Uncertainty is More Than Risk - Survey Evidence on Knightian and Bayesian Firms

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Bundesbank Banque de France Spring Conference on Monetary Policy and Expectations of Households and Firms

Motivation

- Growing literature on measuring subjective uncertainty in firms
    - ▸ existing surveys elicit probabilities
    - → uncertainty = risk (Bayesian uncertainty)

- This paper: do managers think in terms of probabilities?
    - ▸ new module in established German business survey
    - ▸ survey question: how likely is positive sales growth next quarter?
    - ▸ option to express beliefs by a probability *interval*
    - → uncertainty can be Bayesian or Knightian
    - ▸ simple question that managers routinely think about
    - ▸ why a binary event? Bayesians cannot express confidence in probability assessments, must reduce compound probs to arrive at one number

Message

- Knightian responses pervasive among managers
  - ▶ in any given quarter, 20-30% choose a probability interval
  - ▶ 76% choose a probability interval at least once in 16 quarters
  - → frequent switching between Bayesian & Knightian responses

- Knightian responses reflect lack of clarity, not lack of sophistication
  - ▶ self-assessment of planning process, motivation for Knightian responses
  - ▶ consistency with other forecasts provided by firms
  - ▶ Bayesian & Knightian responses similarly miscalibrated

- More Knightian responses when aggregate uncertainty high
  - ▶ comovement of response switches & credit spreads

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Data

- ifo Business Survey
  - long-running survey of German businesses
  - mostly stand-alone firm, sometimes divisions of conglomerates

- New questions on Knightian uncertainty
  - added to online questionnaire for manufacturing sector
  - stable participation: 400-500 firms per wave
  - here use 16 waves 2013:Q2 - 2017:Q1

- Quality of responses
  - typical responder = top manager, even in large firms
  - identity of responder changes infrequently
  - 80% of responders use existing results from quantitative sales planning

Our question

- Survey administered in first two weeks of every quarter

- From questionnaire for July 2020:

  You can either answer with a probability or a probability interval.

  How do you assess the probability (in percentage terms) that your sales will increase in **the third quarter of 2020**

  - *probability is ... percent*
  - *probability lies between ... and ... percent*
  - *don't know*

Summary statistics: how likely is positive sales growth?

- Extensive margin: probability or interval?
  - firms occasionally enter persistent Knightian spells:

	Bayesian in t+1	Knightian in t+1
Bayesian in t	.81	.19
Knightian in t	.45	.55

  - beginning of spell hard to predict with firm characteristics
  - longer spells for smaller, shrinking, non-exporting firms

- Intensive margin: probabilities & probability intervals

	mean	P10	P25	P50	P75	P90
Bayesian	50	10	25	50	75	90
Knightian max	47	10	20	50	70	90
Knightian min	30	0	5	25	50	70

Knightian (K) and Bayesian (B) responses for different groups of firms

	K share responses	Prob(K|B) responses	Prob(B|K) responses	ever-K share firms
small	0.32 (0.03)	0.19 (0.03)	0.44 (0.05)	0.82 (0.04)
large	0.25 (0.02)	0.20 (0.03)	0.68 (0.06)	0.75 (0.05)
non-exporter	0.33 (0.04)	0.22 (0.04)	0.51 (0.07)	0.82 (0.05)
exporter	0.26 (0.01)	0.18 (0.01)	0.58 (0.03)	0.76 (0.03)
low growth	0.30 (0.03)	0.20 (0.03)	0.56 (0.06)	0.85 (0.04)
high growth	0.27 (0.03)	0.17 (0.03)	0.62 (0.07)	0.71 (0.05)

Are Knightians (un)sophisticated?

- Self-assessment of the planning process
  - one-time survey in 2018 *after* sample period
  - use of routine quantitative planning when answering survey?
  - follow up: use of statistical analysis or scenario analysis?
  - $\rightarrow$ answers do not differ by share of Knightian responses

- Actual forecasting performance
  - check calibration: compare survey probability to frequency
  - Bayesian case: nonparametric regression of event dummy on probability
  - for Knightians, use max and min probabilities

Firms' planning process: use of statistical analysis
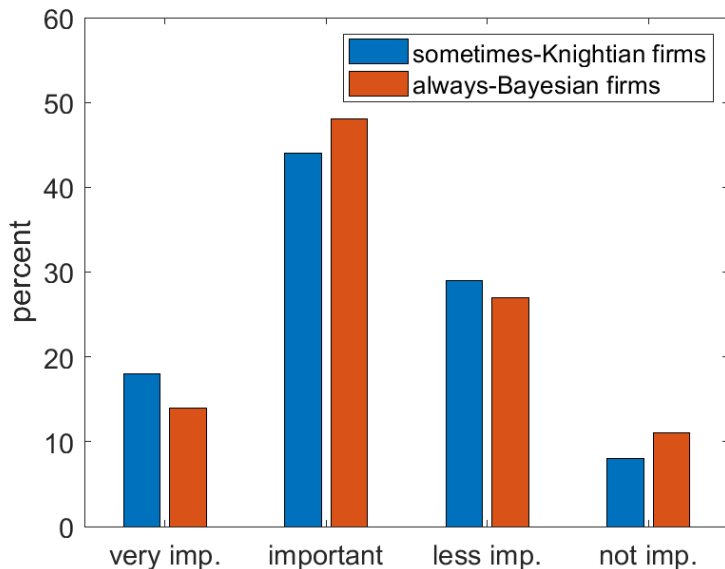
Firms' planning process: use of scenario analysis
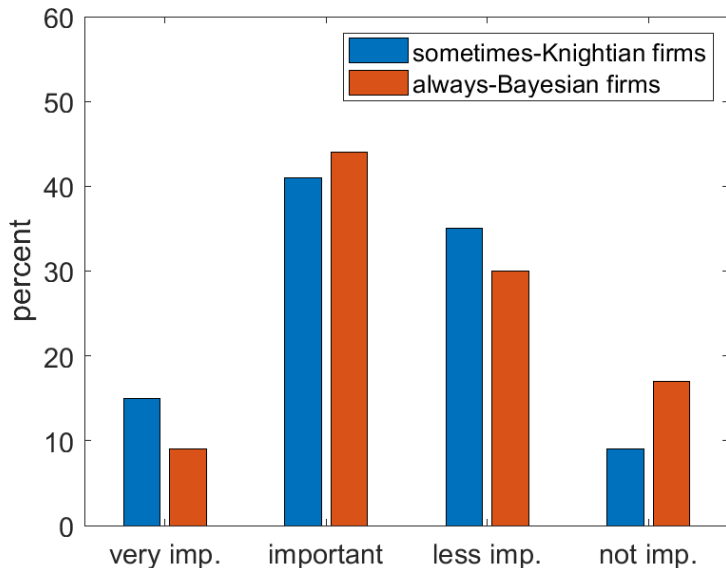
Consistency with other forecasts provided by firms

Share of all responses
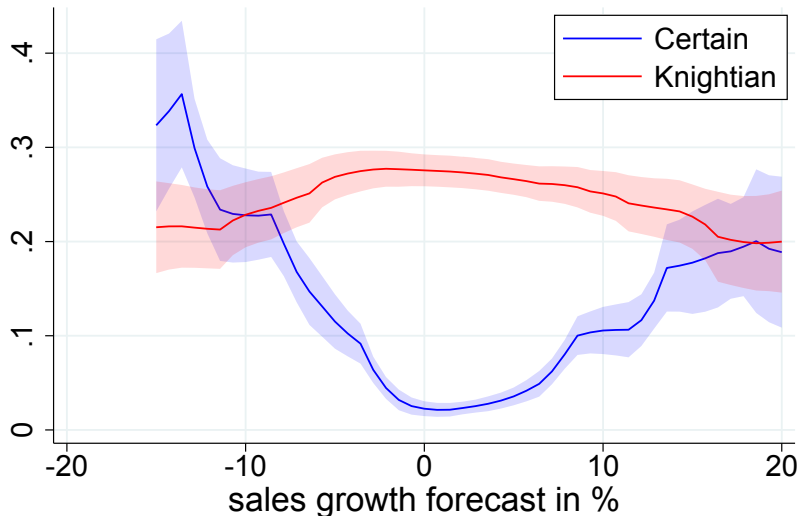
Survey probability vs frequency of sales increase
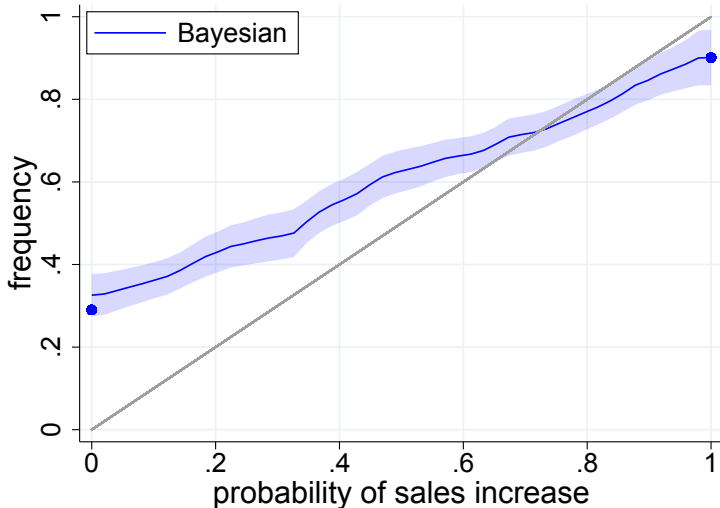
$\Rightarrow$ Bayesians too pessimistic (optimistic) at low (high) probabilities

Knightian midpoint probability vs frequency
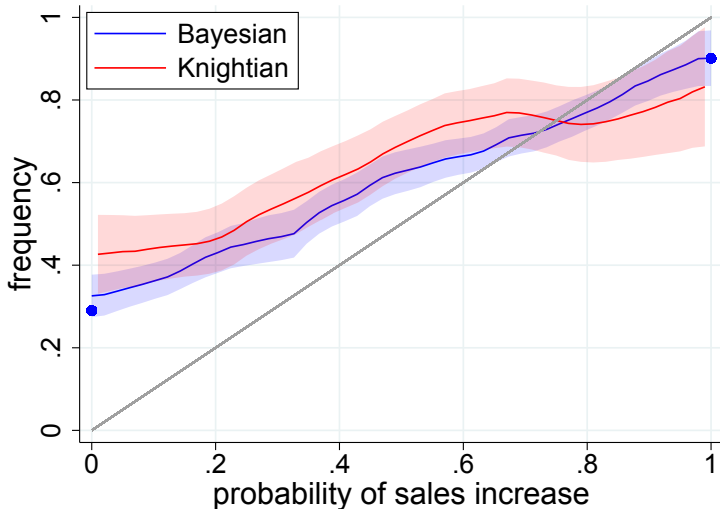
⇒ Knightian midpoint probability similarly miscalibrated

Knightian max probability vs frequency
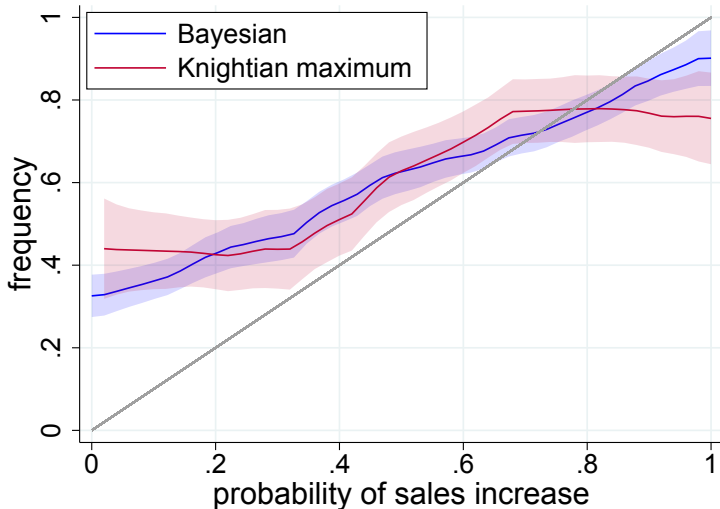
⇒ Knightian max probability too pessimistic at low probabilities

Knightian min probability vs frequency
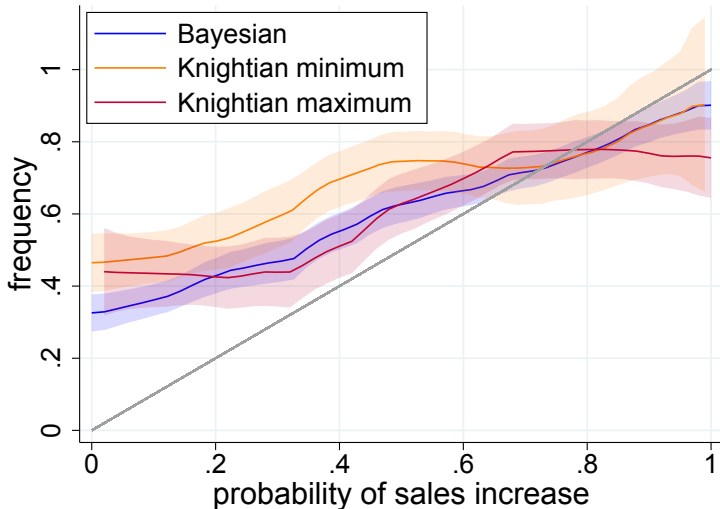
⇒ Knightian min probability too optimistic at high probabilities

European junk bond yield 2013-2017
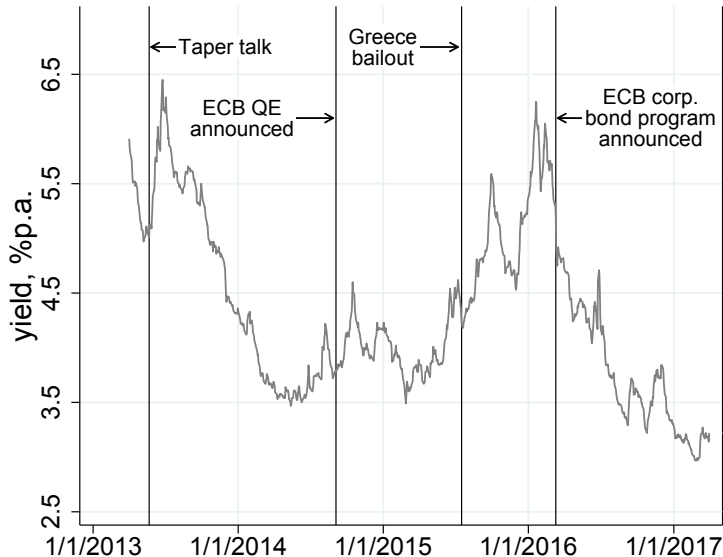
Share of Knightian responses 2013-2017
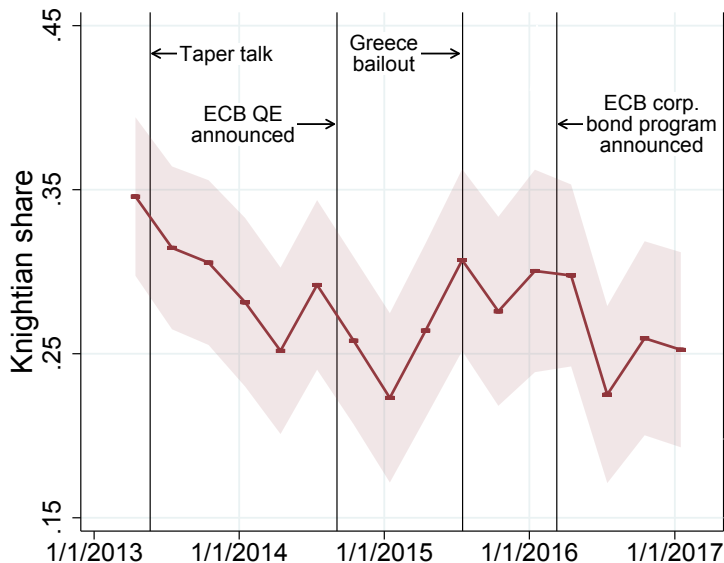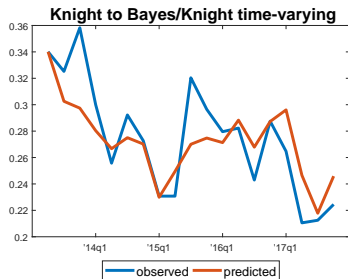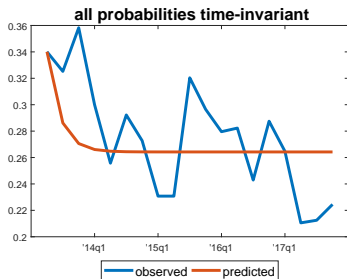
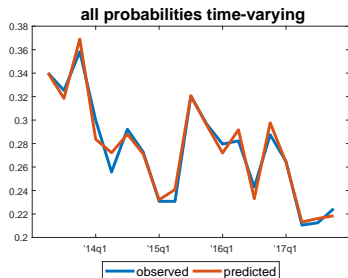# Junk bond yield & share of Knightian responses
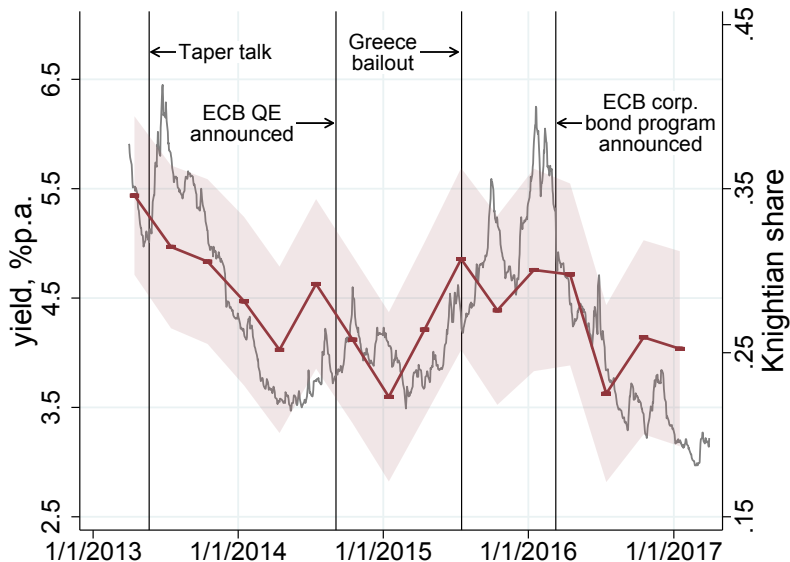
More Bayesians become Knightian during Greek Crisis
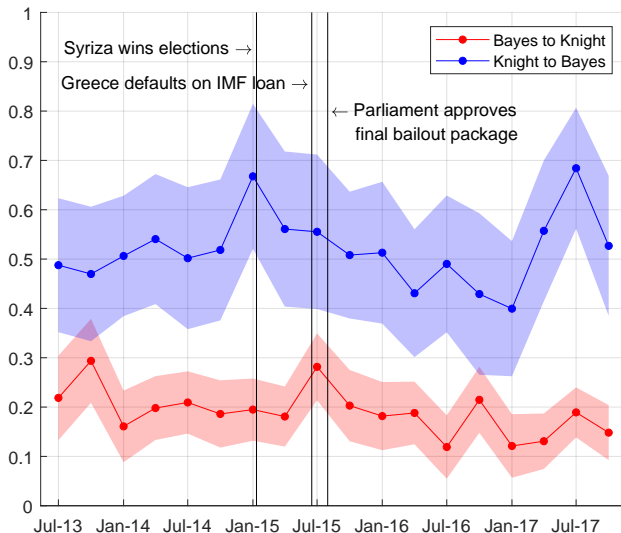
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all probabilities time-invariant

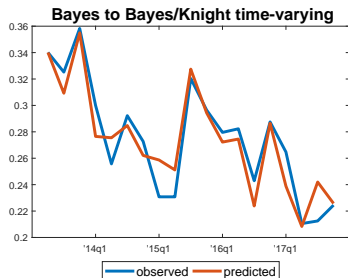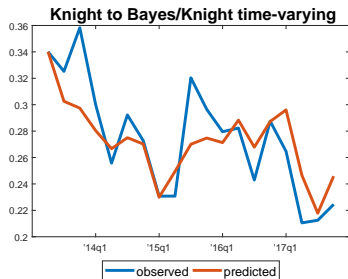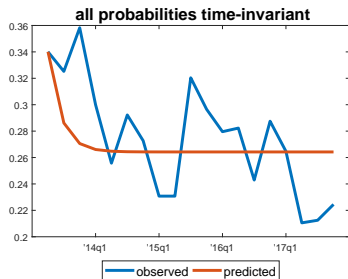Knight to Bayes/Knight time-varying
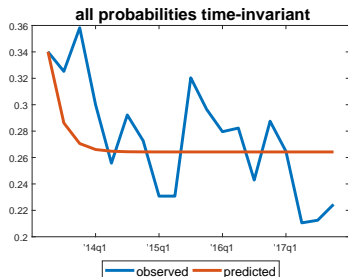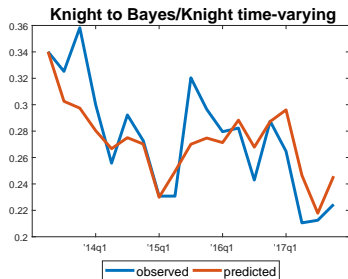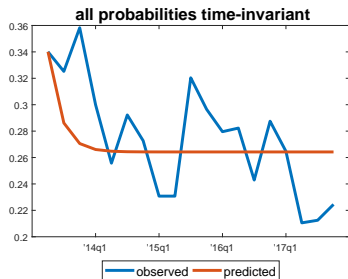
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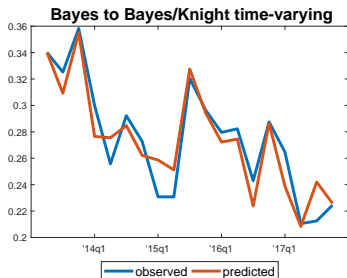
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