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Heterogonous Expectations of Agricultural Bankers

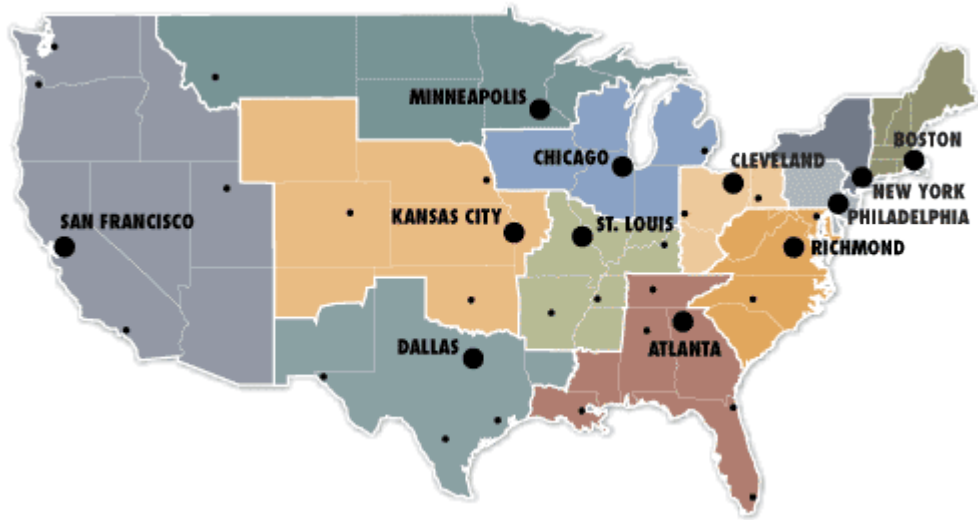
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Minneapolis, MN

Land Value and Credit Conditions Survey



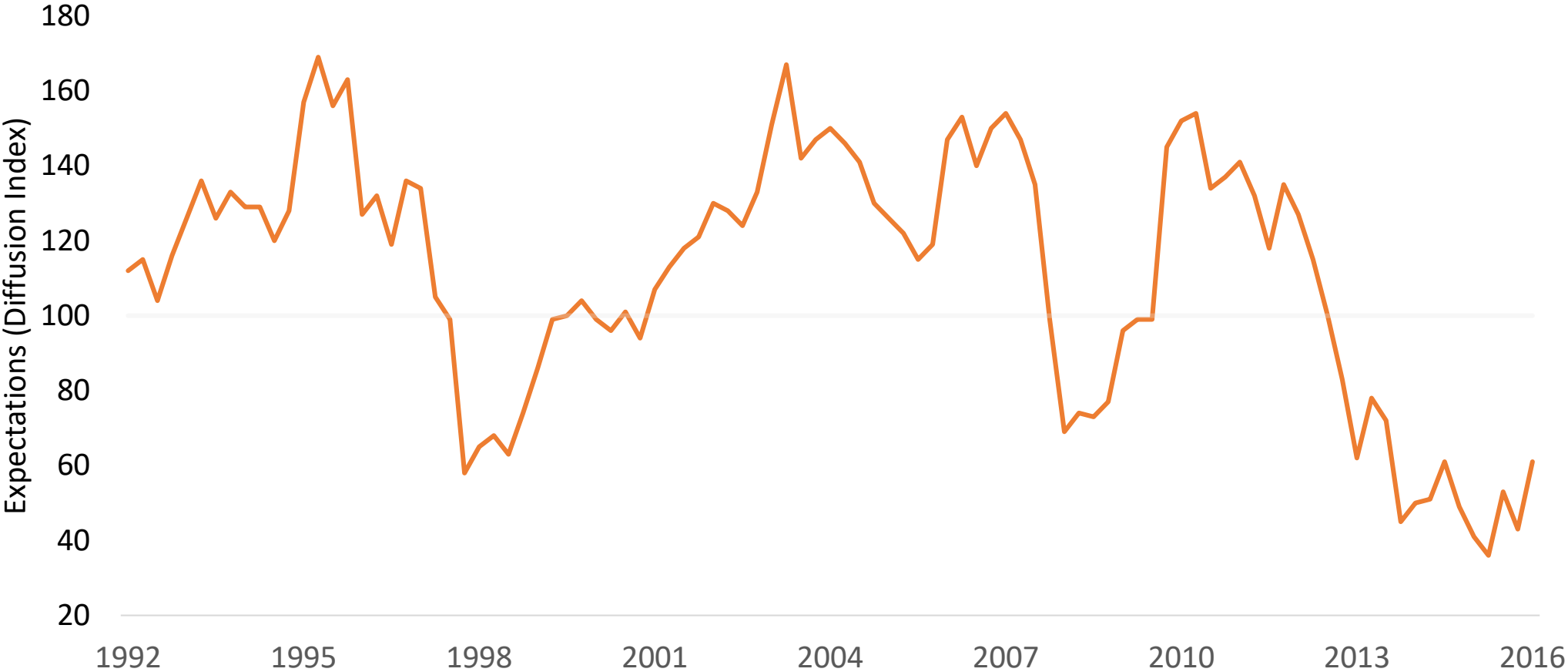
Land Value and Credit Conditions Survey

What trend in farmland values do you expect in your area in the next three months?

Possible answers: Up, Down, or Stable

- Good predictor of District farm real estate values (Covey, 1999; Zakrzewicz, et al., 2013 (KC Fed survey))
- Report diffusion index (balance statistic) quarterly
 - $(\text{Up} - \text{Down}) + 100$

Diffusion Index of Expected Changes



Land Value and Credit Conditions Survey

What trend in farmland values do you expect in your area in the next three months? Answers: Up, Down, or Stable

Very common elicitation method in business surveys:

- Respondents reluctant to report quantitative assessment
- Avoids “spurious precision”
- Less respondent burden

Yet...

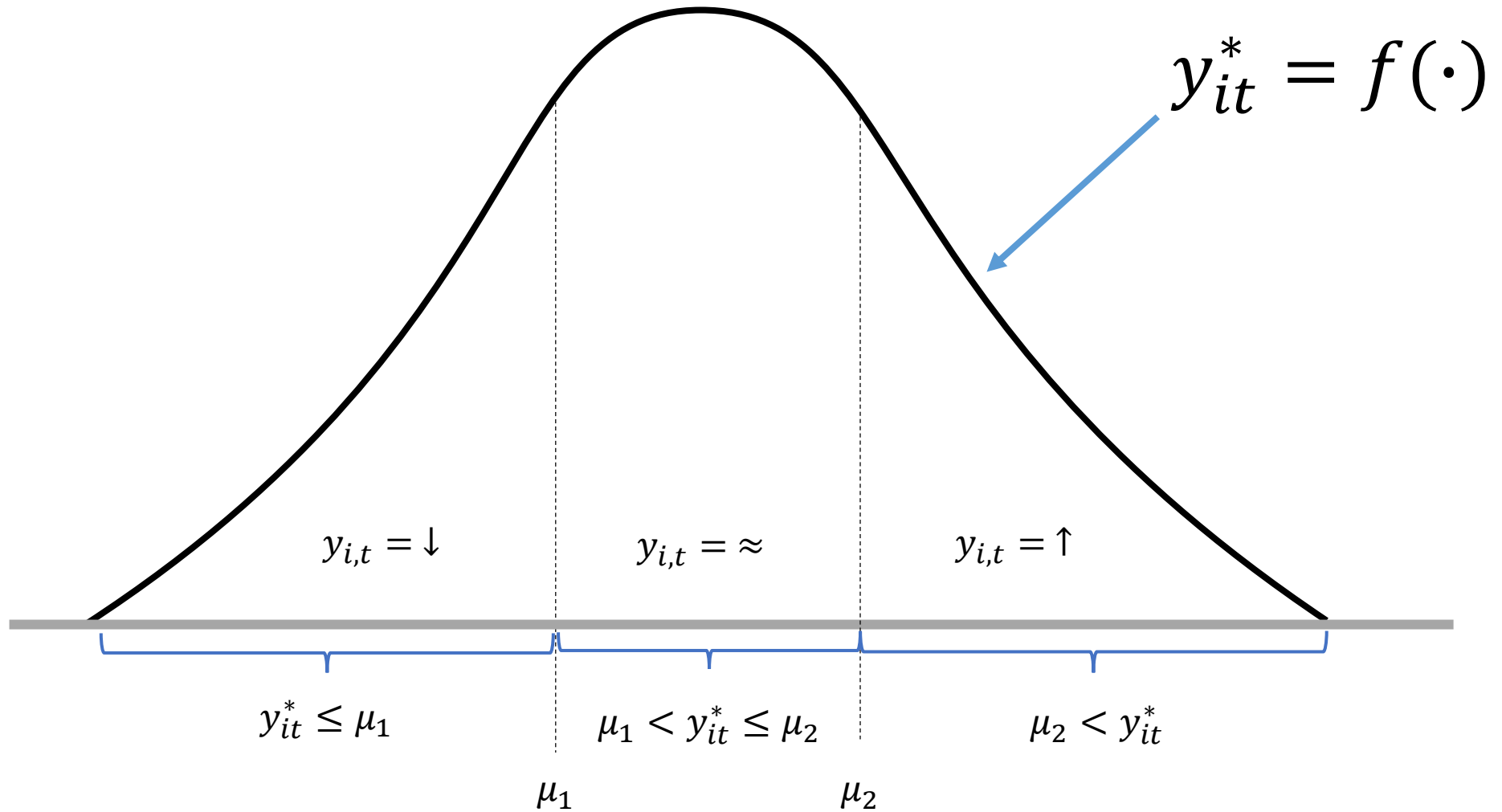
- Can be difficult to interpret: *What do bankers actually mean by “up”?*
- Assumes symmetry of “up” and “down”

Qualitative surveys can be “quantified”

Assume:

- Respondents have some unobservable continuous distribution of expectations (latent expectations)
- The (ordinal) discrete responses are based on unobserved threshold values

Bankers' (Latent) Expectations

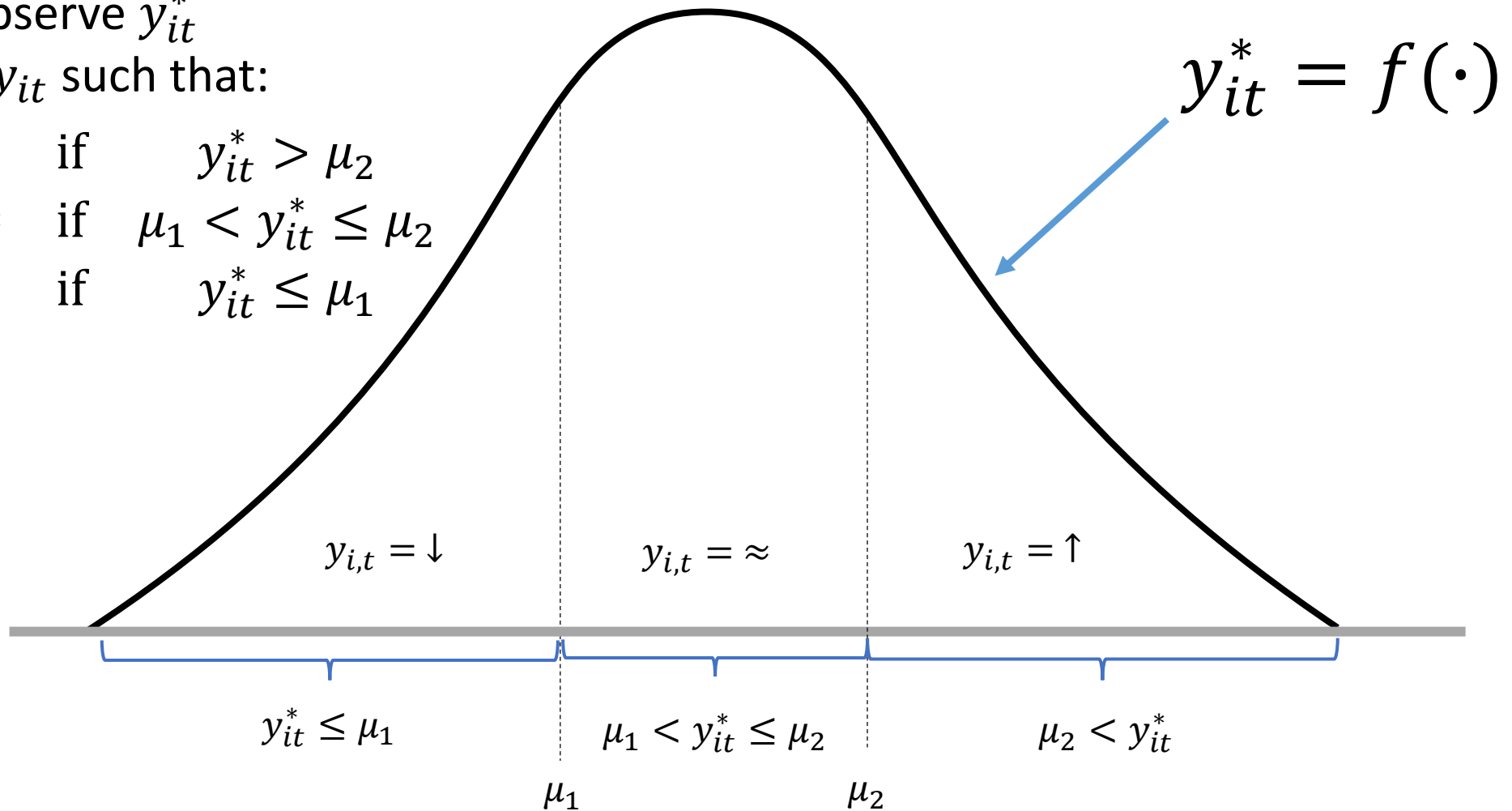


Bankers' (Latent) Expectations

We do not observe y_{it}^*

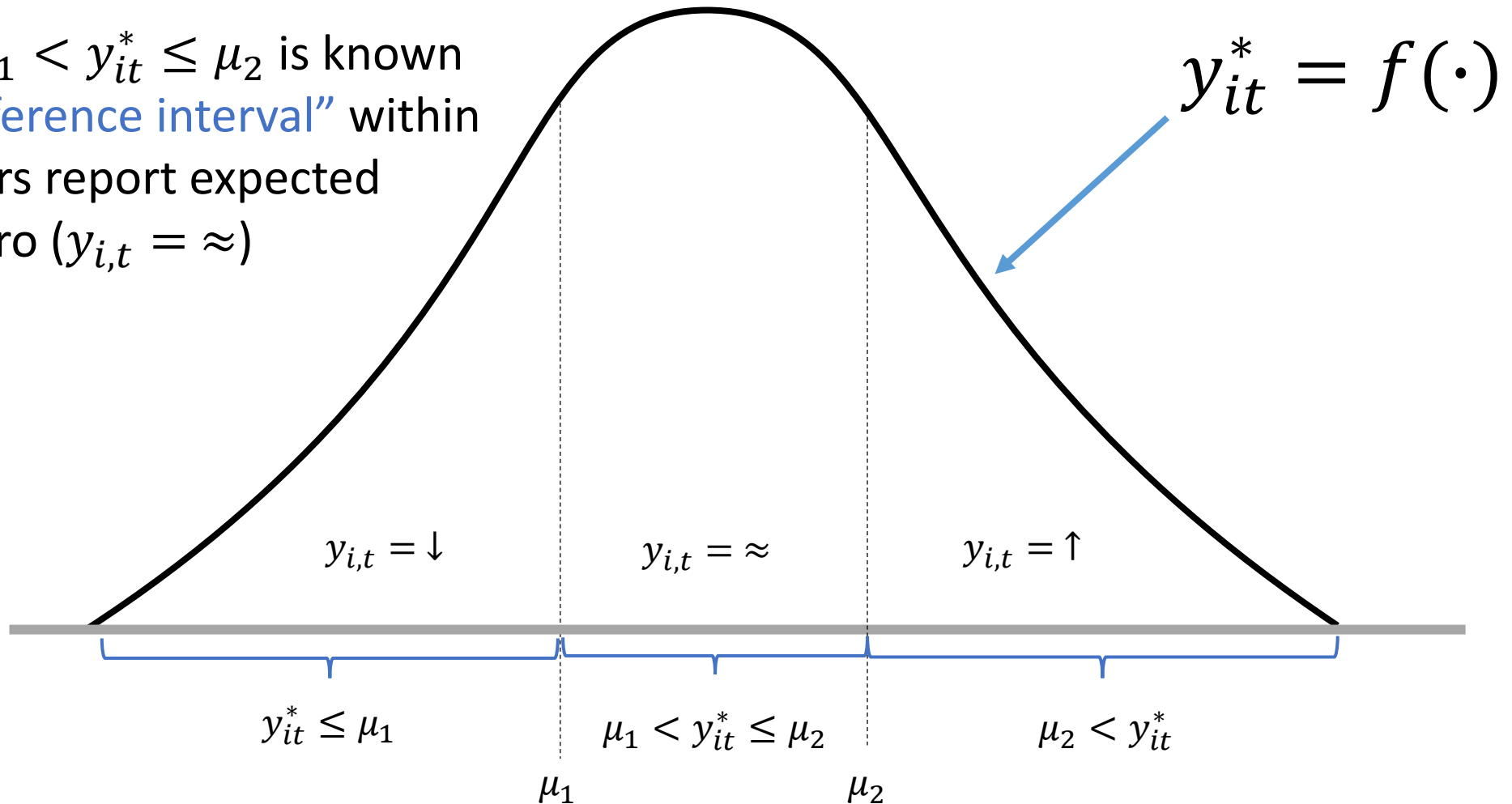
We observe y_{it} such that:

$$y_{it} = \begin{cases} \uparrow & \text{if } y_{it}^* > \mu_2 \\ \approx & \text{if } \mu_1 < y_{it}^* \leq \mu_2 \\ \downarrow & \text{if } y_{it}^* \leq \mu_1 \end{cases}$$



Bankers' (Latent) Expectations

The region $\mu_1 < y_{it}^* \leq \mu_2$ is known as the “indifference interval” within which bankers report expected change of zero ($y_{i,t} = \approx$)



Bankers' (Latent) Expectations

- A number of empirical methods have been proposed to estimate quantitative “mean” expectations (\bar{y}_{it}^*) and indifference interval (μ_1, μ_2) from **aggregate** survey responses
 - Probability method of Carlson and Parkin (1975)
 - Regression method of Pesaran (1984)
- Methods have a number of recognized limitations (Nardo, 2003)
 - Restrictive assumptions of indifference interval
 - Respondent heterogeneity
 - Assumed distribution of y_{it}^*
- More recent studies exploit respondent-level data (Lahiri and Zhao, 2015)

Empirical Model

- Estimate the distribution of bankers' (latent) expectations (y_{it}^*) through **ordered choice regression**

$$y_{it} = \begin{cases} \uparrow & \text{if } y_{it}^* = \sum_t \alpha_t D_{it} + \varepsilon_{it} > \mu_2 \\ \approx & \text{if } \mu_1 < y_{it}^* = \sum_t \alpha_t D_{it} + \varepsilon_{it} \leq \mu_2 \\ \downarrow & \text{if } y_{it}^* = \sum_t \alpha_t D_{it} + \varepsilon_{it} \leq \mu_1 \end{cases}$$

where D_{it} is a dummy variable = 1 if bank i responded in quarter t

Ordered Choice Regression

- Bankers' expectations are a function quarter and i.i.d. error
- We must make an assumption on the distribution of the error (link function): $F(\cdot)$
- The model estimates the probabilities:

$$P[y_i = \uparrow] = 1 - F\left(\frac{\mu_2 - \alpha_t D_{it}}{\sigma}\right)$$

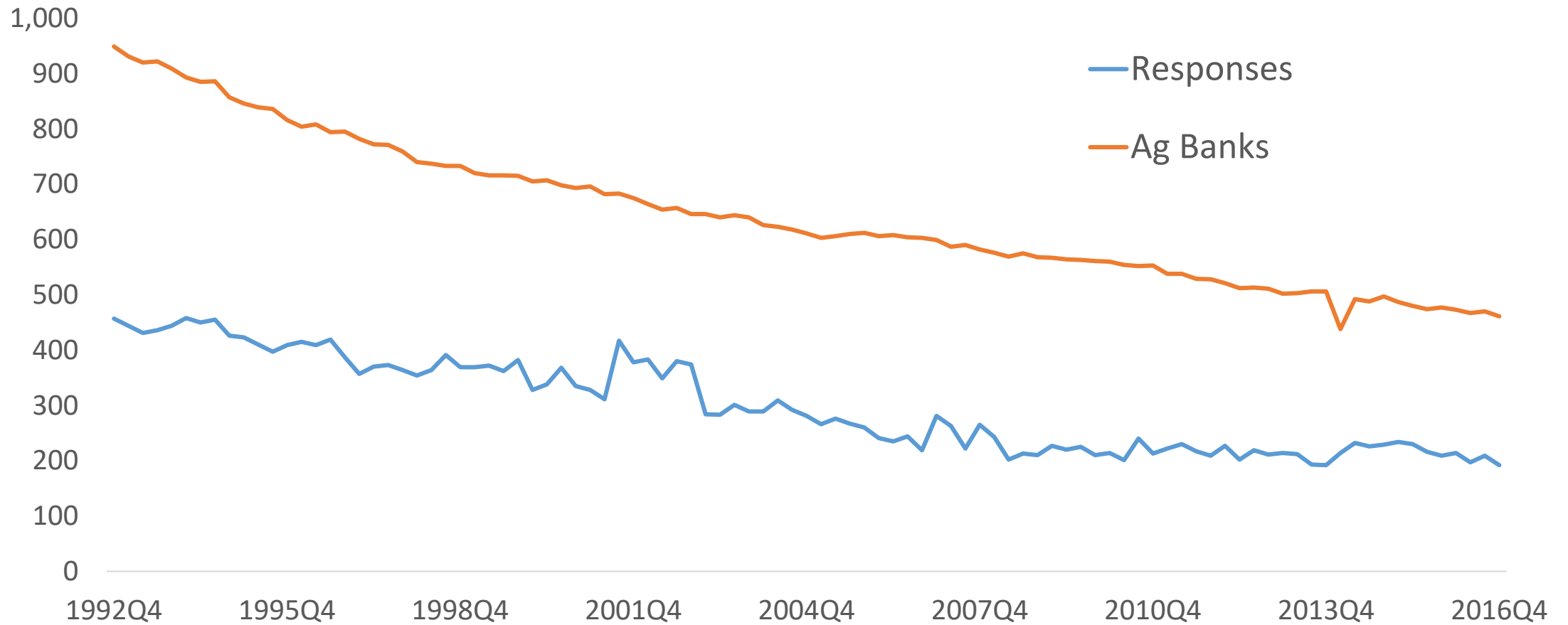
$$P[y_i = \approx] = F\left(\frac{\mu_2 - \alpha_t D_{it}}{\sigma}\right) - F\left(\frac{\mu_1 - \alpha_t D_{it}}{\sigma}\right)$$

$$P[y_i = \downarrow] = F\left(\frac{\mu_1 - \alpha_t D_{it}}{\sigma}\right)$$

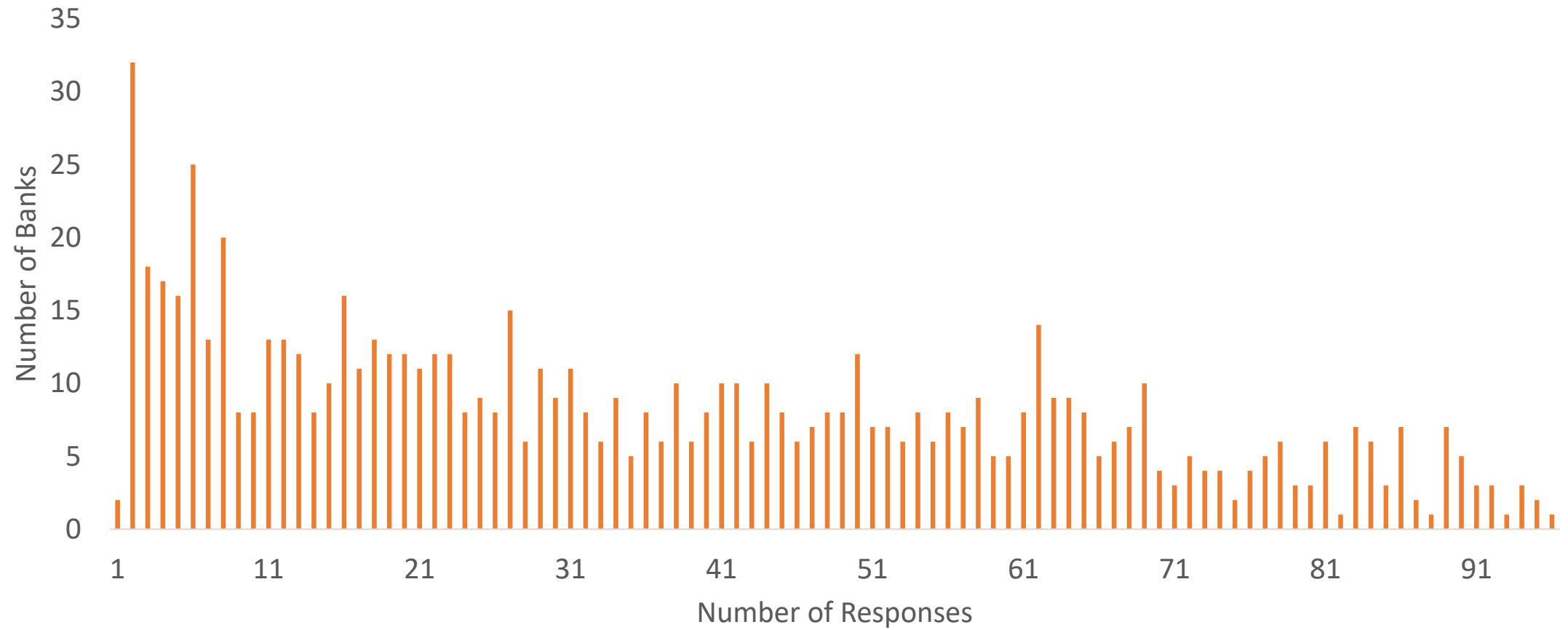
Empirical Model

- Ordered probit model (standard normal link function)
- 787 banks
- 1992Q4 – 2016Q4 (97 quarters)
- 21,121 observations
- Mean of 36.6 responses per bank
- Control variables (observed heterogeneity)
 - Average farmland value
 - State-level fixed effects

Responses per Quarter



Responses per Bank



Preliminary Results

	Estimate	Std. Error	Sig.
μ_1	-1.375	0.060	***
μ_2	0.973	0.060	***

*** $\alpha \leq 0.01$

- Lenders have asymmetric indifference interval
- In order to report “down,” bankers believe that farm real estate values will fall by more than 1.37%
- In order to report “up,” bankers believe that farm real estate values will rise by more than 0.97%

Observed Heterogeneity (marginal effects)

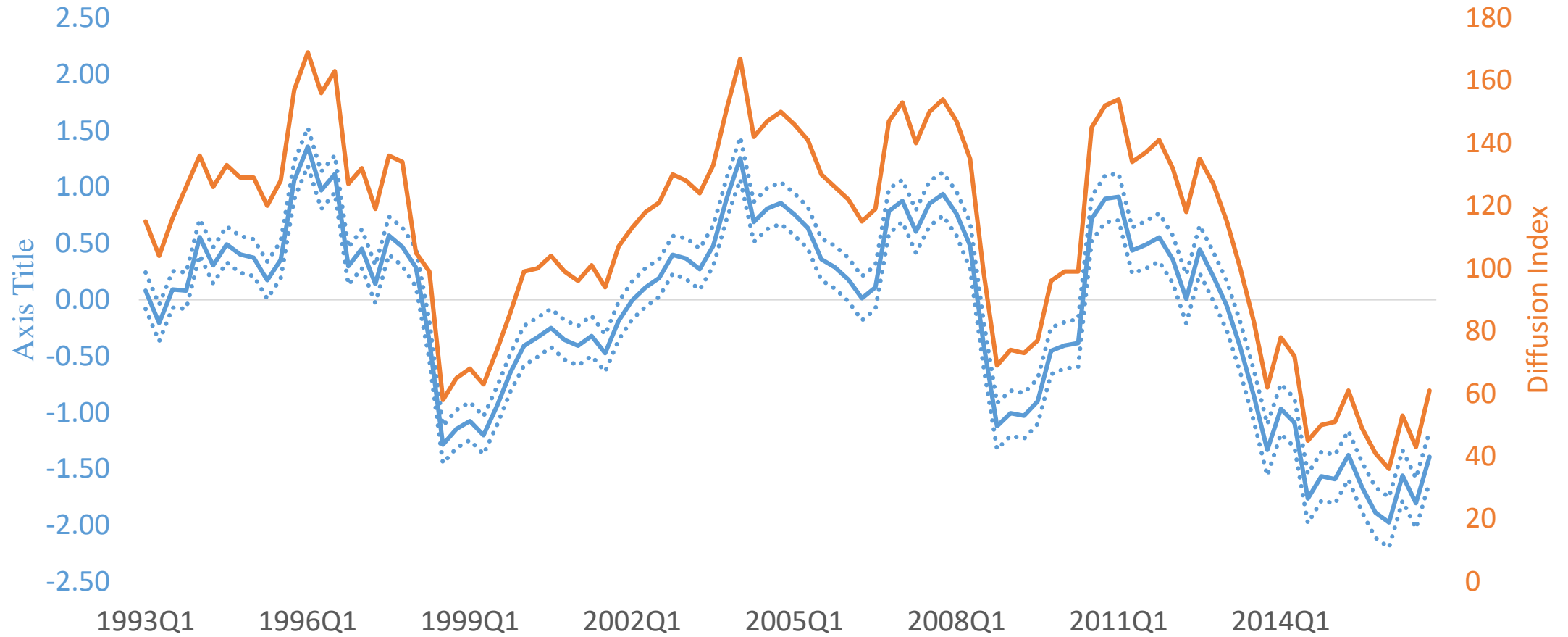
	Down			Stable			Up		
	Marginal Effect	Std. Error		Marginal Effect	Std. Error		Marginal Effect	Std. Error	
Farmland Price (level, in \$10K)	-0.026	0.009	**	-0.031	0.010	**	0.057	0.019	**
Illinois	-0.002	0.002		-0.002	0.003		0.005	0.005	
Indiana	-0.022	0.002	***	-0.034	0.005	***	0.056	0.007	***
Michigan	-0.009	0.004	**	-0.013	0.006	*	0.022	0.009	*
Wisconsin	-0.031	0.002	***	-0.053	0.005	***	0.084	0.008	***

*** $\alpha \leq 0.01$, ** $\alpha \leq 0.05$, * $\alpha \leq 0.10$

Preliminary Results

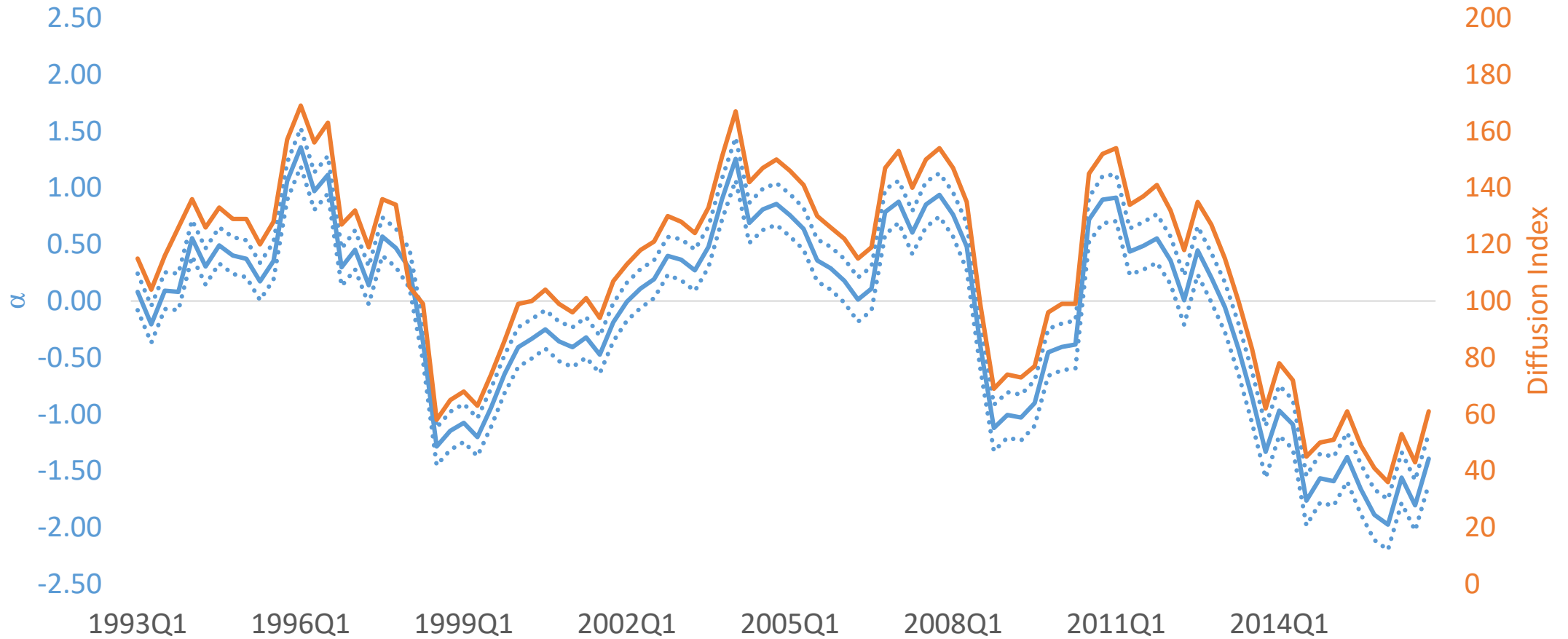


Preliminary Results

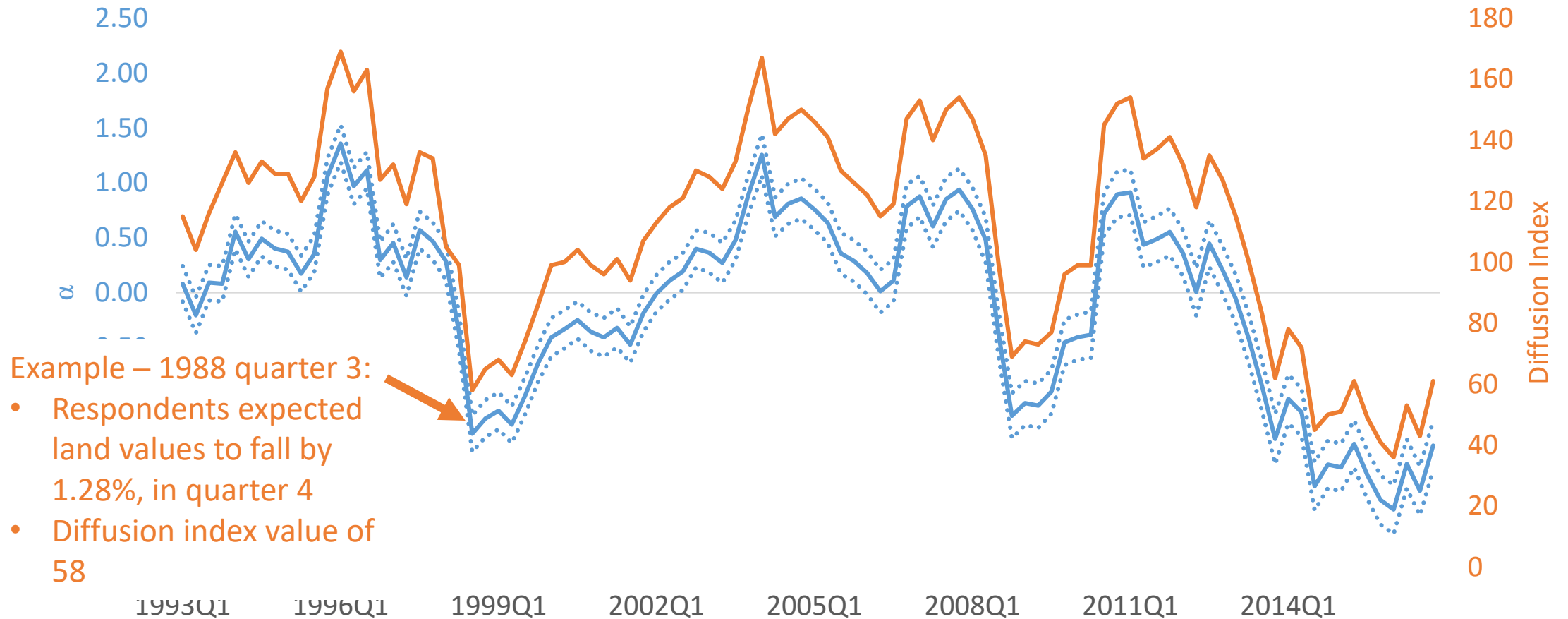


Preliminary Results

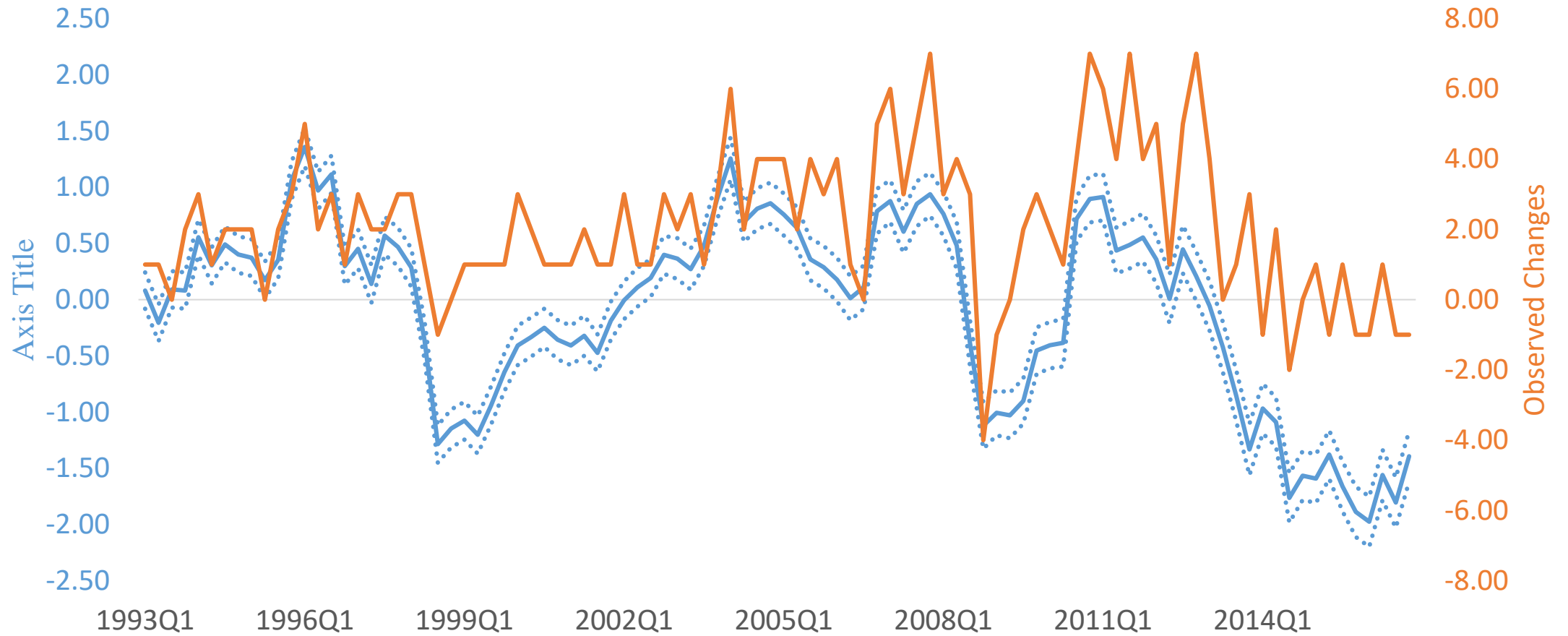
Temporal fixed effects follow same general pattern as the diffusion index, but the values are directly interpretable



Preliminary Results

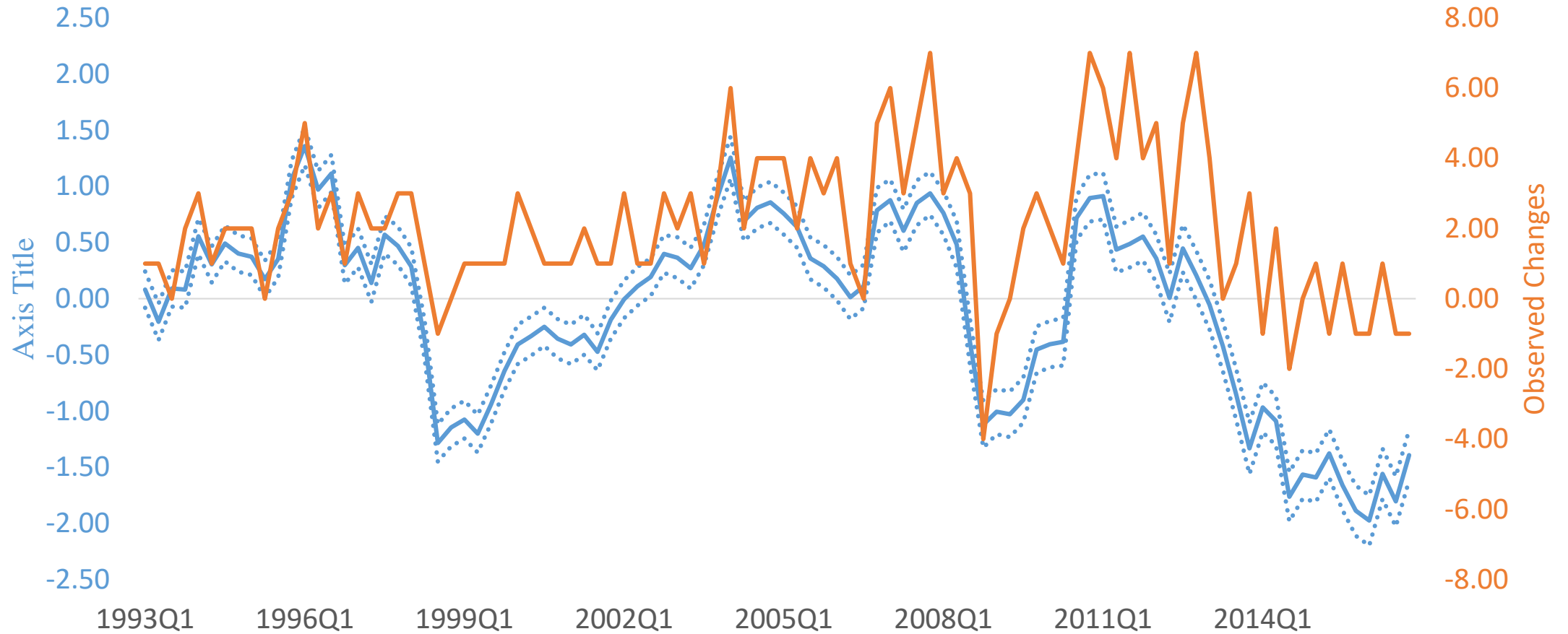


Preliminary Results

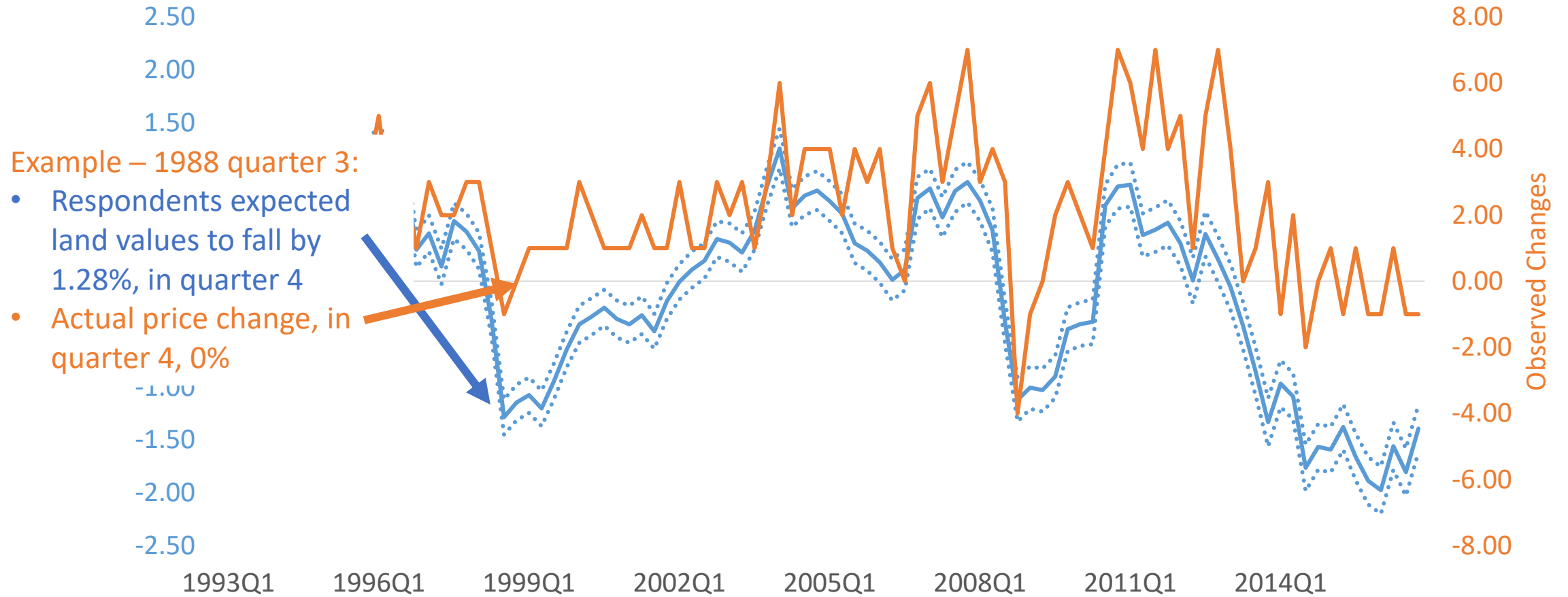


Preliminary Results

Temporal fixed effects can be compared directly to reported percentage change



Preliminary Results



Thank you