Surveying Business Uncertainty
Online Appendices, Not Intended for Publication

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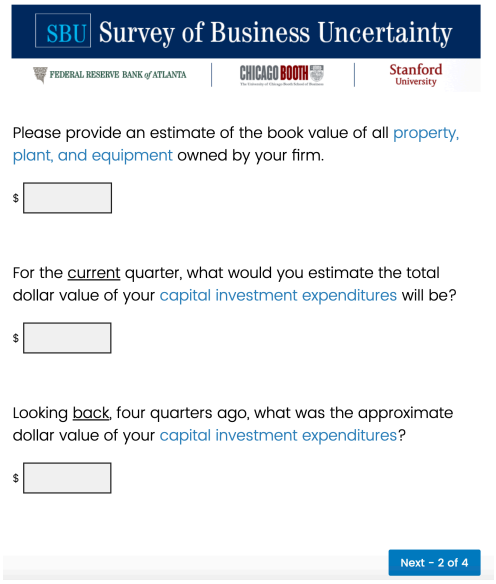
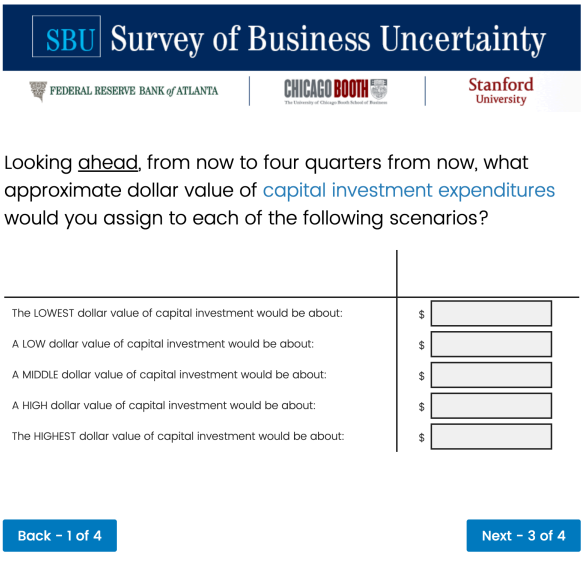
August 2020

A. Additional Information about the SBU

Figure A.1: Capital Expenditures Questionnaire, May 2019 - present





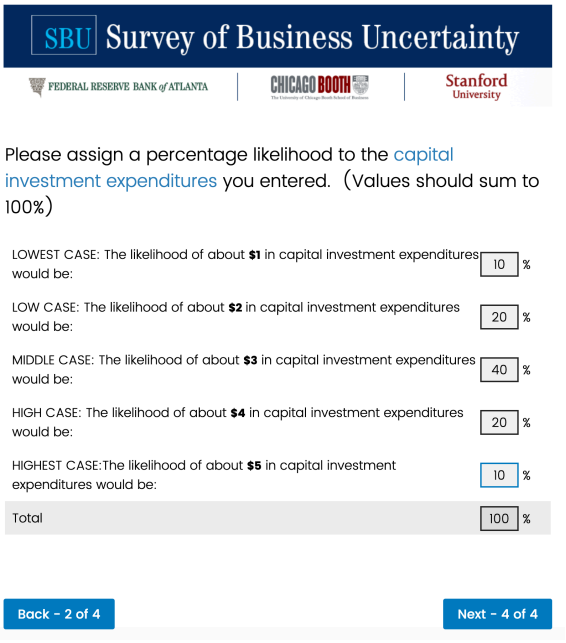
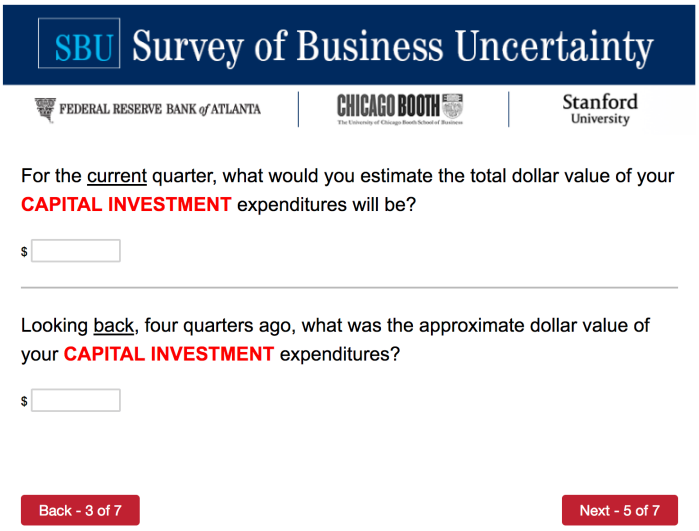


Figure A.2: Capital Expenditures Questionnaire, Prior to May 2019



SBU Survey of Business Uncertainty

FEDERAL RESERVE BANK of ATLANTA | CHICAGO BOOTH | Stanford University

For the current quarter, what would you estimate the total dollar value of your **CAPITAL INVESTMENT** expenditures will be?

$

Looking back, four quarters ago, what was the approximate dollar value of your **CAPITAL INVESTMENT** expenditures?

$

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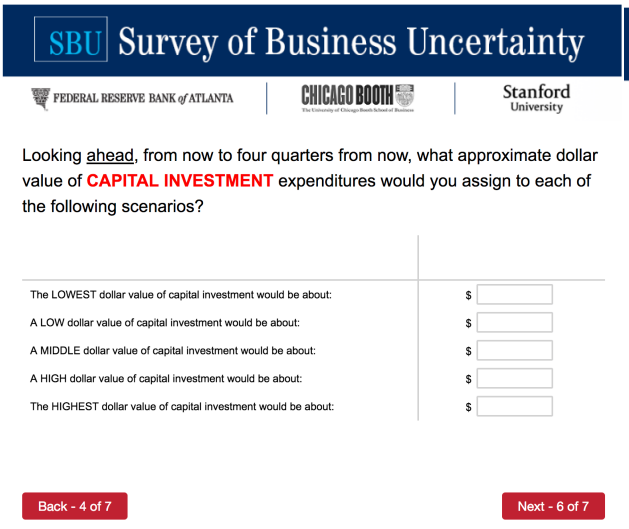

SBU Survey of Business Uncertainty

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Looking ahead, from now to four quarters from now, what approximate dollar value of **CAPITAL INVESTMENT** expenditures would you assign to each of the following scenarios?

The LOWEST dollar value of capital investment would be about:	$
A LOW dollar value of capital investment would be about:	$
A MIDDLE dollar value of capital investment would be about:	$
A HIGH dollar value of capital investment would be about:	$
The HIGHEST dollar value of capital investment would be about:	$

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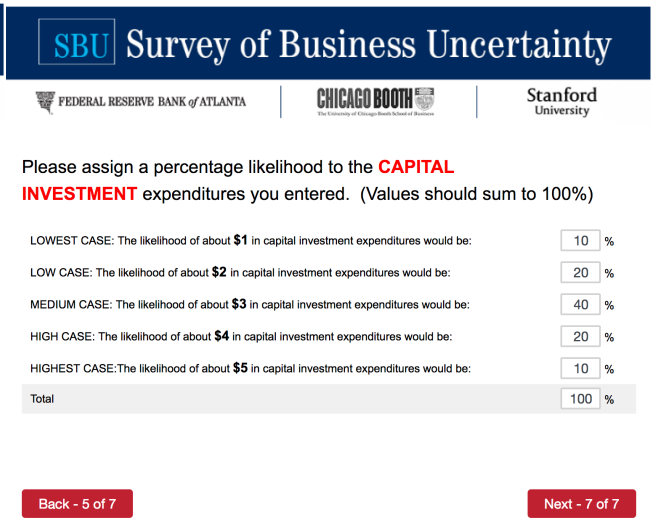

SBU Survey of Business Uncertainty

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Please assign a percentage likelihood to the **CAPITAL INVESTMENT** expenditures you entered. (Values should sum to 100%)

LOWEST CASE: The likelihood of about **$1** in capital investment expenditures would be:	10 %
LOW CASE: The likelihood of about **$2** in capital investment expenditures would be:	20 %
MEDIUM CASE: The likelihood of about **$3** in capital investment expenditures would be:	40 %
HIGH CASE: The likelihood of about **$4** in capital investment expenditures would be:	20 %
HIGHEST CASE:The likelihood of about **$5** in capital investment expenditures would be:	10 %
Total	100 %

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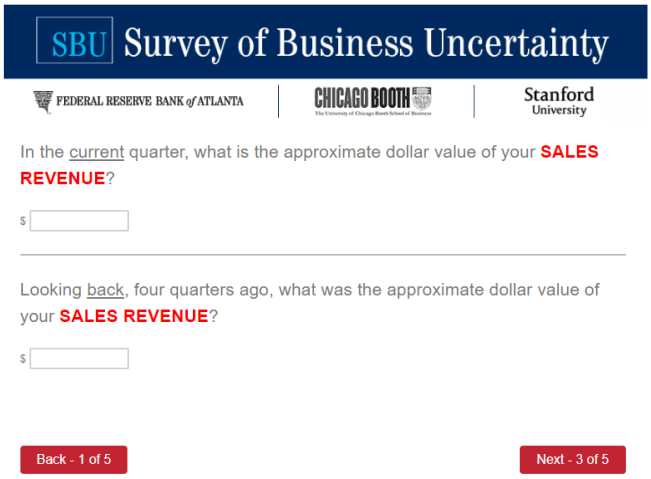
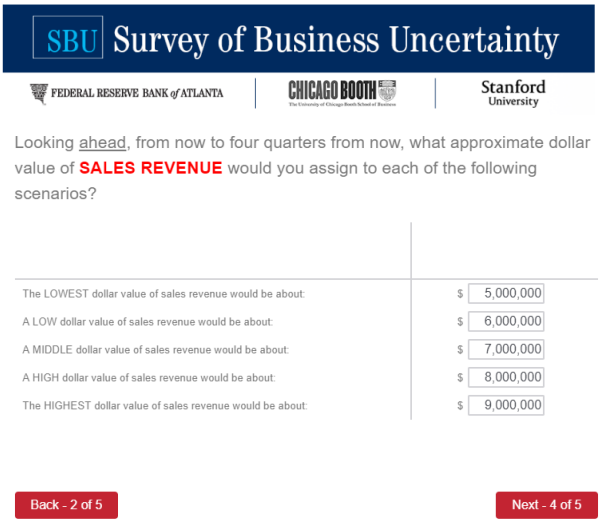
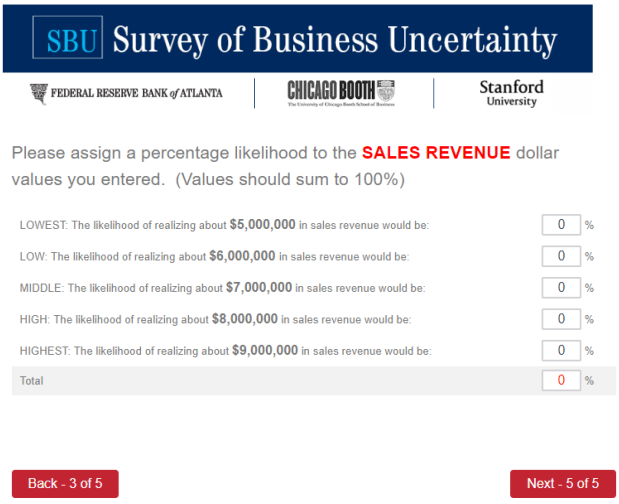
Figure A.3: Sales Question (in levels) During SBU 1st Generation (August 2014 - August 2016)







A.1 Obtaining subjective moments (expectations and uncertainty) about future own-firm outcomes from the raw survey data

- The next few slides slides explain how we use the survey responses to compute moments of subjective probability distributions over own–firm future outcomes.
- We calculate first and second moments of the subjective growth rate distributions of employment, sales and unit costs over the next 12 months or four quarters, as appropriate.
- Following standard practice in the literature on business–level dynamics, we calculate the growth rate of *x* from *t–1* to *t* as $g_t = 2(x_t - x_{t-1})/(x_t + x_{t-1})$. *
- For capital investment, we calculate first and second moments of the subjective distribution for future investment rate (I/K).

* This definition of the growth rate of sales is convenient for its symmetry around zero and because its support lies on the closed interval [–2, 2], with the endpoints of the interval corresponding to entry and exit. See "Gross Job Creation, Gross Job Destruction, and Employment Reallocation" by Steven J. Davis and John Haltiwanger in the 1992 *Quarterly Journal of Economics* for a more extensive discussion.

A.1.1 Employment

Respondent Data

$CEmp =$ firm's current employment level, as reported by the respondent

$FEmp_i =$ employment 12 months hence, $i = 1, 2, 3, 4, 5$

$p_i =$ *the associated probabilities,* $i = 1, 2, 3, 4, 5$

Scenario-Specific Growth Rates

$EGr_i = 2(FEmp_i - CEmp)/(FEmp_i + CEmp),\ i = 1, 2, 3, 4, 5$

First and Second Moments of the Subjective Growth Rate Distribution

$Mean(EGr) = \sum_{i=1}^{5} p_i\, EGr_i$

$Var(EGr) = \sum_{i=1}^{5} p_i (EGr_i - Mean(EGr))^2$

$SD(EGr) = \sqrt{Var(EGr)}$

A.1.2 Sales Revenue (Current SE Questionnaire)

Respondent Data

$CSale =$ firm's sales revenue in the current quarter, as reported by the respondent

$FSaleGr_i =$ respondent's scenario–specific sales growth rate from now to four quarters hence, $i = 1, 2, 3, 4, 5$

$p_i =$ *the associated probabilities,* $i = 1, 2, 3, 4, 5$

Implied Future Sales Level

$FSale_i = \left(1 + \frac{FSaleGr_i}{100}\right) CSale, i = 1, 2, 3, 4, 5$

Scenario–Specific Growth Rates (re–expressing respondent growth rates to our growth rate measure)

$SaleGr_i = 2(FSale_i - CSale)/(FSale_i + CSale) = 2FSaleGr_i/(FSaleGr_i + 2), i = 1, 2, 3, 4, 5$

First and Second Moments of the Subjective Growth Rate Distribution

$Mean(SaleGr) = \sum_{i=1}^{5} p_i \, SaleGr_i$

$Var(SaleGr) = \sum_{i=1}^{5} p_i (SaleGr_i - Mean(SaleGr)_i)^2$

$SD(SaleGr) = \sqrt{Var(SaleGr)}$

A.1.3 Sales Revenue (Old SE Questionnaire)

Respondent Data

$CSale =$ firm's sales revenue in the current quarter, as reported by the respondent

$FSale_i =$ sales revenue four quarters hence, $i = 1, 2, 3, 4, 5$

$p_i =$ the associated probabilities, $i = 1, 2, 3, 4, 5$

Scenario–Specific Growth Rates

$SaleGr_i = 2(FSale_i - CSales)/(FSale_i + CSale), i = 1, 2, 3, 4, 5$

First and Second Moments of the Subjective Growth Rate Distribution

$Mean(SaleGr) = \sum_{i=1}^{5} p_i \, SaleGr_i$

$Var(SaleGr) = \sum_{i=1}^{5} p_i (SaleGr_i - Mean(SaleGr))^2$

$SD(SaleGr) = \sqrt{Var(SaleGr)}$

A.1.4 Capital Investment Rates

Respondent Data

$CCap =$ firm's capital investment expenditures in the current quarter, as reported by the respondent

$FCap_i =$ capital investment expenditures 4 quarters hence, $i = 1, 2, 3, 4, 5$

$p_i =$ the associated probabilities, $i = 1, 2, 3, 4, 5$

$K =$ our measure of the firm's capital stock

Current Investment Rate

$CInvRate = CCap/K$, which we winsorize at the 1st and 99th percentiles

First and Second Moments of the Subjective Distribution for Future Capex:

$Mean(FCap) = \sum_{i=1}^{5} p_i \, FCap_i$

$Var(FCap) = \sum_{i=1}^{5} p_i (FCap_i - Mean(FCap))^2$

$SD(FCap) = \sqrt{Var(FCap)}$

Capital Investment Rates (cont.)

First and Second Moments of the Distribution of Future Investment Rates:

$Mean(InvRate) = Mean(FCap)/K$

$SD(InvRate) = SD(FCap)/K$

We also winsorize these first and second moments at the 1st and 99th percentiles

A.1.5 Measuring Capital Stocks

- In September and October 2017 as well as February and March 2019 we included the following special question with the CC (Capex/Unit Costs) questionnaire:

  Please provide an estimate of the book value of all property, plant, and equipment owned by your firm.

  $ 0

- We thus have data on our respondents' capital stock (PPENT) during at most two survey waves.
- Our goal is to approximate firm's actual investment rates $\left(\frac{I}{K}\right)_t$ in quarter *t*, as well as their expectations and uncertainty for future investment from the standpoint of quarter *t:* $\mathrm{E_t}\left[\left(\frac{I}{K}\right)_{t+4}\right]$, $\mathrm{SD_t}\left[\left(\frac{I}{K}\right)_{t+4}\right]$ in <u>all survey waves</u>.

- We impute the firm's capital stock based on the responses to the special questions from September/October 2017 and February/March 2019 as follows:
  - <u>Case 1. We observe a firm's reported capital stock once:</u>
    In this case we impute the capital stock $K_t = \mathrm{K}$,the reported capital stock for all survey waves t the firm participates in.
  - <u>Case 2. We observe a firm's reported capital stock twice, once in 2017 and once in 2019:</u>
    - In months prior to the first observation, we impute $K_t = K_1$, the first reported capital stock.
    - In months between the two observations, we impute $K_t = w_t * K_1 + (1 - w_t) * K_2$ where $w_t = (D_2 - t)/(D_2 - D_1)$, $D_i, i = 1,2$ is an integer representing the month in which we observe a reported capital stock, and $D_1 < t < D_2$.
  - <u>Case 3. We do not observe the firm's reported capital stock in any survey wave:</u>
    - We impute K_t based on a regression $\log K_{ft} = \alpha_s + \alpha_t + \beta \log E_{ft} + \varepsilon_{ft}$ where f indexes firms, s indexes sectors, and t indexes dates and $E =$ employment. Our estimate for $\hat{\beta} = 1.009(0.013)$ and the R-squared of the regression is 0.432.
- After these imputations we have a (rough) measure of K for most survey responses.
- We winsorize our measure of K at the 1st and 99th percentile before starting the imputation procedure, and again before running the procedure in case 3.
- Since May 2019, the core SBU questionnaire asks for the current value of the capital stock directly (See Figure A.1), so we no longer need to impute the value based on employment or special questions.

A.1.6 Obtaining Realizations and Forecast Errors

- Consider a firm's subjective mean employment growth in month *t,* looking 12 months ahead (*Mean*(EGr)).
- We measure the firm's realized employment growth *Realized*(EGr) as follows:
  - We record its realized employment <u>level</u> in month *t+12,* $CEmp_{t+12}$.
  - We record Realized(EGr)$= 2 * (CEmp_{t+12} - CEmp_t)/(CEmp_{t+12} + CEmp_t)$.
  - If $CEmp_{t+12}$ is missing, we use $CEmp_{t+11}$ and define *Realized*(EGr)$= 2 * (CEmp_{t+11} - CEmp_t)/(CEmp_{t+11} + CEmp_t)$*12/11.
  - If $CEmp_{t+11}$ is also missing, we use $CEmp_{t+13}$ and record *Realized*(EGr)$= 2 * (CEmp_{t+11} - CEmp_t)/(CEmp_{t+11} + CEmp_t)$*12/13.
  - If $CEmp_{t+13}$ is also missing, we use the same formula with $CEmp_{t+10}$, or with $CEmp_{t+14}$ as a last resort.
- We record the firm's forecast error for employment growth looking 12 months ahead = *Mean*(EGr) – *Realized*(EGr).

- Consider a firm's subjective mean sales growth in month *t* of quarter *q,* looking 4 quarters ahead (*Mean*($SaleGr$)).
- We measure the firm's realized sales growth, *Realized*(SaleGr), as follows:
  - We record its current quarterly sales <u>level</u> reported in month *t+12,* $CSale_{t+12}$.
  - We record *Realized*(SaleGr)$= 2 * (CSale_{t+12} - CSale_t)/(CSale_{t+12} - CSale_t)$.
  - If $CSale_{t+12}$ is missing, we proceed differently depending on whether *t* is the first, second, or third month of the quarter.
    - If *t* is the first month of the quarter, we then try $CSale_{t+13}$ and $CSale_{t+14}$ in that order.
    - If *t* is the second month of the quarter, we then try $CSale_{t+11}$ and $CSale_{t+13}$ in that order.
    - If *t* is the third month of the quarter, we then try $CSale_{t+11}$ and $CSale_{t+10}$ in that order.
  - This procedure ensures that we use the level of quarterly sales reported in quarter *q+4,* though not necessarily in month *t+12*.
- We record the firm's forecast error for sales growth looking four quarters ahead = *Mean*($SaleGr$) – *Realized*($SaleGr$)

- Consider a firm's subjective mean investment rate looking four quarters ahead, as recorded in month *t* of quarter *q* (*Mean*($InvRate$)).
- We measure the firm's realized investment rate in quarter *q+4* *Realized*($InvRate$) as follows:
  - We record their current quarterly capital expenditures level reported in month *t+12,* $CCap_{t+12}$.
  - We record *Realized*($InvRate$)= $CCap_{t+12}/K_t$. Here we use K_t rather than K_{t+12} to focus on changes in investment rather than changes in (potentially mis-measured) capital stocks. This is symmetrical with how we construct expectations of future investment *Mean*($InvRate$) in Appendix A.
  - If $CCap_{t+12}$is missing, we proceed differently depending on whether *t* is the first, second, and third month of the quarter.
    - If *t* is the first month of the quarter, we then try $CCap_{t+13}$ and $CCap_{t+14}$in that order.
    - If *t* is the second month of the quarter, we then try $CCap_{t+11}$ and $CCap_{t+13}$ in that order.
    - If *t* is the third month of the quarter, we then try $CCap_{t+11}$ and $CCap_{t+10}$ in that order.
  - This procedure ensures that we use the level of quarterly capital expenditures reported in quarter *q+4,* though possibly not in month *t+12*.
- We record the firm's forecast error for its investment rate looking four quarters ahead = *Mean*($InvRate$) – *Realized*($InvRate$).

A.2 More Information about the SBU Recruitment Process and Panel

The SBU's panel of respondents consists of firms from throughout the United States economy. With the exception of agriculture and government, our panel includes firms from every sector and a broad range of sizes (in terms of number of employees), from owner-operated firms to large publicly-traded companies.

Panel Recruitment Process

A team of research assistants at the Atlanta Fed identifies and recruits new panel members using lists of eligible firms purchased from an affiliate of Dunn & Bradstreet, a supplier of business information and research. We requested that the lists include a proportion of firms in each (broad, one-digit) sector according to sectoral contribution to US Gross Domestic Product. We expect that the sampling universe in Dunn & Bradstreet differs from the US Census' since small and young firms less likely to appear in the former data, whereas the Census observes the universe of establishments and firms with employment. The recruiting team deduplicates lists of contacts that we subsequently purchase, preventing us from re-recruiting previously listed firms.

The team of research assistants at the Atlanta Fed randomly selects potential recruits from a contact list, focusing on contacts in senior finance or executive roles. Since our goal is to use the survey to create indices that aggregate business expectations and uncertainty, the team oversamples firms with more than 100 and 500 employees. Figure A.5 uses a bin-scatter plot to show that the probability of being contacted increases with firm size. Our recruiters contact potential respondents via telephone, explaining the nature of the survey, its purpose, and informs them that individual survey responses are confidential. If the contact agrees to join the survey, the recruiter records his or her email address, where we deliver the personalized link to the survey

instrument each month. We verify that the email address is valid by sending a confirmation that they have joined the SBU panel.

During the period covering June 2014 to June 2018, approximately 42 percent of potential contacts reached via telephone agreed to join the panel. Among those who joined, 62 percent responded at least once. In any given month about 43 percent of all continuing panel members responded to the survey.[1] We believe these are fairly high and adequate response rates for a voluntary and complex survey.

To maintain the survey's sample size over time, we constantly recruit new firms to join the panel and replace those who stop responding. Our aim is to maintain a sample size of about 300 or more responses per month.

Figure A.6 shows how the equally-weighted and employment-weighted firm distribution in the Census Bureau's 2015 Statistics on US Businesses compares with: (1) our sampling frame; (2) the sample of firms we contact; and (3) those who ultimately respond. We report the comparison separately in terms of firms size, industry sector, and region. Focusing on firm size in Figure A.6a, the sampling frame indeed under-samples small firms (with less than 20 employees), and over-samples medium to large firms (with more than 20 and less than 500 employees). As we saw in Figure A.5, our recruiters contact larger firms with a higher probability, in particular those with more than 100 employees. Finally, looking at the employment-weighted distribution of SBU responses, we see that it is skewed towards larger firms. This finding is a robust fact of voluntary firm level surveys. For example, the Decision Maker Panel survey fielded by the University of Nottingham in collaboration with the Bank of England, which uses the SBU's methodology to

[1] These response rates refer to the period between September 2016 (when we made the most recent major change to the survey) and October 2018.

elicit five-point subjective probability distributions, has a similar skew towards larger firms (see Bloom et al., 2018).

Figure A.7 repeats the comparison between the unweighted and employment-weighted composition of our survey panel against the rest of the US economy in terms of firm size, sector, age, region. Figure A.7e also shows the share of firms and share of employment in our sample belonging to publicly traded firms, as self-reported answers to special questions fielded in February and March 2019. Figures A.6 and A.7 also appear in the Online Appendix of Barrero (2019), which also uses SBU data. Figure A.8 shows the distribution of respondents (one per firm) according to their job titles. CFOs and other financial managers account for about 60 percent of respondents, with other C-level managers accounting for about 20 percent, and owners for about 10 percent. Thus, our respondents are primarily business executives who should actively participate in budgeting, forecasting, and decision making.

Table A.1 asks whether we can predict continued participation in the survey based on observable firm characteristics. As we already knew from Figure A.6a, larger firms are more likely to responding to a subsequent survey. We find that the magnitude of expectations and uncertainty do not correlate strongly with subsequent participation, which eases worries that our sample of loyal respondents may differentially select firms that are relatively optimistic or pessimistic, or more or less uncertain. While fixed effects for time, sector, region, or firm increase the R-squared of these predictive regressions, the within R-squared is small and the same order of magnitude as the R-squared from regressions that do not include fixed effects.

Data Collection, Preparation, and Cleaning

In a typical month, we email our respondents an individual link to the survey instrument on the Monday of the second full week of the month. We collect responses during the next two

workweeks, so data collection ends on the Friday of the third full week of the month. The Monday following the end of the survey collection, we download and store all responses in a folder that contains all prior monthly data files. Then we run programs to combine all monthly files into an aggregate file and perform a series of automated cleaning procedures on the raw survey data. This cleaning program includes the following processes:

1. Rescaling of subjective probabilities: On occasion, respondents provide subjective probabilities that do not add up to 100 percent. We rescale probability vectors that add to between 95 and 105 percent to make them add up to 100 percent. We disregard responses whose probability vectors add up to a number outside the 95-105 percent range. Typically, this filter eliminates very few of the responses in a given month.
2. Adjustment of estimates and probabilities given in reverse order: In rare instances, some respondents provide their range of estimates in reverse order, starting with their "highest case" value in the "lowest case" scenario. We reverse these estimates and their associated probabilities to conform to the typical response pattern of lowest to highest.

Once the automated cleaning processes are completed, we perform a manual review of all large firms (firms with 1000 employees or more). We check a large firm's current month responses for consistency with its historical responses. If responses are found to be inconsistent, we conduct a review of publicly available information, including news reports, public filings, etc. If a review of publicly available information is inconclusive, we consider contacting the respondent for clarification. We focus on larger firms for the manual audit because of their greater weight on the aggregate indices produced from the SBU survey.

We also conduct a manual review of forecast errors once a month, as we describe in the main text. After computing realized growth rates (for employment in the 12 months after a survey,

for sales in the four quarters following a survey), we compute the forecast error for a firm responding in month t as the difference between the ex-ante subjective mean and the realized growth rate we record in the data. We manually review the responses of firms whose forecast errors for employment and sales growth exceed one in absolute value. We use the firm's history of responses about current sales and employment to correct obvious mistakes. Common mistakes include missing or added zeros and reporting an annual rather than a quarterly sales figure. If we cannot find an obvious mistake, we flag these observations as potential errors, typically excluding them from analyses of forecast error behavior.

Figure A.4: Time Series of the Number of SBU Responses

Figure A.4a

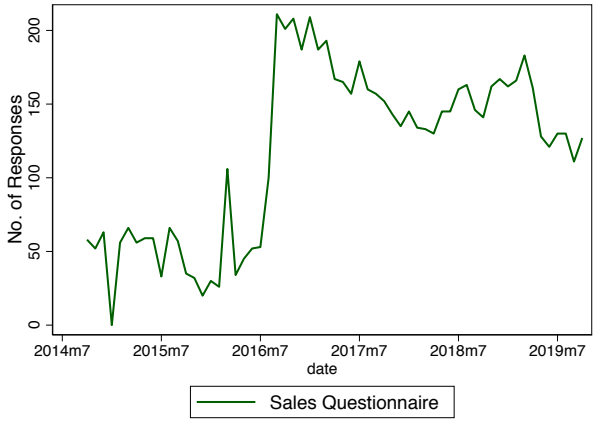
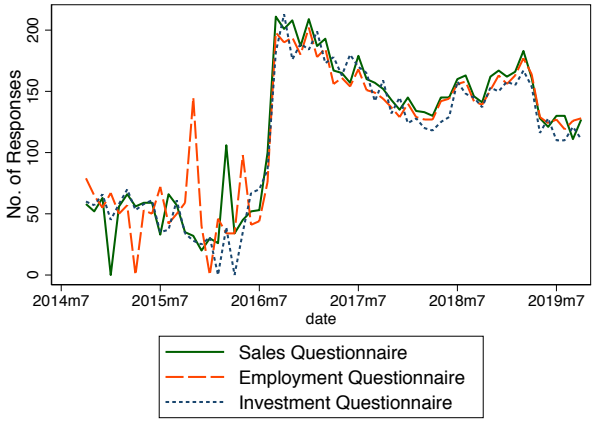
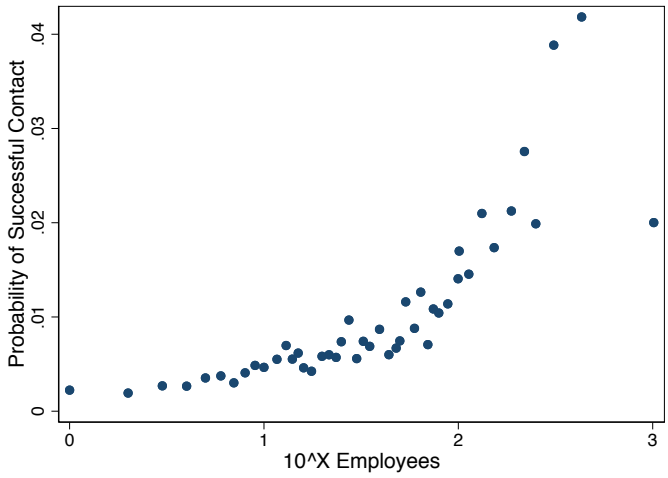


Figure A.4b



Notes: The figure on the left shows the number of responses to the SBU's sales questionnaire for which we can compute an expectation for sales growth over the next four quarters. The figure on the right shows the number of responses to the sales, employment, and investment questionnaires for which we can compute, respectively, expected sales growth for the next four quarters, employment growth for the next twelve months, and the expected investment rate four quarters ahead. Data are from the SBU and include all survey months between 10/2014 and 10/2019.

Figure A.5: Probability of being contacted by our research team as a function of firm size



Notes: This figure shows the probability with which the team of SBU recruiters successfully contacts a firm in the SBU's sampling frame, for each percentile of the firm size distribution in the sampling frame (on the horizontal axis). We say that a firm is successfully contacted if our recruiting team speaks to a person at the firm in question. Data are from the SBU's sampling frame combined with the recruiting team's call log data as of October 2018.

Figure A.6: The SBU sampling frame and sample

A.6a. Firm Size

Figure A.6a.i

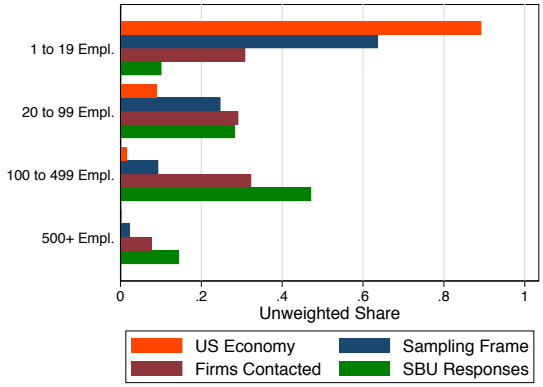
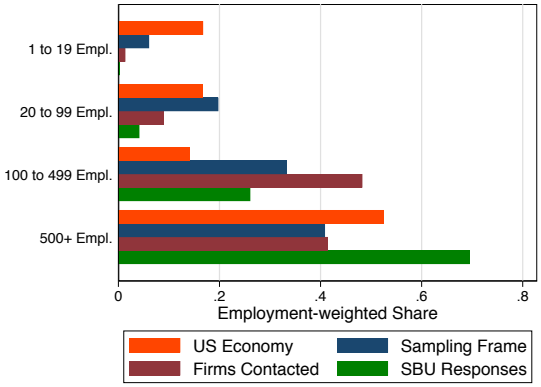


Figure A.6b.ii



Notes: The above figures show the unweighted (left) and employment-weighted (right) shares of (1) firms in the US economy, (2) the SBU's Dunn & Bradstreet sampling frame, (3) firm that SBU recruiters contact successfully, and (4) SBU responses across each of the five employment categories shown on the vertical axis. The SBU data covers all waves of the SBU from 10/2014 to 10/2019. Data for the US Economy come from the US Census Bureau's 2015 Statistics on US Businesses. An observation in the SBU is a response for which we can construct a subjective probability distribution for one of employment, sales, investment, or unit cost growth looking one year ahead. Data for the sampling frame include all purchased lists and call logs up to October 2018. We say that SBU recruiters contact a firm successfully if they manage to speak to an individual at the firm.

A.6b. Industry

Figure A.6b.i

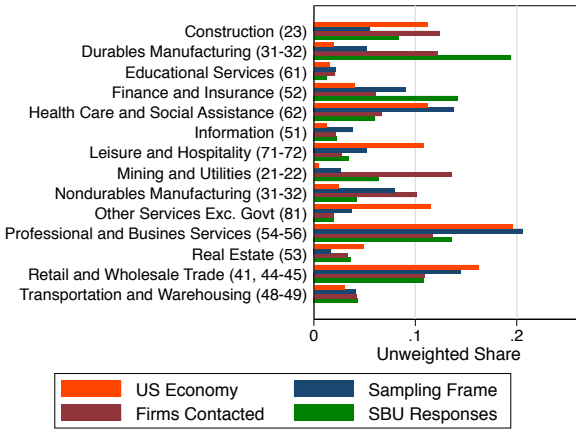
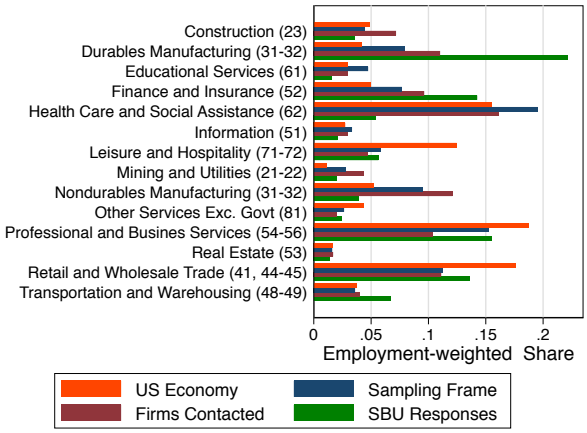


Figure A.6b.ii



Notes: The above figures show the unweighted (left) and employment-weighted (right) shares of (1) firms in the US economy, (2) the SBU's Dunn & Bradstreet sampling frame, (3) firm that SBU recruiters contact successfully, and (4) SBU responses across each of the industry sectors shown on the vertical axis. The SBU data covers all waves of the SBU from 10/2014 to 10/2019. Data for the US Economy come from the US Census Bureau's 2015 Statistics on US Businesses. An observation in the SBU is a response for which we can construct a subjective probability distribution for one of employment, sales, investment, or unit cost growth looking one year ahead. Data for the sampling frame include all purchased lists and call logs up to October 2018. We say that SBU recruiters contact a firm successfully if they manage to speak to an individual at the firm.

A.6c. Region

Figure A.6c.i

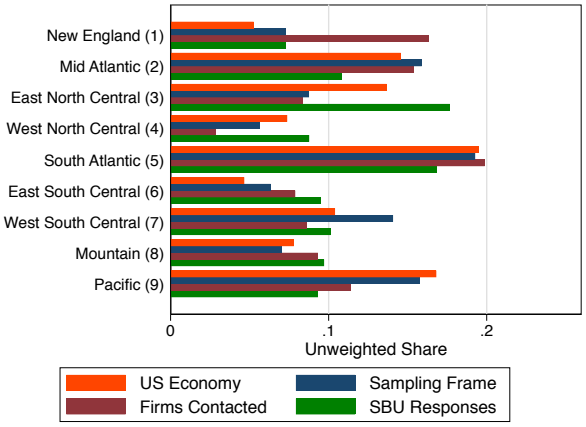
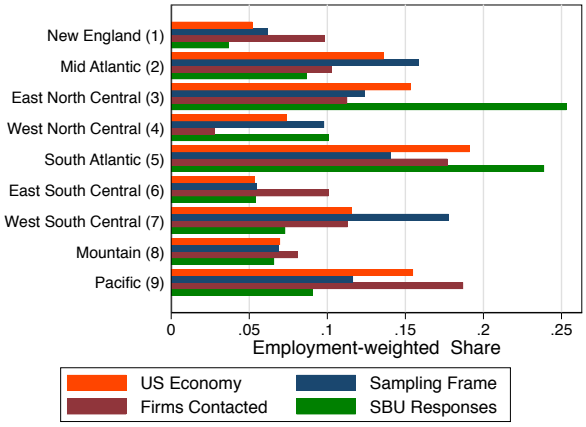


Figure A.6c.ii



Notes: The above figures show the unweighted (left) and employment-weighted (right) shares of (1) firms in the US economy, (2) the SBU's Dunn & Bradstreet sampling frame, (3) firm that SBU recruiters contact successfully, and (4) SBU responses across each of the regions (Census Divisions) shown on the vertical axis. The SBU data covers all waves of the SBU from 10/2014 to 10/2019. Data for the US Economy come from the US Census Bureau's 2015 Statistics on US Businesses. An observation in the SBU is a response for which we can construct a subjective probability distribution for one of employment, sales, investment, or unit cost growth looking one year ahead. Data for the sampling frame include all purchased lists and call logs up to October 2018. We say that SBU recruiters contact a firm successfully if they manage to speak to an individual at the firm.

Figure A.7: SBU Panel Distributions vs US Economy

A.7a. Firm Size

Figure A.7a.i

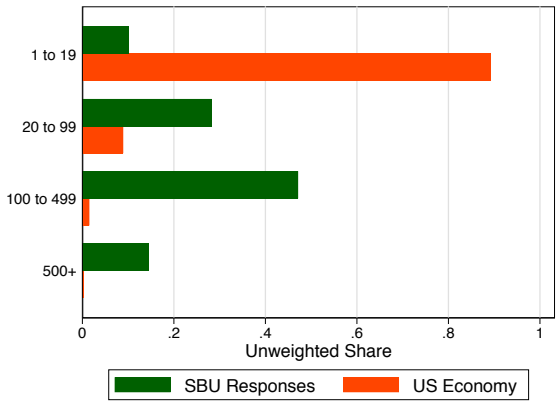
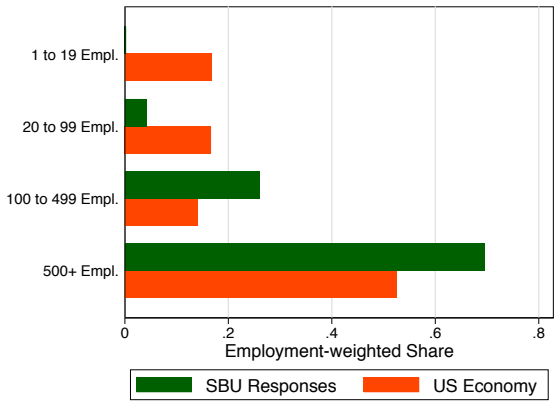


Figure A.7a.ii



Notes: The above figures show the unweighted (left) and employment-weighted (right) shares of (1) SBU responses and (2) the US Economy accounted for by firms each of the five employment categories shown on the vertical axis. The SBU data covers all waves of the SBU from 10/2014 to 10/2019. Data for the US Economy come from the US Census Bureau's 2015 Statistics on US Businesses. An observation in the SBU is a response for which we can construct a subjective probability distribution for one of employment, sales, investment, or unit cost growth looking one year ahead.

A.7b. Industry

Figure A.7b.i

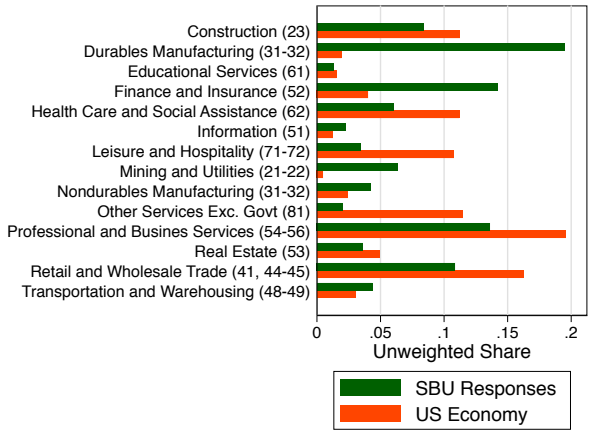
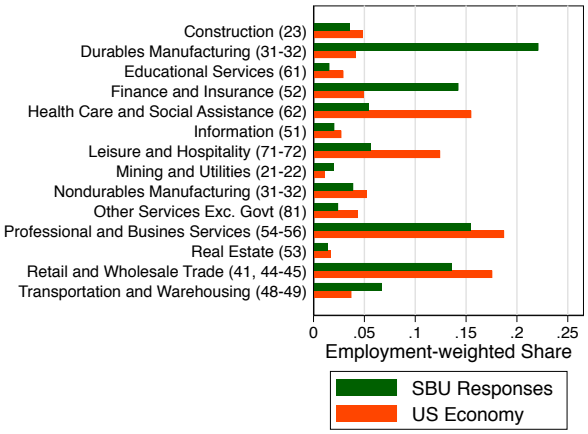


Figure A.7b.ii



Notes: The above figures show the unweighted (left) and employment-weighted (right) shares of (1) SBU responses and (2) the US Economy accounted for by firms each of the sectors shown on the vertical axis. The SBU data covers all waves of the SBU from 10/2014 to 10/2019. Data for the US Economy come from the US Census Bureau's 2015 Statistics on US Businesses. An observation in the SBU is a response for which we can construct a subjective probability distribution for one of employment, sales, investment, or unit cost growth looking one year ahead.

A.7c. Geography

Figure A.7c.i

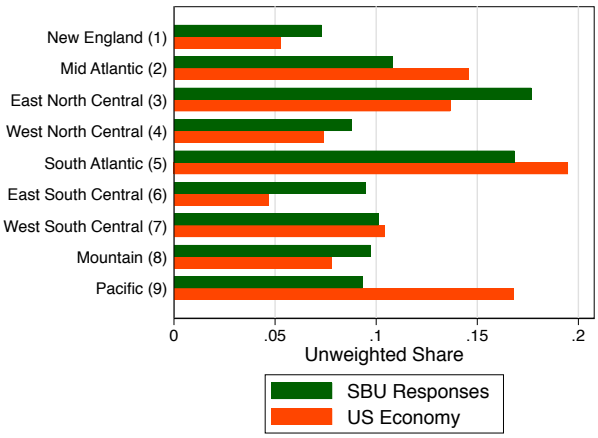
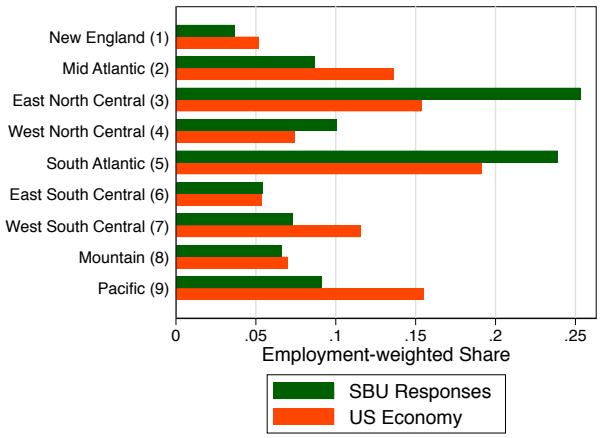


Figure A.7c.ii



Notes: The above figures show the unweighted (left) and employment-weighted (right) shares of (1) SBU responses and (2) the US Economy accounted for by firms in each Census Division as shown on the vertical axis. The SBU data covers all waves of the SBU from 10/2014 to 10/2019. Data for the US Economy come from the US Census Bureau's 2015 Statistics on US Businesses. An observation in the SBU is a response for which we can construct a subjective probability distribution for one of employment, sales, investment, or unit cost growth looking one year ahead.

A.7d. Firm Age

Figure A.7d.i

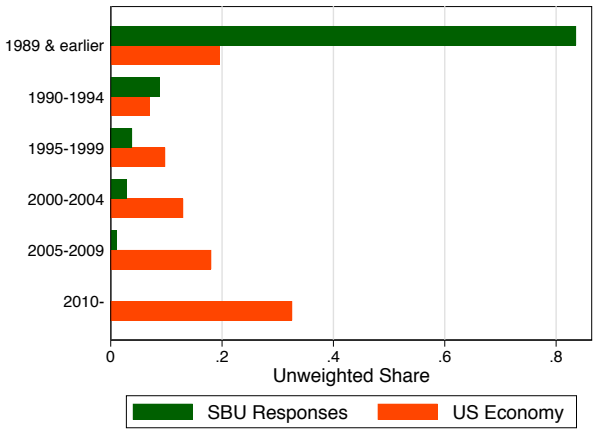
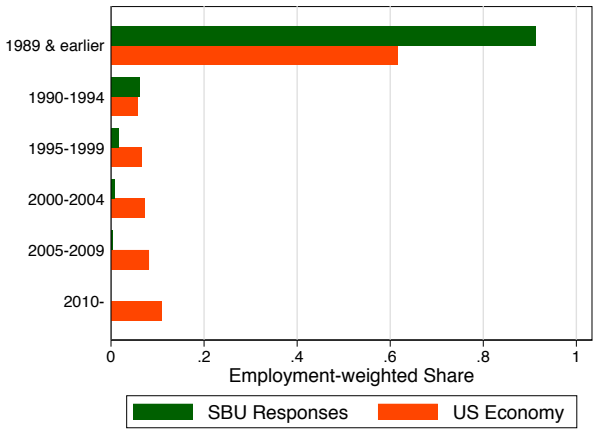
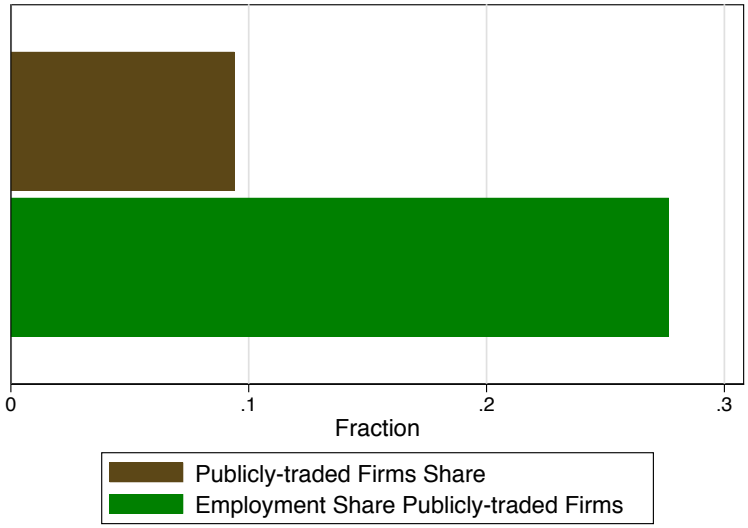


Figure A.7d.ii



Notes: The above figures show the unweighted (left) and employment-weighted (right) shares of (1) SBU responses and (2) the US Economy accounted for by firms who hired their first paid employee during the years listed on the vertical axis. The SBU data covers all waves of the SBU from 10/2014 to 10/2019. Data for the US Economy come from the US Census Bureau's 2015 Business Dynamics Statistics. An observation in the SBU is a response for which we can construct a subjective probability distribution for one of employment, sales, investment, or unit cost growth looking one year ahead. We obtained information on when SBU respondents hired their first paid employee based on a special question that accompanied the core SBU survey in January 2017.

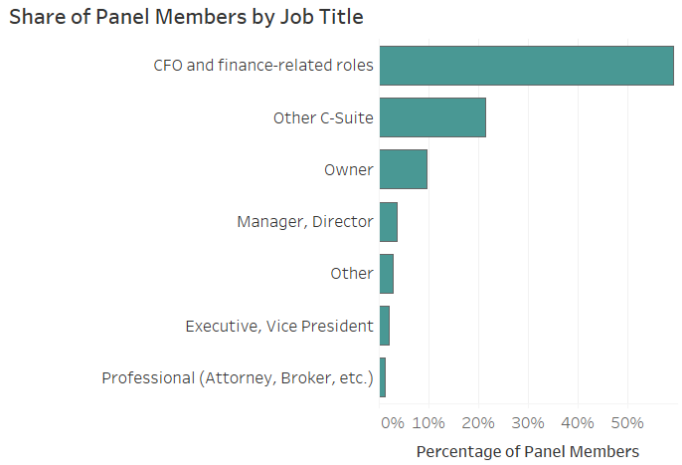
A.7e. Publicly-traded vs. Privately-held



Notes: This figure shows the share of unique firms in the SBU and the share of employment among all SBU responses accounted for firms whose shares traded in a stock exchange or over-the-counter markets.*

*We determine whether a firm is publicly-traded based on a special survey question from February and March 2019

Figure A.8: Job Titles of SBU Respondents



Notes: This figure shows the percentage of SBU panel members whose job title corresponds to the categories on the vertical axis. The sample includes all firms that have been part of the SBU panel at any point between October 2014 and January 2020. The unit of observation is a firm.

Table A.1: What variables predict continued participation in the survey?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	1(Firm Responds to a Subsequent Survey)							
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	OLS	Probit
log(Employment)	0.017***				0.008*	0.000	0.005	0.031*
	(0.005)				(0.004)	(0.005)	(0.021)	(0.016)
Expected Sales Growth, Next 4 Quarters		-0.012		-0.008	-0.008	0.001	0.021	-0.036
		(0.077)		(0.077)	(0.077)	(0.078)	(0.071)	(0.283)
log(Sales Growth Uncertainty), Next 4 Quarters			-0.009	-0.009	0.010	0.002	-0.018**	0.035
			(0.007)	(0.007)	(0.007)	(0.009)	(0.009)	(0.026)
Industry FE						Y		
Region FE						Y		
Time FE						Y	Y	
Firm FE							Y	
Mean of Dep. Variable	0.768	0.791	0.791	0.791	0.807	0.82	0.824	0.807
Observations	17,388	7,159	7,156	7,153	6,873	6,275	6,612	6,873
(Pseudo) R-squared	0.004	0.000	0.000	0.000	0.001	0.163	0.517	0.001
Within R-squared						2.23e-05	0.00102	

Notes: This table attempts to predict whether a given firm responding to the SBU on date t responds to any subsequent SBU survey at a date $t+j$, $j>0$. We use the current log(Employment), current sales growth expectations and uncertainty (looking four quarters ahead) as well as industry, region, time, and firm FEs as potential predictors. Firm-clustered robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

B. Additional Information about Survey Development and Testing

We document the process through which we came up with the methodology to elicit five-point discrete subjective probability distributions from business executives. Table B.1 summarizes a series of question designs that we fielded and evaluated, initially as part of the BIE's special question series and later in a new panel of firms for the Survey of Business Uncertainty.

October 2013: Initial question formulations

We began fielding trial questions in October 2013, comparing two designs for eliciting information about the firm's subjective distribution over its future sales growth rate. Figure B.1 displays screen shots. We randomly assigned each question design to half the participants.

- The first design asked respondents to select the best, middle and worst-case percentage changes in the firm's sales over the next twelve months. A drop-down menu for each case let respondents choose among values ranging from -10 to +25 in one-point increments. Pop-up boxes instructed respondents to select a "best case" corresponding to the top ten percent of possible outcomes, a "worst case" corresponding to the bottom ten percent, and a "middle case" corresponding to a value the firm would use for planning purposes.
- The second design asked respondents to assign probabilities to five pre-set interval bins for the possible percentage change in sales over the next year. The bins ranged from "less than -1 percent" at the bottom end to "more than 5 percent" at the top end.

The first design resembles that of the Duke CFO Survey question about future stock market returns, and the second is closer to that of the Bank of Italy's Survey on Investment in Manufacturing. These two long-running surveys of business mangers offered a natural starting point for thinking about SBU question design. We were particularly interested in two issues: First,

whether the two designs yield similar inferences about mean expectations and uncertainty, and second, the adequacy of the intervals in the five-bin design.

Using the October 2013 responses, we constructed subjective distributions and compared four moment statistics.[2] The first design yielded a higher mean expectation than the second design (4.2 and 1.9 percent, respectively, for the expected sales growth rate), greater dispersion in expected sales growth rates (standard deviations of 5.9 and 1.7 percent), higher subjective uncertainty (average standard deviation values of 3.6 and 1.4 percent), and more dispersion in subjective uncertainty (standard deviations of 2.1 and 0.8 percent). For each moment, we reject the null hypothesis of equality across the two question designs at a p-value under 0.001. Clearly, the two question designs yield quite different inferences about firm-level forecast distributions.

Each question design also has potentially serious weaknesses for our purposes. The first design allows for only three support points, which affords a rather coarse characterization of the subjective probability distribution. Moreover, the pre-set outcome range in the drop-down menu may inject anchoring effects that distort the responses. Regarding the second design, a large body of literature shows that (a) businesses differ greatly in their realized growth rates and (b) much of the mass in the realized growth rate distribution lies outside the lowest and highest values (-1 percent and 5 percent) specified in the question. See, for example, the literature review in Davis and Haltiwanger (1999). Taken together, (a) and (b) imply that it is infeasible to pre-specify a modest number of support points or bins that allow all firms to characterize their subjective forecast distributions in a reasonably granular manner. This observation argues strongly in favor of letting respondents select the support points. Our survey responses to the second question design

[2] The first design yields a three-point discrete distribution with probability 0.1 for the "worst" case, 0.8 for the "middle" case and 0.1 for the "best." For the second design, we applied the user-selected probability to the interval midpoint. We used 6% and -2% for the top and bottom intervals, respectively.

suggest another reason as well. In particular, the typical respondent assigned a probability of about 30 or 40 percent to the middle bin (1.1 to 3 percent sales growth) and 10 to 20 percent to the outer bins. This pattern is worrisome in light of empirical regularities (a) and (b). It suggests that the question design leads respondents to put too much mass in our pre-set middle bin. This response pattern fits the "middle means typical" heuristic, a well-known source of response distortion in the survey design literature (e.g., Tourangeau, Couper, and Conrad, 2004).

November 2013: Alternative interval bins

We retained the first question design in November 2013 but made it clearer that the worst, middle and best cases correspond to support points with pre-set probabilities of 0.1, 0.8 and 0.1. We tried a variant of the second design with much wider interval bins. Figure B.2 shows both of the questions we tried in November. The wider bins more closely align with the range of outcomes elicited by the first question design in October 2013 and better reflect the heterogeneity in observed firm-level growth rates.

The November 2013 results showed that the spread of the bin intervals in the second design matter greatly. In particular, the moment statistics generated by the second question design in November 2013 are much closer to the ones generated by the first design in either month. For example, the second design yielded an average expected growth rate of 5.1 percent and average uncertainty statistic of 5.8 percent in the November survey. Moreover, the same firms responded quite differently to the October and November variants of the second question design. Among firms that received and answered the second question in both months, the average expected growth rate jumped from 1.7 to 5.1 percent, and the average subjective standard deviation jumped from 1.1 to 4.5 percent. In sharp contrast, among the firms that received and answered the first question in both months, the average expected growth rate was nearly identical (3.3 and 3.2 percent), and

the average subjective standard deviation was similar at 3.4 percent in October and 3.0 percent in November. Finally, among firms that got the second design in October and the first design in November, the moment statistics differ between months very similarly to how they differ across the two designs in October.

The foregoing discussion underscores two advantages of letting respondents select the location of support points. First, it allows for a parsimonious question format (as in the first design) while still accommodating enormous cross-firm heterogeneity in the central tendency and dispersion of growth rates. Second, it avoids anchoring and types of response distortions that might be introduced by pre-specifying support points or interval bins.

December 2013: Testing three-point versus five-bin designs on unit cost questions

In December 2013, we modified the questions to refer to unit cost growth over the next 12 months. Figure B.3 shows screen shots. Again, the two question designs yielded systematic differences in the moment statistics. Although the between-design discrepancies in December 2013 for unit cost growth were smaller than the ones for sales growth in October 2013, the results reinforced our concerns about the pitfalls in pre-specifying the support points or bins.

January 2014: Freeing up the probabilities

In January 2014, we began testing designs that let respondents freely select probabilities ***and*** support points. We used a three-point distribution and returned to sales growth. We modified the questionnaire to refer to scenarios for "low", "medium", and "high" growth, instead of the "worst," "most likely," and "best" scenarios. Figure B.4 shows screenshots.

With this design, respondents reported statistically significantly higher subjective uncertainty and—particularly—greater heterogeneity in both forecasts and subjective uncertainty concerning sales growth over the next 12 months. Letting respondents provide their own

probabilities typically yielded more weight on the "high" and "low" scenarios – closer to 20 or 25 percent than the 10 percent specified in the October and November variants of this question. Respondents also assigned a broad range of probabilities to "high" and "low" scenarios, typically from 5 to 30 percent but in extreme cases as low as zero or as high as 80 or 85 percent. By contrast, the three support point values they selected were similar to the ones they gave in October and November. We did not remind respondents that probabilities should add up to 100 percent. Indeed, 20 percent submitted probability vectors that did not add up to 100.

The January 2014 experiment led us to conclude that letting respondents select support points and probabilities is feasible and allows them to express idiosyncratic features of their subjective probability distributions. From a research standpoint, this question design means our survey questions can capture heterogeneity in expectations and uncertainty in the cross-section of firms as well as within firms over time.

February 2014: Testing a question about employment

In February 2014 we essentially replicated the experiment from January, but now asked BIE respondents to provide a three-point subjective probability distribution for their firm's employment 12 months in the future. We first asked them for the firm's current number of employees (including part-time). Then we asked them to provide three-point outcomes for the level of employment ("low", "middle", and "high") twelve months into the future, and then assign a probability to each of those three outcomes. See Figure B.5 for a screenshot.

The February test showed BIE respondents were willing and able to express a three-point discrete distribution for future employment levels. Similar to our prior tests of questions about sales growth and unit cost growth, the employment levels question had a low rate of item nonresponse, respondents gave monotonic outcomes across the "low", "medium", and "high"

cases, and 98 percent of their probability assignments summed to 100 percent. Thus, we found it feasible to obtain expectations and uncertainty about employment, which is a key indicator of firm size and performance in the firm dynamics literature (e.g. see Davis and Haltiwanger, 1999).

March 2014: Repeating the three-point, three-probability sales question from January 2014

The March 2014 BIE special question included a repeat of the January 2014 question, namely asking respondents for "low", "middle", and "high" scenarios for sales growth over the next year and subsequently ask them to assign a probability to each of these scenarios. (See Figure B.6 for a screenshot.) We confirmed the suitability of the question and found responses to be broadly consistent with those from January.

April-May 2014: Testing five-point, five-probability versions of the sales and employment questions

We decided to test a five-point version of the sales question in April 2014 (again as a special question in the BIE survey), to see whether and how respondents took up the added flexibility. We were also interested to see if we could capture more extreme outcomes by asking for two additional "highest" and a "lowest" scenarios at the tails of the elicited sales growth distribution. (Figure B.7 shows a screenshot of this version of the question.) We found this test to be successful, with many respondents assigning more extreme outcomes and lower probabilities—on the order of 10 percent—to the extreme outcomes.

In May 2014 we tested a five-point version of the employment question from February 2014. The screenshot for this test, again implemented among BIE respondents, is shown in Figure B.8. Once more, we found this test to be successful, with respondents assigning low probabilities to the outermost "highest" and "lowest" scenarios and associating those outcomes with more extreme outcomes.

June 2014: Testing a three-point version of the sales question, plus asking for extreme scenarios

In June 2014 we returned to the three-point sales question from January and March and considered how responses changed if we asked for "best" and "worst" tail scenarios in addition to the three-point distribution, without asking for associated probabilities for those tail scenarios. Figure B.9 shows a screenshot of this test.

Responses to the three-point question in this experiment yielded forecasts and subjective uncertainty over future sales that had a similar mean and dispersion as those from January and March. We interpreted this consistency between January, March, and June responses as a sign of the reliability of our methodology.

June 2014 was the last time we tested questions as part of the BIE special question series.

July 2014: First tests on the new SBU panel

From July 2014 on, we conducted survey testing on a new panel of firms recruited specifically for the Survey of Business Uncertainty (described in more detail in Online Appendix E below). Following the A/B testing strategy employed previously, we split the sample randomly and sent three-point or five-point versions of the questions, now covering three topics: employment, sales growth, and prices. See Figure B.10 for screenshots of these questions.

In the inaugural SBU survey, we found that respondents were willing and able to provide monotonic scenarios (i.e. the "lowest" support point is less than the "low" support point, etc.) across the five support points for the outcomes, that probability vectors nearly always summed up to 100 percent, and that the distributions of respondents' implied subjective expectations and uncertainty resembled those of the three-point questions we tested in previous months. Additionally, as we first found in the April 2014 test, the five-point questions gave respondents additional flexibility to express their perception of outcomes farther out on the tails. As a

consequence of these findings we decided to focus on our five-point question design going forward.

Summer and Early Fall 2014: Cognitive interviews and further development of questions

During summer 2014, the team conducted cognitive interviews with 7 members of the BIE panel to assess their understanding of the questions that constituted the new SBU survey. Most interviewees found the questions to be interesting, worthwhile, and user-friendly. Much of the feedback they provided was quite industry-specific and thus not particularly actionable since we wanted our survey to work for firms throughout the private business sector.

One useful finding from the interviews concerned the way we were asking respondents to select the five potential support point outcomes ("lowest" to "highest"). Up to that point, we had been using drop-down boxes with one-unit increments. For example, the bottom box would correspond to -20 percent (or lower) sales growth over the next year, the next to -19, the following one -18 percent, and so forth. Many respondents asked the increments to be finer in order to increase precision.

Additionally, we found that the drop-down boxes could be problematic. This was especially true for sales, where we had made the range covered the drop-down box very large (from less than -24 percent in the lowest case to more than +35 percent in the highest). Some respondents confused the minus with a dash and thus ended up selecting the wrong outcome. Others had difficulty working with such a large drop down menu. In light of these comments and observations, we moved to an open-text question format, allowing respondents to enter the values each of the support point outcomes freely for all questions. We tested that question design in August 2014, which was the same as in July except for the replacement of the drop-down boxes with open text boxes.

In early fall 2014 we also changed the format of the sales questionnaire to mimic that of employment, namely asking for the current level of sales in dollars and asking for five potential sales levels one year ahead, using an open-text format. We had been using this open-text, free selection approach for the questions on employment levels because it was harder for us to preset the support point outcomes in the presence of vast heterogeneity in the number of employees across firms. We additionally changed the wording in the sales question to refer to quarterly values, given that sales are a flow rather than a stock variable and are often tracked quarterly. See Figure A.2, for a look at the revised sales question.

During the August test we also tested questions on unit costs (which we had previously tested in December 2013), capital investment (following the new sales question, see Figure A.1) and new questions about profit margins (see Figure B.11). In September we conducted tests that were very similar to those of August, also trying out questions on average prices.[3]

October 2014: Initial version of the SBU operates regularly

In October 2014 we settled on the first stable version of the SBU questionnaire (at the time known as the "Decision Maker Survey"). Since then, the survey has been administered monthly out of the Atlanta Fed with monthly response rates averaging roughly 40 percent, resulting in about 300 responses per month. Up until October 2015 we divided the panel into three subgroups, each answering questions about two topics in a given month, with topics including employment, sales, capex, unit costs, average prices, and profit margins. From November 2015 to August 2016 we used six sub-groups, each answering questions about two of the six topics.

September 2016 to April 2019

[3] See Figure B.11 for the wording of the prices and profit margins questions. In subsequent rounds of the survey we eliminated the questions on these two topics and they are not part of our main analyses.

We made a major change to the SBU in September 2016, at which time we eliminated the questions on average prices and profit margins. Based on feedback from our respondents these were the questions that created the most confusion. Eliminating these two topics also allowed us to split the sample into just two groups, greatly increasing the number of responses per topic per month. Starting in September 2016, the monthly SBU form thus contained two of the four topics in the following combinations: Average Unit Cost/Capital Expenditures (CC), and Sales Revenue/Number of Employees (SE). We sorted our panel respondents randomly into two subgroups. In a given month group A received the Sales Revenue/Number of Employees (SE) questionnaire and vice versa for group B.

In September 2016 we also changed the sales question back to asking about sales *growth rates* looking ahead over the next four quarters, rather than sales *levels* four quarters ahead. Figure A.2 reflects this change, in contrast with Figure 1b in the main text. Our rationale for the change was that many respondents made mistakes in entering the dollar value of sales four quarters into the future. Some common mistakes included giving an annual rather than quarterly value for the firm's current or future sales level or failing to keep units consistent. In some cases, respondents reported current sales in units of dollars and future values in thousands or millions of dollars, at other times using different units across months. By asking for sales growth rates we created fewer opportunities for respondents to make such mistakes.

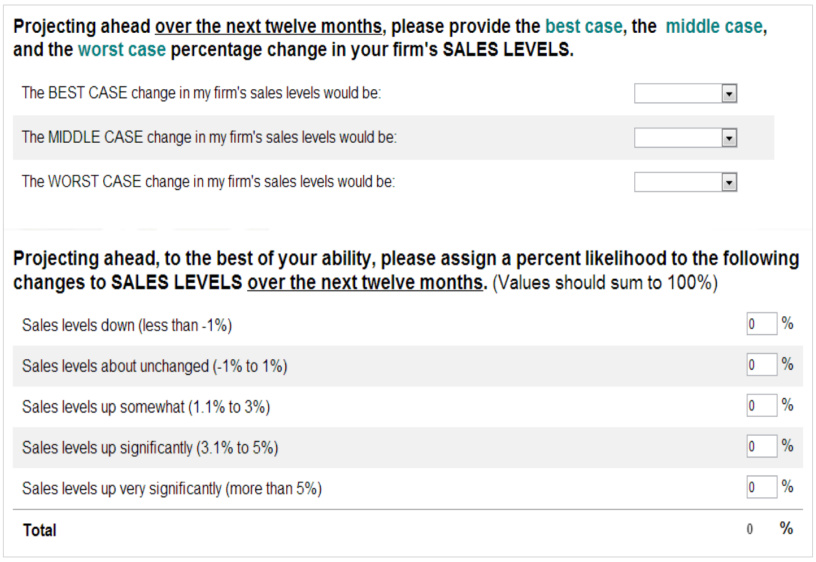
<u>May 2019 onwards</u>

In May 2019 we implemented a new round of changes to the SBU questionnaire. We eliminated the unit cost growth questions given our limited ability to track actual changes in unit costs and due to feedback from our respondents concerning that question. Several respondents have cited difficulty answering questions about unit costs. Service firms, in particular, cited

confusion about this question, often saying that unit costs are more relevant for manufacturing. We therefore decided to concentrate on subjective probability distributions for future employment, sales, and capital expenditures, asking about only one of these topics in a given month. These changes expanded the number of respondents receiving questions about a given topic in a given month. Having a rotating panel of three questions rotated monthly also means that a given firm answers questions about a given topic once per quarter.

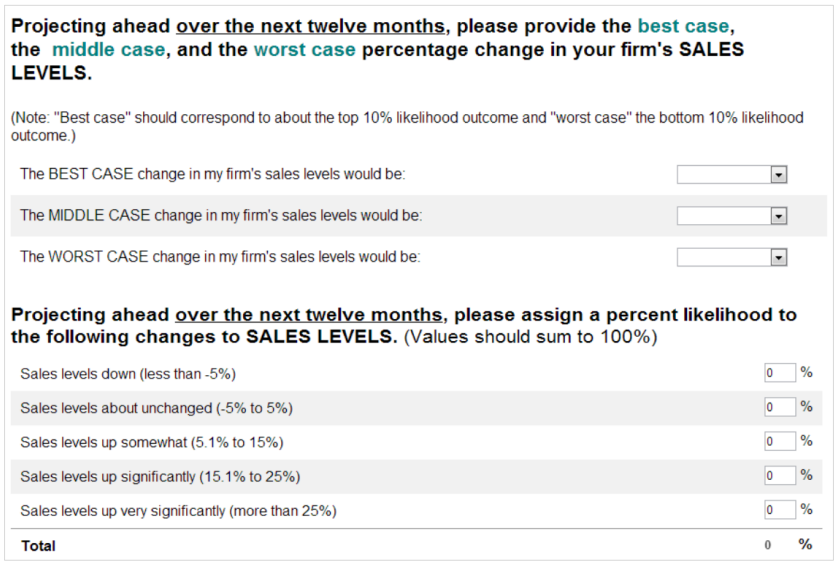
Starting in May 2019, we also include a question about the level of the stock of capital (i.e., property, plant and equipment) as part of the investment questionnaire. Responses to this question let us construct measures of current and future investment rates (I/K).

Figure B.1: October 2013 Trial Questions



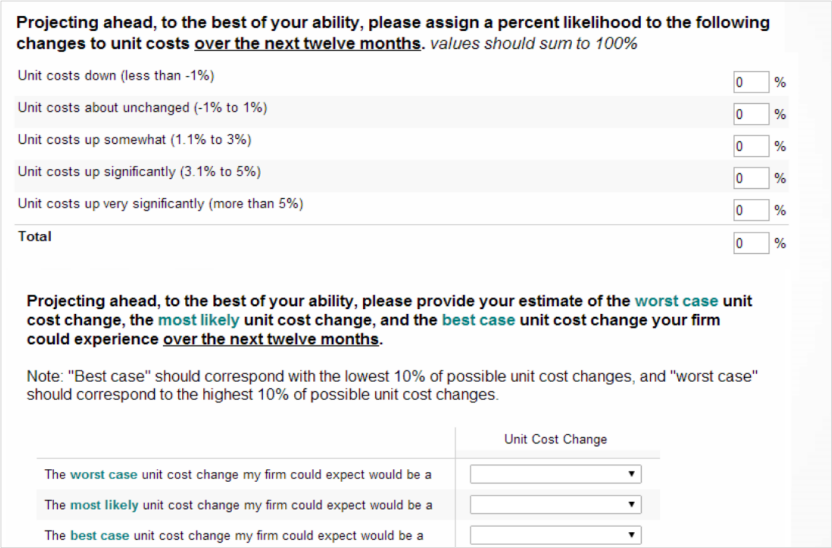
Notes: This figure shows screenshots from our first trial at eliciting subjective probabilities for future sales growth in October 2013. We performed an A/B test, giving half of the Atlanta Fed's BIE panel the three-point question above and the other half the bottom question.

Figure B.2: November 2013 Trial Questions



Notes: This figure shows screenshots from our November 2013 test, again attempting to elicit subjective probabilities for future sales growth. We again performed an A/B test, giving half of the Atlanta Fed's BIE panel the three-point question above and the other half the bottom question.

Figure B.3: December 2013 Trial Questions



Projecting ahead, to the best of your ability, please assign a percent likelihood to the following changes to unit costs over the next twelve months. *values should sum to 100%*

Unit costs down (less than -1%)	0 %
Unit costs about unchanged (-1% to 1%)	0 %
Unit costs up somewhat (1.1% to 3%)	0 %
Unit costs up significantly (3.1% to 5%)	0 %
Unit costs up very significantly (more than 5%)	0 %
Total	0 %

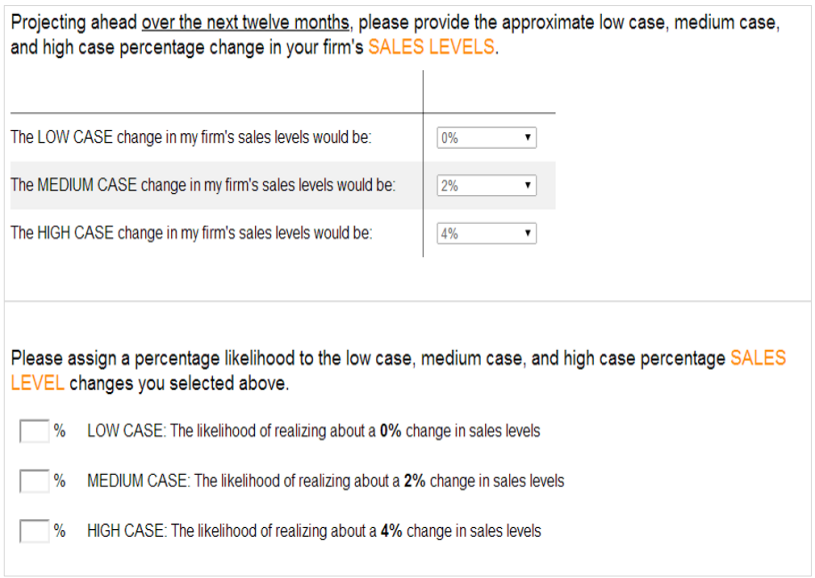
Projecting ahead, to the best of your ability, please provide your estimate of the worst case unit cost change, the most likely unit cost change, and the best case unit cost change your firm could experience over the next twelve months.

Note: "Best case" should correspond with the lowest 10% of possible unit cost changes, and "worst case" should correspond to the highest 10% of possible unit cost changes.

	Unit Cost Change
The worst case unit cost change my firm could expect would be a	
The most likely unit cost change my firm could expect would be a	
The best case unit cost change my firm could expect would be a	

Notes: This figure shows screenshots from our December 2013 test, now attempting to elicit subjective probabilities for future unit cost growth. We again performed an A/B test, giving half of the Atlanta Fed's BIE panel the five-bin question above and the other half the bottom question with three support points.

Figure B.4: January 2014 Trial Question



Projecting ahead over the next twelve months, please provide the approximate low case, medium case, and high case percentage change in your firm's SALES LEVELS.

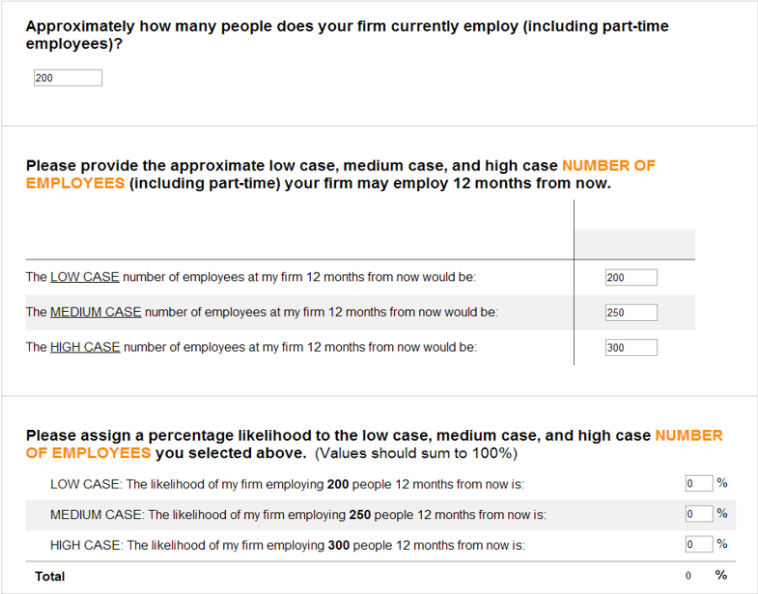
The LOW CASE change in my firm's sales levels would be:	0%
The MEDIUM CASE change in my firm's sales levels would be:	2%
The HIGH CASE change in my firm's sales levels would be:	4%

Please assign a percentage likelihood to the low case, medium case, and high case percentage SALES LEVEL changes you selected above.

- % LOW CASE: The likelihood of realizing about a **0%** change in sales levels
- % MEDIUM CASE: The likelihood of realizing about a **2%** change in sales levels
- % HIGH CASE: The likelihood of realizing about a **4%** change in sales levels

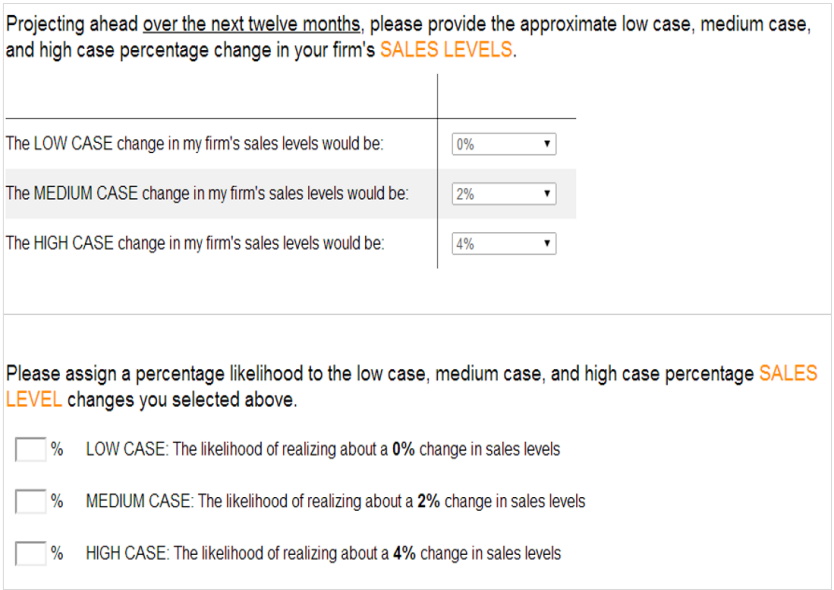
Notes: This figure shows screenshots from our January 2014 test question, again eliciting subjective probabilities for future sales growth. We sent the same question to all of the Atlanta Fed's BIE panel of respondents. This new question has two parts: the top asks firms to provide numerical outcomes for their "low", "medium", and "high" outcomes and the bottom asks for probabilities.

Figure B.5: February 2014 Trial Question



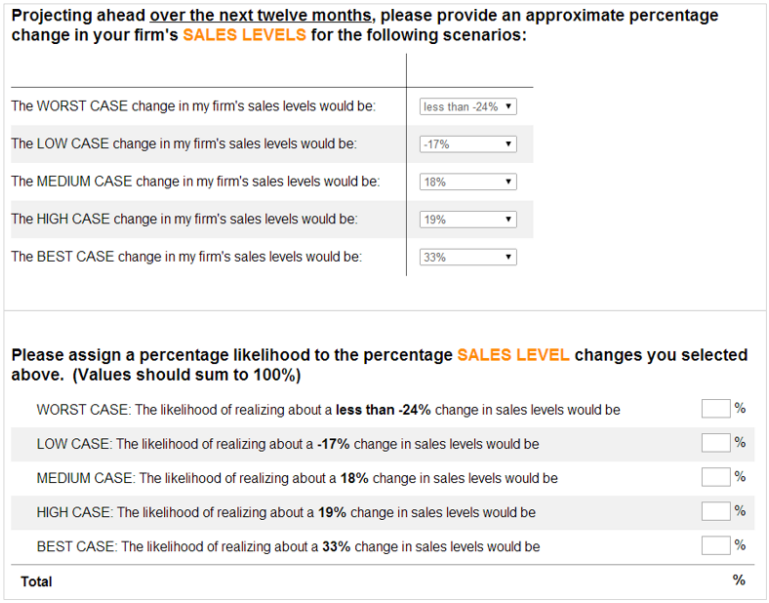
Notes: This figure shows screenshots from our February 2014 test question, now eliciting subjective probability distributions for future employment. We sent the same question to all of the Atlanta Fed's BIE panel of respondents. This new question has three parts: first it asks for current employment levels, then asks for numerical outcomes for the "low", "medium", and "high" outcomes, and finally the bottom asks for probabilities for those outcomes.

Figure B.6: March 2014 Trial Question



Notes: This figure shows screenshots from our March 2014 test question, which repeated the January 2014 experiment and elicited subjective probabilities for future sales growth. We sent the same question to all of the Atlanta Fed's BIE panel of respondents.

Figure B.7: April 2014 Trial Question



Projecting ahead over the next twelve months, please provide an approximate percentage change in your firm's SALES LEVELS for the following scenarios:

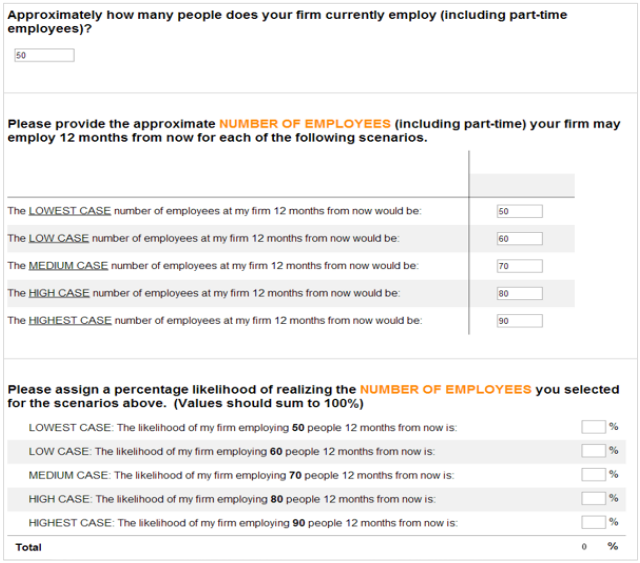
The WORST CASE change in my firm's sales levels would be:	less than -24%
The LOW CASE change in my firm's sales levels would be:	-17%
The MEDIUM CASE change in my firm's sales levels would be:	18%
The HIGH CASE change in my firm's sales levels would be:	19%
The BEST CASE change in my firm's sales levels would be:	33%

Please assign a percentage likelihood to the percentage SALES LEVEL changes you selected above. (Values should sum to 100%)

WORST CASE: The likelihood of realizing about a **less than -24%** change in sales levels would be	%
LOW CASE: The likelihood of realizing about a **-17%** change in sales levels would be	%
MEDIUM CASE: The likelihood of realizing about a **18%** change in sales levels would be	%
HIGH CASE: The likelihood of realizing about a **19%** change in sales levels would be	%
BEST CASE: The likelihood of realizing about a **33%** change in sales levels would be	%
Total	%

Notes: This figure shows screenshots from our April 2014 test question, which extended our January and March 2014 experiments to a five-point format, again eliciting subjective probabilities for future sales growth. We sent the same question to all of the Atlanta Fed's BIE panel of respondents.

Figure B.8: May 2014 Trial Question



Approximately how many people does your firm currently employ (including part-time employees)?

50

Please provide the approximate NUMBER OF EMPLOYEES (including part-time) your firm may employ 12 months from now for each of the following scenarios.

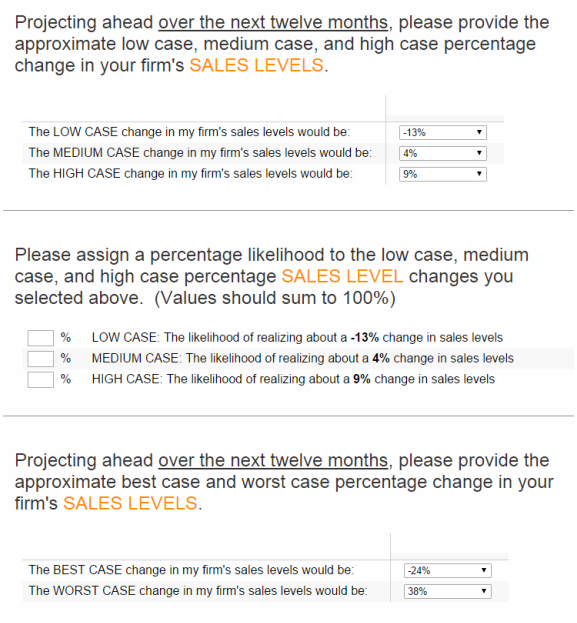
The LOWEST CASE number of employees at my firm 12 months from now would be:	50
The LOW CASE number of employees at my firm 12 months from now would be:	60
The MEDIUM CASE number of employees at my firm 12 months from now would be:	70
The HIGH CASE number of employees at my firm 12 months from now would be:	80
The HIGHEST CASE number of employees at my firm 12 months from now would be:	90

Please assign a percentage likelihood of realizing the NUMBER OF EMPLOYEES you selected for the scenarios above. (Values should sum to 100%)

LOWEST CASE: The likelihood of my firm employing **50** people 12 months from now is:	%
LOW CASE: The likelihood of my firm employing **60** people 12 months from now is:	%
MEDIUM CASE: The likelihood of my firm employing **70** people 12 months from now is:	%
HIGH CASE: The likelihood of my firm employing **80** people 12 months from now is:	%
HIGHEST CASE: The likelihood of my firm employing **90** people 12 months from now is:	%
Total	0 %

Notes: This figure shows screenshots from our May 2014 test question, which extended our February 2014 test for eliciting subjective probabilities for future employment levels, now using a five-point format. We sent the same question to all of the Atlanta Fed's BIE panel of respondents.

Figure B.9: June 2014 Trial Question



Notes: This figure shows screenshots from our June 2014 test question, which replicated the question from January and March 2014, using a three-point design to elicit subjective probabilities for future sales growth levels. Then we additionally asked respondents for estimates of their "worst" and "best" case scenarios. We sent the same question to all of the Atlanta Fed's BIE panel of respondents.

Figure B.10: July 2014 Questions (Asking for five vs. three support points)

Notes: This figure shows screenshots from our July 2014 test questions, in which we A/B tested three- and five-support point designs to elicit subjective probability distributions about employment, prices and sales. July 2014 was the first month in which we tested our questions on a newly-recruited panel of firms for the SBU specifically. We randomly split the panel into two sub-groups, with the first group assigned the three-point question and the second assigned the five-point question.

B.10a. Employment Questions

Please provide the approximate NUMBER OF EMPLOYEES (including part-time) your firm may employ 12 months from now for each of the following scenarios.

The LOWEST CASE number of employees at my firm 12 months from now would be:	12
The LOW CASE number of employees at my firm 12 months from now would be:	114
The MEDIUM CASE number of employees at my firm 12 months from now would be:	200
The HIGH CASE number of employees at my firm 12 months from now would be:	300
The HIGHEST CASE number of employees at my firm 12 months from now would be:	400

Please assign a percentage likelihood of realizing the NUMBER OF EMPLOYEES you selected above. (Values should sum to 100%)

LOWEST CASE: The likelihood of my firm employing **12** people 12 months from now is:	%
LOW CASE: The likelihood of my firm employing **114** people 12 months from now is:	%
MEDIUM CASE: The likelihood of my firm employing **200** people 12 months from now is:	%
HIGH CASE: The likelihood of my firm employing **300** people 12 months from now is:	%
HIGHEST CASE: The likelihood of my firm employing **400** people 12 months from now is:	%
Total	%

Projecting ahead over the next twelve months, please provide the approximate low case, medium case, and high case NUMBER OF EMPLOYEES (including part-time) you may have.

The LOW CASE number of employees my firm may have 12 months from now would be:	250
The MEDIUM CASE number of employees my firm may have 12 months from now would be:	300
The HIGH CASE number of employees my firm may have 12 months from now would be:	400

Please assign a percentage likelihood to the low case, medium case, and high case NUMBER OF EMPLOYEES you selected above. *(Responses should sum to 100)*

LOW CASE: The likelihood of my firm employing **250** employees 12 months from now is:	0 %
MEDIUM CASE: The likelihood of my firm employing **300** employees 12 months from now is:	0 %
HIGH CASE: The likelihood of my firm employing **400** employees 12 months from now is:	0 %
Total	0 %

B.10b. Prices

Projecting ahead over the next twelve months, for each of the following scenarios please provide an approximate percentage change in the AVERAGE PRICE you charge:

The LOWEST CASE change in the average price my firm charges would be:	0%
The LOW CASE change in the average price my firm charges would be:	1%
The MEDIUM CASE change in the average price my firm charges would be:	2%
The HIGH CASE change in the average price my firm charges would be:	3%
The HIGHEST CASE change in the average price my firm charges would be:	4%

Please assign a percentage likelihood to the percentage AVERAGE PRICE changes you selected above. (Values should sum to 100%)

LOWEST CASE: The likelihood of realizing about a **0%** change in average price would be	%
LOW CASE: The likelihood of realizing about a **1%** change in average price would be	%
MEDIUM CASE: The likelihood of realizing about a **2%** change in average price would be	%
HIGH CASE: The likelihood of realizing about a **3%** change in average price would be	%
HIGHEST CASE: The likelihood of realizing about a **4%** change in average price would be	%
Total	%

Projecting ahead over the next twelve months, please provide the approximate low case, medium case, and high case percentage change in the AVERAGE PRICE you charge.

The LOW CASE change in the average price my firm charges would be:	0%
The MEDIUM CASE change in the average price my firm charges would be:	5%
The HIGH CASE change in the average price my firm charges would be:	7%

Please assign a percentage likelihood to the low case, medium case, and high case percentage AVERAGE PRICE changes you selected above. (Values should sum to 100%)

LOW CASE: The likelihood of my firm realizing about a **0%** change in its average price would be	%
MEDIUM CASE: The likelihood of my firm realizing about a **5%** change in its average price would be	%
HIGH CASE: The likelihood of my firm realizing about a **7%** change in its average price would be	%
Total	%

B.10c. Sales Growth

Projecting ahead over the next twelve months, for each of the following scenarios please provide an approximate percentage change in your firm's SALES REVENUE:

The LOWEST CASE change in my firm's sales levels would be:	0%
The LOW CASE change in my firm's sales levels would be:	1%
The MEDIUM CASE change in my firm's sales levels would be:	2%
The HIGH CASE change in my firm's sales levels would be:	3%
The HIGHEST CASE change in my firm's sales levels would be:	4%

Please assign a percentage likelihood to the percentage SALES REVENUE changes you selected above. (Values should sum to 100%)

LOWEST CASE: The likelihood of realizing about a **0%** change in sales levels would be	%
LOW CASE: The likelihood of realizing about a **1%** change in sales levels would be	%
MEDIUM CASE: The likelihood of realizing about a **2%** change in sales levels would be	%
HIGH CASE: The likelihood of realizing about a **3%** change in sales levels would be	%
HIGHEST CASE: The likelihood of realizing about a **4%** change in sales levels would be	%
Total	%

Projecting ahead over the next twelve months, please provide the approximate low case, medium case, and high case percentage change in your firm's SALES REVENUE.

The LOW CASE change in my firm's revenue would be:	0%
The MEDIUM CASE change in my firm's revenue would be:	2%
The HIGH CASE change in my firm's revenue would be:	4%

Please assign a percentage likelihood to the low case, medium case, and high case percentage changes in your firm's SALES REVENUE you selected above. (Values should sum to 100%)

LOW CASE: The likelihood of my firm realizing about a **0%** change in revenue	%
MEDIUM CASE: The likelihood of my firm realizing about a **2%** change in revenue	%
HIGH CASE: The likelihood of my firm realizing about a **4%** change in revenue	%
Total	%

Figure B.11: Additional SBU Questions During 1st Generation (August 2014-August 2016)

B.11a. Profit Margins

Currently, what is your AVERAGE PROFIT MARGIN, considering all of your products and services (in percentage terms)?

%

Looking back, 12 months ago, what was your AVERAGE PROFIT MARGIN (in percentage terms)?

%

Looking ahead, 12 months from now, what AVERAGE PROFIT MARGIN would you assign to each of the following scenarios (in percentage terms)?

Our LOWEST-CASE average profit margin would be:	1
Our LOW-CASE average profit margin would be:	2
Our MEDIUM-CASE average profit margin would be:	3
Our HIGH-CASE average profit margin would be:	4
Our HIGHEST-CASE average profit margin would be:	5

Please assign a percentage likelihood to the AVERAGE PROFIT MARGINS you entered above. (Values should sum to 100%)

LOWEST CASE: The likelihood of about a **1** percent average profit margin would be:	%
LOW CASE: The likelihood of about a **2** percent average profit margin would be:	%
MEDIUM CASE: The likelihood of about a **3** percent average profit margin would be:	%
HIGH CASE: The likelihood of about a **4** percent average profit margin would be:	%
HIGHEST CASE: The likelihood of about a **5** percent average profit margin would be:	%
Total	%

B.11b. Prices

Looking back, from 12 months ago to now, what was the approximate percentage change in the AVERAGE PRICE you charge, considering all of your products and services?

____ %

Looking ahead, from now to 12 months from now, what approximate percentage change in AVERAGE PRICE would you assign to each of the following scenarios?

The LOWEST-CASE percentage change in the average price you charge would be:	1
The LOW-CASE percentage change in the average price you charge would be:	2
The MEDIUM-CASE percentage change in the average price you charge would be:	3
The HIGH-CASE percentage change in the average price you charge would be:	4
The HIGHEST-CASE percentage change in the average price you charge would be:	5

Please assign a percentage likelihood to the AVERAGE PRICE changes you entered above. (Values should sum to 100%)

LOWEST CASE: The likelihood of about a **1** percent change in the average price you charge would be:	%
LOW CASE: The likelihood of about a **2** percent change in the average price you charge would be:	%
MEDIUM CASE: The likelihood of about a **3** percent change in the average price you charge would be:	%
HIGH CASE: The likelihood of about a **4** percent change in the average price you charge would be:	%
HIGHEST CASE: The likelihood of about a **5** percent change in the average price you charge would be:	%
Total	%

Table B.1: Summary of Tests for Developing the Survey of Business Uncertainty

Panel	Date	Variable(s)	Abbreviated description	Description
BIE Survey Panel – Special Question Series	Oct–13	sales levels	A/B test. three–estimate and five-binned range versions.	Participants were randomly assigned to one of two groups. Group 1 received a question eliciting the "best,“ "most likely," and "worst" case change in sales levels over the next 12 months. A drop–down box was provided with estimates ranging from –15% to 30%. Group 2 received a question asking respondents to assign a likelihood to five potential percentage sales level change ranges (from "less than –1%" to "more than 5%") over the next 12 months.
	Nov–13	sales levels	A/B test.	Participants were randomly assigned to one of two groups. Group 1 received a question eliciting the "best," "most likely," and "worst" case change in sales levels over the next twelve months. For each estimate a drop–down box was provided with options ranging from –15% to 30%. A note indicating "best" and "worst" case scenarios should be associated with a 10% chance of occurrence was includeC. Group 2 received a question asking respondents to assign a likelihood to five potential percentage sales level change ranges (ranging from "less than –5%" to "more than 25%") over the next 12 months.
	Dec–13	unit costs	A/B test	Participants were randomly assigned to one of two groups. Group 1 received a question eliciting the "best," "middle," and "worst" case percentage change in unit costs over the next 12 months. Group 2 received a question asking respondents to assign a likelihood to five potential percentage unit cost change ranges (from "less than –1%" to "more than 5%") over the next 12 months.
	Jan–14	sales levels	three estimates	Participants received a two–part question. Part one elicited the expected "low," "middle," and "high" case changes in sales levels over the next twelve months. Part two asked respondents to assign a likelihood of occurrence for each of the three scenarios.
	Feb–14	number of employees	three estimates	Participants received a two–part question. Part one elicited the expected "low," "middle," and "high" case number of employees twelve months ahead. Part two asked respondents to assign a likelihood of occurrence for each of the three scenarios.
	Mar–14	sales levels	three estimates	Repeat of the January 2014 question.
	Apr–14	sales levels	five estimates	The same question as in January and March 2014 with the addition of a "worst case" and "best case" scenario for a total of five response categories.
	May–14	number of employees	five estimates	The same question as in February 2014 with the addition of a "worst case" and "best case" scenario for a total of five response categories.
	Jun–14	sales levels	three estimates with a best case/worst case follow–up	Repeat of the January 2014 question with a follow–up question asking for the "best case" and "worst case" scenarios without a likelihood assignment.

Panel	Date	No. of Groups	Variable(s)	Notes	Description
Survey of Business Uncertainty Panel	Jul–14	2	number of employees, average price, sales revenue	A/B Test – 5 estimate and 3 estimate versions with drop down boxes for estimates and open text boxes for likelihoods	Participants were randomly assigned to one of two groups. In each group, respondents received a two–part question for each variable. Grop 1: Part one elicited the "high," "medium," and "low" case change in each variable over the next 12 months. Part two asked respondents to assign a likelihood to each of these scenarios. Group 2: Same format as Group 1 with two additional scenarios eliciting the "lowest case" and "highest case."
	Aug–14	2	sales revenue, average price, number of employees, unit cost, capital investment, profit margin	five estimates with drop down box for estimates and open text box for likelihoods	Participants received a two–part question for each variable. Part one elicited the “highest," "high," "medium," "low," and “lowest” case change in each variable over the next 12 months. Part two asked respondents to assign a likelihood to each of these scenarios.
	Sep–14	2	sales revenue, average prices, unit cost, capital investment	five estimates with open text boxes for estimates and likelihoods	Participants received a two–part question for each variable. Part one elicited the “highest," "high," "medium," "low," and “lowest” case change in each variable over the next 12 months. Part two asked respondents to assign a likelihood to each of these scenarios.
	Oct–14 to Jan–15	3	sales revenue, average price, number of employees, unit cost, capital investment, profit margin	five estimates with open text boxes for estimates and likelihoods	Participants received a two–part question for each variable. Part one elicited the “highest," "high," "medium," "low," and “lowest” case change in each variable over the next 12 months. Part two asked respondents to assign a likelihood to each of these scenarios.
	Feb–15 to Oct–15	3	sales revenue, average price, number of employees, unit cost, capital investment, profit margin	five estimates with open text boxes for estimates and likelihoods	Participants received a two–part question for each variable. Part one elicited the “highest," "high," "medium," "low," and “lowest” case change in each variable over the next 12 months. Part two asked respondents to assign a likelihood to each of these scenarios.
	Nov–15 to Jan–16	6	sales revenue, average price, number of employees, unit cost, capital investment, profit margin	five estimates with open text boxes for estimates and likelihoods	Participants received a two–part question for each variable. Part one elicited the “highest," "high," "middle," "low," and “lowest” case change in each variable over the next 12 months. Part two asked respondents to assign a likelihood to each of these scenarios.
	Feb–16 to Aug–16	6	sales revenue, average price, number of employees, unit cost, capital investment, profit margin	five estimates with open text boxes for estimates and likelihoods	Participants received a two–part question for each variable. Part one elicited the “highest," "high," "middle," "low," and “lowest” value for each variable over the next 12 months. Part two asked respondents to assign a likelihood to each of these scenarios.
	Sep–16 to Present	2	sales revenue, average unit cost, capital expenditures, number of employees	five estimates with open text boxes for estimates and likelihoods	Participants received a two–part question for each variable. Part one elicited the “highest," "high," "middle," "low," and “lowest” value for each variable over the next 12 months. Part two asked respondents to assign a likelihood to each of these scenarios.

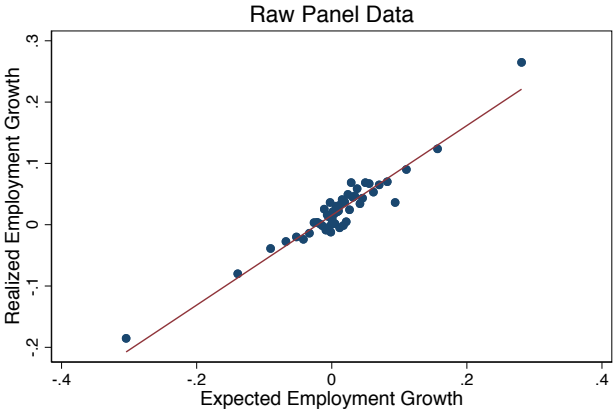
C. Additional Empirical Results: Microdata

C.1 Core results focusing on employment growth expectations and uncertainty

- The next few slides replicate some of the core results about the SBU microdata focusing on employment growth rather than sales growth expectations and uncertainty.
- Broadly speaking the results are the same whether we focus on sales or employment. In several cases they are sharper for employment, which we believe owes to less measurement error in employment expectations and realizations.

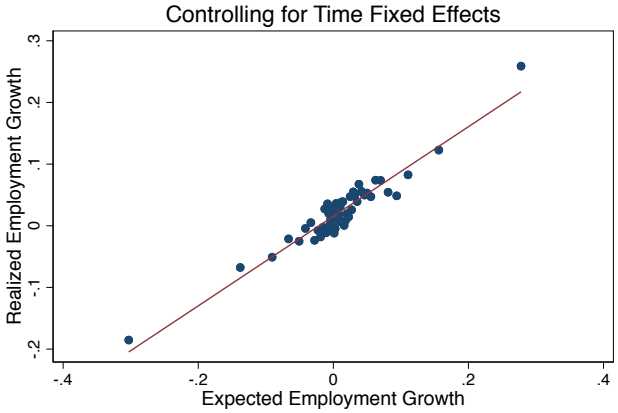
Figure C.1: Subjective Expectations Predict Realizations

Figure C.1a



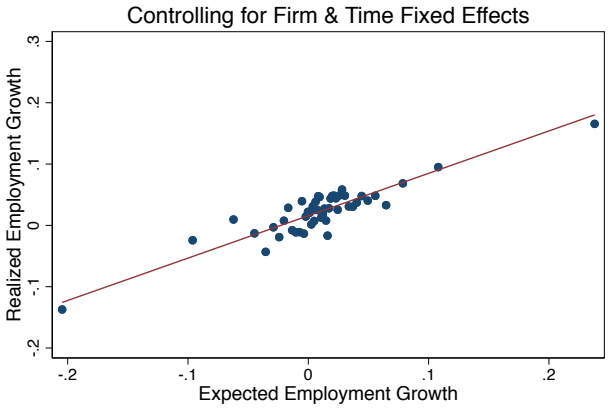
Coeff. = .732, S.E. = .082, R^2 = .110, N = 3692

Figure C.1b



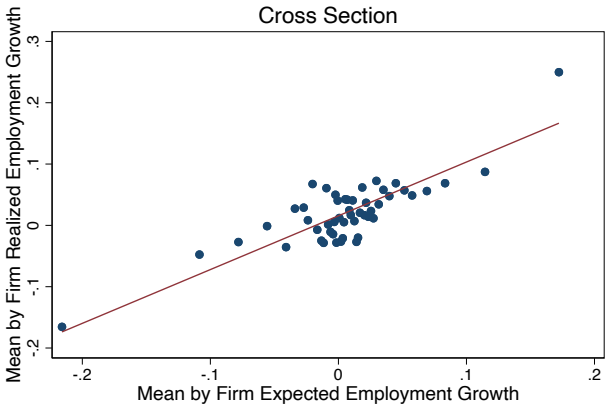
Coeff. = .726, S.E. = .083, Within R^2 = .109, N = 3692

Figure C.1c



Coeff. = .691, S.E. = .117, Within R^2 = .080, N = 3570

Figure C.1d

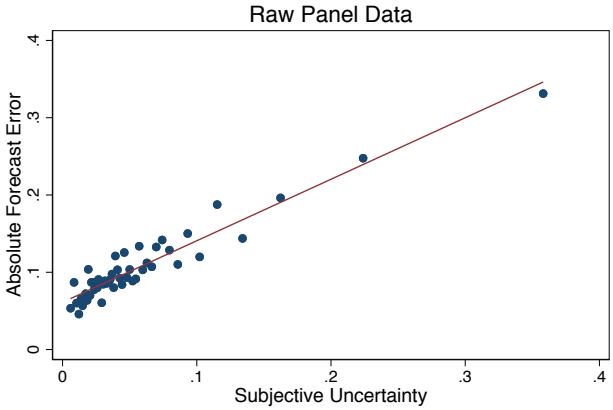


Coeff. = .876, S.E. = .153, R^2 = .136, N = 589

Notes: This figure shows bin-scatter plots of employment growth expectations for the next 12 months on the horizontal axis against measured employment growth over the ensuing 12 months on the vertical axis. Figure B.1a shows the relationship in the raw panel data. Figure B.1b controls for time effects. Figure B.1c controls for both firm and time fixed effects. Figure B.1d shows the relationship in the cross section, plotting the mean-by-firm expected employment growth on the horizontal axis and mean-by-firm realized employment growth on the vertical axis. The reported statistics below each figure correspond to the OLS regression in the underlying microdata, reporting firm-clustered standard errors. Data are from all waves of the SBU from 10/2014 to 10/2019.

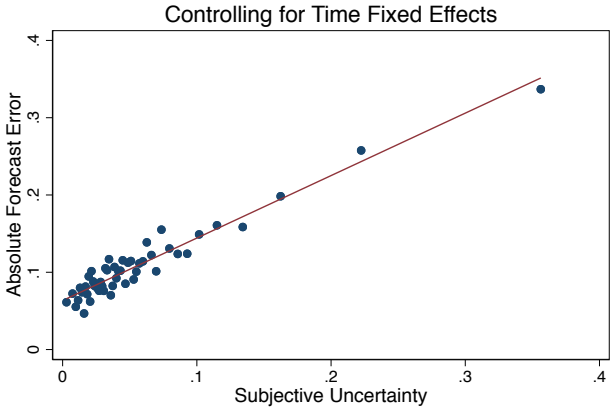
Figure C.2: Subjective Uncertainty Predicts Absolute Forecast Errors

Figure C.2a



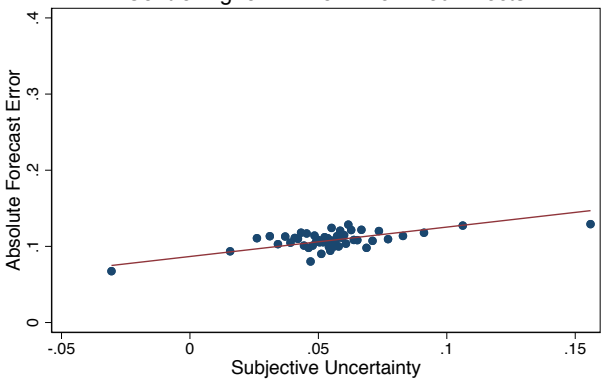
Coeff. = .812, S.E. = .067, R^2 = .138, N = 3692

Figure C.2b



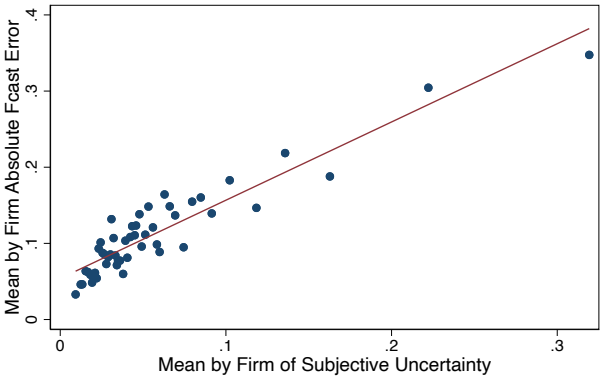
Coeff. = .808, S.E. = .067, Within R^2 = .138, N = 3692.

Figure C.2c



Coeff. = .386, S.E. = .097, W/in R^2 = .011, N = 3570.

Figure C.2d

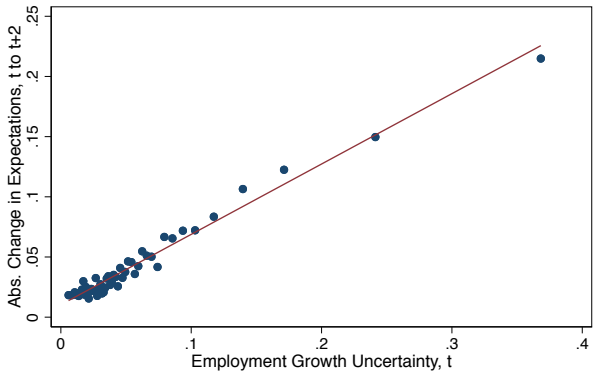


Coeff. = 1.02, S.E. = .096, R^2 = .285, N = 576

Notes: This figure shows bin-scatter plots of subjective uncertainty about the firm's employment growth for the next 12 months on the horizontal axis, against the respondent's absolute forecast error for employment growth over the ensuing 12 months on the vertical axis. Figure B.2a shows the relationship in the raw panel data. Figure B.2b controls for time effects. Figure B.2c also controls for firm effects. Figure B2.d shows the relationship in the cross section, plotting mean-by-firm subjective uncertainty on the horizontal axis against mean-by-firm absolute forecast errors on the vertical axis. The statistics below each figure correspond to the population OLS regression. Data are from all waves of the SBU from 10/2014 to 10/2019.

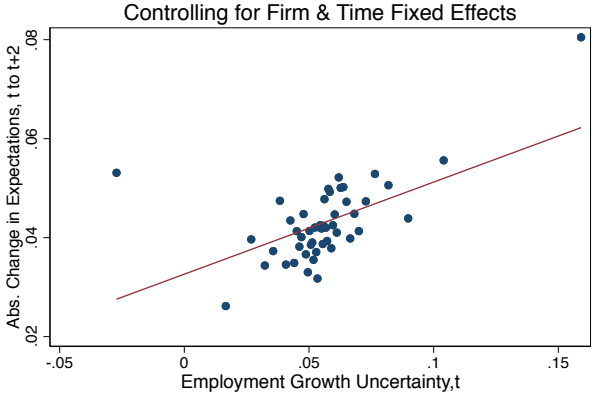
Figure C.3: Uncertainty and subsequent expectations revisions

Figure C.3a
Raw Panel Data



Coeff. = .584, S.E. = .044, R^2 = .271, N = 3720

Figure C.3b
Controlling for Firm & Time Fixed Effects

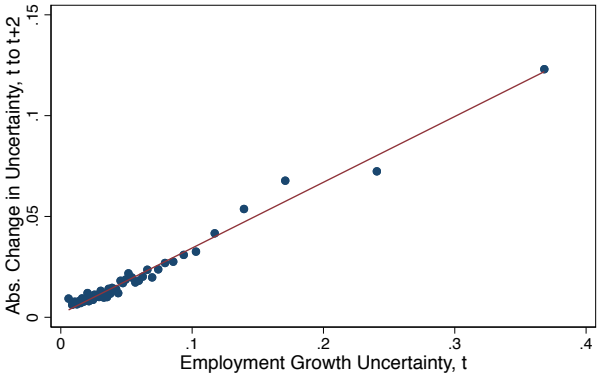


Coeff. = .186, S.E. = .107, Within R^2 = .009, N = 3597

Notes: This figure shows two bin-scatter plots. On the horizontal axis, both show 50 quantiles of subjective uncertainty for employment growth over the next 12 months, measured in month *t*. Both have on the vertical axis the absolute value of the change in employment growth expectations (looking for 12 months ahead) from months *t* to *t+2* (or *t+3*). On the left, we show the relationship in the raw panel data, while on the right we show the relationship controlling for firm and time fixed effects. We report the underlying firm-level regressions with firm-clustered standard errors at the bottom of each figure, using SBU data from 10/2014 to 10/2019.

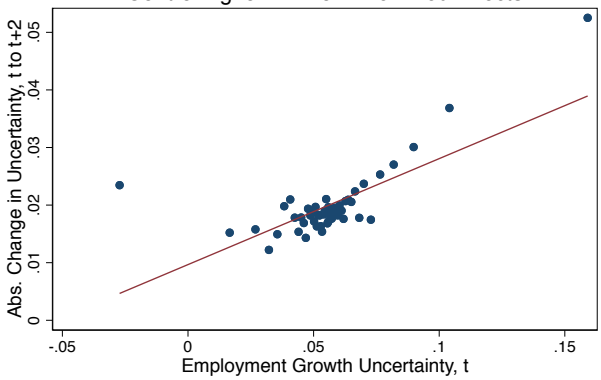
Figure C.4: Uncertainty and subsequent uncertainty revisions

Figure C.4a
Raw Panel Data



Coeff. = .326, S.E. = .025, R^2 = .408, N = 3725

Figure C.4b
Controlling for Firm & Time Fixed Effects



Coeff. = .184, S.E. = .054, Within R^2 = .049, N = 3602

Notes: This figure shows two bin-scatter plots. On the horizontal axis, both show 50 quantiles of subjective uncertainty for employment growth over the next 12 months, measured in month *t*. Both have on the vertical axis the absolute value of the change in employment growth uncertainty from months *t* to *t+2* (or *t+3*). On the left, we show the relationship in the raw panel data, while on the right we show the relationship controlling for firm and time fixed effects. We report the underlying firm-level regressions with firm-clustered standard errors at the bottom of each figure, using SBU data from 10/2014 to 10/2019.

Figure C.5: Past sales growth and recent forecast revisions predict higher subjective uncertainty

Figure C.5a

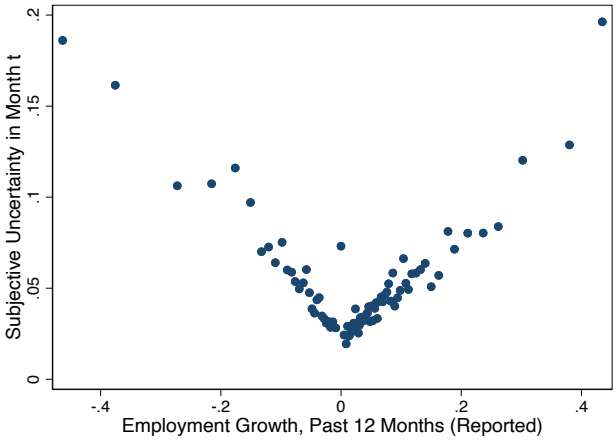


Figure C.5b

Notes: This figure shows two bin-scatter plots with subjective uncertainty over employment growth in the 12 months following month *t* on the vertical axis. Figure 6a shows shows 100 quantiles of past employment growth from month *t – 12* to *t* on the horizontal axis. Figure 6b instead shows 100 quantiles of the change in twelve-months-ahead employment growth expectations from *t – 2* (or *t - 3*) to *t*. Data are from the SBU and the sample covers all survey waves from 10/2014 to 10/2019.

Figure C.6: Reinterpreting responses as continuous distributions consisting of 5 uniform bins

Figure C.6a

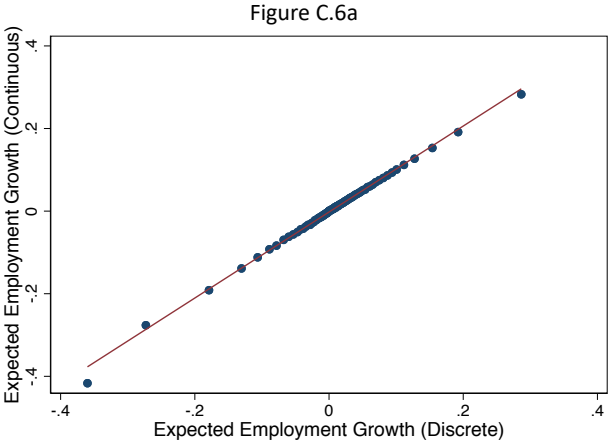
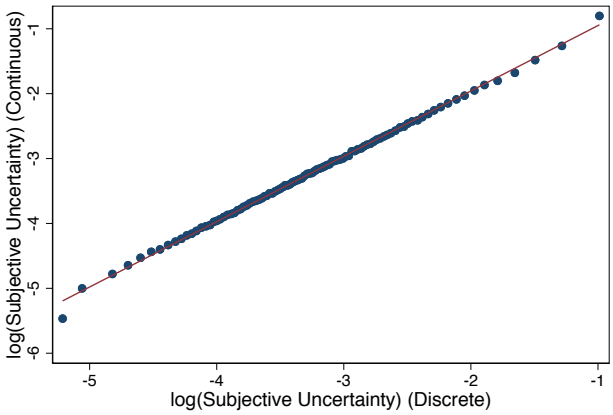


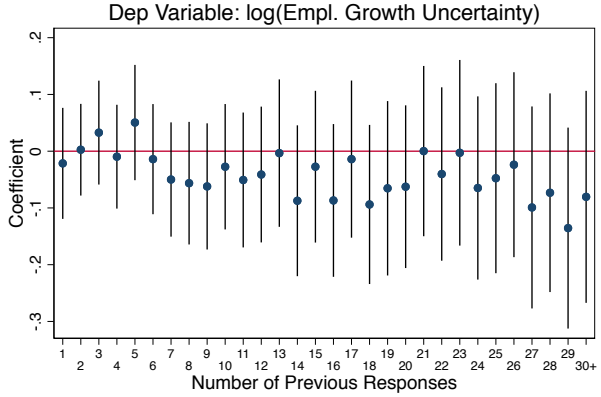
Figure C.6b



Notes: The above figures show bin-scatter plots that compare our measures of subjective mean expectations and uncertainty interpreting SBU responses as discrete or subjective distributions. Our baseline measures interpret SBU responses as discrete, 5-point probability distributions. Alternatively, we can interpret the responses as a continuous distribution consisting of 5 bins, with a uniform distribution within each bin. Figure 12a plots 100 percentiles of our discrete measure of expected employment growth (looking 12 months ahead) on the horizontal axis against the continuous measure of expectations on the vertical axis. Figure 12b repeats the exercise for the natural logarithm of subjective uncertainty. Statistics below the figure correspond to the OLS regression in the underlying microdata, reporting firm-clustered standard errors. Data are from all waves of the SBU from 10/2014 to 10/2019.

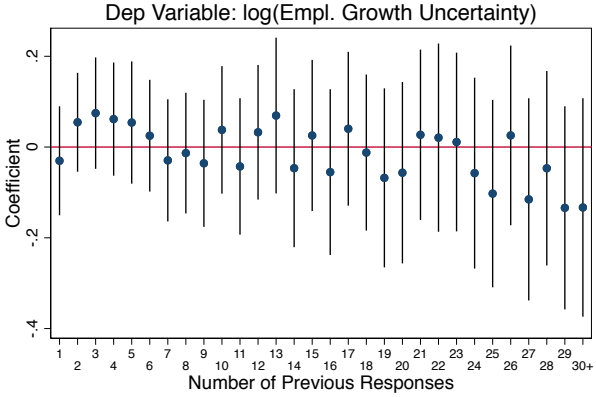
Figure C.7: Subjective Uncertainty and Previous Survey Completions

Figure C.7a



Mean (SD) of Dep. Var: -3.24 (.833)

Figure C.7b



Mean (SD) of Dep. Var: -3.24 (.830). Employment-weighted

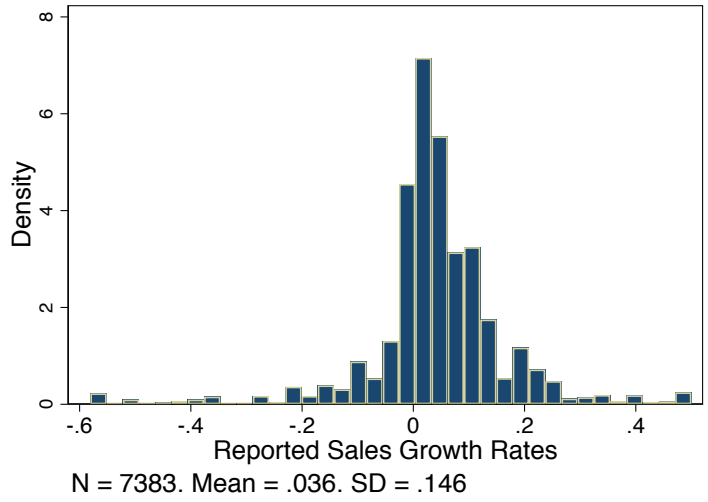
Notes: This figure shows estimated coefficients and 95 percent confidence intervals from regressions of the natural log of employment growth uncertainty (looking ahead over the next 4 quarters) on a set of indicators for the firm's number of previous SBU responses on the right-hand-side as well as firm and time fixed effects (not shown). Figure B.3a (left) shows unweighted estimates, while figure B.3b (right) weights observations by employment (winsorized at 500 employees). We top-code the number of responses at 30. Data are from the SBU and cover all survey waves between 10/2014 and 10/2019. We construct the 95 percent confidence intervals based on firm-clustered robust standard errors.

C.2 Additional descriptive results about the SBU microdata

- Below we report some additional results pertaining to our expectations and uncertainty indices based on the SBU data.

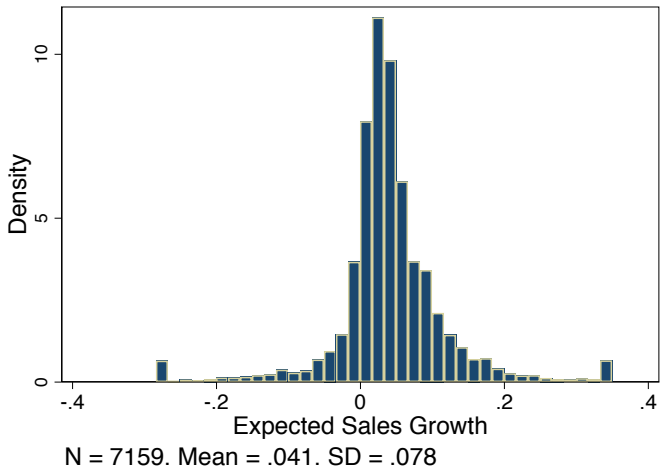
Figure C.8: Marginal Distributions

C.8a. Reported Sales Growth Rates, Past 12 Months



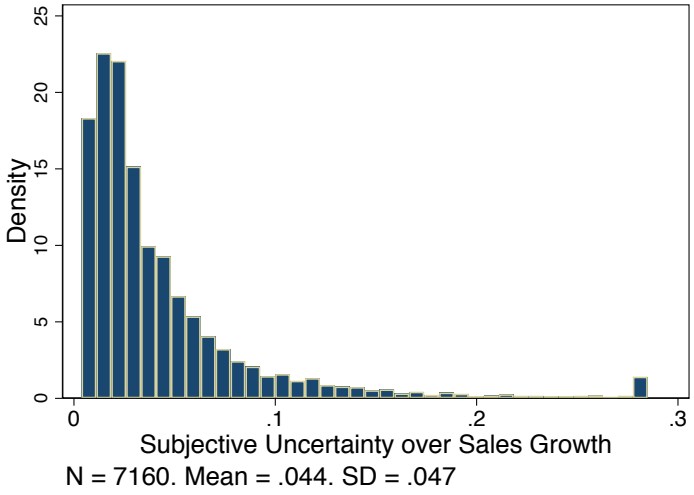
Notes: The histogram shows the empirical distribution of reported sales growth rates for the past 12 months in the Survey of Business Uncertainty. The sample includes all SBU responses between 10/2014 to 10/2019. For survey months prior to 9/2016, we compute the firm's employment growth rate in the 12 months to *t* using the firm's sales in the current quarter (measured in month *t)* and its answer to the question, *"Looking back, four quarters ago, what was the approximate dollar value of your SALES REVENUE?".* For survey months since 9/2016, we use responses to the question, "Looking back, over the last 12 months, what was your approximate percentage SALES REVENUE GROWTH rate?" In both cases we report growth rates measured as the change divided by the average between the start and end. For responses since 9/2016 we assume the raw data report conventional growth rates (change divided by initial period) and we transform them to obtain our preferred growth rate measured. Before plotting, we winsorize the distribution at the 1st and 99th percentiles.

C.8b. Sales Growth Expectations, Next 4 Quarters



Notes: The histogram shows the empirical distribution of expected sales growth rates, looking ahead to the next four quarters. The sample includes all SBU responses between 10/2014 to 10/2019 for which we have a five-point subjective distribution over future employment growth rates. We compute these subjective mean growth rates as described in Section 2 of the main text.

C.8c. Sales Growth Uncertainty, Next 4 Quarters

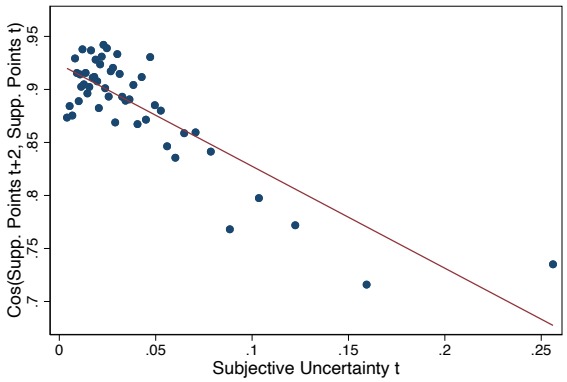


Notes: The histogram shows the empirical distribution of subjective uncertainty about sales growth, looking ahead to the next four quarters. The sample includes all SBU responses between 10/2014 to 10/2019 for which we have a five-point subjective distribution over future sales growth rates. We compute subjective uncertainty about sales growth as the standard deviation of the five-point subjective distribution. See Section 2 of the main text for details.

Figure C.9 Subjective uncertainty in month *t* predicts the extent of beliefs revisions in the next survey

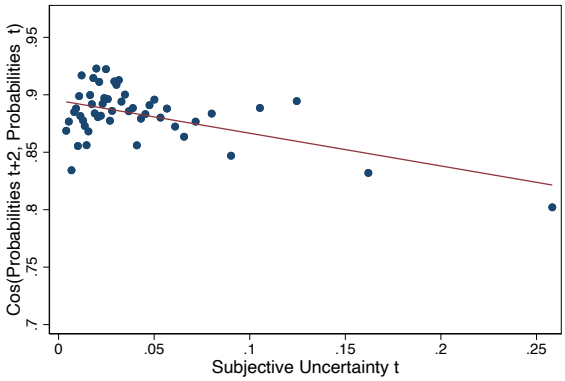
C.9a. Sales growth subjective distribution

Figure C.9a.i Revising the Vector of Support Points



Coeff. = -.96, S.E. = .120, R^2 = .033, N = 4698

Figure C.9a.ii Revising the Vector of Probabilities

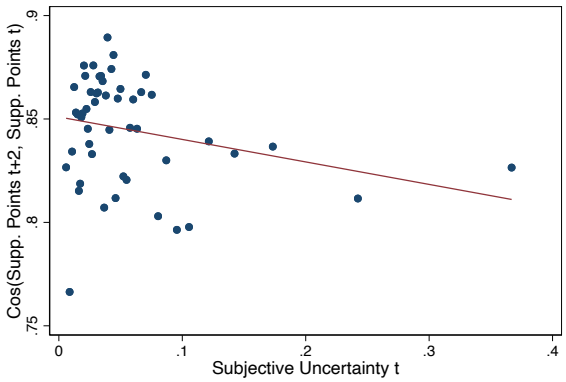


Coeff. = -.28, S.E. = .072, R^2 = .006, N = 4733

Notes: Both bin scatters show 50 quantiles of subjective uncertainty at *t* for the sales growth rate over the next four quarters. The vertical axis in panel (a) shows the cosine similarity between forecast distribution support points for sales growth rates at *t* and *t*+2 (or *t*+3) for the same firm. The vertical scale in panel (b) shows cosine similarity for forecast distribution probabilities at *t* and *t*+2 (or *t*+3). We report the underlying firm-level regressions with firm-clustered standard errors at the bottom of each figure, using SBU data from 10/2014 to 10/2019.

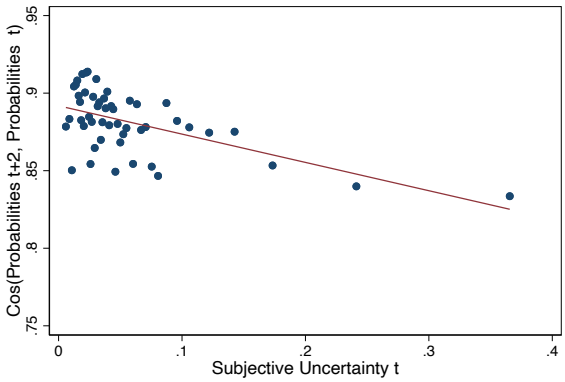
C.9b Employment growth subjective distribution

Figure C.9b.i Revising the Vector of Support Points



Coeff. = -.10, S.E. = .075, R^2 = .000, N = 4487

Figure C.9b.ii Revising the Vector of Probabilities



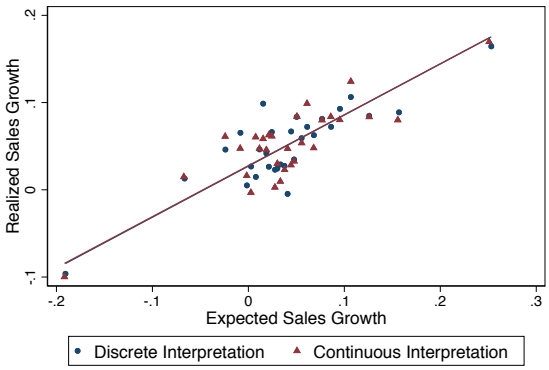
Coeff. = -.18, S.E. = .058, R^2 = .005, N = 4563

Notes: This figure shows two bin-scatter plots. On the horizontal axis, both show 50 quantiles of subjective uncertainty for employment growth over the next 12 months, measured in month *t*. In figure 5a (left) the vertical axis shows the cosine similarity of the vector of support points respondents provide across consecutive surveys, in months *t* and *t+2 (or t+3)*. In figure 5b (right) we instead show the cosine similarity across vectors of probabilities from nearest same-topic surveys. The regression results reported below each figure correspond to the underlying microdata regression, reporting firm-clustered standard errors. Data are from the SBU and the sample covers all survey waves from 10/2014 to 10/2019.

Figure C.10: Predictive power of discrete vs. continuous subjective moments

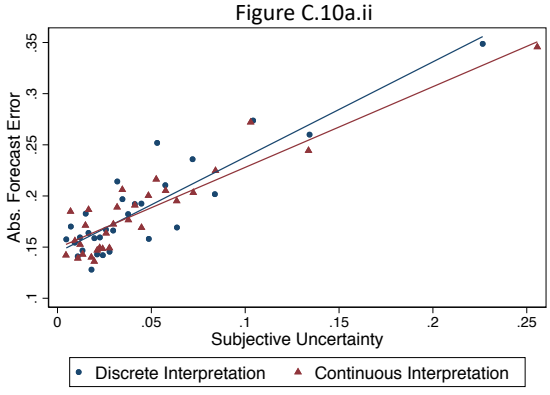
C.10a. Sales Growth Expectations and Uncertainty

Figure C.10a.i



Discrete: .585 (.084). Continuous: .584 (.084). N = 6074

Figure C.10a.ii

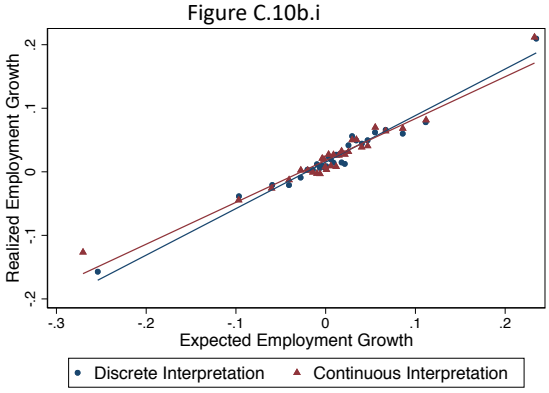


Discrete: .931 (.100). Continuous: .788 (.090). N = 6074

Notes: Each of the above figures figure superimposes two bin-scatter plots. On the left we show forecast employment growth over the next twelve months on the horizontal axis against actual employment growth. On the right we have subjective uncertainty over employment growth for the next twelve months on the horizontal axis against the respondent's absolute forecast error for employment growth over the ensuing twelve months on the vertical axis. The blue dots show each relationship under our baseline interpretation that SBU responses are discrete, 5-point probability distributions. The red triangles show the relationship if we interpret the responses as a continuous distribution consisting of 5 bins, with a uniform distribution within each bin. Statistics below the figure correspond to the population OLS regression, reporting firm-clustered standard errors. Data are from all waves of the SBU from 10/2014 to 10/2019.

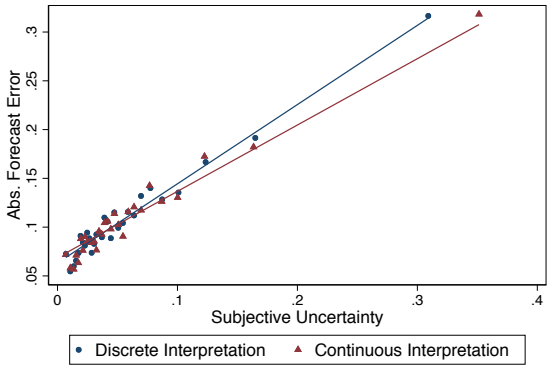
C.10b. Employment Growth Expectations and Uncertainty

Figure C.10b.i



Discrete: .732 (.082). Continuous: .658 (.079). N = 7400

Figure C.10b.ii



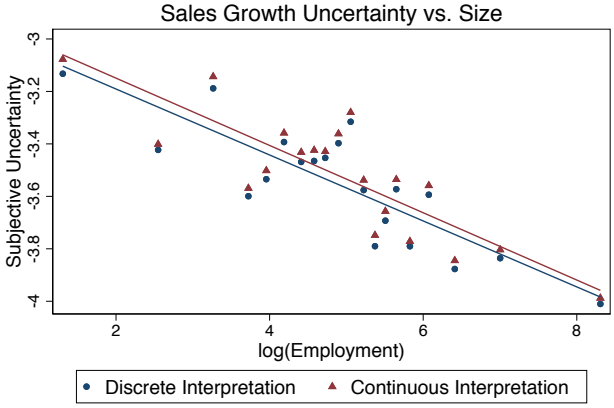
Discrete: .812 (.067). Continuous: .679 (.069). N = 7384

Notes: Each of the above figures figure superimposes two bin-scatter plots. On the left we show forecast employment growth over the next twelve months on the horizontal axis against actual employment growth. On the right we have subjective uncertainty over employment growth for the next twelve months on the horizontal axis against the respondent's absolute forecast error for employment growth over the ensuing twelve months on the vertical axis. The blue dots show each relationship under our baseline interpretation that SBU responses are discrete, 5-point probability distributions. The red triangles show the relationship if we interpret the responses as a continuous distribution consisting of 5 bins, with a uniform distribution within each bin. Statistics below the figure correspond to the population OLS regression, reporting firm-clustered standard errors. Data are from all waves of the SBU from 10/2014 to 10/2019.

Figure C.11: Uncertainty vs. Firm Size

Figure C.11a

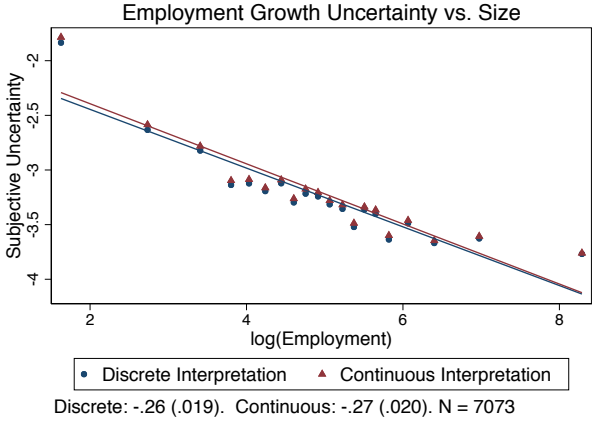
Sales Growth Uncertainty vs. Size



Discrete: -.12 (.020). Continuous: -.12 (.021). N = 6882

Figure C.11b

Employment Growth Uncertainty vs. Size

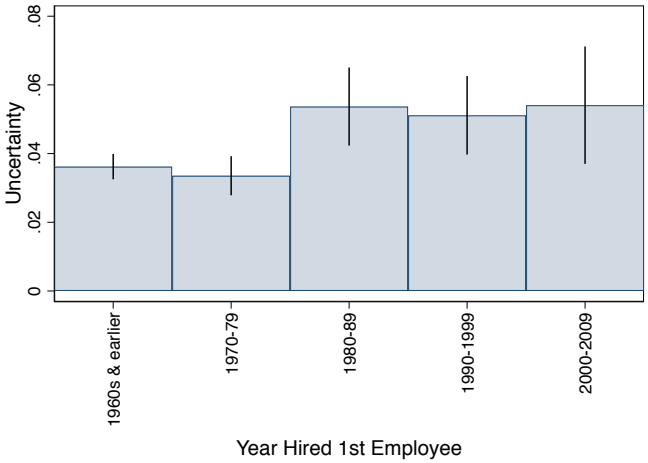


Discrete: -.26 (.019). Continuous: -.27 (.020). N = 7073

Notes: Each of the above figures shows a bin-scatter plot of the natural logarithm of subjective uncertainty on the vertical axis against 20 quantiles of the natural log of current firm-level employment. Figure B.11a focuses on sales growth uncertainty for the next four quarters on the vertical axis, while Figure B.11b focuses on employment growth uncertainty looking ahead over the next twelve months. Subjective uncertainty is the standard deviation of each respondents' five-point subjective distribution over future sales or employment growth. See Section 2 and Appendix A for more details on how we measure subjective uncertainty. The statistics below each figure report the slope coefficient and firm-clustered standard error in the underlying microdata regression. Data are from all waves of the SBU from 10/2014 to 10/2019.

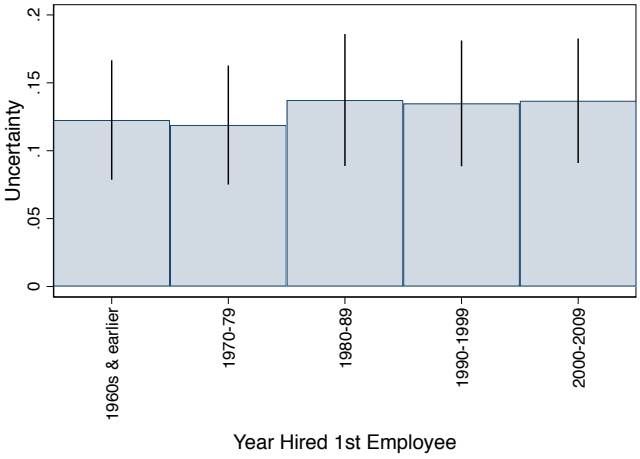
Figure C.12: Uncertainty vs. Age

C.12a. Without controlling for size



Notes: This figure shows within group means and 95 percent confidence intervals of sales growth uncertainty looking ahead over the next four quarters, grouping firms by the decade in which they hired their first paid employee. Data are from the SBU and cover all survey waves between 10/2014 and 10/2019. The vertical lines are 95 percent confidence intervals based on firm clustered robust standard errors.

C.12b. Controlling for Size



Notes: This figure shows within group means and 95 percent confidence intervals of sales growth uncertainty over the next four quarters, grouping firms by the decade in which they hired their first paid employee after controlling for the relationship between uncertainty and firm size (measured as log(current sales)). Data are from the SBU and cover all survey waves between 10/2014 and 10/2019. The vertical lines are 95 percent confidence intervals based on firm clustered robust standard errors.

Table C.1: How do higher-order subjective moments predict outcomes and forecast errors?

C.1a. Sales Growth, Next 4 Quarters

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Realized Sales Growth, Next 4 Quarters				**Abs(Forecast - Realized Sales Growth), Next 4 Quarters**			
Expected Sales Growth, Next 4 Quarters	0.589***	0.569***	0.569***	0.451***	0.032	0.006	0.006	-0.025
	(0.084)	(0.081)	(0.081)	(0.110)	(0.060)	(0.061)	(0.061)	(0.059)
Sales Growth Uncertainty, Next 4 Quarters	0.058	0.087	0.095	0.065	0.936***	0.974***	0.948***	0.400***
	(0.163)	(0.159)	(0.155)	(0.229)	(0.100)	(0.098)	(0.096)	(0.150)
Sales Growth Skewness, Next 4 Quarters		0.019**	0.020**	0.026***		0.025***	0.024***	0.008*
		(0.008)	(0.008)	(0.008)		(0.005)	(0.005)	(0.004)
Sales Growth Kurtosis, Next 4 Quarters			-0.001	-0.002			0.002	0.000
			(0.002)	(0.002)			(0.001)	(0.001)
Time FE				Y				Y
Firm FE				Y				Y
Observations	3,037	3,037	3,037	2,913	3,037	3,037	3,037	2,913
R-squared	0.026	0.030	0.030	0.287	0.049	0.062	0.062	0.397
Adjusted R-squared	0.0258	0.0293	0.0291	0.161	0.0480	0.0606	0.0612	0.290
Firms	511	511	511	387	511	511	511	387

Notes: This table regresses realized sales growth in the 4 quarters following a survey and the associated absolute forecast error on the mean, standard deviation (i.e. uncertainty), skewness, and kurtosis of the subjective distribution provided by a respondent with regards to sales growth in quarters q to q+4. We drop singleton observations in columns 4 and 8 when we include firm and time fixed effects in the regression. Data are from the SBU, including all survey waves between 10/2014 and 10/2019. Robust standard errors in parentheses, clustered by firm. *** p<0.01, ** p<0.05, * p<0.1

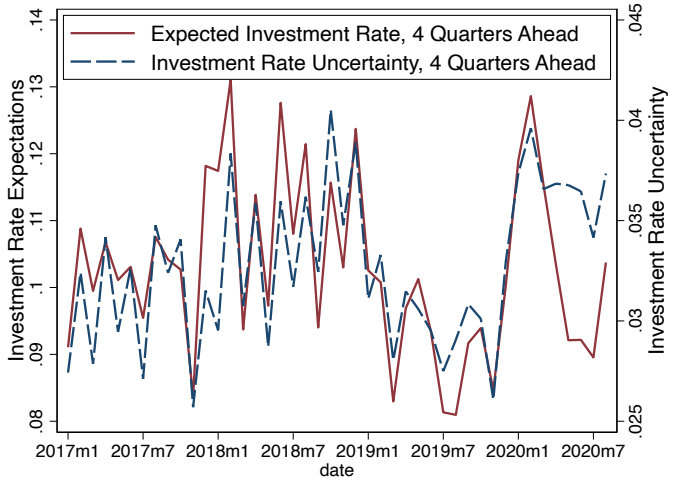
C.1b. Employment, Next 12 Months

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Realized Employment Growth, Next 12 Months				**Abs(Forecast - Realized Employment Growth), Next 12 Months**			
Expected Employment Growth, Next 12 Months	0.751***	0.732***	0.734***	0.671***	0.002	-0.006	-0.001	-0.142**
	(0.083)	(0.080)	(0.079)	(0.109)	(0.062)	(0.059)	(0.059)	(0.059)
Employment Growth Uncertainty, Next 12 Months	0.114	0.126	0.118	0.143	0.813***	0.818***	0.795***	0.361***
	(0.082)	(0.082)	(0.083)	(0.134)	(0.070)	(0.071)	(0.069)	(0.097)
Employment Growth Skewness, Next 12 Months		0.010**	0.011**	0.015***		0.004	0.006*	0.000
		(0.004)	(0.004)	(0.005)		(0.004)	(0.003)	(0.003)
Employment Growth Kurtosis, Next 12 Months			0.001	0.001			0.003***	0.001
			(0.001)	(0.002)			(0.001)	(0.001)
Time FE				Y				Y
Firm FE				Y				Y
Observations	3,692	3,692	3,692	3,570	3,692	3,692	3,692	3,570
R-squared	0.112	0.115	0.115	0.349	0.139	0.139	0.145	0.477
Adjusted R-squared	0.112	0.114	0.114	0.242	0.138	0.139	0.144	0.391
Firms	576	576	576	454	576	576	576	454

Notes: This table regresses realized employment growth in the 12 months following a survey, the associated absolute forecast error, and the raw forecast error on the mean, standard deviation (i.e. uncertainty), and skewness of the subjective distribution provided by a respondent with regards to Employment Growth in the 12 months following the survey. We drop singleton observations in columns 4 and 8 when we include firm and time fixed effects in the regression. Data are from the SBU, including all survey waves between 10/2014 and 10/2019. Robust standard errors in parentheses, clustered by firm. *** p<0.01, ** p<0.05, * p<0.1

D. Additional Empirical Results: Aggregate Indices

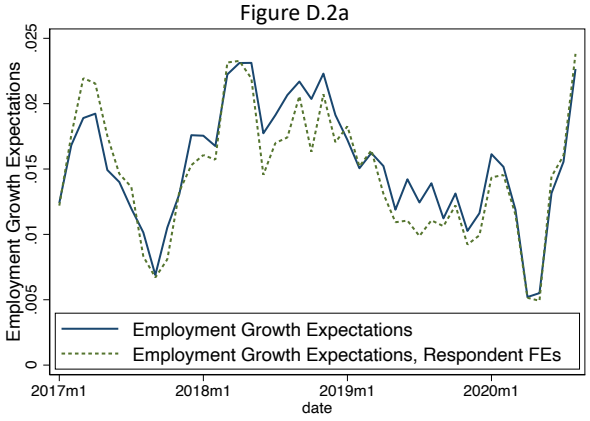
Figure D.1: Investment Rate Indices



Notes: This figure shows our investment rate expectations (left axis) and uncertainty (right axis) indices, looking four quarters ahead. We smooth both indices using the same procedure as for the sales growth and employment growth indices, which we describe in the main text. Both indices appear on the official Survey of Business Uncertainty website as of February 2020.

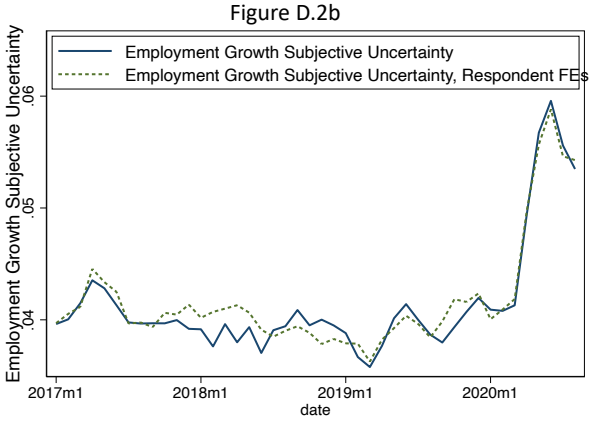
Figure D.2: Employment growth expectations and uncertainty Indices controlling for panel composition

Figure D.2a



Correlation .940

Figure D.2b

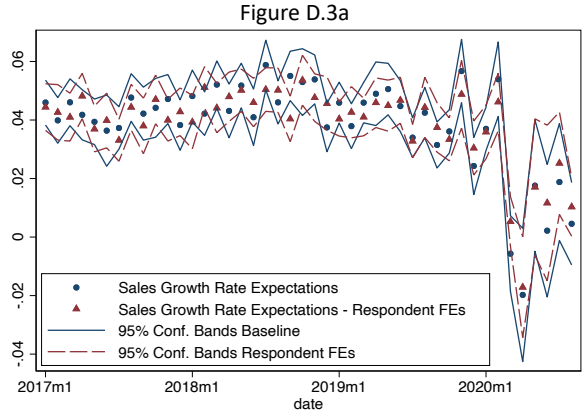


Correlation .973

Notes: The above figures plot our baseline employment growth expectations (left) and uncertainty (right) indices alongside an alternative index that accounts for changing panel composition across months. Our baseline index computes an activity-weighted mean for expectations or uncertainty in each month. By contrast, the alternative index computes the same activity weighted mean after controlling for respondent fixed effects. We smooth both indices using the same procedure. Data are from the SBU and cover all months between 1/2015 and 10/2019.

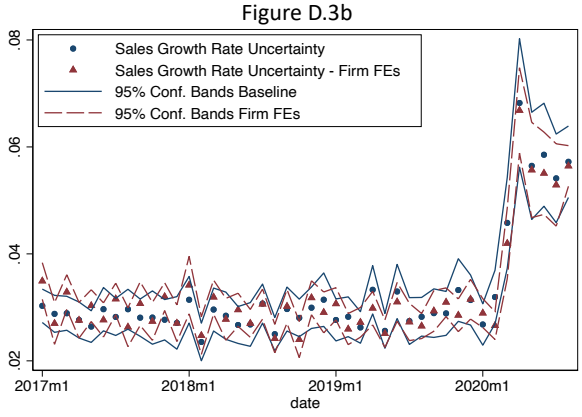
Figure D.3: Our sales growth expectations and uncertainty indices and 95 percent confidence bands with/without controlling for panel composition

Figure D.3a



Correlation .939

Figure D.3b



Correlation .968

Notes: The above figures plot our baseline sales growth expectations (left) and uncertainty (right) indices alongside alternative indices that account for changing panel composition across months and also display 95 percent confidence bands for each index based on two-way firm and date clustered robust standard errors. Our baseline index computes an activity-weighted mean for expectations or uncertainty in each month. By contrast, the alternative index computes the same activity weighted mean controlling for respondent fixed effects. This figure does not smooth the indices time series. Data are from the SBU and cover all months between 1/2015 and 10/2019.

D.1 How do our expectations and uncertainty indices change if we reweight our sample to match the share of employment by industry and region?

- In the following pages, we test how reweighting our SBU sample to resemble its target population (the private nonfarm sector) more closely changes our expectations and uncertainty indices.
- We construct versions of our indices that match the share of employment by industry and region in each year, and compare them with our baseline (employment-weighted) indices.
- We obtain the target industry and region employment shares using private nonfarm payroll data from the Bureau of Labor Statistics.

D.1.1 Reweighting Procedure

1. We calculate industry employment shares (source: BLS) for each year from 2014 to 2018. Data for 2019 are not yet available as of mid-March 2020, so we use the 2018 shares for 2019. Let POP_{jt} denote industry *j*'s employment share in year *t.*

2. We calculate region employment shares (source: BLS) in each year from 2014 to 2018. Data for 2019 are not yet available as of mid-March 2020, so we use the 2018 shares for 2019. Let POP_{rt} denote region *r*'s employment share in year *t.*

3. We calculate industry and region employment shares in the SBU for each year from 2014 to 2019, based on reported employment (winsorized at 500 employees). Let SBU_{jt} denote industry *j*'s employment share in year *t,* and SBU_{rt} region *r*'s employment share in year t in the SBU.

4. We calculate industry (region) representativeness weights by dividing the population industry (region) employment share by its SBU counterpart POP_{jt}/SBU_{jt} (POP_{rt}/SBU_{rt}).

5. We then multiply our baseline activity weight--the firm's employment, winsorized at 500--by the appropriate industry and region representativeness weights, i.e the product $POP_{jt}/SBU_{jt} \times POP_{rt}/SBU_{rt}$.

6. We use the adjusted weights from step 5 to construct topic-specific indices for sales growth and employment, following the procedure described in the main text.

D.1.2 Industry and Region Disaggregation

- The industry disaggregation we consider is the following:
  - 1) Construction; 2) Durable goods manufacturing; 3) Educational services; 4) Finance and insurance; 5) Health care and social assistance; 6) Information; 7) Leisure and hospitality; 8) Mining and utilities; 9)Nondurable goods manufacturing; 10) Other services except government; 11) Professional and business services; 12) Real estate and rental and leasing 13) Retail and wholesale trade 14) Transportation and warehousing

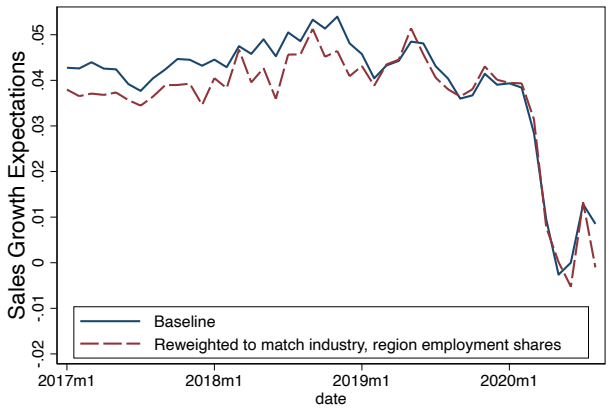
- The regional disaggregation we consider uses the nine Census Divisions:
  - 1) New England; 2) Mid-Atlantic; 3) East North Central; 4) West North Central; 5) South Atlantic; 6) East South Central; 7) West South Central; 8) Mountain; 9) Pacific

Figure D.4: Sales growth rate indices, baseline and reweighted to match industry and region employment shares, no smoothing

Notes: The above figures plot our baseline employment-weighted sales growth expectations (left) and uncertainty (right) indices, respectively alongside alternative indices that reweight the microdata to match the employment shares of 14 major industries and 9 Census Divisions by year in BLS nonfarm payrolls data. This figure does not smooth the baseline or reweighted indices. Data are from the SBU and BLS and cover all months between 1/2015 and 10/2019.

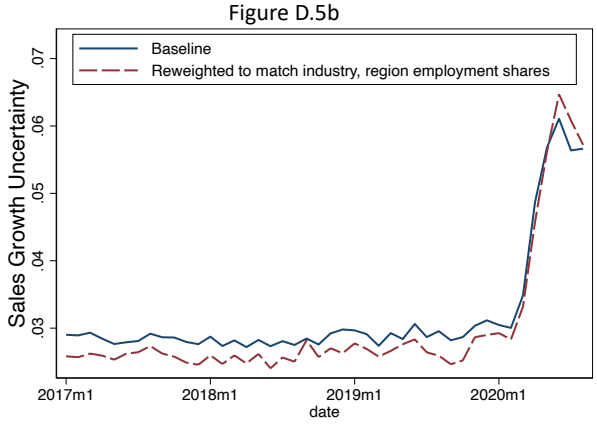
Figure D.5: Sales growth rate indices, baseline and reweighted to match industry and region employment shares, smoothed

Figure D.5a



Correlation: .966

Figure D.5b

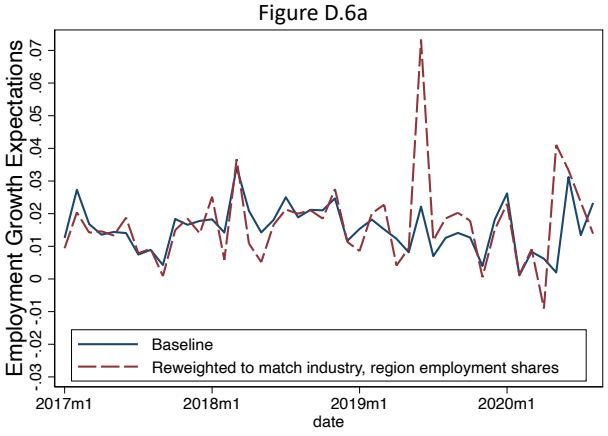


Correlation: .994

Notes: The above figures plot our baseline employment-weighted sales growth expectations (left) and uncertainty (right) indices, respectively alongside alternative indices that that reweight the microdata to match the employment shares of 14 major industries and 9 Census Divisions by year in BLS nonfarm payrolls data. This figure smooths the baseline and reweighted indices using the procedure outlined in the main text. Data are from the SBU and BLS and cover all months between 1/2015 and 10/2019.

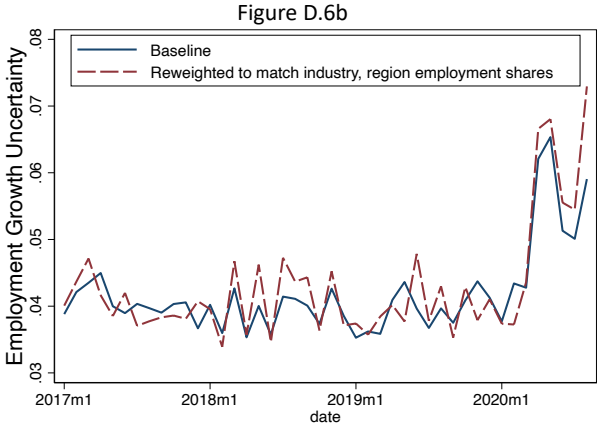
Figure D.6: Employment growth indices, baseline and reweighted to match industry and region employment shares, no smoothing

Figure D.6a



Correlation: .515

Figure D.6b

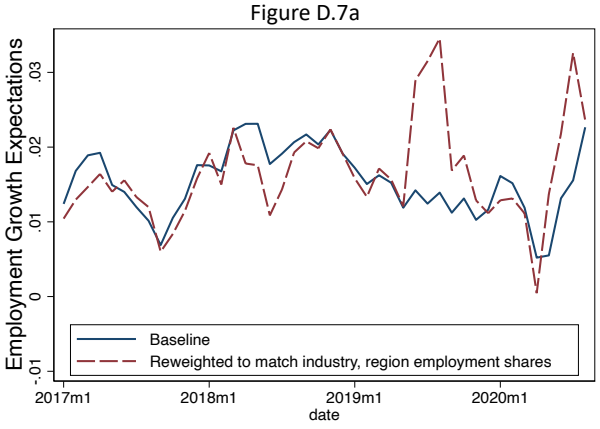


Correlation: .911

Notes: The above figures plot our baseline employment-weighted employment growth expectations (left) and uncertainty (right) indices, respectively alongside alternative indices that reweight the microdata to match the employment shares of 14 major industries and 9 Census Divisions by year in BLS nonfarm payrolls data. This figure does not smooth the baseline or reweighted indices. Data are from the SBU and BLS and cover all months between 1/2015 and 10/2019.

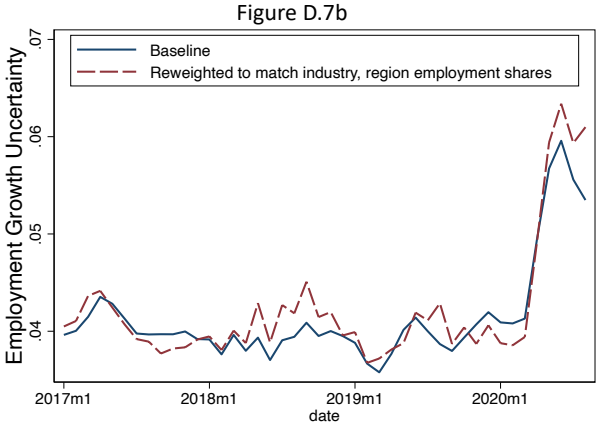
Figure D.7: Employment growth indices, baseline and reweighted to match industry and region employment shares, smoothed

Figure D.7a



Correlation: .418

Figure D.7b



Correlation: .954

Notes: The above figures plot our baseline employment-weighted employment growth expectations (left) and uncertainty (right) indices, respectively alongside alternative indices that reweight the microdata to match the employment shares of 14 major industries and 9 Census Divisions by year in BLS nonfarm payrolls data. This figure smooths the baseline and reweighted indices using the procedure outlined in the main text. Data are from the SBU and BLS and cover all months between 1/2015 and 10/2019.

Table D.1 Summary Statistics for Baseline and Reweighted indices, 1/2017 to 8/2020

Table D.1a Sales growth rate indices

Moment	Reweighted to match empl. shares	Smoothing?	Corr(Baseline, Reweighted) (%)	SD(Baseline) (%)	SD(Reweighted) (%)	Mean(Baseline – Reweighted) (%)
Expectations	Industry, region	No	92.5	1.67	2.02	0.31
Uncertainty	Industry, region	No	96.8	1.02	0.98	0.20
Expectations	Industry, region	Yes	96.7	1.32	1.31	0.31
Uncertainty	Industry, region	Yes	99.4	0.88	0.82	0.19
Expectations	Industry	No	93.9	1.67	1.60	0.28
Uncertainty	Industry	No	98.5	1.02	0.97	0.17
Expectations	Industry	Yes	97.8	1.32	1.03	0.29
Uncertainty	Industry	Yes	99.7	0.89	0.82	0.17

Table D.1b Employment growth rate indices

Moment6	Reweighted to match empl. shares	Smoothing?	Corr(Baseline Reweighted) (%)	SD(Baseline) (%)	SD(Reweighted) (%)	Mean(Baseline – Reweighted) (%)
Expectations	Industry, region	No	51.5	0.74	1.47	-0.11
Uncertainty	Industry, region	No	91.2	0.66	0.97	-0.10
Expectations	Industry, region	Yes	41.9	0.45	0.58	-0.11
Uncertainty	Industry, region	Yes	95.5	0.53	0.57	-0.08
Expectations	Industry	No	70.7	0.74	1.02	0.01
Uncertainty	Industry	No	93.3	0.66	0.88	-0.12
Expectations	Industry	Yes	69.2	0.46	0.43	0.01
Uncertainty	Industry	Yes	96.9	0.53	0.56	-0.10

Notes: This table reports the correlation and individual standard deviations of our baseline and reweighted expectations and uncertainty indices. The top panel (Table D.1a) focuses on sales growth rate indices while the bottom panel (Table D.1b) focuses on employment growth rate indices. We report those statistics separately for both raw and smoothed versions of the indices. In the latter case we use the smoothing procedure described in the main text. We report statistics for reweighted indices that match both industry and region employment shares, where the reweighting follows the procedure in section D.1.1 above, as well as indices where we reweight to match only industry employment shares. Data are from the SBU and the sample period covers 9/2016 to 10/2019.