also has the expected negative sign, as debt. Lagged cash flow has a strong coefficient regardless of the categorization, and Chow tests suggest that this coefficient does not

change much accross firms. Once again, lagged cash flow explanatory power seems greater for low Z-score firms and debt less so.

Although Schnure's results can be reproduced with our splitting criterion, the robustness of these results might be improved by using a better tailored splitting criterion. In particular, one would want to use a criterion that is built without relying on the working capital variable for that particular study. Since the focus of the current paper is to study the precautionary part of investment, the use of alternative financial stress indicators is left for future research. Note also that, in most experiments, the coefficients do not significantly change accross firms categories. For example, cash flow hoarding is a phenomenon common to all firms. Among other reasons, this consistency is due to the fact that the splitting criterion captures the *average* Z-score. Hence, in these experiments, a low Z-score firm is one that is financially troubled on average, and not necessarily one that is often constrained -the Z-score is quite a volatile series.

4.3 Investment and Financial Expectations

To further assess the "excessive conservatism" argument it is possible to use the mode of the Z-score in conjunction with our splitting criterion. In the following experiments, I split firms in two categories (the Low Z-score class and the High Z-score class), depending on their average Z-score *and* the modes of their Z-score. The minimum mode of the Z-score accross the 10435 firms has a mean of 1.554 and a standard deviation of 5.054. The mean of the maximum mode is 7.2 (with a standard deviation of 9.7). The category representing the financially constrained firms (the Low Z-score class) excludes firms with a Z-score greater than 1.81 on average and a minimum mode exceeding -3.5. The healthy firms category (the High Z-score class) includes firms with a Z-score greater than 4 on average and a maximum mode exceeding 17.

In the first experiment, I regress investment (capital expenditures) on a proxy for firm's profitability (q), cash flow, sales and inventories controlling for fixed effects for

Table 4: Investment-Cash Flow Sensitivity (dependent variable: Investment)

Z-score	q	Cash Flow	Sales	Inventories	Constant
All firms	**.011**	**.007**	**.004**	**.005**	**.170**
10186 firms	**(.000)**	**(.001)**	**(.000)**	**(.000)**	**(.000)**
Low Z-score	.01	-.044	.009	-.005	0.084
296 firms	(.000)	(.000)	(.000)	(.687)	(.011)
High Z-score	-.004	.062	-.003	.046	.042
459 firms	(.007)	(.000)	(.217)	(.007)	(.338)

the entire sample. The R^2 is 0.396 (0.4 within and 0.281 between) and q displays the strongest significance ($t = 39.11$ compared to 36.93 for the constant). More importantly, cash flow is found significant ($t = 3.21$). This is consistent with the Fazzari et. al (1988) findings and suggests a relationship between investment and financial variables. Table 4 also reports results from an experiment ran on two subsamples of firms (the Low Z-score class and the High Z-score class). The model is the same, $R^2 = 0.492$ (0.503 within and 0.439 between) and $Wald\ Chi2 = 704.44$ ($Prob > Chi2 = 0.000$). Inventories are not significant for the Low z-score class and sales are not significant for the High Z-score class. In both cases, q and cash flow are significant. Cash flow seems to act as a significant substitute for investment in the Low Z-score category[9] (i.e. the most severely constrained firms), while it is the most significant explanatory variable in the High Z-score class: $|z| = 5.54$ compared to 2.69 for q. Chow tests reveal that the two categories behave quite distinctively, with $Chi2(1) = 43.82,\ Prob > Chi2 = 0.000$ for cash flow and $Chi2(1) = 23.72,\ Prob > Chi2 = 0.000$ for q (inventories and sales displaying different coefficients also, $Prob > Chi2 = 0.08$ and $Prob > Chi2 = 0.002$ respectively). In the next exploratory experiment, I proxy overinvestment with the difference between a firm's

[9] This corroborates the precautionary motive illustrated in Table 2 and Table 3.

Table 5: Overinvestment and Financial Health (dependent variable: overinvestment)

Z-score	Sales	q	prob
Low Z-score	.006	.006	.015
296 firms	(.043)	(.027)	(.022)
High Z-score	-.001	-.001	.399
459 firms	(.59)	(.607)	(.539)

investment and the average investment of its class (its Z-score category). I construct a dummy variable, *prob*, equal to unity if Z-score is below the threshold of 1.81 (i.e. the firm faces a strong average probability of bankruptcy), and zero otherwise. There appears to exist more underinvesting firms (i.e. negative overinvestment) than overinvesting ones so that *prob* has a negative coefficient unless underinvesting firms are discarded. The regression of (positive) overinvestment on sales, q and *prob* has a reasonable fit for the 302 observations ($Wald\ Chi2(6) = 137.81,\ Prob > Chi2 = 0.000$). As expected, removing any firm with negative overinvestment delivers a positive coefficient of *prob* for Low Z-score firms (see Table 5). It is also found significant for this class. It is not the case of any regressor for the High Z-score firms, which could be explained by the fact that overinvestment is less frequent in this category.

Finally, note that these results are only a primary indication of speculative overinvestment. First, the Chow tests reveal no significant difference in the coefficients of the two categories, suggesting that speculative overinvestment is still common among all firms and (or) that it is a short-lived phenomenon hard to capture even with average Z-scores refined with Z modes. Second, the splitting criterion I use might also lead to a biased result because it is somewhat related to the *prob* regressor[10]. In light of this evidence, it seems that financial factors are significant variables for investment -at least when they

[10] I thank Eric Santor for mentioning that point.

are isolated from the profitability variable. But we should not necessarily consider the investment-cash flow relationship as only an intratemporal one. Indeed, the evidence suggests that any splitting criterion used to assess the investment-cash flow sensitivity should take into account the degree of expected financial constraints. This can be performed by relying on a splitting criterion based on the Z-score, as is done in this exploratory study, or any other financial stress indicator of the same nature. When using this kind of "forward looking" criterion, it is possible to investigate a precautionary aspect for investment.

5 Conclusion: Some Macroeconomic Implications

The asymmetric information-based interpretation of investment sensitivity to internal funds' variations leads to an internal propagation mechanism. When the economy is experiencing an upturn, external funds can be acquired at a cheaper cost. Indeed, an increase in internal funds, ceteris paribus, reduces the cost of borrowing. Therefore, financially constrained firms can then reduce the degree of underinvestment. They can increase investment both because of the increase in internal funds, and also because external funds are becoming less expensive. So their investment decisions are sensitive to the variations of internal funds. This phenomenon is believed to generate a financial accelerator (Gertler and Gilchrist 1994). It is argued that business fluctuations are amplified by the counter-cyclicality of external funds costs (Gertler 1992, Carlstrom and Fuerst 1997). During upturns, financially constrained firms have access to external funds at low cost. As their net worth increases they invest more. This in turn triggers a further increase in output.

Some form of limited commitment makes investment and borrowing sensitive to expected variations in cash flows. However, this leads to a financial decelerator consistent with the "excessive conservatism" argument studied in this paper. Therefore, in downturns, a firm can invest more than what an asymmetric framework would predict. This is

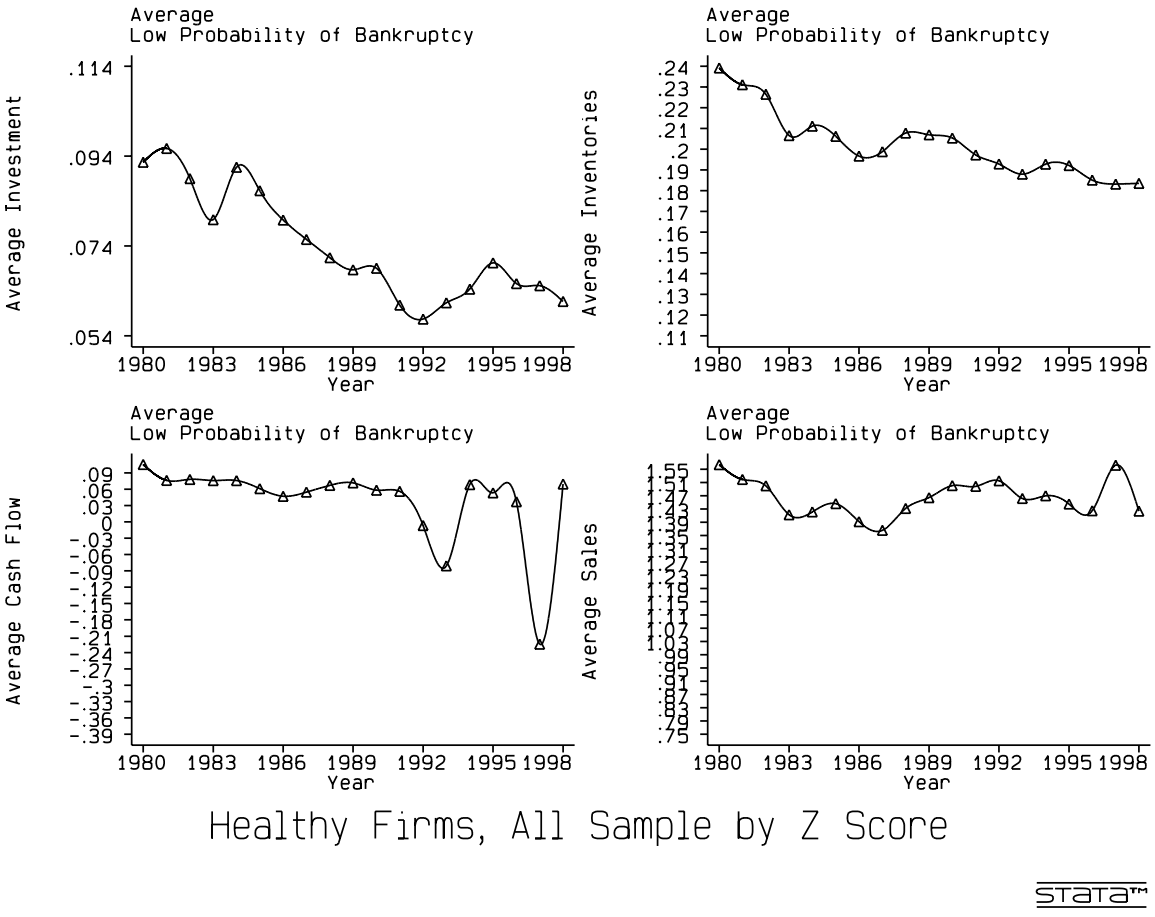
because risk sharing fully plays its role here; the precautionary motive strongly prevails. The intuition behind this is relatively straightforward. In asymmetric information models, financially constrained firms can only decrease their degree of underinvestment while in upturns. Whereas in some limited commitment models, the financial constraint does not bind all the time. It only arises (endogenously) during downturns. So, depending on the contract design, a firm expecting a decrease in its future internal funds may have the opportunity to overinvest before facing the financial constraint vis-à-vis its creditor. This corresponds to the investment smoothing found in this exploratory study.

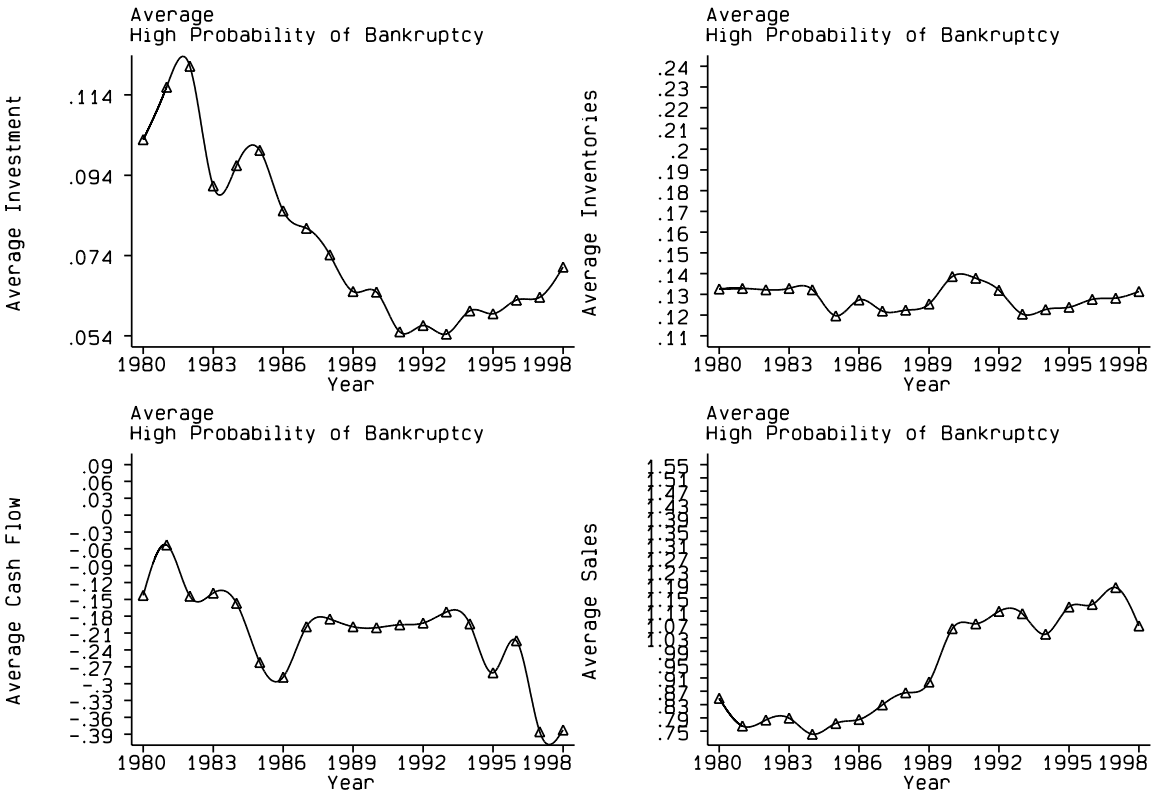
In this paper, I categorize firms using a criterion that roughly captures the forward looking nature of investment decisions, beyond what can be achieved using a profitability variable. As long as this criterion is independent from q, it is possible to unveil a precautionary motive directly leading to a financial decelerator. This financial decelerator is explained in Sigouin (2003) by relying on limited commitment, self-enforcing contracts and risk-sharing between a borrower and a lender.

Our results have the following implications regarding monetary policy. First, an interest rate hike is likely to announce an economic cooldown. Such tightening of monetary policy could be implemented whenever there is any expectation of inflation pressure. However, prior to the intervention, the rise in inflation, whether wage cost induced or not, makes real interest rates lower, which, ceteris paribus, stimulates investment. A tightening monetary policy can also be implemented when there is financial euphoria, a period also caracterized by high investment levels. Hence, whatever the reason that motivates the tightening of monetary policy, it is likely to operate when cash flow hoarding, inventory investment and lending are increasing –i.e. during an overinvestment phase. As far as the existence of a precautionary investment is confirmed, it is not clear whether this policy is purging or precipitating an unavoidable output drop. Indeed, if overinvestment is interpreted as some form of speculative precaution, then the rate increase might actually *trigger* the (already) expected financial correction.

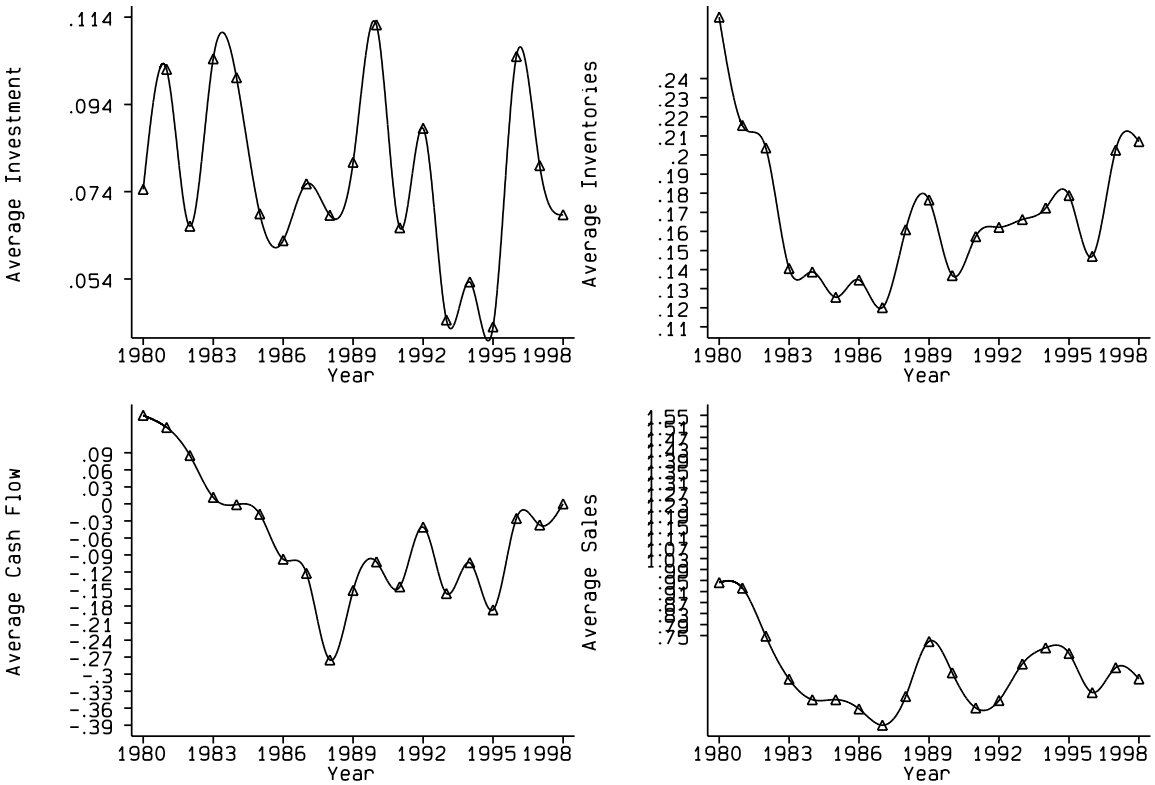
Second, when the central bank decreases the interest rate, it helps the economy to recover. However, recovery is empirically found to be a slow process. The interest rate has an asymmetric effect in the sense that the liquidity effect, through which the central bank has a positive short term effect on the economy, is weak. Again, this could be related to the precaution argument. Since firms with high cash flow and inventory levels do not need to invest under unfavourable circumstances, or if so, can rely on internal finance, they are temporarily immune to the easing in credit conditions. Consistently with the interpretation of the investment-cash flow relation given above, Kaplan and Zingales (1995) go further, arguing that "policies designed to make credit more available in recessions will not lead to increased investment by firms with the highest investment-cash flow sensitivity."

APPENDIX A


Average
Low Probability of Bankruptcy
Average Investment
.114
.094
.074
.054
1980 1983 1986 1989 1992 1995 1998
Year
Average
Low Probability of Bankruptcy
Average Inventories
.24
.23
.22
.21
.2
.19
.18
.17
.16
.15
.14
.13
.12
.11
1980 1983 1986 1989 1992 1995 1998
Year
Average
Low Probability of Bankruptcy
Average Cash Flow
.09
.06
.03
0
-.03
-.06
-.09
-.12
-.15
-.18
-.21
-.24
-.27
-.3
-.33
-.36
-.39
1980 1983 1986 1989 1992 1995 1998
Year
Average
Low Probability of Bankruptcy
Average Sales
1.55
1.51
1.47
1.43
1.39
1.35
1.31
1.27
1.23
1.19
1.15
1.11
1.07
1.03
.99
.95
.91
.87
.83
.79
.75
1980 1983 1986 1989 1992 1995 1998
Year
Healthy Firms, All Sample by Z Score
STATA™



Troubled Firms, All Sample by Z Score



Set of Bankrupt Firms

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