PRELIMINARY: DO NOT CITE

Inflation Expectations and Firm Decisions: New Causal Evidence

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Annual Research Conference 2018
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INFLATION EXPECTATIONS AS A POLICY TOOL

- *When inflation expectations go up with zero nominal rates, real rates go down. When real rates go down, investments and the economic activity improves. That's the reasoning [of QE]."*

  Mario Draghi (2015)

- *"The first element [of QE] was to dispel people's deflationary mindset and raise inflation expectations…"*

  Haruhiko Kuroda (2014)

Since the onset of the ZLB, there has been growing interest in policies that move expectations, and especially inflation expectations, to affect the real interest rates that households and firms perceive.

STANDARD MECHANISMS

- *Households consume more*: when inflation expectations rise and nominal interest rates are unchanged (ZLB), real interest rates are lower, so households should save less and spend more.

- *Firms raise their prices*: with sticky prices, inflation lowers firms' relative price over time, so expectation of higher inflation induces them to raise prices more than they would otherwise.

- *Workers raise their wage demands*: with sticky wages, inflation lowers real wage over time, so expectations of higher inflation induces to raise wage demands, which should raise prices further.

- *Firms invest more and hire more workers*: when inflation expectations rise and nominal interest rates are unchanged (ZLB), real interest rates are lower so user cost of capital and labor are lower, inducing firms to raise their capital and employment.

CURRENTLY AVAILABLE EVIDENCE

- *Consumption:* A lot of evidence relating households' inflation expectations to their consumption decisions.

  - *Correlations:* Bachmann et al. (2015), Crump et al. (2017), Drager and Nghiem (2017), Duca et al. (2018).
  - *Causal*: d'Acunto et al. (2017)

Higher inflation expectations are associated with higher consumption.

CURRENTLY AVAILABLE EVIDENCE

- *Consumption:* A lot of evidence relating households' inflation expectations to their consumption decisions.

- *Firms:* Very little evidence relating firms' inflation expectations to their pricing, investment, hiring and wage decisions.

    - Limited availability of survey data on firms.
    - Difficult to identify exogenous variation in expectations.
    - Firm surveys do not often measure firm-level outcomes.

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  Coibion, Gorodnichenko and Kumar (forthcoming):
  - Fields repeated surveys of firms in New Zealand.
  - Measures ex-ante expectations of firms for inflation and firm-level decisions like prices, wages, employment, investment.
  - Provides information treatment to some firms then measures outcomes in treatment and control groups after 6 months.

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  - Measures ex-ante expectations of firms for inflation and firm-level decisions like prices, wages, employment, investment.
  - Provides information treatment to some firms then measures outcomes in treatment and control groups after 6 months.
  - Exogenously higher inflation expectations lead to *higher employment and investment, little change in prices and wages*.

WHAT WE DO

- Use a survey of firms in Italy in which information about recent inflation has been *repeatedly* provided to a *random* subset of firms *during ZLB period*.

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- Use an instrumental variable approach (based on treatment) to study the causal effect of inflation expectations on firm-level decisions at the ZLB:

    - Higher inflation expectations lead to *temporarily higher prices* by firms.

    - Higher inflation expectations lead to *persistently lower employment*.

    - Higher inflation expectations lead to *persistently lower investment* plans.

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- Try to explain why firms in Italy react the way they do.

SURVEY ON INFLATION AND GROWTH EXPECTATIONS (SIGE)

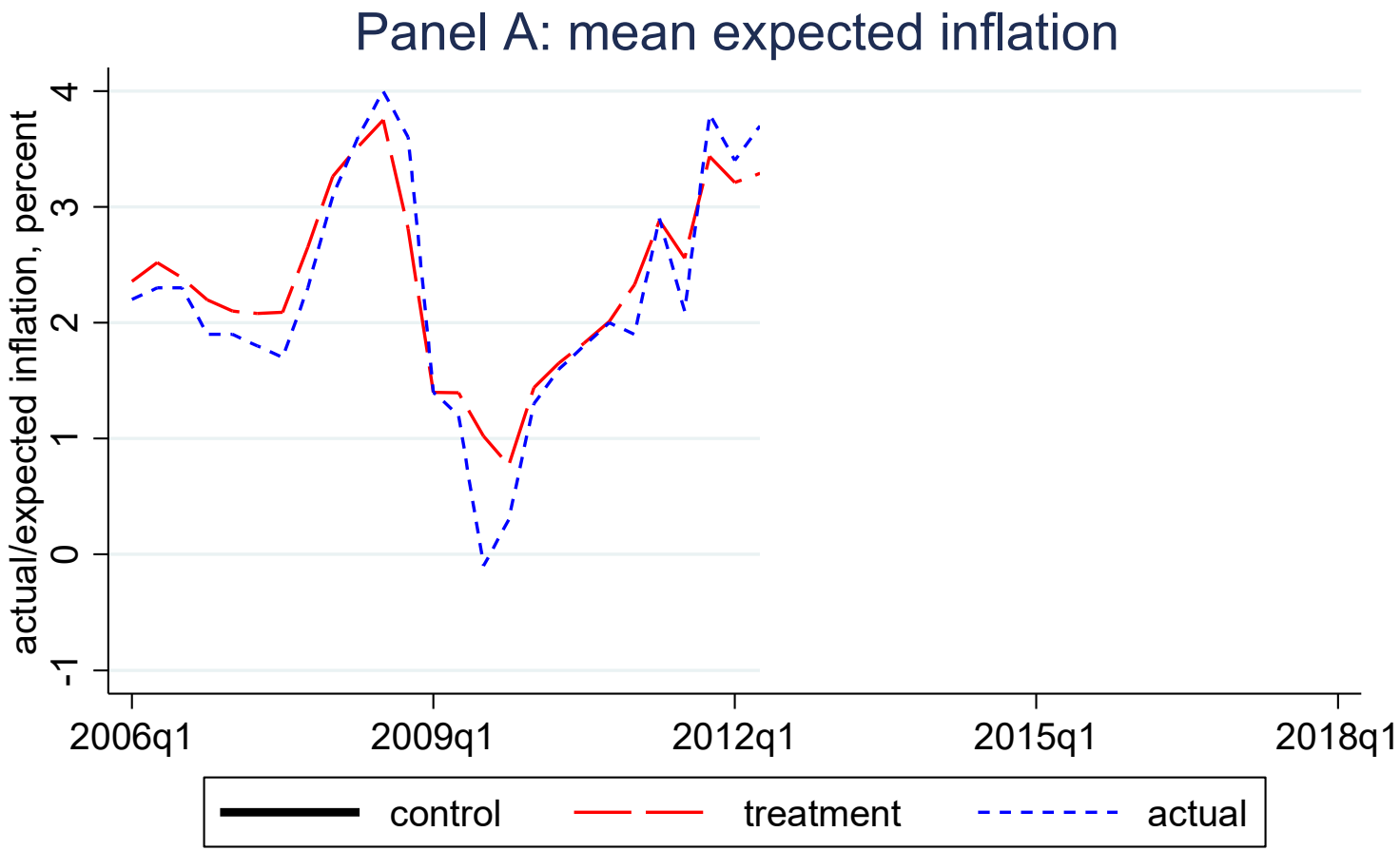
- Ongoing quarterly survey since 1999 run by the Bank of Italy.
- Nationally representative survey by sector, size, and geography.
- Large cross-section: ~ 1,000 firms per wave.
- Panel of firms: ~ 2,000 firms total since 2012.
- Response rate is ~ 45 percent.
- Survey includes questions about the firm and the aggregate economy. Most questions are qualitative but some (including inflation expectations) are quantitative.

INFORMATION TREATMENT

Prior to 2012Q3, all firms receiving the survey were given the following language for the inflation expectations question:

> "*In [previous month], consumer price inflation measured by the 12-month change in the Harmonized Index of Consumer Prices was [X.X]% in Italy and [X.X]% in the Euro area. What do you think it will be in Italy …*"

INFORMATION TREATMENT



Inflation expectations were always close to actual inflation.

INFORMATION TREATMENT

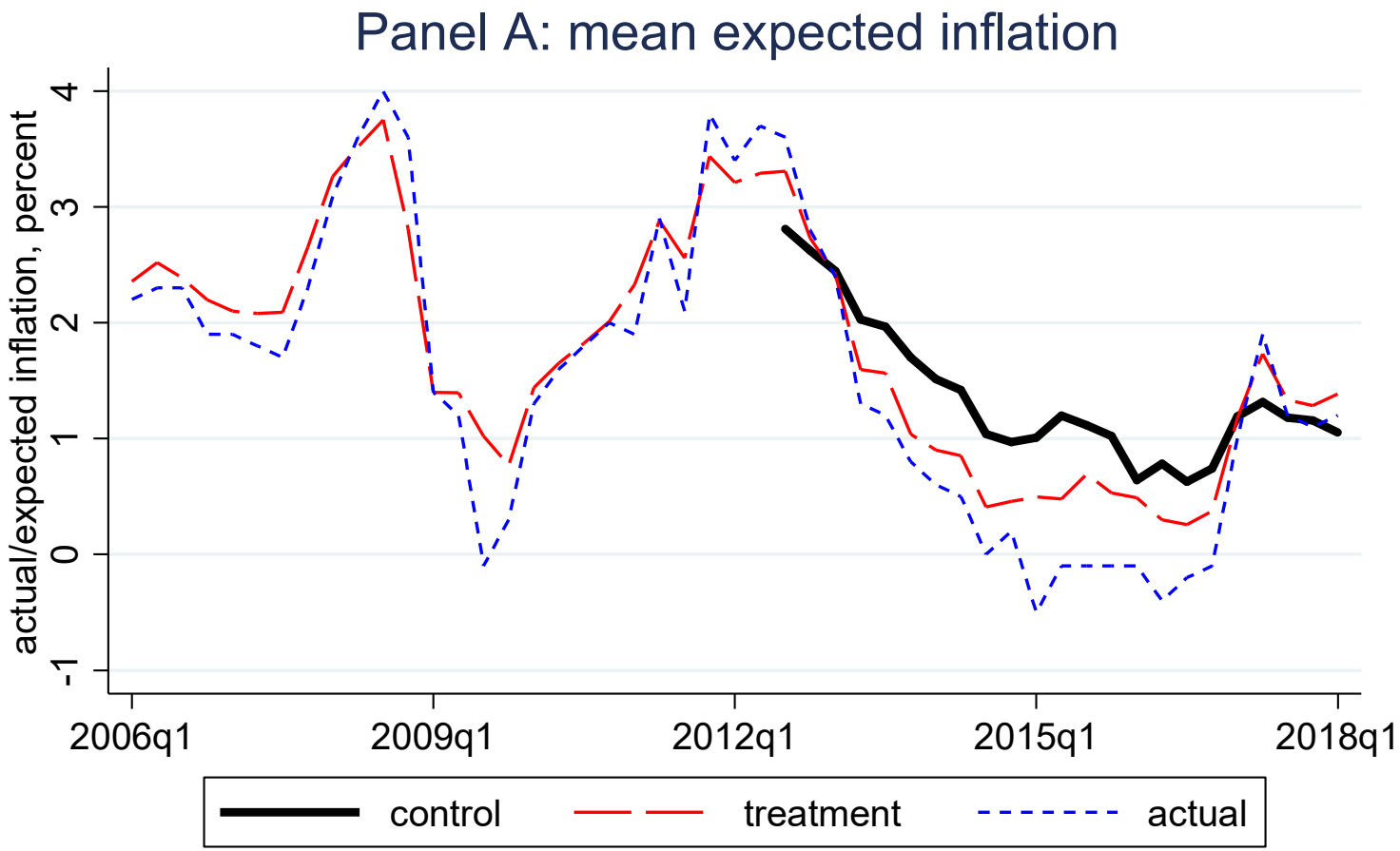
Starting in 2012Q3…

- 2/3 of firms continued to receive the exact same question [*TREATMENT GROUP*].

- 1/3 of firms received the following alternative language: [*CONTROL GROUP*]

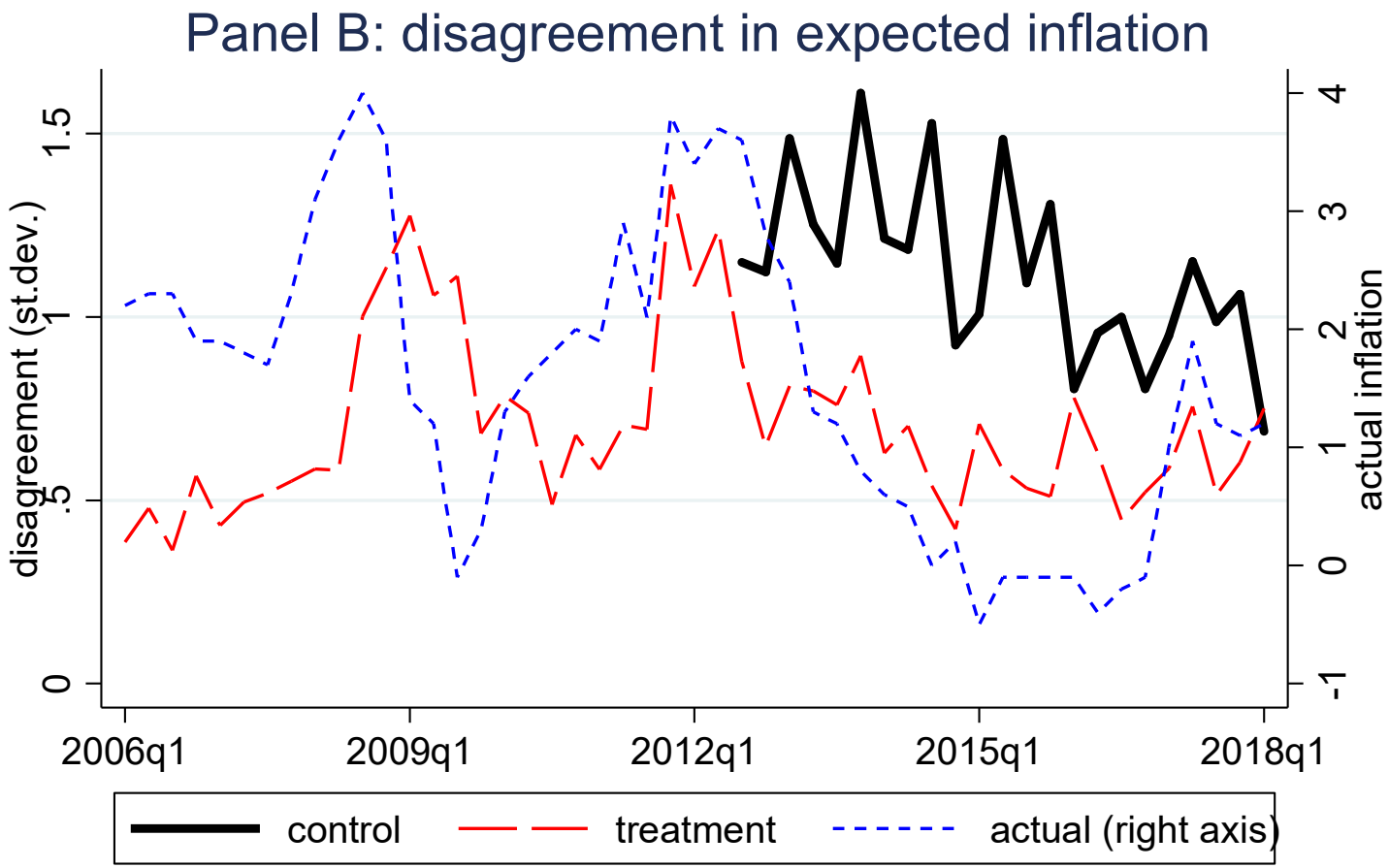
> "*What do you think consumer price inflation in Italy, measured by the 12-month change in the Harmonized Index of consumer prices, will be…*"

INFORMATION TREATMENT



Large differences between the two groups arose rapidly.

INFORMATION TREATMENT



Large differences between the two groups arose rapidly.

QUANTIFYING THE TREATMENT

We define $T_t^i = D_t^i * \pi_{t-1}$ where D_t^i is dummy = 1 if treated.

We assess the effect of the treatment on inflation expectations using:

$$F_t^i \pi^{(h)} = \alpha_h + \beta_h T_t^i + error_{t,h}^i$$

For one-year ahead inflation, this yields $\widehat{\beta_4} = 0.57^{***}\ (0.06),\ R^2 = 0.23$

This suggests that this information treatment can serve as a strong instrument for identifying exogenous variation in inflation expectations.

FACTS ABOUT THE TREATMENT

- It does appear random. We cannot predict which firms receive the information based on any observable characteristics.

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- It has larger effects on short-horizon inflation expectations than long-horizon inflation expectations.

	Dependent variable: Inflation expectations by horizon,			
	6 month	1 year	2 years	4 years
	(1)	(2)	(3)	(4)
$Treatment_{it}$	0.617***	0.574***	0.490***	0.353***
	(0.060)	(0.057)	(0.051)	(0.059)
Observations	22,149	22,149	22,149	16,609
R-squared	0.259	0.226	0.166	0.049
Sample	12Q3-18Q1	12Q3-18Q1	12Q3-18Q1	14Q1-18Q1

FACTS ABOUT THE TREATMENT

- It does appear random. We cannot predict which firms receive the information based on any observable characteristics.
- It has larger effects on short-horizon inflation expectations than long-horizon inflation expectations.
- It has transitory effects on expectations.

$$F_t^i \pi^{(h)} = \alpha_h + \beta_{h,0} T_t^i + \beta_{h,1} T_{t-1}^i + \beta_{h,2} T_{t-2}^i + \cdots + \beta_{h,q} T_{t-q}^i + error_{t,h}^i$$

yields $\hat{\beta}_{h,2} \approx \hat{\beta}_{h,3} \approx \cdots \approx \hat{\beta}_{h,q} \approx 0$.

FACTS ABOUT THE TREATMENT

- It does appear random. We cannot predict which firms receive the information based on any observable characteristics.

- It has larger effects on short-horizon inflation expectations than long-horizon inflation expectations.

- It has transitory effects on expectations.

- Its effects are not very heterogeneous. We find similar effects across
  - Industries
  - Geographic regions
  - Export share
  - Firm size

FACTS ABOUT THE TREATMENT

- It does appear random. We cannot predict which firms receive the information based on any observable characteristics.
- It has larger effects on short-horizon inflation expectations than long-horizon inflation expectations.
- It has transitory effects on expectations.
- Its effects are not very heterogeneous.
- Being treated with information about the ECB's inflation target affects expectations in a similar way.

INFLATION EXPECTATIONS AND PRICES

- The survey asks firms each quarter for their price changes over the previous year.

- We regress ex-post price changes at different horizons on inflation expectations and controls using treatment as instrument for expectations.

$$dp^i_{t+k} = \alpha_k + \gamma_k F^i_{t-1}\pi^{(12\ \ )} + controls^i_{t-2} + error^i_{t-1,t+k}$$

- Controls include various qualitative expectations from the previous wave:
  - Expected future (3-month) firm-specific business conditions
  - Expected future employment growth
  - Expected liquidity over next 3 months
  - Perceptions about current Italian economic situation
  - Probability of improved Italian economic situation over next 3 months

INFLATION EXPECTATIONS AND PRICES

	x_{it}	$x_{i,t+1}$	$x_{i,t+2}$	$x_{i,t+3}$	$x_{i,t+4}$	$x_{i,t+5}$
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Effect on Prices, IV Estimates						
$F^{i}_{t-1}\pi^{(12m)}$						
Observations						
R-squared						
1st stage F stat	114.2	115.2	118.7	121.8	120.9	107.8

The information treatment is a very strong instrument for inflation expectations.

INFLATION EXPECTATIONS AND PRICES

	x_{it}	$x_{i,t+1}$	$x_{i,t+2}$	$x_{i,t+3}$	$x_{i,t+4}$	$x_{i,t+5}$
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Effect on Prices, IV Estimates						
$F^i_{t-1}\pi^{(12m)}$	0.182**	0.165*				
	(0.084)	(0.080)				
Observations	14,127	12,013				
R-squared	0.177	0.165				
1st stage F stat	114.2	115.2	118.7	121.8	120.9	107.8

Prices are initially higher:

a 1% increase in inflation expectations leads to 0.18% increase in prices.

INFLATION EXPECTATIONS AND PRICES

	x_{it}	$x_{i,t+1}$	$x_{i,t+2}$	$x_{i,t+3}$	$x_{i,t+4}$	$x_{i,t+5}$
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Effect on Prices, IV Estimates						
$F^i_{t-1}\pi^{(12m)}$	0.182**	0.165*	0.028	-0.053	-0.048	-0.112
	(0.084)	(0.080)	(0.111)	(0.083)	(0.099)	(0.085)
Observations	14,127	12,013	11,238	10,496	9,743	8,970
R-squared	0.177	0.165	0.138	0.116	0.115	0.111
1st stage F stat	114.2	115.2	118.7	121.8	120.9	107.8

The effects on prices die out quickly.

INFLATION EXPECTATIONS AND PRICES

	x_{it}	$x_{i,t+1}$	$x_{i,t+2}$	$x_{i,t+3}$	$x_{i,t+4}$	$x_{i,t+5}$
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: Effect on Prices, OLS Estimates						
$F^{i}_{t-1}\pi^{(12m)}$	0.165***	0.119***	0.017	0.032	-0.033	-0.006
	(0.049)	(0.035)	(0.046)	(0.045)	(0.052)	(0.048)
Observations	13,950	11,818	11,048	10,310	9,626	8,841
R-squared	0.179	0.168	0.137	0.116	0.112	0.113
1st stage F stat						

OLS estimates are almost identical to IV estimates for prices.

INFLATION EXPECTATIONS AND EMPLOYMENT

- The survey asks firms each quarter to report their total employment.

- We regress the cumulative growth in firm-level employment at different horizons on inflation expectations and controls using treatment as instrument for expectations.

$$\ln\left(\frac{n_{t+k}^{i}}{n_{t-1}^{i}}\right) = \alpha_k + \gamma_k F_{t-1}^{i}\pi^{(12m)} + controls_{t-2}^{i} + error_{t-1,t+k}^{i}$$

- Controls include various qualitative expectations from the previous wave:
  - Expected future (3-month) firm-specific business conditions
  - Expected future employment growth
  - Expected liquidity over next 3 months
  - Perceptions about current Italian economic situation
  - Probability of improved Italian economic situation over next 3 months

INFLATION EXPECTATIONS AND EMPLOYMENT

	x_{it}	$x_{i,t+1}$	$x_{i,t+2}$	$x_{i,t+3}$	$x_{i,t+4}$	$x_{i,t+5}$
	(1)	(2)	(3)	(4)	(5)	(6)
Panel C: Effect on Employment, IV Estimates						
$F^{i}_{t-1}\pi^{(12m)}$	-0.089	-0.337***	-0.480***	-0.810***	-0.866***	-1.137***
	(0.071)	(0.108)	(0.096)	(0.107)	(0.158)	(0.163)
Observations	14,127	12,013	11,238	10,496	9,743	8,970
R-squared	0.022	0.028	0.037	0.055	0.053	0.051
1st stage F stat	114.2	115.2	118.7	121.8	120.9	107.8

Employment falls progressively after a rise in inflation expectations:

A 1% increase in inflation expectations leads to 1% drop in employment.

INFLATION EXPECTATIONS AND EMPLOYMENT

	x_{it}	$x_{i,t+1}$	$x_{i,t+2}$	$x_{i,t+3}$	$x_{i,t+4}$	$x_{i,t+5}$
	(1)	(2)	(3)	(4)	(5)	(6)
Panel C: Effect on Employment, OLS Estimates						
$F^{i}_{t-1}\pi^{(12m)}$	-0.063	-0.052	-0.134	-0.247**	-0.323**	-0.350**
	(0.040)	(0.061)	(0.085)	(0.086)	(0.113)	(0.122)
Observations	14,014	11,912	11,155	10,408	9,743	8,970
R-squared	0.022	0.031	0.040	0.059	0.056	0.055
1st stage F stat	114.2	115.2	118.7	121.8	120.9	107.8

The IV approach matters: with OLS, there is a much smaller effect on identified effect on employment.

INFLATION EXPECTATIONS AND INVESTMENT

- The survey asks firms each quarter to predict qualitatively their change in employment over the next three months and investment over the calendar year.

- We regress these expected changes at different horizons on inflation expectations and controls using treatment as instrument for expectations.

$$y^i_{t+k} = \alpha_k + \gamma_k F^i_{t-1}\pi^{(12\ \ )} + controls^i_{t-2} + error^i_{t-1,t+k}$$

- We find that investment is expected to decline by about twice as much as employment is predicted to decline when inflation expectations rise.

WHY ARE HIGH INFLATION EXPECTATIONS STAGFLATIONARY?

Using the same IV approach, we characterize how changes in inflation expectations affect firms' other economic expectations.

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Row	Outcome variable	Coef. (s.e.)	Obs.	R^2
	Macroeconomic expectations			
(1)	General economic situation relative to 3 months ago	-0.204*** (0.040)	23,309	-0.005
(2)	Probability of improved situation in the next 3 months	-1.844** (0.666)	23,508	0.001

Firms become more pessimistic about the aggregate economic outlook when their inflation expectations rise.

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Row	Outcome variable	Coef. (s.e.)	Obs.	R^2
	Expectations about firm-specific conditions			
(3)	Expected firm business conditions, next 3 months	-0.151*** (0.023)	23,527	0.012
(4)	Expected demand for products, next 3 months	-0.108** (0.048)	21,035	0.004
(5)	Expected liquidity for company, next 3 months	-0.077*** (0.014)	23,231	0.035
	Uncertainty			
(8)	3-month ahead	0.011*** (0.003)	23,094	0.013
(9)	3-year ahead	0.015*** (0.002)	23,087	0.012

Firms become more pessimistic about the outlook for their firm when their inflation expectations rise.

WHY ARE HIGH INFLATION EXPECTATIONS STAGFLATIONARY?

Using the same IV approach, we characterize how changes in inflation expectations affect firms' other economic expectations.

Row	Outcome variable	Coef. (s.e.)	Obs.	R^2
(10)	Expected price change, next 12 months	0.180*** (0.049)	23,626	0.022
	Factors affecting future price changes			
(11)	Expected change in demand			
(12)	Expected raw material prices			
(13)	Expected labor costs			
(14)	Expected prices of competitors			

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(10)	Expected price change, next 12 months	0.180*** (0.049)	23,626	0.022
	Factors affecting future price changes			
(11)	Expected change in demand	-0.107*** (0.021)	22,906	0.007
(12)	Expected raw material prices	0.102*** (0.024)	22,843	0.023
(13)	Expected labor costs	0.017 (0.014)	22,872	0.004
(14)	Expected prices of competitors	-0.029 (0.018)	22,811	0.004

Firms expect lower demand to push prices down but higher raw materials to push prices up.

HETEROGENEITY IN EFFECTS

There is significant variation in the strength of these effects across:

- Industry type:
  - Construction has much larger increases in prices and declines in employment than either manufacturing or services.

HETEROGENEITY IN EFFECTS

There is significant variation in the strength of these effects across:

- Industry type.
- Firm size:
  - Larger firms experience larger price increases but employment effects are broadly similar across size groups.

HETEROGENEITY IN EFFECTS

There is significant variation in the strength of these effects across:

- Industry type.
- Firm size.
- Export share:
  - Declines in employment are much larger for firms that export little to none than for firms that primarily serve export markets.

HETEROGENEITY IN EFFECTS

There is significant variation in the strength of these effects across:

- Industry type.
- Firm size.
- Export share.
- Geography:
  - Firms in the South of Italy experience declines in employment that are five times larger than firms in the rest of the country (and larger price increases) for the same increase in inflation expectations.

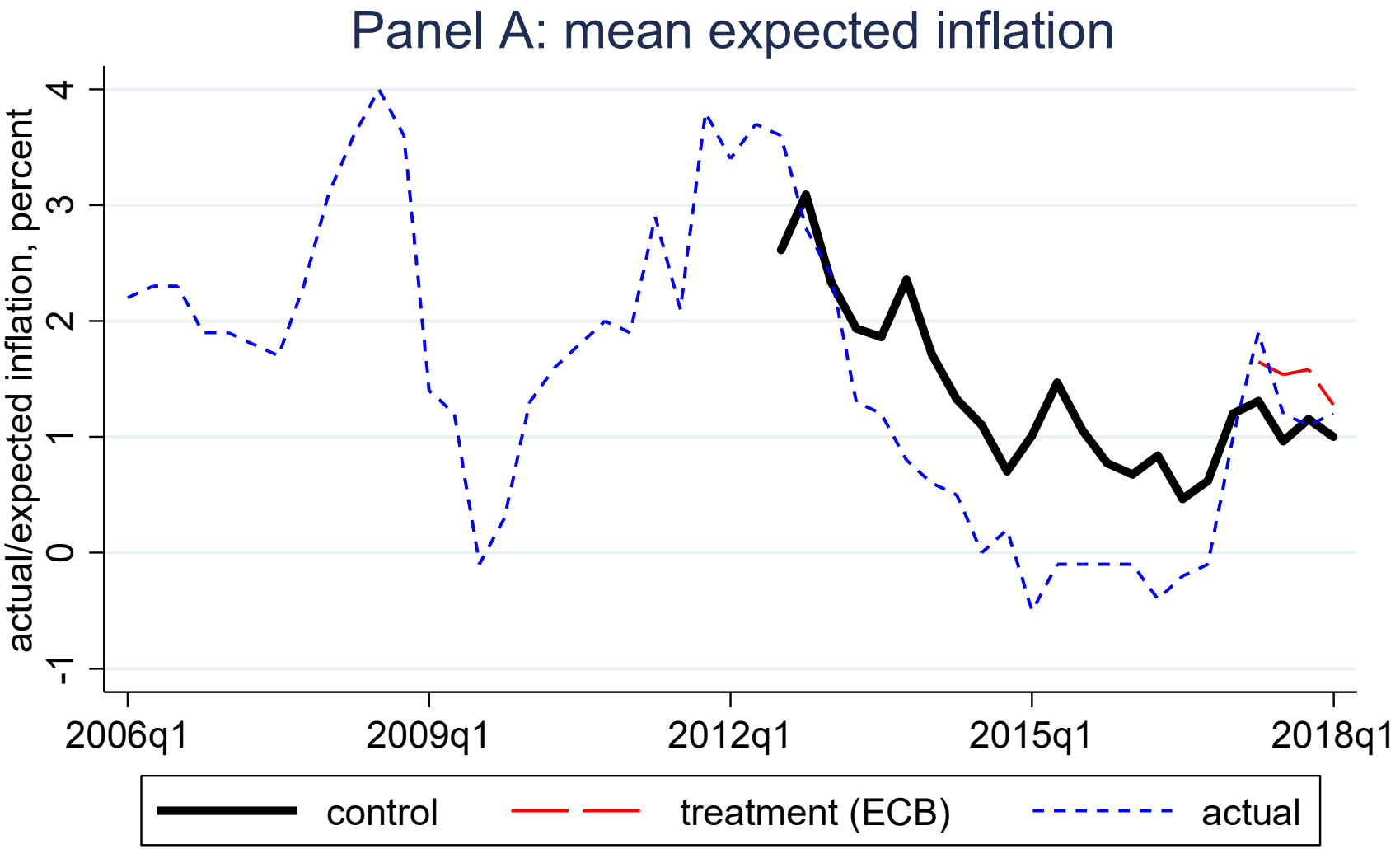
THE ECB TARGET TREATMENT

Starting in 2017Q2, a new random assignment was made:

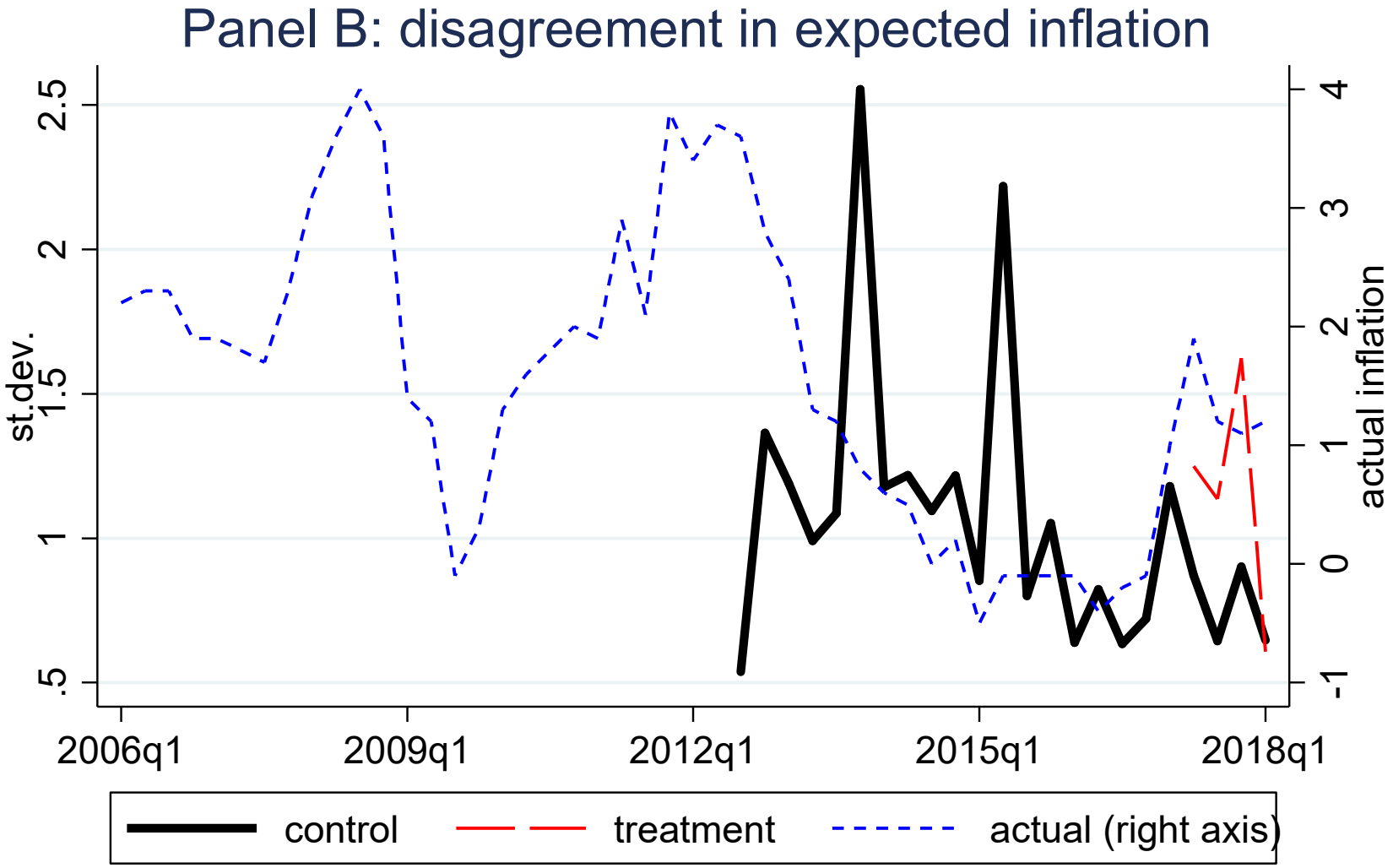
- One-fifth of firms are not provided with any information
- Three-fifths of firms are provided with treatment of recent inflation dynamics.
- One-fifth of firms receive the following treatment:

"*The European Central Bank has the maintenance of the 12-month change in the Harmonized Index of Consumer Prices in the Euro area near but under 2 percent in the medium run. What do you think consumer price inflation in Italy, measured by the Harmonized Index of Consumer Prices, will be …*"

THE ECB TARGET TREATMENT



THE ECB TARGET TREATMENT



THE ECB TARGET TREATMENT

	Dependent variable: Inflation expectations by horizon			
	6 months	1 year	2 years	4 years
Panel A: ECB inflation target treatment				
$Treatment_{it}$	0.213***	0.195**	0.181**	0.183**
	(0.071)	(0.075)	(0.083)	(0.091)
Observations	248	248	248	248
R-squared	0.046	0.037	0.025	0.024
Sample	17Q2-18Q1	17Q2-18Q1	17Q2-18Q1	17Q2-18Q1
Panel B: Past inflation treatment				
$Treatment_{it}$	0.219***	0.213***	0.210***	0.208***
	(0.044)	(0.048)	(0.052)	(0.056)
Observations	2,642	2,642	2,642	2,642
R-squared	0.033	0.028	0.024	0.019
Sample	17Q2-18Q1	17Q2-18Q1	17Q2-18Q1	17Q2-18Q1

The two treatments have equal-sized effects.

CONCLUSION AND IMPLICATIONS

- We show that firms in Italy during the ZLB period responded to exogenously higher inflation expectations by temporarily raising their prices and persistently lowering their employment.

- Communications strategies that affect firms' economic expectations can affect economic outcomes in sizeable ways.

- Policy-makers can emphasize different kinds of information (e.g. recent inflation or the inflation target) depending on which way they want expectations to move.