INVESTMENT-CASH FLOW SENSITIVITIES ARE USEFUL: A COMMENT ON KAPLAN AND ZINGALES*

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A recent paper in this *Journal* by Kaplan and Zingales reexamines a subset of firms from work of Fazzari, Hubbard, and Petersen and criticizes the usefulness of investment-cash flow sensitivities for detecting financing constraints. We show that the Kaplan and Zingales theoretical model fails to capture the approach employed in the literature and thus does not provide an effective critique. Moreover, we describe why their empirical classification system is flawed in identifying both whether firms are constrained and the relative degree of constraints across firm groups. We conclude that their results do not support their conclusions about the usefulness of investment-cash flow sensitivities.

In a recent paper in this *Journal* Kaplan and Zingales [1997, hereinafter KZ] argue that investment-cash flow sensitivities do not provide useful evidence about the presence of financing constraints. Because KZ use a subset of the same firms and the same regressions as Fazzari, Hubbard, and Petersen [1988, hereinafter FHP] and claim [page 176] that FHP "can legitimately be considered the parent of all papers in this literature," it is appropriate that we respond. Based on a simple theoretical model, KZ reach the provocative conclusion [page 211] that "the investment-cash flow sensitivity criterion as a measure of financial constraints is not well-grounded in theory." In Section I we show that the KZ model does not capture the theoretical approach employed in FHP and many subsequent studies. Most of the KZ paper attempts to show that empirical investment-cash flow sensitivities do not increase monotonically with the degree of financing constraints within the 49 low-dividend firms from the FHP sample. In Section II we explain why the KZ classification of the degree of constraints is flawed in identifying both whether or not firms are constrained (absolute constraints) as well as the relative degree of constraints across firms. As a result, we argue in Section III that there is no expected ex ante pattern for the

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investment-cash flow sensitivities across the KZ categories, making their empirical results uninformative about the usefulness of investment-cash flow sensitivities.[1]

I. The KZ Model and Tests of Financing Constraints

The one-period KZ model consists of a return on investment $F(I)$, internal financing (W) with constant opportunity cost, external financing (E), and a premium for external funds $C(E,k)$, where k measures the cost wedge between internal and external funds. KZ show that the investment-cash flow sensitivity is

$$\frac{dI}{dW} = \frac{C_{11}}{C_{11} - F_{11}}, \tag{1}$$

where C_{11} is the slope of the supply curve for external finance and F_{11} is the slope of the investment demand curve. KZ focus on firm heterogeneity in dI/dW as measured by the level of W. To analyze dI/dW at different levels of W they compute

$$\frac{d^2I}{dW^2} = \left[\frac{F_{111}}{F_{11}} - \frac{C_{111}}{C_{11}}\right] \frac{F_{11}^2 C_{11}^2}{(C_{11} - F_{11})^3}. \tag{2}$$

KZ note that d^2I/dW^2 is negative only if the term in brackets is negative. They then point out that the bracketed term could be positive if $F_{111} > 0$ or $C_{111} < 0$. This leads KZ to conclude that the theoretical foundation of previous research is weak because dI/dW may not fall as the degree of financing constraints declines (with larger W).

Before we assess this conclusion, it is helpful to consider the intuition (which does not appear in KZ) behind why d^2I/dW^2 may be positive. In Figure I investment is on the horizontal axis, F_1 is investment demand, W^L or W^H indicates the quantity of internal financing (with constant marginal cost as indicated by the horizontal line segment), and C_1 is the supply of external funds. In the left panel of Figure I, $F_{111} = 0$ and $C_{111} < 0$ (i.e., linear demand and concave supply). Investment is more sensitive to small internal finance fluctuations (ΔW) at high internal finance (W^H) than at low internal finance (W^L) because a firm at W^H uses less external

1. Extensive empirical research since FHP (surveyed by Hubbard [1998]) also addresses many of the issues raised in KZ.

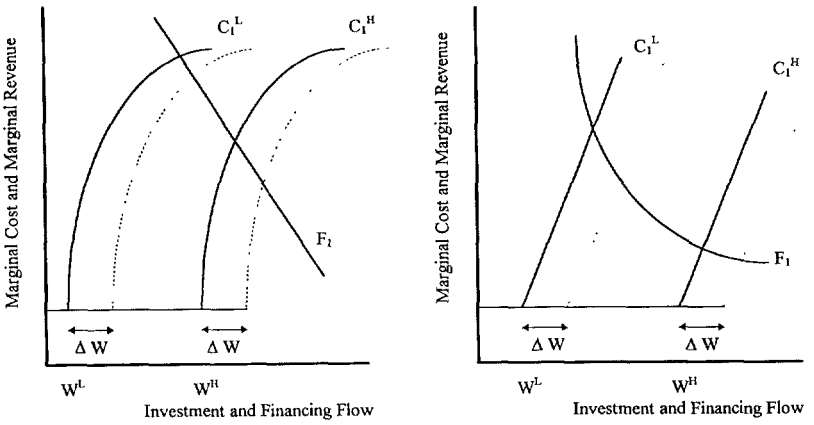

FIGURE I
Illustrations of the KZ Model

financing, and therefore the concavity of supply causes its C_{11} to be larger (see equation (1)). Alternatively, consider $F_{111} > 0$ and $C_{111} = 0$ (i.e., convex demand and linear supply) as in the right panel of Figure I. Again, investment is more sensitive to W at W^H than at W^L because investment demand is more sensitive to the cost of capital as W rises.

This focus in KZ on d^2I/dW^2 does not provide an effective critique of the literature (including the FHP theoretical approach) because most studies do not use the level of W to classify firms.[2] Instead, FHP and much of the literature classify firms according to a priori criteria designed to give large differences in the slope of the external financing schedule, C_{11}, across groups. The obvious testable implication of this approach, using equation (1), is that constrained firms with a large C_{11} should have a larger dI/dW than (relatively) unconstrained firms with a small (or zero) C_{11}, other things equal.[3]

The necessary condition for dI/dW to be larger for constrained firms is

$$(3) \qquad C_{11}^{Constrained}/C_{11}^{Unconstrained} > F_{11}^{Constrained}/F_{11}^{Unconstrained}.$$

2. In fact, KZ never reference any specific study, including FHP, to demonstrate the relevance of d^2I/dW^2.

3. To appreciate the intuition graphically, consider the effect of a small change in W on two firms with linear demand curves. If the "constrained" firm faces relatively steep and the "unconstrained" firm relatively flat supply, the result is obvious. KZ implicitly assume away this possibility by positing that all firms face the same C_{11} for a given level of E.

While F_{11} may differ across firms, we can think of no reasons why $F_{11}^{Constrained}$ should be systematically greater than $F_{11}^{Unconstrained}$, and KZ provide no reasons. Thus, as long as researchers separate firms by a priori criteria that result in $C_{11}^{Constrained} > C_{11}^{Unconstrained}$ in the relevant range, the comparison of dI/dW across firm groups has a solid theoretical foundation. We also point out that as $C_{11}^{Unconstrained}$ approaches zero, as we argue below is the case in many studies, (3) almost certainly holds. In addition, if (3) holds, the issues that KZ raise about curvature and nonlinearity are not likely to be relevant.[4]

The only remaining question is whether previous research has effectively classified firms in ways that generate large differences in C_{11}. Consider the model and discussion in FHP [pages 146–157 and Appendix A]. In the supply of funds schedule in FHP Figure I, C_{11} equals zero for internal financing (as in KZ) and C_{11} is greater than zero for external financing. One group of firms faces C_{11} of zero at the margin because investment demand is less than internal financing. In contrast, constrained firms exhaust internal funds and finance marginal investment with external funds, and thus face a positive C_{11}. Operationally, as implied by the model, unconstrained firms are those with large dividend payouts, and constrained firms are those with low or zero dividends.

Since FHP, many other researchers have devised different approaches for separating firms into groups with low and high C_{11}.[5] A common separating criterion is access to public debt. Calomiris, Himmelberg, and Wachtel [1995] report that firms with debt ratings are very different from firms without rated debt. Firms that issue public debt, especially commercial paper, are far larger on average, have much lower volatility of sales and income, and therefore pose relatively little, possibly negligible, default risk. The case can be made that firms with commercial paper or high bond ratings face a C_{11} close to zero. Almost surely, firms that issue public debt tend to have a substantially lower C_{11} than those

4. KZ also mention the possibility of "nonmonotonicity" with the wedge k as a proxy for the degree of financing constraints. This approach is not relevant to the FHP model, discussed in the next paragraph, because high-dividend firms, in theory, face no wedge at the margin. In general, if researchers effectively split their samples with criteria that generate large differences in k that lead to large differences in C_{11}, the condition in equation (3) is likely to be satisfied.

5. See Calomiris, Himmelberg, and Wachtel [1995]; Gilchrist and Himmelberg [1995, 1998]; Kashyap, Lamont, and Stein [1994]; and Whited [1992] Hubbard [1998] provides many other references. Hoshi, Kashyap, and Scharfstein [1991] use association with a large bank to identify firms with a relatively low C_{11}. In addition, many studies split samples by firm size which is highly correlated with both dividend payout and access to public debt.

that do not. In contrast, many firms without public debt also have little bank debt, consistent with the fact that many of them are small, high-technology companies with little collateral and likely pronounced moral hazard and adverse selection problems (see, for example, Himmelberg and Petersen [1994]). Thus, a strong case can be made that these firms face a high C_{11} for external financing.

Empirical evidence from most studies is consistent with equation (1) in the sense that firms likely to have a priori high C_{11}, (e.g., firms with low dividends, no public debt, or small size) almost always have a larger dI/dW than firms likely to have a low C_{11}. Furthermore, many studies cannot reject dI/dW equals zero for control groups selected to have a low (or zero) C_{11} (e.g., Gilchrist and Himmelberg [1995, 1998]).[6] Thus, the implications of the theoretical approach in much previous research are supported by the evidence.

II. Problems with the KZ Empirical Classification Approach

KZ employ managerial statements and quantitative measures from firms' financial statements to sort the 49 FHP low-dividend firms into one of five groups:[7] Not Financially Constrained (*NFC*), Likely Not Financially Constrained (*LNFC*), Possibly Financially Constrained (*PFC*), Likely Financially Constrained (*LFC*), and Financially Constrained (*FC*). This section summarizes our concerns about the effectiveness of their approach for determining both absolute and relative constraints across firms.

A. Reliance on Managers' Statements and Regulation S-K

To justify use of managerial statements to identify the degree of financing constraints, KZ [p. 180] rely on Securities and Exchange Commission Regulation S-K which they claim "explicitly requires firms to disclose whether or not they are having difficulty financing their investments." It is not obvious, however, that this regulation forces a firm to reveal financing constraints. We contacted Robert Lipe, Academic Fellow in the Office of the Chief Accountant of the SEC and asked whether a firm that is

6. See also Kashyap, Lamont, and Stein [1994]. Some Euler equations studies cannot reject C_{11} equal to zero for control groups of firms [Gilchrist 1991; Hubbard, Kashyap, and Whited 1995; Whited 1992].

7. KZ do not explain how these diverse criteria are specifically combined to classify firms into the five groups.

unable to undertake a new, positive NPV project due to financing constraints would be obliged to reveal this information. Lipe responded that this is not the case. Rather, he explained, Regulation S-K requires the firm to reveal the inability to invest due to financing constraints only when the firm fails to act on a *previously announced* investment commitment. As a result, we doubt the relevance of self-serving managers' statements as evidence of the absence of financing constraints in most situations.

B. Problems with the Quantitative Classification Criteria

The classification criteria in KZ include cash stocks, unused lines of credit, and leverage. They report summary measures for these variables in Table III [KZ, pages 185–187] and argue that they support the success of their *relative* ranking of the degree of financing constraints and their finding that the firms face *absolute* financing constraints (*PFC, LFC,* or *FC*) in only 15 percent of the firm-years.

We begin by explaining why the summary statistics in KZ do not support their surprising finding about the infrequency of absolute constraints in the FHP sample. KZ suggest that both the cash flow and the cash stock positions for *NFC* and *LNFC* firm-years are so large relative to fixed investment that these firms could not be financially constrained. Their numbers in Table III, however, are misleading because they implicitly assume that firms use sources of financing only for fixed investment when, in fact, growing companies invest heavily in both inventories and accounts receivable (see Fazzari and Petersen [1993, pages 330–331]).

We recomputed the KZ figures with the proper comparison of cash flow and cash stocks relative to total investment (fixed investment plus the changes in inventories and accounts receivable). These new statistics change some of the KZ conclusions. For example, KZ [page 184] note that the median value of cash flow less fixed investment is positive for *NFC* firm-years and write "[t]his suggests that *NFC* firms could have increased their investment without tapping external sources of capital." In sharp contrast, in our computations the median value of cash flow less total investment is negative at the seventy-fifth percentile for even the *NFC* and *LNFC* firms. Thus, most *NFC* and *LNFC* firms exhaust all internal finance for investment purposes. Furthermore, while the median cash stock-fixed investment ratio for *NFC* and *LNFC* firm-years is 0.66 (similar to the statistics in KZ Table

III) the median ratio of cash stocks to *total* investment is only 0.27.[8]

In our opinion, this cash stock ratio is too small to support the interpretation in KZ of the absence of financing constraints. Financially constrained firms will rationally maintain some buffer stock of cash to protect against having to cancel or delay investment projects as well as to avoid the costs associated with financial distress. It is well-known that cash flow is volatile in manufacturing, frequently declining by 50 percent or more and often becoming negative during a recession. Suppose, for example, that cash flow declined to zero. Our computations indicate that *NFC* and *LNFC* firms could maintain only about three months of median total investment from cash stocks, and then only if these stocks were (implausibly) driven to zero. We believe these statistics are consistent with the view that these firms face *absolute* financing constraints.

The cash stock, unused lines of credit, and leverage figures are also unreliable measures of the *relative* degree of financing constraints. Firms may have low debt because they cannot convince lenders to provide them with credit, perhaps due to lack of collateral, and low-debt firms may therefore face more severe constraints. For example, small high-tech companies—much of the FHP sample—tend to have little collateral value, and little debt, possibly because their assets are intangible or firm-specific (see, for example, Himmelberg and Petersen [1994]). In addition, comparatively large cash positions or unused lines of credit may indicate relatively severe constraints. As argued in recent papers [Fazzari and Petersen 1993; Carpenter, Fazzari, and Petersen 1994; Calomiris, Himmelberg, and Wachtel 1995], it is costly for constrained firms to adjust fixed investment when internal funds fluctuate. Forward-looking firms will therefore partially protect themselves with buffer stocks of cash or unused debt capacity. The more financially constrained a firm is, the greater is its incentive to accumulate liquid buffer stocks. Such a firm may be able to invest more at the margin at a moment in time, but the firm is nonetheless financially constrained. This dynamic perspective contrasts with the static view of financing constraints employed by KZ, which creates problems in their classification approach.

8. This statistic excludes observations for which total investment is less than or equal to zero. KZ also point out that unused lines of credit are larger for *NFC* and *LNFC* firms. We do not have these data, but the ratios of slack to investment reported by KZ on page 188 would be similarly reduced by recognizing a broader measure of investment.

C. The Absence of Heterogeneity in the KZ Classification

One striking finding in KZ is that only 19 of 719 observations (2.6 percent) are *FC* and another 34 observations (4.8 percent) are *LFC*. Given so few *FC* and *LFC* observations, how do KZ obtain enough *FC* firms for their regressions? KZ placed firms in the *FC* category if they had just a *single year* (out of 15) with an *FC* or *LFC* rating. In the *FC* category, 14 of the 22 firms had an *FC* or *LFC* rating only one or two times, while six firms had *FC* or *LFC* ratings in just three or four of the fifteen years. For this reason, the difference in cash flow coefficients across the KZ regressions may have little to do with their relative ranking of financing constraints.

III. The KZ Regression Results

KZ find that the investment of *NFC* and *LNFC* firms displays a greater sensitivity to cash flow than *FC* firms. Space does not permit a detailed discussion of this pattern of results. One possibility is that the *FC* firms include some years of financial distress. KZ describe firms in *FC* years as having "liquidity problems," which is not surprising given that their criteria for receiving the *FC* classification include violation of debt covenants and renegotiation of debt payments [page 182]. The KZ summary statistics in Table III also strongly suggest that the *FC* firm-years are periods of financial distress.[9] During years of financial distress, firms, possibly at the insistence of their creditors, are likely to use cash flow to enhance liquidity and avoid bankruptcy resulting in little change in fixed investment as measured in Compustat. A broader measure of investment, however, is likely to respond much more to cash flow for such firms.[10]

Financial distress is one possible explanation for the low cash flow coefficient of the *FC* firms. Regardless of how one explains the

9. The mean cash flow-net plant ratio for these observations is −0.047 and the mean of interest coverage is only 1.650. While KZ recognize the possibility of financial distress in *FC* observations [page 208], the defense they offer is not convincing. They note that firms increase rather than repay debt in the *PFC*, *LFC*, and *FC* years. This observation, however, may be due to creditors permitting illiquid, but growing, firms to rebuild liquidity.

10. Financially distressed firms (with low or negative cash flow) often disinvest assets with low adjustment costs such as working capital (see Fazzari and Petersen [1993]). In addition, such firms likely sell off existing fixed assets. Neither of these responses are included in the Compustat measure of fixed investment and ignoring them causes a downward bias in the cash flow coefficient, especially at times of financial distress.

pattern of results in KZ, however, we argue that this pattern is not informative. As discussed in the previous section, the firms in the *NFC* and *LNFC* categories likely *are* financially constrained and the relative degree of constraints across the KZ categories is far from clear. If there is no clear a priori difference in financing constraints across the firm groups in KZ, their strategy does not meet the criterion (summarized by equation (3)) necessary for meaningful tests of financing constraints with firm heterogeneity.

Finally, KZ [page 196] present additional tests with groupings based on "quantitative/objective data." The only one of these tests consistent with their main findings shows that firms with high interest coverage have higher cash flow coefficients than firms with low coverage. KZ imply that the pattern should be the opposite, but this need not be the case. As we discussed earlier, either low levels of debt or high interest coverage may indicate an inability to obtain debt financing, possibly signaling relatively severe financial constraints. KZ [page 211] themselves note that some studies use high leverage as an indicator of more severe financing constraints, while other studies argue the opposite. Thus, these tests do little to bolster the KZ conclusions.[11]

IV. Conclusion

KZ argue that investment-cash flow sensitivities do not provide useful evidence about the presence of financing constraints. We believe that this conclusion does not follow from their analysis for two reasons. First, their theoretical model fails to capture the approach of most previous research, making their theoretical analysis irrelevant as a criticism of FHP and most subsequent research. Second, the KZ empirical findings are difficult to interpret. The 49 low-dividend FHP firms are a poor choice for such a study because they are relatively homogeneous for purposes of testing for capital-market imperfections, making it extremely difficult to classify these firms finely by degree of financing constraints. Furthermore, some of the KZ classification

11. Two new studies are relevant to the KZ results. In a sample of large, dividend-paying firms, Cleary [1999] argues that the "most financially constrained" firms have the lowest investment-cash flow sensitivity. These *FC* firms, however, appear to be financially distressed. Their mean net income is −4.8 percent of sales compared with 9.6 percent for *NFC* firms. Mean sales growth for *FC* firms is −2.3 percent versus 23.5 percent for the *NFC* firms. Winter [1998], using the KZ sample, includes the KZ indicator of financial constraint status in regressions for investment and firm exit. He finds that the KZ indicator is either statistically insignificant or, when significant, has the wrong sign.

criteria (e.g., stock of cash and degree of leverage), may indicate high or low levels of constraints. We therefore believe their finding of nonmonotonic investment-cash flow sensitivities is not informative.

While the sweeping critical conclusions in KZ do not follow from their results, we believe their paper makes a contribution. Empirical work in this area has not always clearly identified the theoretical model under investigation. While FHP provided a model of investment behavior that described the criteria for separating firms into "constrained" and "unconstrained" categories, not all papers have done so. In addition, while commonly used separating criteria have a solid theoretical foundation, not all criteria are as defensible. KZ (and we hope this comment) will lead future researchers to clearly state their model and to carefully choose the criteria used for defining constrained and unconstrained groupings.

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