

Business Expectations, Forecast Errors, and Dynamics of Transaction Relationships

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Atsushi Ohyama (Hitotsubashi University)

Takuya Hiraiwa (University of Maryland)



HITOTSUBASHI
UNIVERSITY

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The data on business transactional relationships are provided by Teikoku Databank through TDB-CAREE.**



Motivation

- A firm's forecast about its business performance (Business Expectation) is integral to business decisions
 - Production planning and scheduling
- Business expectations are not always accurate, which results in forecast errors
 - Economic shocks and forecast biases
- How do firms form business expectations?
- How are forecast errors generated?

Motivation

- Business expectations and forecast errors affect economic outcomes
 - Large temporary uncertainty shocks lead to fluctuations in employment, investment, output, and productivity (Bloom, 2009)
 - Uncertainty leads to resource misallocation (David et al., 2016)
 - The accuracy of firm's forecast is positively correlated with capital investments, sales, and profitability (Tanaka et al., 2019)
 - Business expectations and forecast errors differ among firms
 - Firm's business expectation and forecasting error vary with its characteristics and phases of a business cycle (Massenot and Pettinicchi, 2018)
 - Firm's inattentiveness distorts macroeconomic belief (Coibion et al., 2018)
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Motivation

Implicit assumptions:

- A firm's forecasting is primarily about macro-economic conditions
- One's business expectations are not affected by other firms
- Firms' own forecast errors, not other firms' forecast errors, are the only influential factors for their conduct and performance
- But firm activities are not independent of other firms' activities
- Supply chains are a channel for shock propagation
 - Forecast errors may disturb firm performances and travel within a supply chain

Motivation



We have known very little about

- How is the formation of one firm's business expectation affected by its transaction relationships with other firms?
- How are the forecast errors of one firm influenced by the forecast errors of its transaction partners?
- Do forecast errors transmit to transaction partners? If so, how?
- Do forecast errors reflect economic shocks or forecast biases?

We try to answer these questions by data



Points of Consideration for Implications

- How should firms choose and manage transaction partners and, more generally, build supply chains?
 - Forecast errors transmit?
 - What can and cannot be done to minimize forecast errors?
 - Endogenous effect vs. exogenous effect vs. correlated effect
- Portfolio view (Lucas) vs. Propagation view (Acemogul)
 - Lucas: Micro-level shocks are canceled out of each other
 - Acemoglu: Micro-level shocks propagate through transaction networks and amplify
- Flexible Adjustment vs. Long-term Relationship

Main Empirical Results



Main Message: With whom a firm builds transaction relationships affects business expectations and forecast errors

- (a) Business expectations are positively correlated with the number of transaction partners
- (b) Many transaction partners reduce forecast errors (weak evidence)
- (c) Stable transaction relationships tend to reduce forecast errors
- (b) Uncertainty is a source of forecast errors
- (e) Forecast errors are large when transaction partners' uncertainty is large
- (f) Forecast errors likely transmit to transaction partners (requires further investigation)

JP-MOPS, TDB, Manufacturing Census



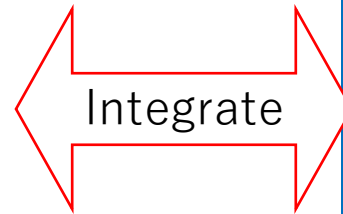
Government Statistics

**JP-MOPS
&
Manufacturing Census**

**Business Expectations
(Dependent Variable)**

**Forecast Errors
(Dependent Variable)**

Forecast Variation



Teikoku Databank

**Transaction
Relationships
(Independent Variable)**

**Firm Information
(Control Variable)**



Construction of Key Variables

- Business Expectations, Forecast Variation, and Forecast Errors
 - JP-MOPS: Two questions about business expectations
 - Manufacturing Census: Realizations
 - Noise control
- Transactional Relationships
 - Teikoku DataBank (TDB): List of pairs of transaction partners
 - Number of transaction partners
 - Duration of transaction relationships

JP-MOPS: Business Expectation



問 2 4. 貴事業所の 2016 年のおよその出荷額及び 2017 年のおよその出荷額の見込みはいくらですか。
消費税込みの金額を記入してください。 企業内取引、委託生産品、輸出品も含めてください。た
だし、出荷額を積込料、運賃、保険料及びその他諸掛を除いた金額で記入してください。

	Shipment value								
	兆	千億	百億	十億	億	千万	百万	十万	万円
2016 (Actual Value)									
2017 (Forecast Value)									

What are the approximate values of products shipped you estimate for 2017?

問 2 5. 貴事業所の 2018 年(1 月から 12 月)の出荷額の予測について質問します。表中の 3 つのシナリ
オを考えた時、貴事業所のおよその出荷の予測額はそれぞれのシナリオに対してどのような数値
になるとお考えですか。またそれぞれのシナリオが起こりうる可能性について、確率を割り当て
てください。貴事業所としての予測値が用意されていない場合には、御回答者の最善の判断に基
づいた予測でもかまいませんので、御回答ください。

2018 (Forecast)	Shipment value									Probability				
	兆	千億	百億	十億	億	千万	百万	十万	万円	百桁	十桁	一桁		
Low Scenario													%	
Medium Scenario													%	
High Scenario													%	
										合計	1	0	0	%

What are the approximate values of products shipped you estimate for each scenario in 2018?

Main Research Variables

- Business Expectation

$$g_{exp} = \frac{Y_{17_forecast} - Y_{16_realized}}{Y_{16_realized}}$$

- Business Realization

$$g_{act} = \frac{Y_{17} - Y_{16}}{Y_{16}}$$

- Forecast Errors

$$f_{error} = |g_{exp} - g_{act}|$$

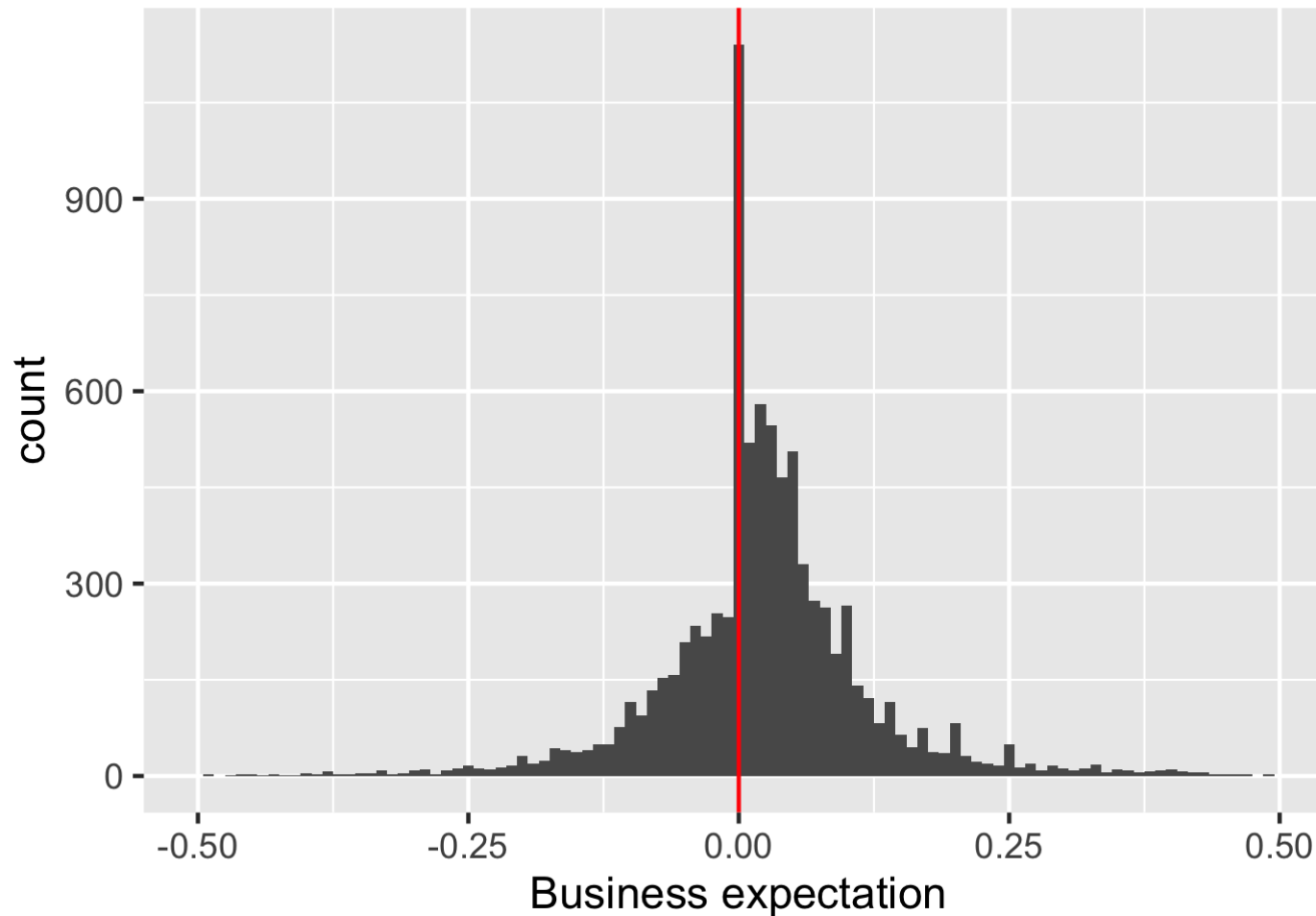
- Forecast Variation

$$f_V = \frac{Var(Y_{18_forecast})}{E(Y_{18_forecast})}$$

Distribution of Business Expectations



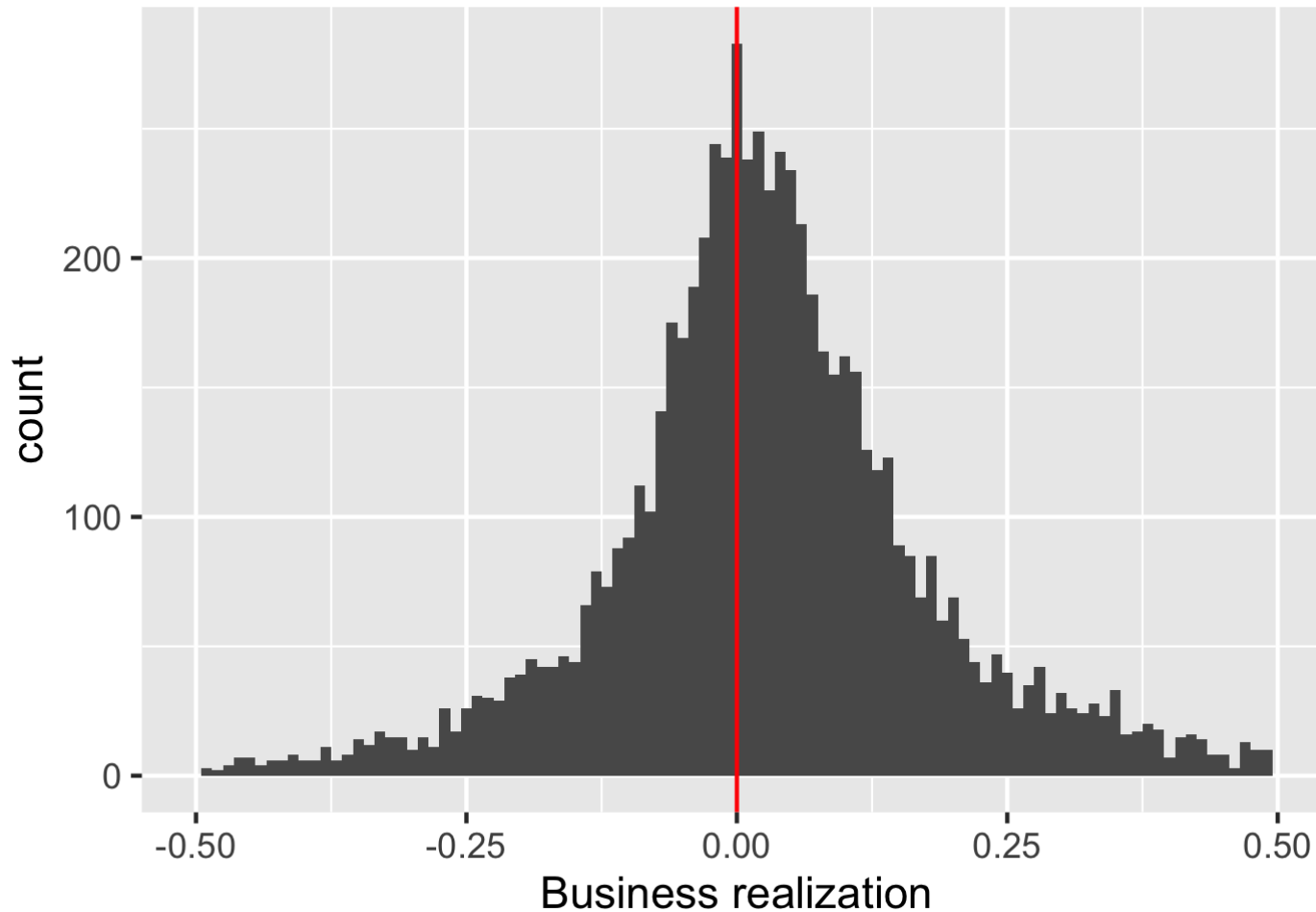
Distribution of business expectation



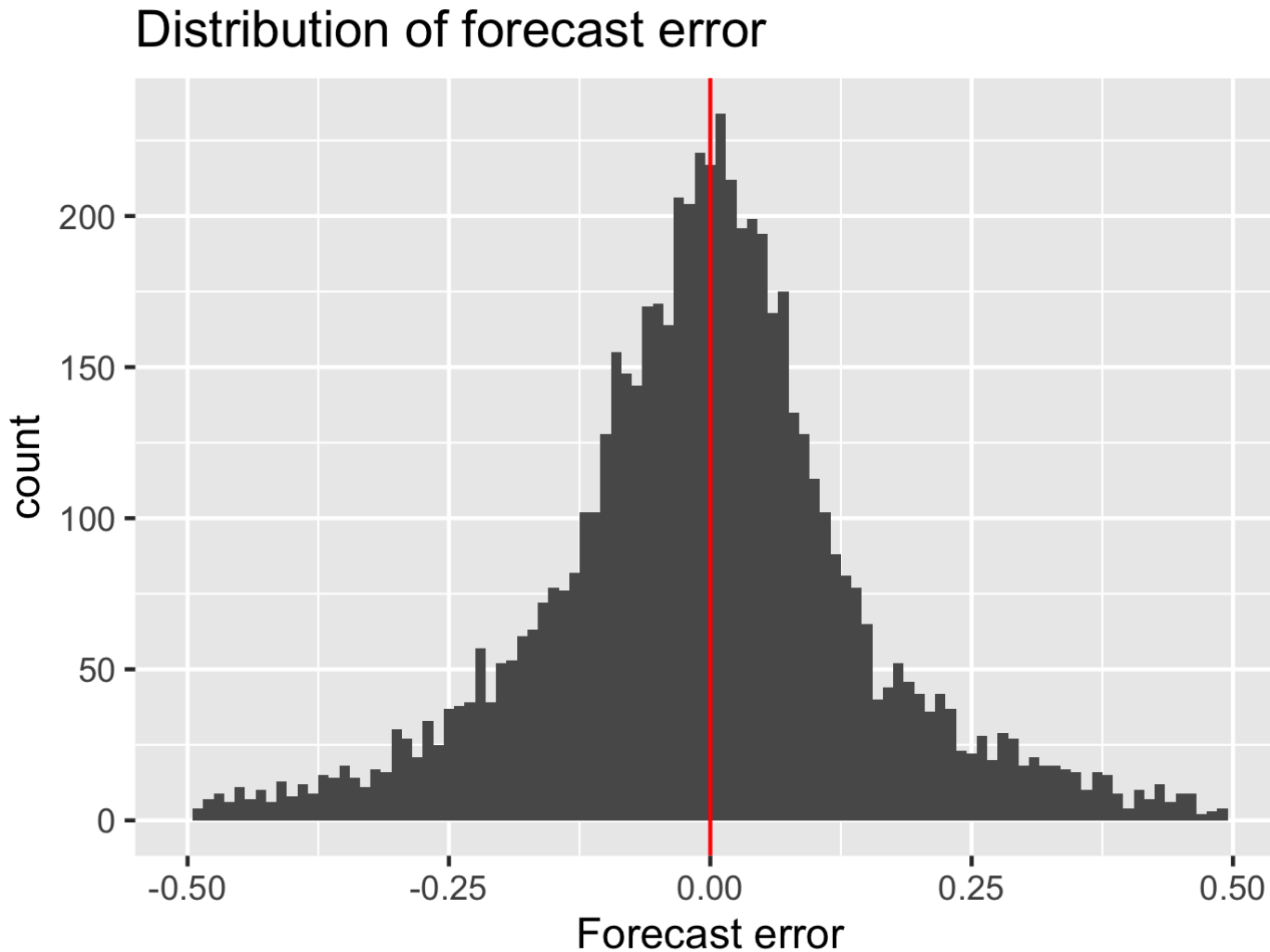
Distribution of Business Realizations



Distribution of business realization



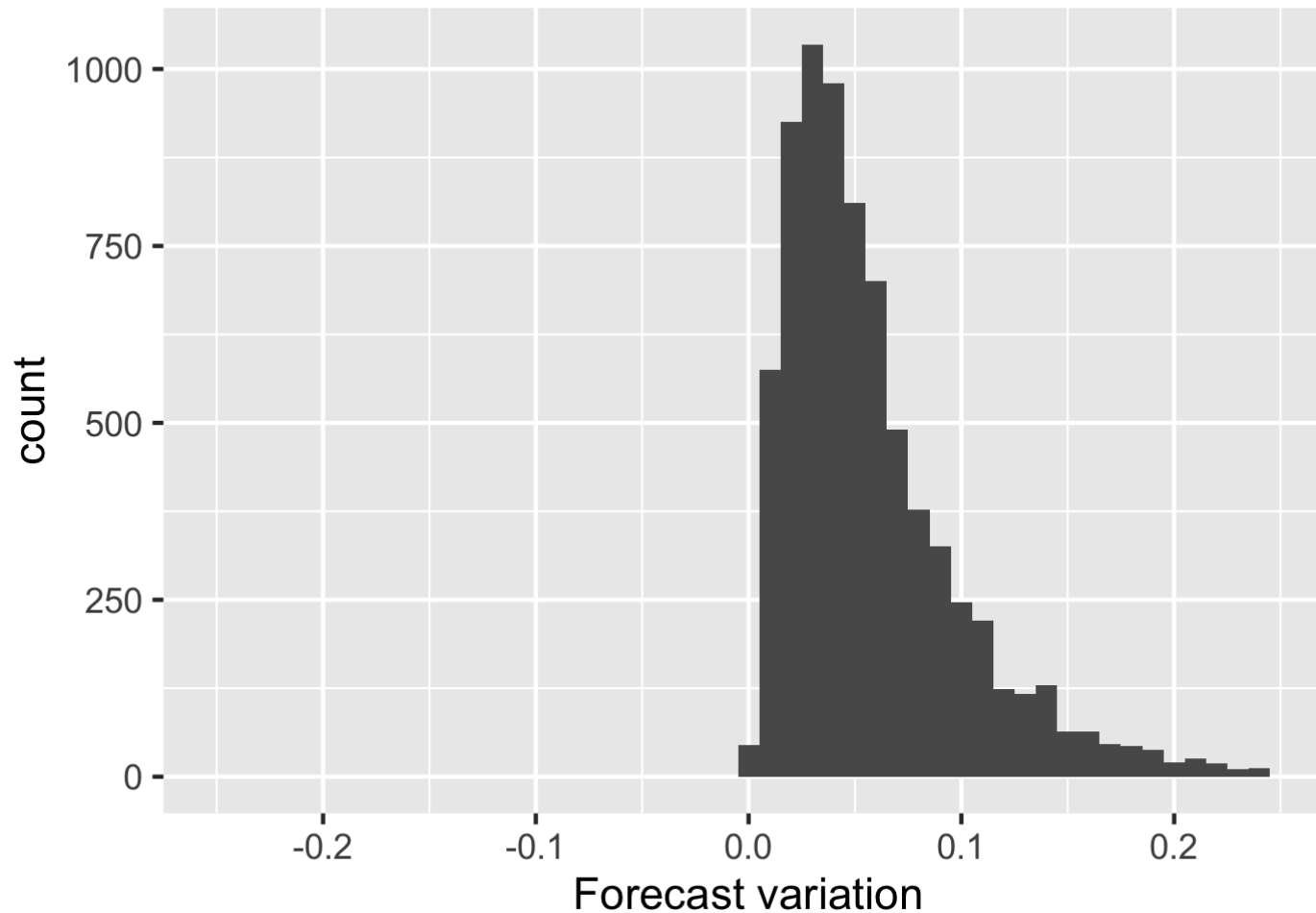
Distribution of Forecast Errors



Distribution of Forecast Variations



Distribution of forecast variation



Summary Statistics



Table 1A

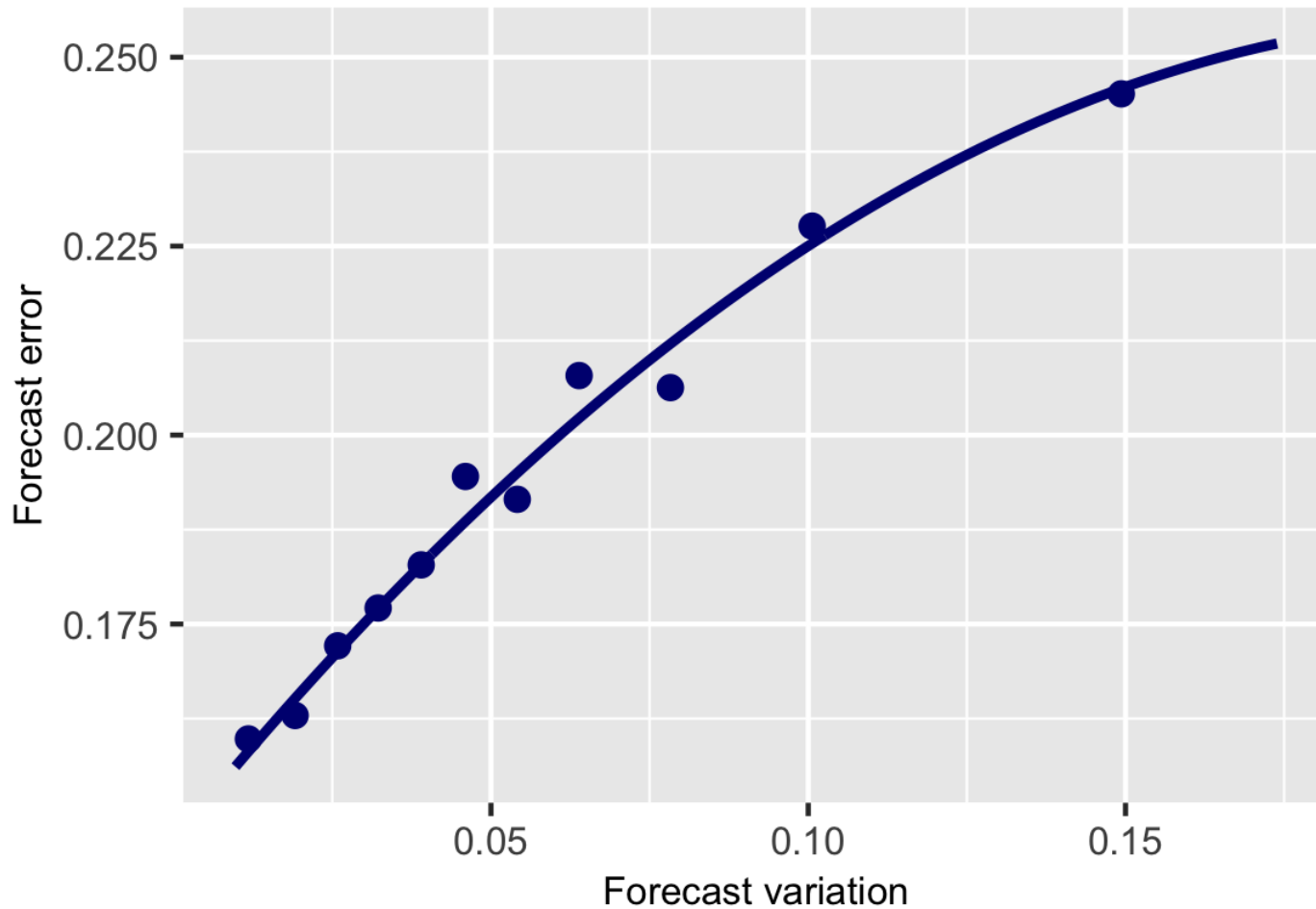
	Mean	Min	1st Qu.	Median	3rd Qu.	Max
Business Expectation	0.025	-0.178	-0.015	0.020	0.066	0.253
Business Realization	0.045	-0.326	-0.050	0.026	0.117	0.598
Forecast Error	-0.018	-0.543	-0.097	-0.005	0.075	0.374
Forecast Variation	0.058	0.009	0.028	0.047	0.077	0.177

- The distributions of Business Expectations and Realizations are similar

Forecast Errors and Forecast Variations



Forecast error and forecast variation



Summary Statistics



	Mean	Std. Dev	Min	Quartile			Max
				1st	Med ian	3rd	
	(1) Number of transaction partners						
Full sample	55.5	199.4	2	10	16	34	5425
Small firms	10.7	6	2	7	10	13	89
Medium firms	19.3	13.4	2	11	16	23	196
Large firms	136.5	330.5	2	26	50	113	5425

- The number of transaction partners increases with firm size (sales)

Estimation Method- Business Expectations



- Determinants for business expectations

$$g_{exp_i} = \beta_0 + \beta_1 Own_{ch_i} + \beta_2 TR_i + \beta_3 Ptr_{ch_i} + \varepsilon_i$$

where

g_{exp_i} : business expectation (growth rates of shipment values)

Own_{ch_i} : Own characteristics

TR_i : Transaction relationships

Ptr_{ch_i} : Transaction partners' characteristics

Estimation Method- Forecast Errors

- Determinants for forecast errors

$$f_{err_i} = \beta \frac{1}{n_i} \sum_{j \in P_i} f_{err_j} + \gamma x_i + \delta \frac{1}{n_i} \sum_{j \in P_i} x_j + \alpha_l + \varepsilon_i$$

where f_{err_i} : Firm i 's forecast errors

- **Endogenous effects**: β , the influence of transaction partners' forecast errors
- **Exogenous effects**: δ , the influence of transaction partners' characteristics
- **Correlated effects** : α_l , make forecast errors in a similar fashion

Estimation Method- Forecast Errors

- Generalized 2SLS (Bramouille et al., 2009)

$$f_{err} = \beta G f_{err} + \gamma X + \delta GX + \sum_{l \in P} \alpha_l l + \varepsilon$$

First Step

- Use $[X, GX, G^2X]$ as instruments for Gf_{err} and estimate by 2SLS
 - Use variation in transaction partner's partners

Second Step

- Use $[Gf_{err}(\hat{\theta}), X, GX]$ as instruments for Gf_{err} and estimate by 2SLS



Business Expectation Formation

- What factors affect the formation of business expectations?
- What factors contribute to generating forecast variations?
- Are a firm's business expectations and forecast variations affected by the number of transaction partners and the duration of transaction relationships?

Estimation

- Dependent variable: Business Expectations, Forecast variation
- Key independent variables: Number of transaction partners, Duration of transaction relationships, TFP, and Management scores
- Controls: No. of employees, Age, Location, Industry



Factors to Determine Business Expectation

Table 2	Business Expectation		Forecast Variation	
	(1)	(2)	(3)	(4)
No. transaction partners	0.002 ** (0.001)		-0.0013 ** (0.0006)	
Page rank		0.002 ** (0.001)		-0.002 *** (0.001)
Transaction duration	-0.0006 ** (0.0003)	-0.0006 ** (0.0003)	-0.0005 *** (0.0001)	-0.0005 *** (0.0001)
TFP	-0.011 *** (0.003)	-0.010 *** (0.003)	-0.005 *** (0.001)	-0.005 *** (0.001)
Management score	0.030 *** (0.007)	0.030 *** (0.007)	-0.013 *** (0.004)	-0.013 *** (0.004)
No. observations	5,816	5,816	5,071	5,071
R_squared	0.02	0.02	0.09	0.09

Controls: No. of employees, Age, Location, Industry

Impact of Transaction Partner's Characteristics

Table 3

<i>Partner's characteristics</i>	DV: Business Expectation	DV: Forecast Variation
Business expectation	0.018 (0.027)	0.01 (0.012)
Forecast variation	-0.019 (0.058)	0.043 ** (0.026)
TFP	0.004 (0.003)	-0.002 (0.002)
Management Score	0.008 (0.014)	0.008 (0.006)
Size	-0.001 (0.001)	0.0003 (0.0003)
No. transaction partners	0.00001 (0.00001)	0.00001 (0.00001)
No of observations	3,252	2,873
R_squared	0.019	0.078



Summary 1

- Firms with many transaction partners and high management scores expect higher (positive) growth
- Firms with many transaction partners, long duration of transaction relationships, high productivity, and high management scores tend to have a low variation of growth forecast
 - Ex ante uncertainty is low
- Forecast variations are affected by its transaction partners' forecast variations
 - The second moment is important

Forecast Errors

- What factors affect forecast errors?
 - Endogenous effects: Transaction partners' forecast errors
 - Exogenous effects: Transaction relationships and firm and its transaction partners' characteristics
 - Correlated effects: Make forecast errors in a similar fashion

Estimation

- Dependent variable: Forecast errors
- Key independent variables: Transaction partners' forecast errors, Number of transaction partners, Duration of transaction relationships, Forecast variation

Factors to Affect Forecast Errors (OLS)

Table 4

	DV: Forecast Errors (absolute value)		
	(1) All	(2) $g_act < g_exp$	(3) $g_act > g_exp$
# of transaction partners	-0.003 *** (0.002)	-0.005 ** (0.002)	-0.002 (0.003)
Transaction duration	-0.002 *** (0.0005)	-0.001 *** (0.001)	-0.002 *** (0.001)
Forecast variation	0.0336 *** (0.046)	0.378 *** (0.054)	0.314 *** (0.068)
TFP	-0.011 *** (0.004)	-0.013 ** (0.005)	-0.011 (0.007)
Management score	-0.016 (0.011)	0.011 (0.014)	-0.035 * (0.018)
Noise control	0.070 *** (0.006)	0.040 *** (0.007)	0.097 *** (0.009)
No. observations	5,782	2,425	2,557
R_squared	0.063	0.099	0.137

Factors to Affect Forecast Errors (2SLS)



Table 5

	DV: Forecast Error (absolute value)		
	(1)	(2)	(3)
Transaction partners' Forecast error (absolute value)	0.110 *** (0.023)	0.375 ** (0.187)	-0.239 (0.197)
<i>Focal firm's transaction relationships</i>			
Number of transaction partners	-0.003 (0.002)	-0.006 (0.005)	-0.003 (0.002)
Transaction duration	-0.002 *** (0.001)	-0.002 ** (0.001)	-0.002 *** (0.001)
Estimation methods	OLS	2SLS	2SLS

Factors to Affect Forecast Errors



Table 5

	DV: Forecast Error (absolute value)		
	(1)	(2)	(3)
<i>Focal firm's characteristics</i>			
Forecast variation	0.576 *** (0.056)	0.551 *** (0.067)	0.629 *** (0.064)
<i>Transaction partners' characteristics</i>			
Transaction duration	-0.001 ** (0.001)	-0.002 * (0.001)	-0.002 ** (0.001)
Forecast variation	0.178 ** (0.073)	0.004 (0.131)	0.414 *** (0.001)
Estimation methods	OLS	2SLS	2SLS

Summary 2

Endogenous Effects

- A firm's forecast errors are correlated with its transaction partners' forecast errors (**Weak evidence**)
→ Forecast errors can be transmitted to transaction partners

Caution

- Forecast Errors = Economic Shocks + Forecast Biases
- Economic Shocks = Aggregate Shocks + Idiosyncratic Shocks
- Forecast Biases = Group Biases + Individual Biases
→ Under Investigation

Summary 3



Exogenous Effects

- Firms with a long duration of transaction relationships tend to make small forecast errors → Information sharing and flexible adjustment
- Firms with high forecast variation tend to make large forecast errors → Uncertainty is a source of forecast errors
- Transaction partners' duration and forecast variation affect forecast errors
→ With whom a firm builds transaction relationships affects its forecast error

Conclusion



- With whom a firm builds transaction relationships affects business expectations and forecast errors
 - (a) Business expectations are positively correlated with the number of transaction partners
 - (b) Many transaction partners reduce forecast errors (weak evidence)
 - (c) Stable transaction relationships tend to reduce forecast errors
 - (b) Uncertainty is a source of forecast errors
 - (e) Forecast errors are large when transaction partners' uncertainty is large
 - (f) Forecast errors likely transmit to transaction partners (requires further investigation)