Asset Redeployability, Economic Uncertainty, and Corporate Investment

Hyunseob Kim* Howard Kung†

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Abstract

How does asset redeployability affect corporate investment decisions, particularly when economic uncertainty changes? To address this question, we construct measures of across-industry redeployability of assets and study exogenous increases in aggregate uncertainty spurred by major economic and political events, including the First Gulf War and the 9/11 Terrorist Attack. We find that after an increase in aggregate uncertainty, firms using less redeployable assets decrease investment more than firms using more redeployable assets. We also find that the effect of across-industry redeployability is pronounced when other firms in the same industry are financially constrained. Our results suggest that frictions in real asset markets are an important consideration for corporate investment decisions.

*Samuel Curtis Johnson Graduate School of Management, Cornell University, 366 Sage Hall, Ithaca, NY 14853, USA. Email: hyunseob.kim@cornell.edu

†University of British Columbia, Sauder School of Business, 2053 Main Mall, Vancouver, BC V6T1Z2, Canada. Email: howard.kung@sauder.ubc.ca

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1 Introduction

How does asset redeployability[1] affect corporate investment decisions, and how is this decision influenced when economic uncertainty changes? Despite extensive research on corporate investment, there is little understanding as to how "real frictions" such as imperfect asset markets affect corporate investments decisions. In addition, it is important to examine the role of uncertainty given recent research documenting the dampening effects of uncertainty on aggregate outcomes such as output and employment.[2] In this paper, we explore an approach to corporate investment based on asset redeployability and uncertainty. We find that after an increase in economic uncertainty, firms with less redeployable capital experience a significantly larger decrease in investment than do firms with more redeployable capital.

Corporate managers have an *ex ante* incentive to delay investment when firms cannot fully disinvest *and* uncertainty about the future profitability of the investment projects is high (Bernanke (1983)). Because less redeployable capital tend to have lower liquidation values (Shleifer and Vishny (1992); Ramey and Shapiro (2001)), managers of firms with less redeployable assets would be more concerned about potential "bad times" in which they want to sell those assets. Therefore, after an increase in uncertainty, which in turn increases the possibility of the bad times, firms with less redeployable capital would decrease (i.e., delay) investment more than firms with more redeployable capital (Caballero (1991)).

Our empirical approach has two distinguishing features to test this prediction. First, we construct a measure of asset redeployability based on the salability of assets across industries. Specifically, we construct our measure of asset redeployability using the Bureau of Economic Analysis (BEA) input-output table, which breaks down capital expenditures of 123 industries into 180 asset categories. Using this information, we measure the across-industry redeploya-

[1] The ease at which assets can be sold to alternative users is referred to as 'asset redeployability,' 'asset salability,' or 'asset liquidity (or market thickness)' in the financial economic literature. (Shleifer and Vishny (1992); Benmelech (2009); Gavazza (2011)). We use the term 'asset redeployability' throughout this paper for consistency.

[2] See, for example, Bloom (2009), Baker, Bloom, and Davis (2011), and Fernández-Villaverde, Guerrón-Quintana, Kuester, and Rubio-Ramírez (2012).

bility of a given asset by computing the proportion of industries in which the asset is used. That is, if more industries use an asset, the more redeployable is the asset and thus the higher the redeployability score. Then, we compute the industry-level redeployability index as the value-weighted average of each asset's redeployability score. Hence, a higher value of the redeployability index implies that the capital of the industry is more easily salable.[3] The resulting measure of asset redeployability exhibits considerable variation across over 100 industries, which allows a powerful test of our prediction.

Second, to examine the impact of uncertainty on firm investment, we identify sudden yet dramatic increases in aggregate uncertainty due to major political and economic events, such as the First Gulf War in 1990 and the Russian/LTCM default in 1998. These events are plausibly exogenous, and the economy-wide nature of the shock implies that they are likely to impact economic uncertainty similarly across firms. To quantify the magnitude and timing of the jump in aggregate uncertainty, we use the VIX index, a widely used measure of *ex-ante* aggregate stock market volatility.

Using these unexpected increases in aggregate uncertainty from 1990 to 2009 as a natural experiment, we find that asset redeployability, in conjunction with the large increases in uncertainty, has an economically sizeable effect on corporate investment decisions. Our baseline estimates indicate that in response to a typical increase in aggregate uncertainty in the sample[4], a one-standard-deviation decrease in our measure of asset redeployability leads to a 0.13 percentage point decrease in the quarterly investment rate (i.e., capital expenditure/total assets), which is 14% of the median quarterly investment rate (0.9%). These estimates imply that substantial variation in asset redeployability leads to a wide dispersion across firms in their response of investment to changes in uncertainty. We also find that the investment of firms with less redeployable capital rebounds more quickly when uncertainty resolves (i.e., decreases). Our main results are largely unaffected by controlling for time-varying investment opportunities, de-

[3]Based on this measure, the industries with the least redeployable assets include materials, transportation, and manufacturing related while those with the most redeployable assets are service related. See Section 2.1 for details of constructing the measure.

[4]See Figure 1 for fluctuations of aggregate uncertainty (proxied by the VIX) over our sample period.

mand shocks, internal cash flows, and omitted industry characteristics. Further analysis shows that the effect of across-industry salability is pronounced when within-industry redeployability is limited because industry insiders are liquidity constrained (Shleifer and Vishny (1992)). Overall, our findings suggest that capital redeployability is an important determinant of corporate investment, particularly when economic uncertainty changes.

Our paper contributes to the growing empirical literature that uses asset redeployability (or specificity) to measure liquidation values of assets in studying corporate policies. This line of research examines the effects of asset redeployability on capital structure choices including debt maturity (Benmelech (2009)), cost of capital, debt capacity (Benmelech and Bergman (2009); Ortiz-Molina and Phillips (2012)), and leverage (Campello and Giambona (2012)). In addition, Almeida, Campello, and Hackbarth (2011) examine the effect of asset specificity on asset reallocation through mergers. Our paper contributes to this literature by showing how asset redeployability affects an important corporate policy, namely investment.

Previous empirical research has examined relation between uncertainty and investment using micro data. Leahy and Whited (1996) and Guiso and Parigi (1999) document a negative relation between firm-level uncertainty and investment for manufacturing firms. Julio and Yook (2012) show that political uncertainty driven by election cycles has a negative effect on corporate investment.[5] While this line of empirical research has focused on the relation between uncertainty and investment, relatively less attention has been paid to a mechanism that drives this relation, namely the redeployability of capital.[6] This paper uniquely contributes to the literature on investment by showing that irreversible investments, captured by expenditures on non-redeployable assets, are a key driving force behind the negative uncertainty-investment relationship. [7] Moreover, our use of the plausibly exogenous shocks to uncertainty may allow a

[5]Related, Durnev (2010) shows that the investment-stock price sensitivity also decreases in election years compared to non-election years, suggesting that political uncertainty dampens the informativeness of stock price for investment decisions.

[6]Guiso and Parigi (1999) find that the negative effect of uncertainty on investment response to demand conditions is more pronounced for more irreversible investments using dichotomous (i.e., high and low) measures. For the most part, however, their focus is on testing the basic uncertainty-investment relationship.

[7]See Bernanke (1983), McDonald and Siegel (1986), Pindyck (1988), Abel and Eberly (1996) for theories of investment focusing on the relationship between uncertainty and investment and how irreversibility shapes this relationship.

causal interpretation of the results on the impact of uncertainty on investment.

Finally, the results in this paper support policymakers' concerns about the negative effects of uncertainty on the economy. We show that uncertainty can significantly dampen the accumulation of capital with limited alternative users (i.e., specific assets). Given that capital accumulation is one of the key drivers of economic growth, increases in economic uncertainty combined with difficulties in reallocating assets can have significantly negative effects on economic growth.[8] Moreover, our findings suggest that the effect of uncertainty can vary significantly depending on the redeployability of assets: Industries that use less redeployable capital, such as materials and manufacturing, are particularly negatively affected by increases in uncertainty, while industries that use more redeployable capital, such as services, are relatively unaffected.

The rest of the paper is organized as follows. Section 2 describes the construction of our measure of asset redeployability, firm-level data on investment, and the natural experiment for increases in economic uncertainty. Section 3 provides the empirical analysis of the effect of asset redeployability, combined with changes in uncertainty, on corporate investment. The final section concludes.

2 Measurement and Data

2.1 Measure of Asset Redeployability

We construct an industry-level measure of asset redeployability using the Bureau of Economic Analysis (BEA) 1997 capital flow table. The table breaks down expenditures on new equipment, software, and structures by 180 commodities (i.e., assets) for 123 industries covering a compre-

[8]In fact, Bloom (2009) shows that an increase in uncertainty can have a large negative effect on aggregate economic activity and thus is a possible explanation for recessions.

hensive set of sectors in the U.S. economy, such as manufacturing, transportation, and services.[9] In addition, the table gives a detailed breakdown of asset categories for each industry, which include new office building and plants, various machinery, electronics and computers, and office equipment.[10] We construct the measure in the following steps. First, for each asset category we compute the ratio of the number of industries in which that asset is used to the number of total industries. (Hereafter, we refer this ratio to as the "redeployability score".) If an industry's expenditure on a given asset constitutes less than 0.1% (i.e., very small fraction) of the total expenditure on the asset in the economy, we exclude that asset from the industry. In addition, if the description of assets implies that they are highly customized for a given firm or industry, and thus would have virtually no salability outside the industry, we set the redeployability score to 0 (i.e., it can be efficiently used only within the industry). Examples of these specialized assets are 'new plants construction' and 'custom computer programs.'[11]

Second, for each industry, we value-weight the redeployability score of asset categories to give us an industry-level redeployability index. A higher value of the redeployability index implies that the composition of assets in the industry is more redeployable. In sum, our industry-level measure of asset redeployability is given by:

$$Redeployability_j = \sum_{a}^{A} w_{j,a}(ARedeployability_a)$$

where $Redeployability_j$ is a measure of asset redeployability for industry j, a indexes assets, $w_{j,a}$ represents industry j's expenditure on asset a divided by its total capital expenditures, and $ARedeployability_a$ is the redeployability score of asset a. Since the resulting measure of asset redeployability exhibits considerable variation across the 123 BEA industries, it would allow a powerful test of the effect of asset redeployability on the uncertainty-investment relationship, relative to coarser measures employed in the previous research.

[9]The industry classification employed by the BEA is based on the North American Industry Classification System (NAICS). Therefore, we match the 123 BEA industries with Compustat firms using the NAICS code.

[10]Land is not included in the BEA asset categories. See footnote 15 for results incorporating corporate expenditure on land in our measure of asset redeployability.

[11]The value of the asset-level redeployability score appears reasonable. For example, the score is 0.65 for the asset 'truck trailers' which are used in a wide range of industries, while it is 0.02 for 'drilling oil and gas wells' which are for the most part used in the oil and gas industries.

Panel A of Table 1 presents descriptive statistics on the asset redeployability measure we construct. The panel shows that the mean value of the measure of asset redploýability is 0.41, and that there is sizeable cross-sectional variation in the measure ranging from 0.12 to 0.68 with a standard deviation of 0.10. Panel B details the cross-sectional variation in asset redeployability by listing the industries with the fifteen most and fifteen least redeployable assets. The ranking of industries appears to make intuitive sense. The industries with the most redeployable assets are clustered in the service sector (e.g., legal services), which requires investment in generic assets such as office buildings and computers. At the opposite end of the spectrum, the industries with the least redeployable assets tend to employ specialized machinery and equipment such as oil rigs (for the oil and gas extraction industry), aircraft (for the air transportation industry), and plants (for the manufacturing sector). Overall, the statistics in the table indicate that the asset redeployable measure we construct is sensible and exhibits significant cross-sectional variation.

2.2 Sample Construction

We choose our sample period by first identifying large, unexpected increases in aggregate economic uncertainty triggered by major economic and political events. Specifically, we quantify changes in aggregate uncertainty using the VIX index from the Chicago Board of Options Exchange, a widely used measure of *ex-ante* volatility for aggregate stock markets. Bloom (2009) shows that the VIX index is highly correlated with cross-sectional measures of uncertainty based on the dispersion of firm-level profit growth and stock returns, industry-level TFP growth, and GDP forecasts, suggesting that the aggregate stock market volatility is a reasonable proxy for overall economic uncertainty. Figure 1 plots the index from 1989 to 2010. Based on the VIX index, we first identify episodes in which the index increases by more than two standard deviations of the time-series distribution within three months. Second, we define "event windows" so that no confounding "uncertainty shocks" occur during each of the event windows, and the pre- and post-event periods have the same number of quarters.[12] Hence, depending on the

[12]As a result, we exclude the period around the Asian financial crisis in late-1997 from our sample because the event is confounded by another episode of uncertainty shock spurred by the Russian default in mid-1998. Also, we choose a sample period consisting of two quarters before and after the event date for the Russian/LTCM

duration of these shocks, we include two to four quarters before and after each of the events in our sample. We define the event date as the trading date in which the VIX index begins to rise sharply.

This procedure yields four episodes of uncertainty shocks including: i) Gulf War I in 1990; ii) defaults of Russia and LTCM in 1998; iii) 9/11 terrorist attack in 2001; and iv) financial crisis during 2007-2009. Details on the four event periods are in Table 2. Given that these events are arguably exogenous shocks to the aggregate economy, they are likely to impact the uncertainty regarding economic conditions similarly across all firms. Furthermore, our identification strategy relying on these sharp, unanticipated rises in uncertainty may provide a causal estimate of the effect of asset redeployability on the uncertainty-investment relationship.

Over these periods marked by uncertainty shocks, we focus on firm-quarter observations with available data on investment (i.e., capital expenditures), Tobin's Q, cash flow, sales growth, all constructed using the Compustat quarterly and CRSP databases, and the measures of asset redeployability. Definitions of the firm-level variables used in the analysis are in Appendix A. We exclude firm-quarters in the financial (SIC codes 6000-6999 or NAICS codes 520000-539999) and regulated utilities (SIC codes 4900-4949 or NAICS codes 221110-229999) industries from the sample. To mitigate the influence of outliers, we exclude firm-quarters with book assets at the beginning of each event period less than 10 million in 2008 constant dollar (adjusted using CPI) and winsorize relevant variables at the 2^{nd} and 98^{th} percentiles.[13] The resulting sample includes 91,526 firm-quarter observations in the four event periods from 1989 to 2010.

2.3 Firm Characteristics

Table 3 shows descriptive statistics on characteristics of firm-quarter observations in the full sample from 1989 to 2010. Panel A shows that cash flow and return on assets are on average

default event to avoid any confounding effect from the Asian crisis.

[13] We confirm that quantitative results throughout the paper are robust to various values of the winsorization cutoff, including 1% and 5%.

close to zero in the sample, consistent with the fact that for three out of the four events in the sample, the aggregate economy was in a recession.[14] The panel also shows that the average capital expenditure is 1.6% of book assets per quarter. Panel B sorts the firm-quarters by the measure of asset redeployability and shows statistics separately for those with below-the-median (right two columns) and above-the-median asset redeployability (left two columns). Broadly, a comparison of the low- and high-asset redeployability firms indicates that the characteristics of those two groups are fairly similar. Although the low-asset redeployability firms tend to be smaller, younger, and have higher Tobin's Q, the differences are not economically significant. One pattern between the two groups worth mentioning is that firms with less redeployable assets have a high ratio of capital expenditure to book assets compared with firms with more redeployable assets (1.8% vs. 1.5% at the mean). This pattern appears sensible given that firms with low asset redeployability are clustered in physical capital-intensive industries such as manufacturing.

3 Empirical Analysis

In this section, we provide empirical analysis of the effect of asset redeployability on the response of corporate investment to an increase in uncertainty.

3.1 Asset Redeployability, Economic Uncertainty, and Investment

3.1.1 Main Results

We use our measure of asset redeployability and exploit the four major economic and political events as a natural experiment to identify the effect of asset redeployability and uncertainty on

[14]Specifically, the rises in uncertainty for the Gulf War I, 9/11 terrorist attack, and recent financial crisis occurred during NBER recessions.

corporate investment. Specifically, we estimate the following difference-in-difference regression:

$$\frac{I_{i,t}}{TA_{i,t-1}} = \alpha_{i\times e} + \alpha_t + \beta_1 After_t + \beta_2 After_t \cdot Redeployability_j + \gamma' X_{i,t} + \epsilon_{i,t}, \tag{1}$$

where $I_{i,t}$ is capital expenditure of firm i for quarter t, $TA_{i,t-1}$ is total assets for firm i at the end of quarter *t-1*, $After_t$ represents a dummy variable equal to one for (two to four) quarters ending after a sharp increase in aggregate uncertainty proxied by the VIX index, $Redeployability_j$ is a measure of asset redeployability for industry j, which also represents the intensity of "treatment" in the natural experiment, $X_{i,t}$ is a vector of control variables for firm i predetermined at the beginning of quarter t, and $\epsilon_{i,t}$ represents random errors. Firm-event fixed effects (represented by $\alpha_{i\times e}$) [15] and time (i.e., year-quarter) fixed effects (α_t) are included in the estimation and all standard errors are computed adjusting for sample clustering at the industry level. $Redeployability_j$ is not included in the estimation as a stand-alone variable because it is perfectly collinear with firm-event fixed effects.

Before describing the results, we emphasize that we do *not* presume that the relation between uncertainty and investment is negative (or positive). As shown in Caballero (1991), the sign of this relationship is theoretically ambiguous depending on the assumption on the market power of the firm and irreversibility of the investment. Rather, our main prediction is that when uncertainty increases, corporate investment decreases more for assets that are less redeployable because the option value of waiting to invest increases more for firms with less redeployable capital.

Table 4 presents the estimation results of equation (1). The coefficient on the dummy variable *After* in column 1 shows that the quarterly investment rate decreases by 0.27 percentage points on average, after aggregate economic uncertainty increases sharply. While this estimate is not of our main interest, it is consistent with the negative relation between uncertainty and levels of investment documented in the literature (see e.g., Leahy and Whited (1996)). Importantly,

[15] We include separate dummies for a given firm in different event windows (rather than including one dummy for the firm) under the assumption that the nature of a given firm can change across event periods which span as long as 20 years. But our results are robust when we employ firm fixed effects.

consistent with the theory, column 2 shows that investment drops less when firm assets are more redeployable in response to a rise in uncertainty. The coefficient on the interaction between the dummy for quarters after uncertainty shocks and the measure of asset redeployability (*After* × *Redeployability*) is 1.51 and statistically significant at the 1% level (t-stat = 2.92). In terms of economic magnitude, a one-standard-deviation (0.10) increase in asset redeployability leads to a 0.15 (= 0.10 × -1.51) percentage point increase in the investment rate after a surge in uncertainty. The magnitude of the investment increase is sizeable given that the mean (median) investment rate is 1.6% (0.9%) per quarter during our sample period.

The estimates in column 2 imply that a firm with the highest degree of asset redeployability in the sample (0.68) *increases* investment by 0.14 (= -0.89 + 1.51 × 0.68) percentage points after an uncertainty shock, while a firm with the lowest degree of asset redeployability (0.12) *decreases* investment by 0.71 (= -0.89 + 1.51 × 0.12) percentage points.[16] Hence, the response of investment to uncertainty shocks varies substantially depending on the degree of asset redeployability, which is consistent with the notion that the option value of postponing investment increases more for firms with less redeployable capital. Furthermore, to the extent that the sharp increases in uncertainty are unexpected by firms and the industry-level measure of asset redeployability is plausibly exogenous to individual firms, a causal interpretation of the effect may be possible.

Given that we do not include control variables for investment opportunities or internal cash flows in column 2, it is possible that low-asset redeployabiliyt firms reduce capital expenditures more because investment opportunities or cash flows deteriorate faster for those firms than high-asset redeployability firms after a spike in uncertainty. In column 3, we examine the validity of this channel by controlling for time-varying investment opportunities and demand shocks using Tobin's Q and sales growth rates (Bloom et al. (2007)), and internal liquidity using cash flows, which are widely used variables in the empirical investment literature (e.g., Hubbard (1998)).

[16] In fact, this finding is consistent with the prediction of Caballero (1991). In that framework, i) the convexity of the profit function with respect to uncertainty and ii) irreversibility have opposing effects on investment. At the lowest degree of irreversibility, the convexity effect dominates, which could lead to an increase in investment after a rise in uncertainty.

As expected, Q and sales growth rates enter the investment equation significantly with positive signs, indicating that investment opportunities reflected in stock market valuation and sales are positively correlated with investment. However, including these control variables does not lead to a significant change in the magnitude and significance of the estimated coefficient on *After* × *Redeployability* (from 1.51 with t-stat=2.92 to 1.31 with t-stat=2.60), suggesting that neither investment opportunities nor internal liquidity subsumes the role of redeployability in determining the relation between uncertainty and investment. Overall, the results in columns 2 and 3 are consistent with the prediction of the theory of irreversible investment under uncertainty: An increase in uncertainty causes more irreversible firms to experience a larger decrease in investment than less irreversible firms.[17]

3.1.2 Dynamic Effects

In column 5 of Table 4, we examine the dynamic effect of the uncertainty shocks on investment following the idea of Granger (1969). Specifically, we replace the dummy variable *After* in columns 1 through 4 with four event-time dummy variables: *Before (-2)* and *Before (-1)* which are equal to one if a sharp increase in aggregate uncertainty occurs in one and two quarter(s), respectively, *After (0)* which is equal to one if a sharp increase in aggregate uncertainty occurrs during the current quarter, and *After (1+)* which is equal to one if a sharp increase in aggregate uncertainty has occurred at least a quarter ago. In the column we report only the coefficients on these dummy variables interacted with our measure of redeployability, omitting the coefficients on the dummies themselves to save space. The column shows that the estimated coefficients on *Before (-2)* × *Redeployability* and *Before (-1)* × *Redeployability* are economically small and statistically insignificant, suggesting that the degree of redeployability has a negligible effect on investment prior to the increase in uncertainty (i.e., no pre-existing trend). In contrast, the coefficients on *After (0)* × *Redeployability* and *After (1+)* × *Redeployability* are statistically

[17]Note that the BEA capital flow table does not include expenditures on land, however we can proxy for the share of expenditure on land by the firm-level ratio of the value of land to the value of plant, properties, and equipment using data from Compustat. We assume that land has an asset redeployability score of 1 and construct a modified version of our asset redeployability measure by incorporating land. Column 4 reports the estimation results based on this modified measure, which yields similar results as in our baseline specification.

significant at the 5% level and economically sizeable. In particular, the coefficient on the latter is larger in magnitude than that on the former (1.62 vs. 0.63), which implies that asset redeployability has an increasingly larger effect on investment as time passes after an uncertainty shock impacts the economy. This result appears reasonable given the potential time lag between investment decisions and actual implementation.

3.1.3 Changes in Uncertainty and Investment

While our main test relies on increases uncertainty, it is also informative to analyze the response of investment after a *decrease* in uncertainty. Importantly, for our theoretical interpretation above to be consistent, the results also need to work in the other direction: Firms with less redeployable capital increase investment more than firms with more redeployable capital in response to a decrease in uncertainty. The two events we use to identify drops in uncertainty are the decrease in uncertainty following the sharp rise in uncertainty due to Gulf War I and the financial crisis of 2007-2009.[18] Specifically we estimate the following difference-in-differences regression:

$$\frac{I_{i,t}}{TA_{i,t-1}} = \alpha_{i\times e} + \alpha_t + \beta_1 Decrease_t + \beta_2 Decrease_t \cdot Redeployability_j + \gamma' X_{i,t} + \epsilon_{i,t}, \qquad (2)$$

where $Decrease_t$ is equal to one for quarters ending after a proxy for aggregate economic uncertainty, the VIX index, decreases to a "normal" level (i.e. less than 20), and all other variables are defined as in equation (1).

Table 5 presents the estimation results of equation (2). Column 1 shows that there is no significant change in average investment across firms when aggregate uncertainty gradually decreases after a surge. Column 2 shows that the coefficient on the interaction term $Decrease \times Redeployability$ is -0.58 and significant at the 5% level (t-stat = 2.36) indicating that when uncertainty declines, firms with less redeployable capital increase their investment relative to

[18] We exclude periods after the other two events given that those events are followed by another increase in uncertainty (i.e., VIX index) in a few quarters, which can confound the effect.

those with more redeployable capital.

In column 3, we further examine how changes in aggregate uncertainty, proxied by the VIX index, generally affect corporate investment depending on the redeployability of assets by expanding our analysis to the whole 1989 to 2010 period. Specifically, we estimate a specification similar to that in equation (2) but including the VIX index measured at the end of the previous quarter in place of the *Decrease* dummy. Because this analysis does not rely on the exogeneity of the uncertainty shocks driven by the economic and political events, we should interpret the result with more caution. Nonetheless, the coefficient on $VIX \times Redeployability$ is 0.04 and statistically significant at the 5% level, which suggests that when uncertainty increases, corporate investment in less redeployable capital decreases more, and vice versa. Overall, the results in this section indicate that variation in uncertainty generally leads to changes in uncertainty in ways that are consistent with the theories and the baseline results using a sudden increase in aggregate uncertainty.

3.2 Robustness

3.2.1 Placebo Tests

Table 6 examines the validity of our results on the role of asset redeployability in shaping the uncertainty-investment relationship by repeating the basic test for "placebo" events. In particular, columns 1 and 2 repeat our specification in Table 4 for the 1994-1996 (column 1) and 2004-2006 periods (column 2) with July 1 of 1995 and 2005 as a placebo event date, respectively. These two periods are suitable to test whether the degree of redeployability has any effect on investment under non-existent uncertainty shocks, given that our proxy for aggregate uncertainty, the VIX index, was very stable during both of the periods moving between 10 and 20.[19] If it is indeed the increase in aggregate uncertainty that enables the degree of asset redeployability to affect investment, we anticipate that there would be no effect absent uncertainty shocks in

[19]The VIX index is generally considered at a "normal" level when it is below 20.

those two sample periods. Consistent with this prediction, we find that the coefficient estimates on *After* × *Redeployability* for both of the placebo samples are statistically and economically insignificant (coefficient = -0.24 and 0.16 and t-stat = -0.61 and 0.84). This evidence confirms our interpretation of the main result that asset redeployability is an important determinant of corporate investment particularly when economic uncertainty changes.

In column 3, we examine another period during which aggregate uncertainty is stable but the U.S. economy is in recession. Particularly, we use the 1980-1982 period which includes the NBER recession from July 1981 to November 1982. In this column, we use *Assetgrowth*, defined as the percentage change in book assets, as a measure of investment (Baker, Stein, and Wurgler (2003)) given that capital expenditure from Compustat is not available for this period. The column shows that the coefficient on *After* is statistically and economically significant, while that on *After* × *Redeployability* is statistically insignificant at a conventional level (coefficient = -0.52 and t-stat = 0.42). This result implies that while investment does decrease on average during the recession, the decrease in investment is not associated with asset redeployability, unlike the periods of large increases in uncertainty. Hence, this result falsifies the alternative explanation that our baseline results are driven by recessions or more generally, business cycles instead of changes in economic uncertainty.

3.2.2 Empirical Specification

One characteristic of low-redeployability firms is that they have higher investment rates (i.e., capital expenditure/total assets) than high-redeployability firms (e.g., 1.8% vs. 1.5% at the mean, see Panel B of Table 3). This difference in the investment rate between the low- and high-redeployability firms could raise the concern that the differential effect of uncertainty on investment depending on asset redeployability is driven by the particular empirical specification that uses the (scaled) investment level as dependent variable. For example, even if the *growth rate* of investment is similar between the low- and high-redeployability firms, the change in the *level* of investment can be larger for low-redeployability firms simply because their pre-event investment level is higher than that of high-redeployability firms.

To mitigate this concern, we re-examine the results in the previous sections using a specification relatively free of this measurement issue. In particular, we estimate a specification that relates the growth rate of investment to the growth rates of investment determinants. Following the macro investment literature which frequently examines the growth rate of investment at the aggregate level (see e.g., Blanchard et al. (1993)), we measure the growth rate of a variable as the first difference of the log of that variable. The empirical specification is given by:

$$\Delta ln\left(\frac{I_{i,t}}{TA_{i,t-1}}\right) = \alpha_{i\times e} + \alpha_t + \beta_1 After_t + \beta_2 After_t \cdot Redeployability_j + \gamma' \Delta ln(X_{i,t}) + \epsilon_{i,t}, \quad (3)$$

where Δln(.) represents the first difference of the log of a variable, and all variables are defined as in equation (1).[20]

Table 7 presents results of estimating equation (3). In general, the results assure our conclusion in the previous sections: low-redeployability firms experience steeper falls in investment than high-redeployability firms after an exogenous increase in uncertainty. Column 1 shows that the growth rate of investment decreases by 4.1% on average after the uncertainty shocks, consistent with the result based on the level specification in equation (1). Furthermore, column 2 shows that firms with less redeployable assets decrease the growth rate of investment significantly more than firms with more redeployable assets. The coefficient on $After \times Redeployability$ is 0.10 and statistically significant at the 5% level. Thus, a one-SD increase in the asset redeployability measure increases the growth rate of investment by 1.0% (= 0.10 $\times$ 0.10) after an increase in uncertainty. Taken together, the results in this and the previous sections suggest that the implications of asset redeployability and uncertainty for investment are robust to the choice of empirical specifications.

[20] We include the first difference of cash holdings instead of that of cash flows given that almost half of observations in the sample have negative values of cash flows, and so drop out in the estimation if we use cash flows.

3.3 Within-industry Salability of Assets and Sellers' Financial Position

Our measure of asset redeployability is based on the salability (or usability) of assets across industries. As Shleifer and Vishny (1992) point out, the ability to deploy assets between industries is particularly important when the possibility to sell assets to industry insiders is limited. Therefore, one important extension of our main prediction is that the impact of increased uncertainty interacted with across-industry asset redeployability would be more pronounced when the industry peer firms are more "constrained" in terms of buying the assets. In this section, we gauge the extent to which industry peers are constrained along two distinct dimensions: financial constraints and output co-movement among the industry peers.

In the first approach, we examine how the limited financial resources of industry insiders to buy assets sold by other firms in the industry affect corporate investment decisions when economic uncertainty increases dramatically. In particular, we measure the financial position of industry peers using leverage ratio, cash holdings, and the Kaplan-Zingales (1997) index. We first compute the industry-level median of each measure for each year, and classify a given industry as financially constrained if its leverage ratio or KZ index (cash holdings) is above (below) the median for each event window, and unconstrained otherwise. Based on each of these schemes, we split the full sample into two groups of constrained and unconstrained industries, and estimate the specification in equation (1) separately for each group.

Panel A of Table 8 shows the estimation results. In columns 1 and 2, we use book leverage ratio as a proxy for financial constraints. A comparison of the coefficient on *After* × *Redeployability* in the two columns (1.49 for "constrained" vs. 0.81 for "unconstrained") indicates that the effect of asset redeployability, combined with increases in uncertainty, is indeed more pronounced among the industries where insiders are liquidity constrained. Estimates in columns 3 through 6 tell a similar story: The effect of across-industry asset salability and increased economic uncertainty is pronounced for the subsamples of financially constrained industries than unconstrained ones when we use cash holdings or the KZ index as a measure of constraints.

Our second empirical approach exploits variation in the extent to which the output of firms in a given industry co-moves. If there is strong co-movement in output among firms within the industry, then when a firm wants to liquidate assets (e.g., due to low profitability), other firms in the industry are also likely to suffer a similar downturn or liquidity constraints. Because within-industry asset redeployability is limited for those industries (Shleifer and Vishny (1992)), we predict that the effect of increased uncertainty would be more pronounced for firms in industries with stronger co-movement of sales.

Panel B of Table 8 verifies this prediction. In the panel, we measure the co-movement of sales at the two-digit SIC industry level by regressing firm sales on year dummies for each industry, and taking the R-squared of the regression (Guiso and Parigi (1999)). We define an industry has "high" ("low") co-movement if the measure is higher than (lower than or equal to) the median. A comparison of the coefficient on *After* $\times$ *Redeployability* in the two columns (1.48 for "high" vs. 0.02 for "low") indicates that the effect of asset redeployability and spikes in uncertainty is indeed concentrated among industries in which firm sales co-move strongly. Overall, the results in Table 8 suggest that the effect of across-industry asset salability and uncertainty shocks on investment is stronger when within-industry salability is limited by the financial constraints or output co-movement of industry insiders.

Next, we examine the effect of *sellers'* financial position on the role of asset redeployability in investment decisions. Ramey and Shapiro (1998) show that sellers with weak financial position are less likely to "invest" in searching for better-matched buyers, and thus assets sold by those firms are fetched at lower prices relative to prices at which less constrained firms sell their assets. Consistent with the theory, using data on airplane transactions in secondary markets, Pulvino (1998) shows that firms with weaker financial positions sell used assets at a significantly lower price. In addition, he shows that financially constrained firms are more likely to sell their aircrafts to industry outsiders (who are likely to have lower valuation for the industry-specific assets), such as banks or leasing firms, in an attempt to sell them quickly. That is, firms with liquidity constraints are more often involved in "asset fire sales" than unconstrained firms.[21]

[21] See Shleifer and Vishny (2010) for an excellent survey of the recent literature on (real and financial) asset

If financially constrained firms are more likely to sell assets at discount and to industry outsiders due to their stronger desire to liquidate assets quickly, then financially constrained firms should have lower resale values for less redeployable assets than their unconstrained counterparts. In contrast, for more redeployable assets, the financial positions of the seller would not affect the resale value as much because returns to additional effort to search potential buyer would be lower (e.g., the difference in valuation between industry insiders and outsiders is smaller). Therefore, we predict that the effect of increased uncertainty and asset redeployability would be more pronounced for potential sellers that are more financially constrained.

In columns 1 and 2 of Table 9, we use book leverage ratio as a proxy for financial constraints. A comparison of the coefficient on *After* × *Redeployability* in the two columns (1.57 for "constrained" vs. 0.90 for "unconstrained") indicates that the effect of asset redeployability and increases in uncertainty is indeed more pronounced for the constrained than unconstrained firms (i.e., potential sellers), consistent with our prediction. Estimates in columns 3 through 6 show consistent results based on cash holdings and the KZ index as a measure of constraints. Overall, these results are consistent with models of asset fire sales which emphasize financial conditions of sellers combined with asset redeployability as a determinant of the liquidation value of capital.

3.4 Alternative Explanations

3.4.1 Omitted Firm or Industry Characteristics

One potential concern about our results is that omitted firm or industry characteristics (which are correlated with our measure of asset redeployability) might drive them. However, first note that descriptive statistics in Panel B of Table 3 suggest characteristics of firms that have high and low redeployability are similar. Second, we address the validity of this type of concerns using two empirical approaches. In the first approach, we control for observable firm- or industry-

fire sales.

level characteristics by including proxies for potential omitted characteristics interacted with the dummy variable *After*. Specifically, we estimate the following specification which adds firm-level (measured at the mean of a given industry) or industry-level characteristics interacted with the *After* indicator variable, to the baseline specification in equation (1):

$$\frac{I_{i,t}}{TA_{i,t-1}} = \alpha_{i\times e} + \alpha_t + \beta_1 After_t + \beta_2 After_t \cdot Redeployability_j + \beta_3 After_t \cdot Z_{j,0} + \gamma' X_{i,t} + \epsilon_{i,t}, \quad (4)$$

where $Z_{j,0}$ is an observable characteristic of the BEA industry j predetermined at the beginning of each event period, and all other variables are defined as in equation (1). It is important to note that we fix the characteristics interacted with *After* within each event because they are meant to capture the innate (as opposed to time-varying) characteristic of the average firm in industries. Further, we measure all of the characteristics at the latest quarter *before* each of the four event periods begins.

Column 1 of Table 10, Panel A reproduces the baseline result as a basis for comparison, and columns 2 through 6 present the estimation results of equation (4) including Tobin's Q (proxying for growth opportunities), log total assets (firm size), firm age, return on assets (profitability), or leverage ratio. Column 2 shows that firms with high Q increase investment more than firms with low Q, after an increase in aggregate uncertainty. However, the coefficient on *After* × *Redeployability* remains significant at the 1% level and the economic significance increases slightly (coefficient = 1.36, t-stat = 3.03). In column 3, we find that larger firms decrease investment more than smaller firms. Again, the coefficient on *After* × *Redeployability* remains significant at the 1% level and the economic significance remains similar. In addition, columns 4 through 6 show that controlling for the effects of industry mean age, profitability or leverage does not lead to a significant change in the coefficient on *After* × *Redeployability*, which remains significant at the 1% level across the columns. Overall, results in Panel A suggest that our baseline results are unlikely to be driven by observable firm characteristics that are omitted in our baseline regression.

Next, we examine a couple of industry characteristics related to potential alternative explanations. One such explanation is that our asset redeployability measure is correlated with the "lumpiness" of investment, which can be driven by high fixed costs. Like investment irreversibility, fixed costs coupled with uncertainty can lead to a region of inaction in investment.[22] Therefore, when uncertainty increases, high fixed costs can have a similar effect on investment with high degrees of investment irreversibility (driven by low asset redeployability).

To rule out this possibility, we control for the effect by adding industry-level proxy variables for the degree of lumpiness interacted with the indicator $After$ to the baseline regression in equation (1). We use two different measures of lumpiness. *Autocorr* measures investment lumpiness by the industry-level mean of the first-order autocorrelation (i.e., AR(1)) of firm-level investment rates. Thus, investment is more lumpy (or less smooth) if this measure is smaller. *LargestInv* follows Doms and Dunne (1998) and measures investment lumpiness of a given firm-quarter using the largest investment over the last 16 quarters divided by the sum of investments for the same 16 quarters. Then we use the industry-level mean of this value in the regression. The estimation results are reported in Panel B of Table 10.

Column 1 reproduces the baseline result for comparison purposes. First, column 2 shows that the coefficient on *After* × *Autocorr* is positive, which is consistent with the prediction that firms with less smooth investment (potentially due to higher fixed costs) would decrease investment more when uncertainty increases. In column 3, the coefficient on *After* × *LargestInv* is negative (although far from being significant), and thus also qualitatively consistent with the argument for fixed costs. However, both in columns 2 and 3, controlling for each of the lumpiness measures essentially does not affect neither the economic magnitude nor statistical significance of the coefficient on *After* × *Redeployability* (coefficient = 1.37 and 1.31 and t-stat = 2.69 and 2.66) relative to the baseline case in column 1. Therefore, it appears unlikely that our baseline results are driven by the lumpiness of investment.

When economic uncertainty rises, firms may want to hold off investing in assets with low depreciation rates to avoid worrying about future liquidation values for those assets with long

[22] See, for example, Caballero and Leahy (1996) for this result.

productive life. Therefore, we examine whether variation in depreciation rate drives our results, by adding additional controls for industry-level depreciation rates interacted with the indicator $After$ to the baseline regression. We obtain the depreciation rate for each industry from the BEA. In column 4, we confirm that our basic result is essentially unchanged even when we include the control for depreciation rates. [23] Taken together, the results in Panel B support our argument that uncertainty and asset redeployability are important determinants of investment, and their effects are independent of the impact of investment lumpiness or productive life of capital.

The second empirical approach addresses potential concerns related to the observation that some of the high-redeployability industries based on our measure are clustered in the service sector, while the low-redeployability industries are in the non-service sectors such as natural resources and manufacturing (see Panel B of Table 1). This difference in industry composition between low- and high-redeployability industries might be correlated with other unobserved industry characteristics. For instance, if investments in assets used in the non-service sector (e.g., building plants and installing machines) generally require lower fixed costs than investments in assets used in the service sector (e.g., installing computers, trucks, and office equipments), then as we discuss above, when uncertainty increases, firms in the non-service sector might be more likely to delay investment projects due to high fixed costs, rather than low asset redeployability.

We examine this type of alternative explanations by repeating our analysis for subsamples consisting of non-service industries only.[24] Panel C of Table 10 shows the estimation result. Again, the first column reproduces our baseline estimates. In column 2, the estimation is based on firms in the non-service sector.[25] Inconsistent with the argument that unobserved differences between the service and non-service sectors drive previous results, the coefficient on *After* $\times$ *Redeployability* in column 2 turns out even more significant (both statistically and economically)

[23]Furthermore, we find that the effect of asset redeployability and uncertainty is concentrated among the low depreciation rate industries, while the effect is negligible for the high depreciation rate industries. This result is consistent with the argument that a lower depreciation rate implies that assets have longer productive life and thus have higher chance to be liquidated in the future.

[24]Appendix Table 1 shows the fifteen most and fifteen least redeployable industries in the non-service sector.

[25]Specifically, we exclude firms with the one-digit NAICS code larger than or equal to 5, which generally represent service industries.

for this sample of non-service sector firms (coefficient = 1.67, t-stat = 3.40) than for the full sample. In column 3, we further focus on the manufacturing industries among the non-service sector.[26] Again, the effect of asset redeployability and increased uncertainty is statistically and economically significant for this subsample. Taken together, the results based on these alternative subsamples suggest that unobserved industry characteristics related to service vs. non-service (or manufacturing), such as fixed costs of investment, are unlikely to account for our main results. If anything, we find evidence that the effect of asset redeployability on investment is more pronounced for firms in the non-service sector.

3.4.2 Contraction in Supply of External Finance

The results so far support the prediction that after economic uncertainty increases, firms with more irreversible capital (due to lower asset redeployability) decrease investment more because the option value of waiting to invest increases more for firms with limited asset salability. However, a casual observation may suggest that spikes in aggregate uncertainty are often accompanied by contractions in the supply of external funds, like in the recent financial crisis. For such events, the indicator variable $After$ used in our analysis potentially captures two simultaneous events: A sharp increase in economic uncertainty and a contraction in the supply of external finance. Therefore, if firms with less redeployable capital have somehow more difficulties in raising external funds in tightening capital markets compared to those with more redeployable capital[27], the result that the former decreases investment more relative to the latter may follow.

We examine this alternative explanation by employing two types of analysis. First, we exclude the events of the Russian/LTCM default in 1998 and the 2007-2009 financial crisis from the sample, which may be arguably driven by shocks in the financial sector. Given that the remaining two episodes of surges in uncertainty (i.e., Gulf War I and 9/11 terrorist attack) are largely driven by exogenous political events, finding similar results for this subsample would

[26] Specifically, we only include firms with the one-digit NAICS code of 3.

[27] One possible mechanism is that firms with less redeployable capital have lower debt capacity (Williamson (1988); Shleifer and Vishny (1992)) and thus are more financially constrained.

support our view that adverse shocks to the supply of finance do not drive our results.

In column 1 of Table 11, we reproduce the baseline result for the full sample as a basis for comparison. Column 2 shows the result of estimating equation (1) for the subsample excluding the two events potentially driven by adverse shocks in the financial sector. Inconsistent with the argument that shocks in the financial market drive the results, the coefficient estimate on *After* × *Redeployablility* in column 2 is statistically significant (at the 1% level) and economically sizeable. In particular, the magnitude of the effect is similar between columns 1 and 2 (1.31 vs. 1.22), indicating that the effect is unlikely to be driven by shocks to the supply of external funds.

We now turn to the second type of analysis, in which we again use the full sample but *control* for the potential effects of the contraction in the supply of external funds on investment. Standard theories of investment under capital market imperfections suggest that the contraction in the supply of external funds would have a more adverse impact on investment for financially constrained than unconstrained firms.[28] Therefore, we control for the effect of the reduction in the supply of external finance by adding firm-level proxy variables for the degree of financial constraints interacted with the indicator $After$ to the baseline regression. Specifically, we estimate the following specification:

$$\frac{I_{i,t}}{TA_{i,t-1}} = \alpha_{i\times e} + \alpha_t + \beta_1 After_t + \beta_2 After_t \cdot \mathit{Redeployability}_j + \beta_3 After_t \cdot Const_{i,0} + \gamma' X_{i,t} + \epsilon_{i,t}, \quad (5)$$

where $Const_{i,0}$ is a proxy variable for the degree of financial constraints for firm i measured at the beginning of each event period, and all other variables are defined as in equation (1).

Columns 3 to 5 of Table 11 present the results of estimating equation (5). We generally find that the measures of financial constraints interacted with $After$ have economically and statistically significant effects on investment. For example, the estimated coefficient on *After* × *Inv. grade rating* (0.10) in column 3 implies that after an increase in uncertainty and a potential

[28]See Hubbard (1998) for an excellent survey of the literature.

deterioration in capital-market conditions, firms having investment grade ratings would invest 1.26 percentage points more (of book assets) relative to firms having non-investment grade or no credit ratings. However, including any of the proxies for the wedge between internal and external financing costs (the existence of investment grade credit ratings and the Whited-Wu (2006) index in column 3) and the need for external funds (Kaplan-Zingales (1997) index and cash holding in column 4), all interacted with $After$, has a negligible impact on the coefficient on *After* × *Redeployability*. In column 5, we confirm that our basic result on the effect of asset redeployability on investment is essentially unchanged even when we include *all* of the financial constraint measures in the regression. The coefficient on *After* × *Redeployability* (1.28) remains significant at the 1% level. Therefore, it appears that the effects of uncertainty and asset redeployability on corporate investment are independent of those of financial market conditions and firms' financial constraints.

4 Conclusion

This paper examines the effect of asset redeployability on the response of corporate investment to a change in economic uncertainty. We develop a new variable that measures asset redeployability based on across-industry salability of assets and exploit exogenous shocks to aggregate uncertainty as a natural experiment. Consistent with the theories of irreversible investment under uncertainty, we find that firms with less redeployable assets experience a significantly larger drop in investment than firms with more redeployable assets in response to an increase in aggregate uncertainty.

The results have important implications for policymakers concerning the negative effects of uncertainty on economic activities. We show that uncertainty can significantly dampen capital accumulation and particularly, that this effect is stronger when capital is more specific. Thus, core industries such as manufacturing and materials which employ specialized machinery and equipment are particularly effected by large increases in uncertainty. More generally, the evidence indicates that real frictions such as the inability to efficiently redeploy assets across firms and industries are important drivers of corporate investment decisions.

Finally, given that our measure of asset redeployability is based on the salability of assets across industries, one potential limitation of the analysis in this paper is that the salability within a given industry is not accounted for using the measure. Examining whether the within-industry specificity of assets also have similar effects on corporate investment decisions would be an interesting issue for future research.

Appendix A: Definitions of Variables

All variables are from the Compustat quarterly database except for the market value of equity which is from CRSP. Income statement items ending 'y' in Compustat (e.g., CAPXY) are reported on a year-to-quarter basis, and thus we "quarterize" those variables by subtracting lagged values.

Investment = Quarterly capital expenditures (CAPXY) / lagged total assets (ATQ)

Tobin's Q = [Market value of equity from CRSP + total assets (ATQ) - book value of equity (CEQQ) - deferred taxes (TXDBQ)] / total assets (ATQ)

Cash flow = [Operating income before extraordinary items (IBQ) + depreciation and amortization (DPQ)] / lagged total assets (ATQ)

Cash holdings = Cash and short-term investments (CHEQ) / total assets (ATQ)

Sales growth = Ln(sales(SALEQ)) - Ln(lagged sales)

Asset growth = Ln(total assets(ATQ)) - Ln(lagged total assets)

Age = Number of years since the firm first appears in Compustat

Investment grade rating = 1 if S&P bond rating is above or equal to "BBB-," and 0 otherwise.

Kaplan-Zingales (1997) index = -1.001909 × Cash flow + 3.139193 × Long-term debt - 39.36780 × Dividend payout - 1.314759 × Cash holdings + 0.2826389 × Tobin's Q

Whited-Wu (2006) index = -0.091 × Cash flow - 0.062 × Dummy(positive dividend) + 0.021 × Long-term debt - 0.044 × Ln(Total assets) + 0.102 × Sales growth for 3-digit SIC industry - 0.035 × Sales growth

Return on assets (ROA) = Operating income before depreciation (OIBDPQ) / lagged total assets (ATQ)

Book leverage = [Long-term debt (DLTTQ) + Short-term debt (DLCQ)] / total assets (ATQ)

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Figure 1 – Proxy for Aggregate Economic Uncertainty (the VIX index)

This figure plots the VIX index for implied volatility of the S&P 500 index from the Chicago Board Options Exchange from January 1989 to March 2010. The four shaded areas represent the event windows used in the analysis of corporate investment around large increases in uncertainty.

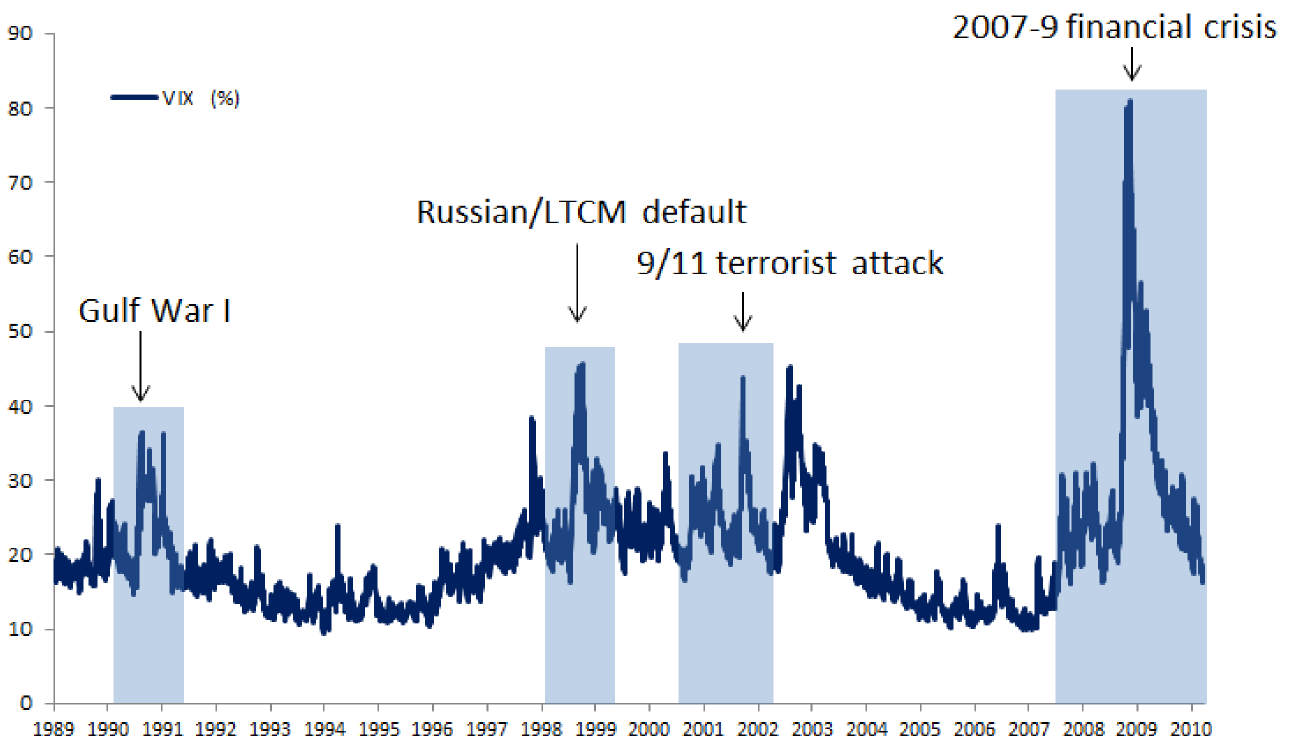

Table 1 – Measures of the Redeployability of Tangible Assets

This table presents statistics on the measure of asset redeployability. Panel A shows descriptive statistics on the measure and Panel B shows the fifteen most and the fifteen least redeployable industries based on the measure.

Panel A: Descriptive Statistics

	Mean	Q1	Median	Q3	Std Dev	Min	Max
Asset redeployability	0.41	0.36	0.44	0.46	0.10	0.12	0.68

Panel B: The Fifteen Most and Fifteen Least Redeployable Industries

Most redeployable industries		Least redeployable industries	
Industry	Redeployability	Industry	Redeployability
Legal services	0.68	Oil and gas extraction	0.12
Employment services	0.59	Rail transportation	0.17
Personal and laundry services	0.57	Water transportation	0.23
Advertising and related services	0.57	Air transportation	0.24
Civic, social, professional and similar organizations	0.57	Textile mills	0.24
All other administrative and support services	0.57	Semiconductor & electronic component manufacturing	0.25
Travel arrangement and reservation services	0.56	Agriculture and forestry support activities	0.27
Social assistance	0.56	Fishing, hunting and trapping	0.28
Electronic, commercial, & household goods repair	0.55	Nursing and residential care facilities	0.29
Machinery and equipment rental and leasing	0.55	Coal mining	0.31
Consumer goods and general rental centers	0.55	Metal ores mining	0.32
Educational services	0.54	Amusements, gambling, and recreation	0.33
Newspaper, book, and directory publishers	0.54	Apparel manufacturing	0.34
Specialized design services	0.54	Textile product mills	0.35
Wholesale trade	0.54	Plastics and rubber products manufacturing	0.35

Table 2 – Events of "Uncertainty Shocks"

This table summarizes the four economic and political events included in the sample which involve a large, yet sudden increase in aggregate economic uncertainty, and shows the numbers of firm observations in each event window. We identify the event date as the trading date when the VIX index from the Chicago Board of Options Exchange begins to surge leading to a more than two-standard-deviation (of the historical distribution) increase within three months.

	Economic/Political Event	Event Month-Year	Length of Event Window	Num. of Firms	Num. of Firm-quarters
1	Gulf War I	August 1990	Four quarters	2,945	11,190
2	Russian/LTCM Default	August 1998	Four quarters	5,500	19,874
3	9/11 Terrorist Attack	September 2001	Six quarters	5,384	29,203
4	Financial Crisis of 2007-2009	September 2009	Eight quarters	4,141	31,259

Table 3 – Descriptive Statistics on Firm Characteristics

This table presents descriptive statistics on firm characteristics in the sample including four episodes of an exogenous spike in aggregate economic uncertainty from 1989 to 2010. Panel A shows the statistics for the full sample and Panel B splits the sample at the median of the redeployability measure and separately shows statistics for firms below and above the median Redeployability. Log (Total assets) is the natural log of total book assets; Age is the number of years since IPO (proxied by the first appearance in Compustat); Tobin's Q is the ratio of the market value of assets to the book value of assets; Sales growth is computed as the first difference of the natural log of sales; ROA is operating income before depreciation and amortization divided by lagged book assets; Cash flow is after-tax operating income plus depreciations and amortizations divided by lagged book assets; Cash holdings is cash and equivalent divided by lagged book assets; Book leverage is total debt divided by book assets; Capex is capital expenditures divided by lagged book assets; R&D is research and development expenses divided by lagged book assets; Redeployability is the measure of asset redeployability; Investment grade rating is coded as 1 if the bond rating from Standard & Poor's is above or equal to 'BBB-,' and 0 otherwise; KZ and WW indexes are the Kaplan and Zingales (1997) and Whited and Wu (2006) indexes of financial constraints, respectively.

Panel A: Full Sample

	Full Sample	
Variable	Mean	Std Dev
Log(Total assets)	5.537	1.905
Age	14.876	10.560
Tobin's q	1.768	1.273
Sales growth	0.055	0.412
ROA	0.003	0.051
Cash flow	0.001	0.059
Cash holding	0.168	0.208
Book leverage	0.245	0.225
Capex	0.016	0.020
R&D	0.013	0.040
Redeployability	0.410	0.096
Investment grade rating	0.109	0.312
KZ index	0.448	1.146
WW index	-0.255	0.108
Observations	91,526	

Panel B: Samples Sorted by Asset Redeployability

	High Redeployability		Low Redeployability	
Variable	Mean	Std Dev	Mean	Std Dev
Log(Total assets)	5.714	1.873	5.347	1.922
Age	15.970	11.193	13.706	9.701
Tobin's q	1.630	1.107	1.916	1.414
Sales growth	0.054	0.358	0.056	0.463
ROA	0.011	0.043	-0.005	0.058
Cash flow	0.008	0.050	-0.006	0.067
Cash holding	0.123	0.170	0.216	0.233
Book leverage	0.260	0.218	0.228	0.232
Capex	0.015	0.018	0.018	0.022
R&D	0.006	0.027	0.022	0.050
Redeployability	0.474	0.046	0.342	0.089
Investment grade rating	0.131	0.337	0.086	0.280
KZ index	0.443	1.147	0.454	1.145
WW index	-0.269	0.105	-0.239	0.110
Observations	47,318		44,208	

Table 4 – Asset Redeployability, Economic Uncertainty, and Investment

This table presents estimation results of equation (1) for the full sample from 1989 to 2010, which specifies the effect of asset redeployability and uncertainty on investment. The indicator variable 'After' is equal to one for quarters ending after a spike in aggregate economic uncertainty, proxied by the VIX index from the Chicago Board of Options Exchange, and is equal to zero for quarters ending before the spike in uncertainty. Column 5 examines dynamic effects of uncertainty and asset redeployability on investment for the full sample from 1989 to 2010. The indicator variables 'Before (-2)' and 'Before (-1)' are equal to one for quarters ending two and one quarter(s), respectively, before a spike in aggregate economic uncertainty, proxied by the VIX index. The indicator variable 'After (0)' is equal to one if the spike in uncertainty occurs in the current quarter. The indicator variable 'After (1+)' is equal to one for quarters ending at least one quarter after the spike in uncertainty. Definitions of other variables are in Table 3. All standard errors are adjusted for sample clustering at the industry level and computed t-statistics are in parenthesis. *, **, and *** signify results significant at the 10, 5, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:			Capital Expenditure / Assets		
Sample:	Full	Full	Full	Full (Incl. land)	Full
After	-0.268***	-0.886***	-0.619***	-0.605***	-
	(-6.04)	(-3.88)	(-3.16)	(-3.16)	-
After × Redeployability	-	1.508***	1.309**	1.311**	-
	-	(2.92)	(2.60)	(2.58)	-
Tobin's q	-	-	0.214***	0.215***	0.214***
	-	-	(6.39)	(6.39)	(6.53)
Sales growth	-	-	0.217***	0.218***	0.199***
	-	-	(3.65)	(3.63)	(4.78)
Cash flow	-	-	-0.001	-0.001	-0.001
	-	-	(-0.42)	(-0.41)	(-0.40)
Before (-2) × Redeployability	-	-	-	-	-0.413
	-	-	-	-	(-1.51)
Before (-1) × Redeployability	-	-	-	-	0.268
	-	-	-	-	(0.96)
After (0) × Redeployability	-	-	-	-	0.626**
	-	-	-	-	(2.07)
After (1+) × Redeployability	-	-	-	-	1.624**
	-	-	-	-	(2.00)
Firm-event fixed effects	Y	Y	Y	Y	Y
Year-quarter fixed effects	N	N	N	Y	Y
R^2	0.712	0.713	0.720	0.723	0.724
Observations	91526	91526	91526	91526	91526

Table 5 – Changes in Uncertainty and Investment

Columns 1 and 2 present estimation results of equation (2) for the sample of firm-quarter observations after the Gulf War II and financial crisis of 2007-09. The indicator variable 'Decrease' is equal to one for quarters ending after a proxy for aggregate economic uncertainty, the VIX index from the Chicago Board of Options Exchange, decreases to a "normal" level (i.e., less than 20), and is equal to zero for quarters ending before the decrease in uncertainty. Column 3 presents estimation results of equation (2) with the dummy 'Decrease' replaced with the VIX index for the full sample of firm-quarters from 1989 to 2010. Definitions of other variables are in Tables 3 and 4. All standard errors are adjusted for sample clustering at the industry level and computed t-statistics are in parenthesis. *, **, and *** signify results significant at the 10, 5, and 1% levels, respectively.

	(1)	(2)	(3)
Dependent Variable:		Capital Expenditure / Assets	
Sample:	After Gulf War II & 2008-09 Financial Crisis		Full panel
Decrease	-0.002	0.295***	-
	(-0.10)	(3.13)	-
Decrease × Redeployability	-	-0.577**	-
	-	(-2.36)	-
VIX	-	-	-0.019***
	-	-	(-3.11)
Redeployability	-	-	-1.902***
	-	-	(-3.60)
VIX × Redeployability	-	-	0.037**
	-	-	(2.40)
Tobin's q	-	0.152***	0.290***
	-	(4.78)	(8.11)
Sales growth	-	0.075***	0.013***
	-	(2.81)	(3.30)
Cash flow	-	0.003	0.321***
	-	(1.57)	(5.88)
Firm-event fixed effects	Y	Y	Y
Year-quarter fixed effects	N	Y	Y
R^2	0.697	0.705	0.525
Observations	58917	56946	342712

Table 6 – Placebo Tests

This table presents estimation results of equation (1) for the placebo samples of 1994-1996 (column 1), 2004-2006 (column 2), and 1980-1982 (column 3). The indicator variable 'After' is equal to one for quarters ending after July 1st of 1995, 2005, and 1981, respectively, when there is no shocks to aggregate economic uncertainty, and is equal to zero for quarters ending before July 1st of each of the placebo event years. Asset growth is defined as the quarterly percentage change in book assets. Definitions of other variables are as in Tables 3 and 4. All standard errors are adjusted for sample clustering at the industry level and computed t-statistics are in parenthesis. *, **, and *** signify results significant at the 10, 5, and 1% levels, respectively.

	(1)	(2)	(3)
Dependent Variable:	Capital Expenditure / Assets		Asset Growth
Sample:	Year: 1994-96	Year: 2004-06	1981-82 Recession
After	-0.121	-0.101	-1.395***
	(-0.71)	(-1.16)	(-2.77)
After × Redeployability	-0.243	0.155	0.520
	(-0.61)	(0.84)	(0.42)
Tobin's q	0.416***	0.225***	3.033***
	(6.78)	(4.49)	(5.33)
Sales growth	0.105	0.067	2.167***
	(1.30)	(1.51)	(3.92)
Cash flow	0.004	0.00	1.189***
	(0.70)	(0.06)	(3.92)
Firm-event fixed effects	Y	Y	Y
Year-quarter fixed effects	Y	Y	Y
R^2	0.662	0.751	0.288
Observations	30,701	32,157	10,674

Table 7 – Robustness: Empirical Specifications Using Growth Rates

This table shows estimation results of equation (3) for the full sample from 1989 to 2010, which relates the growth rate of investment to asset redeployability, uncertainty, and the growth rates of control variables. Definitions of variables are as in Tables 3 and 4. All standard errors are adjusted for sample clustering at the industry level and computed t-statistics are in parenthesis. *, **, and *** signify results significant at the 10, 5, and 1% levels, respectively.

	(1)	(2)
Dependent Variable:	Δln(Capital Expenditure / Assets)	
Sample:	Full	Full
After	-0.041***	-0.125***
	(-6.99)	(-3.20)
After × Redeployability	-	0.101**
	-	(2.21)
Δln(Tobin's q)	-	0.305***
	-	(14.72)
Δln(Sales growth)	-	0.062***
	-	(7.45)
Δln(Cash holding)	-	0.024***
	-	(3.58)
Firm-event fixed effects	Y	Y
Year-quarter fixed effects	N	Y
R^2	0.001	0.024
Observations	81490	81490

Table 8 – Within-industry Salability of Assets

Panel A of this table splits the full sample into financially constrained and unconstrained groups of industries at the median of each of the three measures (book leverage, cash holding, and the KZ index), and separately estimates the specification in equation (1) for the each of the constrained and unconstrained classification schemes. Panel B sort firms based on the degree of sales co-movement among firms in a given industry (at the median). Sales co-movement is measured using the R-squared of the industry-year level regression of sales on year dummies. Definitions of other variables are as in Tables 3 and 4. All standard errors are adjusted for sample clustering at the industry level and computed t-statistics are in parenthesis. *, **, and *** signify results significant at the 10, 5, and 1% levels, respectively.

Panel A: Liquidity of Industry Peers

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	Capital Expenditure / Assets					
Constraint Criterion:	Book leverage		Cash holding		KZ index	
Sample [Industry]:	Constrained	Unconstrained	Constrained	Unconstrained	Constrained	Unconstrained
After	-0.695***	-0.405**	-0.709***	-0.458***	-0.748***	-0.342**
	(-5.77)	(-2.12)	(-4.06)	(-3.00)	(-3.18)	(-2.25)
After × Redeployability	1.492***	0.812*	1.546***	0.901**	1.573**	0.712**
	(4.39)	(1.69)	(3.37)	(2.38)	(2.51)	(2.10)
Tobin's q	0.397***	0.181***	0.391***	0.179***	0.220***	0.214***
	(6.64)	(7.08)	(6.37)	(6.85)	(3.67)	(6.30)
Sales growth	0.323***	0.148***	0.319***	0.135***	0.249***	0.166***
	(3.99)	(4.32)	(3.47)	(4.84)	(2.80)	(3.93)
Cash flow	0.006	-0.005**	0.004	-0.005*	0.001	-0.003*
	(1.56)	(-2.41)	(1.33)	(-1.91)	(0.27)	(-1.89)
Firm-event fixed effects	Y	Y	Y	Y	0.744	0.701
Year-quarter fixed effects	Y	Y	Y	Y	Y	Y
R^2	0.744	0.658	0.750	0.668	0.746	0.664
Observations	47126	44400	46723	44803	46839	44687

Panel B: Co-movement of Industry Peers

	(1)	(2)
Dependent Variable:	Capital Expenditure / Assets	
Criterion:	Sales comovement	
Sample [Industry]:	High	Low
After	-0.699***	-0.063
	(-4.87)	(-0.36)
After × Redeployability	1.482***	0.016
	(4.02)	(0.04)
Tobin's q	0.312***	0.183***
	(4.24)	(6.31)
Sales growth	0.325***	0.117***
	(4.29)	(4.20)
Cash flow	0.005	-0.005***
	(1.46)	(-2.96)
Firm-event fixed effects	Y	Y
Year-quarter fixed effects	Y	Y
R^2	0.742	0.662
Observations	46049	45477

Table 9 – Sellers' Financial Position and Asset Redeployability

This table splits the full sample of firms into financially constrained and unconstrained groups at the median of each of the three measures (book leverage, cash holding, and the KZ index), and separately estimates the specification in equation (1) for the each of the classification schemes. Definitions of variables are as in Tables 3 and 4. All standard errors are adjusted for sample clustering at the industry level and computed t-statistics are in parenthesis. *, **, and *** signify results significant at the 10, 5, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	Capital Expenditure / Assets					
Constraint Criterion:	Book leverage		Cash holding		KZ index	
Sample [Firms]:	Constrained	Unconstrained	Constrained	Unconstrained	Constrained	Unconstrained
After	-0.729***	-0.451**	-0.657***	-0.564***	-0.733***	-0.441***
	(-3.99)	(-2.54)	(-3.12)	(-3.50)	(-3.02)	(-3.56)
After × Redeployability	1.568***	0.897**	1.429***	1.136***	1.620***	0.848***
	(3.31)	(2.02)	(2.69)	(2.93)	(2.64)	(2.69)
Tobin's q	0.353***	0.188***	0.389***	0.188***	0.214***	0.201***
	(5.24)	(6.56)	(6.07)	(6.85)	(6.53)	(5.38)
Sales growth	0.240***	0.201***	0.233***	0.205***	0.210***	0.215***
	(3.55)	(3.84)	(3.56)	(3.75)	(3.15)	(4.32)
Cash flow	0.004	-0.005**	0.005**	-0.006*	0.000	-0.002
	(1.35)	(-2.60)	(2.05)	(-1.89)	(0.02)	(-1.37)
Firm-event fixed effects	Y	Y	Y	Y	Y	Y
Year-quarter fixed effects	Y	Y	Y	Y	Y	Y
R^2	0.734	0.712	0.749	0.698	0.735	0.701
Observations	45947	45579	45428	46098	47503	44023

Table 10 – Omitted Firm or Industry Characteristics

This table presents estimation results of equation (4) to control for omitted firm or industry characteristics. In Panel A, proxies for potential omitted firm characteristics are interacted with the dummy variable 'After.' Column 2 adds Tobin's q, column 3 adds firm size, column 4 adds firm age, column 5 adds return on assets, and column 6 adds leverage. Panel B examines alternative explanations for the main results related to investment lumpiness and depreciation rates of capital. 'Autocorr' measures the lumpiness of investment by the industry-level mean of the first-order autocorrelation (AR(1)) of firm-level investment rates. 'LargestInv' follows Doms and Dunne (1998) and measures lumpiness as the industry mean ratio of investment for the quarter with the largest investment over the last 16 quarters divided by the sum of investment for the same 16 quarters. The depreciation rate is obtained from the BEA at the industry level. In Panel C, we re-estimate the specification in equation (1) for subsamples consisting of non-service industries. Column 2 (column 3) is for the non-service (manufacturing) industries based on the NAICS code. Definitions of variables are as in Tables 3 and 4. All standard errors are adjusted for sample clustering at the industry level and computed t-statistics are in parenthesis. *, **, and *** signify results significant at the 10, 5, and 1% levels, respectively.

Panel A: Observed Firm Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:			Capital Expenditure / Assets			
Sample:	Full	Full	Full	Full	Full	Full
Industry Characteristic	-	Tobin's q	Size	Age	ROA	Leverage
After	-0.619***	-0.794***	-0.239	-0.773***	-0.593***	-0.464***
	(-3.16)	(-3.71)	(-0.96)	(-3.75)	(-3.36)	(-3.26)
After × Redeployability	1.309**	1.355***	1.317***	1.232***	1.303***	1.340***
	(2.60)	(3.03)	(2.67)	(2.67)	(2.78)	(3.09)
After × Industry Characteristic	-	0.075**	-0.070**	0.014**	-0.291	-0.725**
	-	(2.53)	(-2.17)	(2.26)	(-1.06)	(-2.62)
Tobin's q	0.214***	0.222***	0.218***	0.211***	0.217***	0.221***
	(6.39)	(6.60)	(6.56)	(6.40)	(6.59)	(6.44)
Sales growth	0.217***	0.218***	0.217***	0.213***	0.218***	0.221***
	(3.65)	(3.66)	(3.62)	(3.64)	(3.68)	(3.74)
Cash flow	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.42)	(-0.49)	(-0.46)	(-0.35)	(-0.50)	(-0.49)
Firm-event fixed effects	Y	Y	Y	Y	Y	Y
Year-quarter fixed effects	Y	Y	Y	Y	Y	Y
R^2	0.720	0.723	0.723	0.723	0.723	0.724
Observations	91526	91524	91526	91526	91508	91526

Panel B: Investment Lumpiness and Capital Depreciation Rates

	(1)	(2)	(3)	(4)
Dependent Variable:		Capital Expenditure / Assets		
Sample:	Full	Full	Full	Full
After	-0.619***	-0.969***	-0.611**	-0.581***
	(-3.16)	(-3.38)	(-2.31)	(-2.96)
After × Redeployability	1.309**	1.371***	1.306***	1.397***
	(2.60)	(2.69)	(2.66)	(2.82)
After × Autocorr	-	0.485*	-	-
	-	(1.73)	-	-
After × LargestInv	-	-	-0.041	-
	-	-	(-0.04)	-
After × Depreciation	-	-	-	-0.757
	-	-	-	(-0.98)
Tobin's q	0.214***	0.216***	0.214***	-0.757
	(6.39)	(6.52)	(6.60)	(-0.98)
Sales growth	0.217***	0.217***	0.217***	0.213***
	(3.65)	(3.63)	(3.67)	(6.37)
Cash flow	-0.001	-0.001	-0.001	0.217***
	(-0.42)	(-0.43)	(-0.41)	(3.64)
Firm-event fixed effects	Y	Y	Y	Y
Year-quarter fixed effects	Y	Y	Y	Y
R^2	0.712	0.723	0.723	0.723
Observations	91526	91526	91526	91309

Panel C: Alternative Industry Samples

	(1)	(2)	(3)
Dependent Variable:		Capital Expenditure / Assets	
Sample:	Full	Non-service Industries Only	Manufacturing Industries Only
After	-0.619***	-0.738***	-0.431**
	(-3.16)	(-4.11)	(-2.30)
After × Redeployability	1.309**	1.673***	1.010**
	(2.60)	(3.40)	(2.10)
Tobin's q	0.214***	0.221***	0.175***
	(6.39)	(4.72)	(5.60)
Sales growth	0.217***	0.216***	0.139***
	(3.65)	(2.98)	(4.24)
Cash flow	-0.001	0.001	-0.002
	(-0.42)	(0.25)	(-0.86)
Firm-event fixed effects	Y	Y	Y
Year-quarter fixed effects	Y	Y	Y
R^2	0.712	0.723	0.642
Observations	91526	66919	45543

Table 11 – Alternative Explanation: Supply of External Finance

This table examines an alternative explanation for the main results related to the supply of external finance. The sample in column 2 excludes firm-quarters during events spurred by financial market shocks (i.e., LTCM/Russian defaults and 2007-09 financial crisis). Definitions of variables are as in Tables 3 and 4. All standard errors are adjusted for sample clustering at the industry level and computed t-statistics are in parenthesis. *, **, and *** signify results significant at the 10, 5, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	Capital Expenditure / Assets				
Sample:	Full	No Fin. Shock	Full	Full	Full
After	-0.619***	-0.640***	0.133	-0.717***	-0.051
	(-3.16)	(-4.83)	(0.66)	(-3.96)	(-0.13)
After × Redeployability	1.309**	1.215***	1.252***	1.371***	1.277***
	(2.60)	(4.04)	(3.02)	(3.27)	(3.14)
After × Inv. grade rating	-	-	1.257***	-	0.101***
	-	-	(4.73)	-	(3.14)
After × WW index	-	-	3.365***	-	-0.234
	-	-	(4.63)	-	(-1.09)
After × KZ index	-	-	-	-0.023	-0.032**
	-	-	-	(-0.37)	(-2.41)
After × Cash holding	-	-	-	0.488**	0.288***
	-	-	-	(2.46)	(3.10)
Tobin's q	0.214***	0.187***	0.221***	0.221***	0.222***
	(6.39)	(7.80)	(6.52)	(6.54)	(6.45)
Sales growth	0.217***	0.221***	0.213***	0.217***	0.213***
	(3.65)	(5.47)	(3.57)	(3.69)	(3.58)
Cash flow	-0.001	-0.002	-0.001	-0.001	-0.001
	(-0.42)	(-0.54)	(-0.44)	(-0.50)	(-0.47)
Firm-event fixed effects	Y	Y	Y	Y	Y
Year-quarter fixed effects	Y	Y	Y	Y	Y
R^2	0.720	0.716	0.724	0.723	0.724
Observations	91526	40393	91526	91524	91524

Appendix Table 1 - The Fifteen Most and Fifteen Least Redeployable Industries in Non-service Sector

This table shows the fifteen most and the fifteen least redeployable industries in the non-service sector based on the measure of asset redeployability.

Most redeployable industries		Least redeployable industries	
Industry	Redeployability	Industry	Redeployability
Wholesale trade	0.54	Oil and gas extraction	0.12
Warehousing and storage	0.54	Rail transportation	0.17
Couriers and messengers	0.53	Water transportation	0.23
New and maintenance and repair construction	0.53	Air transportation	0.24
Leather and allied product manufacturing	0.51	Textile mills	0.24
Scenic and sightseeing transportation	0.51	Semiconductor & electronic component manufacturing	0.25
Printing and related support activities	0.48	Agriculture and forestry support activities	0.27
Agricultural chemical manufacturing	0.48	Fishing, hunting and trapping	0.28
Transit and ground passenger transportation	0.48	Coal mining	0.31
Boiler, tank, & shipping container manufacturing	0.47	Metal ores mining	0.32
Soap, cleaning compound, & toiletry manufacturing	0.47	Apparel manufacturing	0.34
Electric lighting equipment manufacturing	0.47	Textile product mills	0.35
Cutlery and handtool manufacturing	0.47	Plastics and rubber products manufacturing	0.35
Truck transportation	0.47	Electronic instrument manufacturing	0.35
Household appliance manufacturing	0.47	Aerospace product and parts manufacturing	0.35