Online Appendix to:
Why Isn't Business Investment More Sensitive to Interest Rates: Evidence from Surveys

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A. Survey Measures of Growth Opportunities

Regarding measures of growth prospects, we focus on the three most promising metrics: the firm's expected 12-month growth of (i) revenue, (ii) earnings, and (iii) capital expenditures.[1] While expected capital expenditures (capex) are obviously a very relevant measure given our focus, the measure from the survey only gauges capex relative to its previous year level, which could be quite small, even zero. Furthermore, since capital expenditures can be lumpy, one-year growth will tend to be a noisy measure of overall growth prospects. A better measure would be expected growth in their stock of capital assets, which is unfortunately unavailable in the survey.

Consequently, the two measures of growth prospects we focus on are expected revenue growth and expected earnings growth (over next 12 months), which ought to be reasonable measures of growth prospects, at least in the medium term, and closely related to each other. Among these two measures, however, we favor expected revenue growth because, in the cross-section, earnings has the disadvantage of potentially taking on negative values, making the interpretation of the expected growth rate problematic for some firms. For this reason, we use expected revenue growth as our baseline measure of growth opportunities, and report results with earnings growth in our robustness checks.

Figure A.1 shows the distribution of firms in our sample by expected growth in capital expenditures (Panel A) and expected earnings growth (Panel B). The leftmost and rightmost bars of each distribution include the bottom and top 10 percent of each distribution, respectively. The distribution of firms by expected growth in capital expenditures clearly has very long tails, with the 10th and 90th percentiles at -20 percent and 25 percent, respectively. This is consistent with annual capital expenditures being quite lumpy and volatile, which would presumably make this a relatively noisy measure of a firm's growth prospects. The distribution of expected earnings growth, in Panel B, is similar to that for revenue growth,

[1] We also considered a measure of expected employee growth, which was correlated with the others, missing more frequently than revenue and more imprecisely estimated, owing to separate questions about domestic and foreign employment, without information to determine weights.

though somewhat more skewed to the right. Also, this measure is missing for about 10 percent of the sample (observations for which all other data, including revenue growth, is not missing).

[Insert Figure A.1 about here]

B. Results from the 2014:Q1 Survey

The 2012:Q3 survey was arguably conducted during a period of usually low interest rates and concerns about weak aggregate demand. One question is naturally whether the reported sensitivity of investment would be different in a period of stronger aggregate demand conditions. To shed some light to this question, we can exploit results from the Duke/CFO survey conducted in 2014:Q1 survey, taking advantage of the firming of the U.S. economy in the year and half since the survey we use for our analysis was conducted. In particular, the 2014:Q1 firms were asked: "Compared to interest rates today, how much would your borrowing costs have to increase to cause your company to reduce capital spending?" Respondents were allowed to choose any integer, or mid-point between integers, ranging from 0 to 10, but were not offered the choice "likely would not change plans." It seems quite likely that, because this choice was not offered, many who might have chosen "likely would not change plans" instead chose "not applicable." One important difference between the 2012:Q3 and 2014:Q1 surveys is that the 2014:Q1 survey did not explicitly asked respondents to consider an increase in rates that maintained cost and demand conditions constant.

The distribution of responses to this question in the 2014:Q1 survey is summarized in Table A.1, in comparison with the responses given to the 2012:Q3 survey. In order to compare the results with the distribution of responses in the 2012:Q3 survey reported in Table 1, the response choices 1.5 and 2.5 percentage points were grouped with responses 1 and 2 percentage points, respectively. Overall, the distribution of responses is quite similar to that from the 2012:Q3 survey, confirming that the propensity to report little sensitivity to increases in borrowing costs had yet to significantly change.

[Insert Table A.1 about here]

In Table A.2, we report the results of running Tobit regressions equivalent to those reported in Table 5 of the paper using the responses from the 2014:Q1 survey. Similar to the 2012:Q3 survey, firms in the 2014:Q1 survey with stronger growth opportunities reported that they would require larger increases in interest rates in order to reduce capital expenditures, making such firms relatively more insensitive to increases in interest rates.

[Insert Table A.2 about here]

C. Interest Rate Sensitivity of Investment Plans by Firm Concerns

To assess the degree to which the economic situation in Europe at the time of the survey affected the degree of interest rate sensitivity of firms in the sample, we use answers from a special question asked of respondents in the 2012Q3 GBO survey: "What is the effect on your company of the current economic climate in Europe?" Among the firms that responded to this question, few reported a very negative effect, about 45% reported a negative effect, 48% reported a neutral effect, and a few reported a positive or very positive effect. As shown in Table A.3, firms that reported negative or very negative Europe effects display no difference in the degree of interest rate sensitivity compared to the other firms (the vast majority of the differences across groups are not statistically significant), suggesting that pronounced concerns about weakening demand from spillovers from the European debt crisis are not an important explanation for the relative insensitivity of investment plans to interest rates in our sample.

[Insert Table A.3 about here]

D. Sticky Hurdle Rates as a Framework for Investment Decisions

The responses to the GBO survey summarized in Table 1 suggests that in practice investment plans are not very sensitive to interest rates on average. The relative insensitivity to interest rates contrasts with existing findings that investment is responsive to the cost of capital goods, depreciation, and other non-interest rate components of the user cost of capital (Tevlin and Whelan 2003, Schaller 2006). A simple framework that explains these two findings is a setting that accounts for sticky hurdle rates. In particular, consider a firm

that faces potential projects that require an initial investment in the current period of c_k and pay a future cash flow per period of A_k. The firm only invests in project k if its internal rate return (IRR) is above the hurdle rate of the firm, that is, if:

$$IRR_k = \frac{A_k}{c_k} \geq Hurdle\ Rate \qquad (A.1)$$

If the hurdle rate does not respond much to interest rates, then firm investment decisions will not be very responsive to changes in interest rates. However, changes in other elements of the cost of capital, like the price of investment goods, still modify the IRR of the project (through c_k), thus making investment sensitive to other user cost factors.

Hurdle rates reported by firms tend to be well above the firm's weighted cost of capital (WACC), as documented by Graham and Harvey (2011) and Jagannathan et al. (2016). This finding is consistent with the results of the 2012:Q2 GBO survey, in which firms reported an average hurdle rate of 13.5% and average WACC of 9.3%.[2] This means that the hurdle rate can be thought of as the sum of the WACC and non-WACC components. As reviewed by Jagannathan et al. (2016), the non-WACC component may reflect, among other factors, a tendency of the firms to use high discount rates to account for concerns about idiosyncratic risk or for operational constraints that force managers to be more selective of the projects they can undertake because of limited managerial or organizational capital, or to guard against overly optimistic cash flow forecasts.

$$Hurdle\ Rate = WACC + non - WACC\ component$$

Because many firms are primarily financed by equity instead of debt, for many firms the WACC is responsive to interest rates mostly to the extent that the expected return on equity is sensitive to interest rates. In addition, many of the explanations proposed about the non-WACC component of hurdle rates are

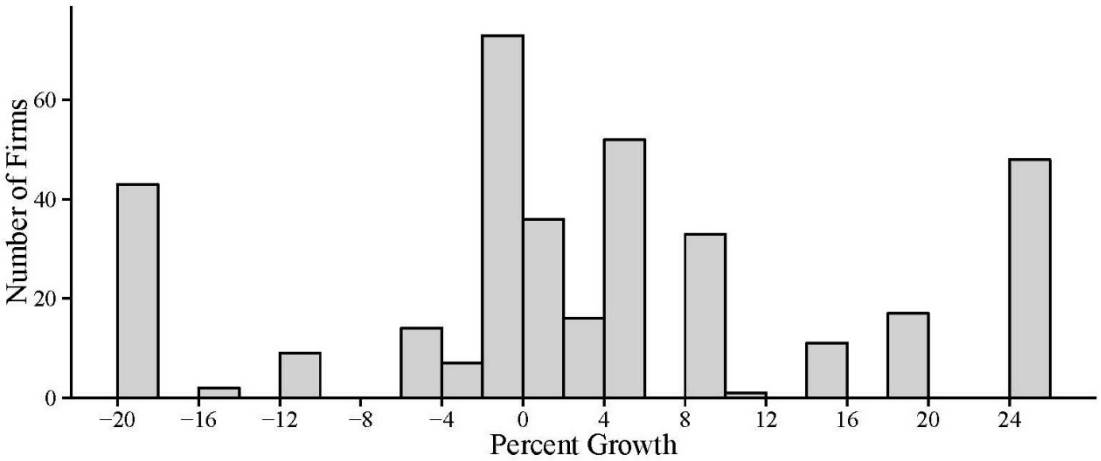
[2] 2012:Q2 is the survey asking questions about hurdle rates that was closest in time to the 2012:Q3 survey we use most extensively in the paper.

not factors that are very sensitive to interest rates. In other words, there are reasons to suspect that hurdle rates do not respond very much to interest rates.

In practice, Figure 1 in the paper indicates that hurdle rates reported in different survey studies have not changed much despite the significant decline in interest rates over the past couple of decades. In addition, the hurdle rates of firms that respond to the GBO survey appear to be not very responsive to interest rates. In a special question included in the 2012:Q2 survey, respondents were asked to consider a situation in which they recently approved a project that just met its hurdle rate. Starting from this hypothetical situation, respondents were asked whether or not a 1 percentage point increase in interest rates would change their decision about pursuing the hypothetical project. Separately, they were asked about the implications of a 2 percentage point increase in interest rates. Only 3% (17%) of respondents answered that, faced with 1 percentage point (2 percentage points) higher rates, they would now delay or stop the hypothetical project.

The simple framework in equation (A.1) could also help to understand the finding in Tables 3 and 4 in the paper that firms with stronger growth prospects tend to be less responsive to interest rates. In particular, consider a situation in which equation (A.1) is a necessary but not sufficient condition for investment. That is, firms do not pursue all projects that meet their hurdle rates. Consistent with this assumption, responses to the GBO survey conducted in 2012:Q2 indicated that more than half of firms did not pursue all the projects that meet their hurdle rate. These responses suggest that for many firms, the marginal project has an IRR well above its hurdle rate. These firms are likely less responsive to interest rates, as, for example, marginal increases in (sticky) hurdle rates brought about by raises in interest rates are less likely to affect the decision on the marginal project. Firms with stronger growth prospects are likely to be those for which the marginal project is well above the hurdle rate. However, the 2012:Q3 survey does not provide evidence for or against this hypothesis, albeit the 2011:Q4 survey does.

Panel A. Distribution by Expected Growth in Capital Expenditures



Panel B. Distribution by Expected Earnings Growth

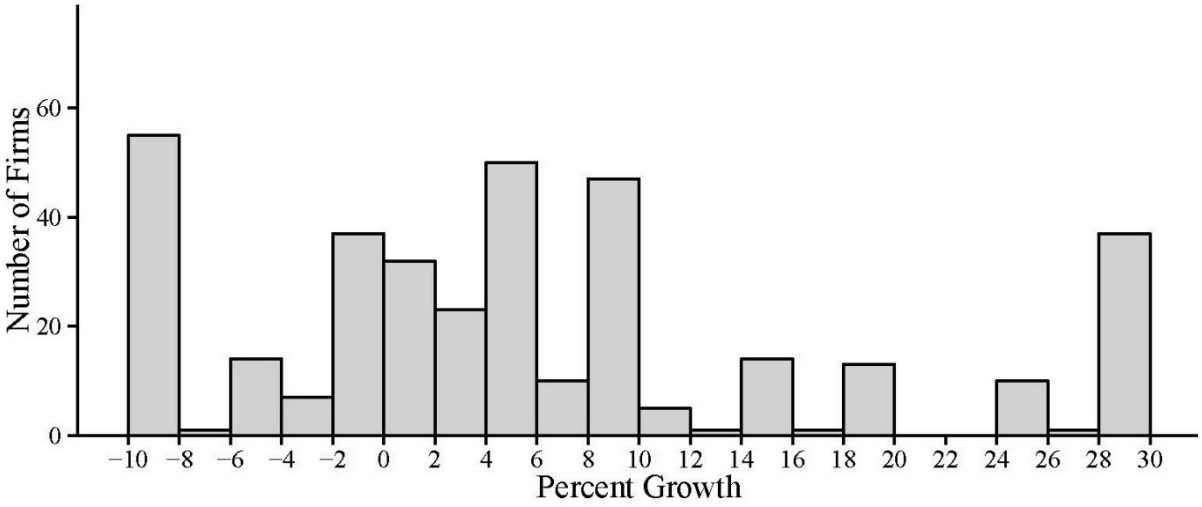


Figure A.1. The figure plots the distribution of respondents to the GBO survey in 2012:Q3 that compose the sample of firms in Table 3 by expected growth in capital expenditures (Panel A) and by expected earnings growth (Panel B).

Table A.1. Sensitivity to Increase in Interest Rates across Surveys

This table compares responses in the 2012:Q3 survey (column (1)) to responses to a similar question added to the 2014:Q1 survey (column (2)) that asked "Compared to interest rates today, how much would your borrowing costs have to increase to cause your company to reduce capital spending?" One notable variation from Table 1, percentages are reported with respect to the total number of firms that answered the question, including those that chose "N.A." as their response. In the later survey, respondents were allowed to choose any integer, or mid-point between integers, ranging from 0 to 10, but were not offered the choice "likely would not change plans." For comparison purposes, response choices 1.5, 2.5, were grouped with responses 1, 2, respectively.

Minimum interest rate increase required to reduce capital spending	(1) 2012:Q3 survey	(2) 2014:Q1 survey
	Number (pct.)	Number (pct.)
0.5 percentage point	30 (4.4%)	4 (1.4%)
1 percentage point	52 (7.6%)	13 (4.6%)
2 percentage points	85 (12.5%)	43 (15.3%)
3 percentage points	61 (9.0%)	20 (7.1%)
More than 3 percentage points	108 (15.9%)	84 (29.9%)
Likely would not change plans	198 (29.1%)	----
Not applicable	146 (21.5%)	117 (41.6%)
Memo: Total no. of responses	680	281

Table A.2. Regressions of Interest Rate Change Required to Prompt Investment Reaction

This table reports coefficients estimates and their standard errors from Tobit regressions with dependent variable equal to the reported interest rate increase needed to induce the respondent to reduce capital spending in the next year as reported in the 2014:Q1 survey. The dependent variable is right censored at 3.1 percentage points. More formally, the baseline specification is: $Threshold\ rate\ increase_i = \max\{3.1,\ \delta' X_i + u_i\}$, where u is an independent and identically distributed normal disturbance. For the 2014:Q1 survey, *No plans to borrow* is a dummy equal to 1 for firms that responded "we do not borrow" to the question "The Federal Reserve has begun tapering its quantitative easing program. In response to tapering and other changes in monetary policy, by how much, if at all, do you expect your borrowing costs to change by the end of 2014?" All other variables are explanatory variables in the vector X are defined as in Table 4. The sample in column (3) is restricted to firms expecting growth greater than −5%. The sample in column (4) is further restricted to firms that gave a response for expected growth in capital expenditures. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Dependent variable	Increase needed to prompt response			
	(1)	(2)	(3)	(4)
No plans to borrow	-0.329	-0.080	-0.745	-1.050
	[0.395]	[0.466]	[0.469]	[0.557]
Working capital concerns	0.031	0.011	0.061	0.002
	[0.273]	[0.321]	[0.279]	[0.335]
Balance sheet concerns	-0.245	-0.238	-0.262	-0.237
	[0.288]	[0.337]	[0.337]	[0.378]
Uncertainty concerns	0.292	0.568*	0.160	0.062
	[0.264]	[0.320]	[0.277]	[0.324]
Expected revenue growth	0.036**		0.047**	0.059***
	[0.015]		[0.019]	[0.022]
Expected earnings growth		0.015		
		[0.011]		
Size	0.072	0.134	0.063	0.036
	[0.073]	[0.086]	[0.080]	[0.091]
Privately held	-0.235	-0.156	-0.205	-0.181
	[0.316]	[0.344]	[0.329]	[0.369]
Constant	2.911***	2.853***	2.865***	2.835***
	[0.515]	[0.568]	[0.542]	[0.587]
Observations	136	129	121	103
Pseudo R^2	0.0847	0.0679	0.0934	0.1079
Censored Observations	69	68	64	56

Table A.3. Interest Rate Sensitivity of Investment Plans by Firm Concerns

This table summarizes responses in the 2012:Q3 GBO survey to special questions about the sensitivity of investment plans to changes in interest rates. Columns (1) and (2) summarizes responses to the question: "By how much would your borrowing costs have to decrease to cause you to initiate, accelerate, or increase investment projects next year?" Columns (4) and (5) summarizes responses to the question: "By how much would your borrowing costs have to increase to cause you to delay or stop investment projects next year?" Columns (3) and (6) show the difference between the fractions in the preceding two columns with statistical significance. Statistics are calculated on the subsamples based on whether or not the firms responded either "Very Negative" or "Negative" to the question "What is the effect on your company of the current economic climate in Europe?" Percentages are reported with respect to the total number of firms that answered the question with an answer different from "Not applicable." *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Change in borrowing costs that would prompt a change in investment plans	In response to a decrease in interest rates			In response to an increase in interest rates		
	Negative effect from European economic climate	Non-Negative effect from European economic climate	Difference	Negative effect from European economic climate	Non-Negative effect from European economic climate	Difference
	(1)	(2)	(3)	(4)	(5)	(6)
	Number (pct.)	Number (pct.)	(pct. points)	Number (pct.)	Number (pct.)	(pct. points)
0.5 percentage point	8 (4%)	4 (2%)	2	9 (4%)	10 (5%)	-1
1 percentage point	9 (4%)	13 (6%)	-2	22 (10%)	15 (7%)	3
2 percentage points	11 (5%)	20 (10%)	-5*	37 (16%)	34 (17%)	-1
3 percentage points	14 (6%)	6 (3%)	3	24 (11%)	22 (11%)	0
More than 3 percentage points	29 (13%)	16 (8%)	5*	46 (20%)	42 (21%)	-1
Likely would not change plans	154 (68%)	144 (71%)	-3	87 (39%)	80 (39%)	0
Total	225 (100%)	203 (100%)		225 (100%)	203 (100%)	