Monetary Policy and the Link Between Inflation and Unemployment

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The Phillips Curve

EE 4G 21:05 8%

The Phillips curve, dead or alive?

Premium

Debate may not make much difference to practical policy

MARTIN SANDBU + Add to myFT

JULY 25, 2019 by Martin Sandbu

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As I wrote last week, the announced death of the Phillips curve drew strange bedfellows to its wake. From Trump economic advisers to the left wing of the Democratic party, some policymakers have welcomed the seeming

myFT Updated 9:04pm

Roger E. A. Farmer
@farmerrf
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Our new paper on the failed Phillips Curve i
now published:

The Phillips curve, dead or alive?
Martin Sandbu, Financial Times

Ricardo Reis
@R2Rsquared
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To which I would add: "Either way, the Phillips curve has come a long way since

Yes, There Is a Trade-off Between Inflation and Unemployment
N. Gregory Mankiw, The New York Times

Ocasio-Cortez, Trump Adviser Unite to Trash the Phillips Curve
Reade Pickert and Katia Dmitrieva, Bloomberg News

Olivier Blanchard
@ojblanchard1
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Logical fallacy: it is not because a relation is complex and shifting that you can dismiss it. 🙁A complete macro model must have an equation reflecting wage formation in labor market. And it is highly unlikely that wage determination depends in no way on state of labor market.

Roger E. A. Farmer @farmerrf
Oh but you can @ojblanchard1. And w
time again, you must replace it. That's
false theory: the Natural Rate Hypothe
@warwicknewsroom @MESandbu @g

7:02 AM - 26 Jul 2019

25 Retweets 97 Likes

Ivan Werning
@IvanWerning
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Phillips Curve "Wars" are back!

Some say it's dead; others, alive and kickin'.

People often talk past each other. (Surprise!) Let me try to explain one big reason why.

I'll use some analogies from basic micro. (1/n)

5:16 PM - 26 Jul 2019

148 Retweets 459 Likes

7 148 459

Ivan Werning @IvanWerning · Jul 26
So why all the disagreements and sometimes nasty fighting?

I think it doesn't help that "Phillips Curve" is a loose term that means different things to different people or different things in different contexts. (2/n)

2 1 22

Ivan Werning @IvanWerning · Jul 26
Is it a...
A. direct correlation we should see in the data?
B. relation or concept within a model, much like a demand curve is in basic micro?
(or both?)

Historically it was born as a correlation (A) but it's about time we focus on it as a concept (B). (3/n)

1 1 30

Ivan Werning @IvanWerning · Jul 26
Why? We know a correlation (A) can break down even if the concept is useful (B).

In micro a demand curve is a concept that we think of and sometimes draw, CETERIS PARIBUS. (4/n)

1 21

Ivan Werning @IvanWerning · Jul 26
If we scatter plot quantity Q of a good against its price P we understand we might get no clear relation or even an upward sloping one (Cowles identification problem).

Lots of debate among the media, academics and market participants about a key aspect of monetary policy transmission: the Phillips curve.

Plan for Talk

1. Is the Phillips Curve Dead?

2. How can we tell?

1. Is the Phillips Curve Dead?

Optimal Inflation and the Identification of the Phillips Curve," Mcleay and Tenreyro (2019)

- **Inflation follows a seemingly exogenous process, unrelated to measures of slack. E.g.,**
  - ✓ Atkeson and Ohanian (2001)
  - ✓ Stock and Watson (2007, 2009)
  - ✓ Hall (2011)
  - ✓ Dotsey, Fujita and Stark (2017),
  - ✓ Cecchetti, Feroli, Hooper, Kashyap, and Schoenholtz (2017)
  - ✓ Forbes, Kirkham and Theodoridis (2017)
  - ✓ Uhlig (2018)

- **The Phillips Curve has flattened (or even disappeared). E.g.,**
  - ✓ Ball and Mazumder (2011)
  - ✓ IMF (2013)
  - ✓ Blanchard, Cerutti and Summers (2015)
  - ✓ Summers (2017)
  - ✓ Andolfatto (2017)
  - ✓ Blinder (2018)

- **Critical for the conduct of monetary policy**
  - ✓ Draghi (2017)
  - ✓ Carney (2017)
  - ✓ Powell (2018)

Stock taking by (some) academics

Harald Uhlig (Chicago), 2018:

"Inflation, in essence, dances to its own music"

Bob Hall (Stanford), 2013:

"Prior to the recent deep worldwide recession, macroeconomists of all schools took a negative relation between slack and declining inflation as an axiom. Few seem to have awakened to the recent experience as a contradiction to the axiom."

- This disconnect between inflation and slack poses a challenge to New Keynesian models, for which the Phillips curve is a key building block.

If there is no Phillips curve…

- This disconnect between inflation and slack poses a challenge to New Keynesian models, for which the Phillips curve is a key building block.

Does the disconnect pose a challenge to the NK model?

- No, on the contrary: this disconnect is exactly what a New Keynesian model with a welfare-optimizing Central Bank would predict

A simple model of optimal inflation and the PC

Galí (2008); Woodford (2003); Clarida, Galí and Gertler (1999)

$$Loss = E_0 \sum_{t=0}^{\infty} \beta^t (\pi_t^2 + \lambda x_t^2)$$

<u>Under discretion</u>

$$\min \pi_t^2 + \lambda x_t^2$$

s.t.:

$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t + u_t \qquad \text{(PC)}$$

<u>Solution: Targeting rule</u>

$$\pi_t = -\frac{\lambda}{\kappa} x_t \qquad \text{(TR)}$$

Optimal inflation and the PC

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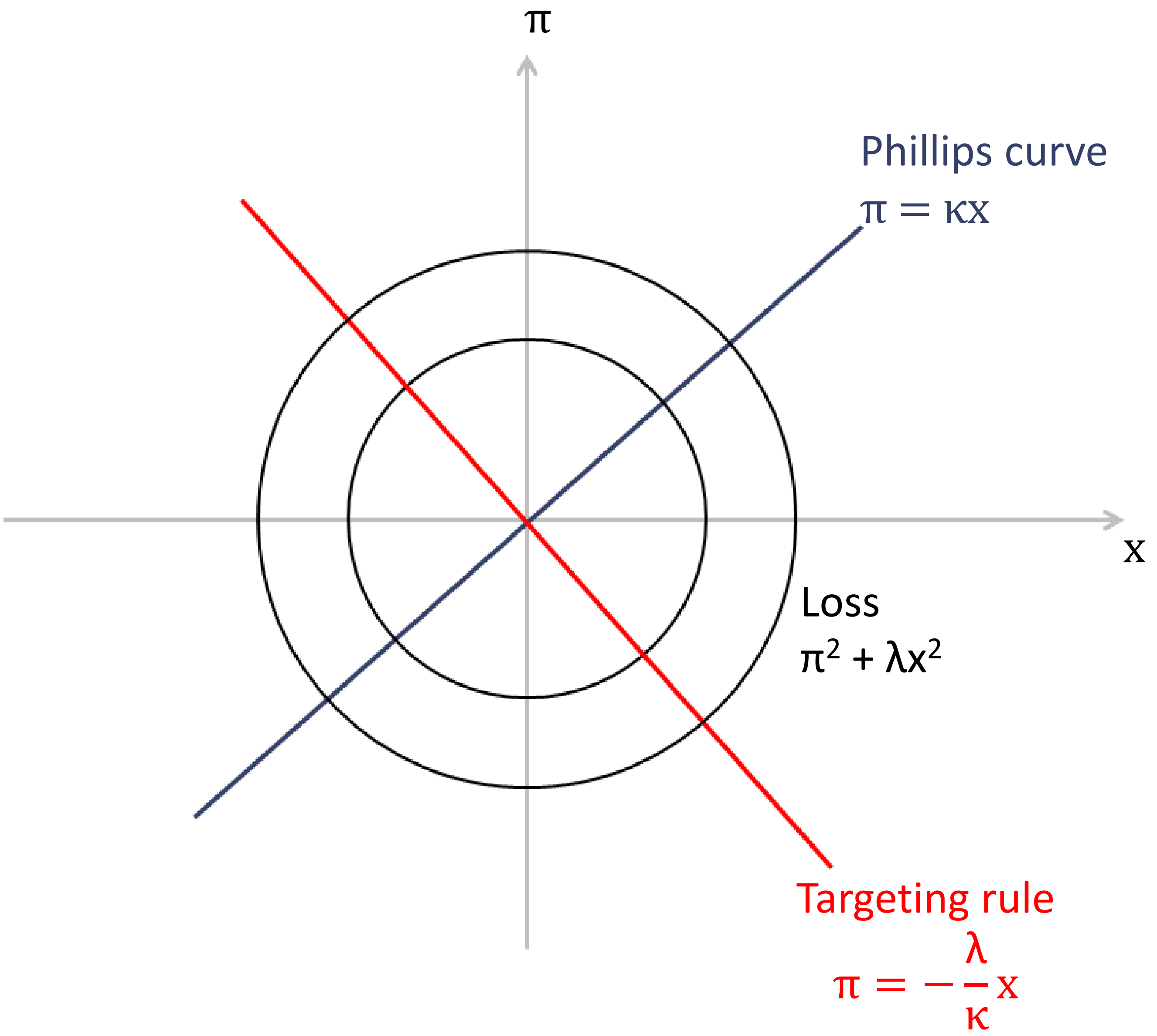

Identification

$$\min \pi_t^2 + \lambda x_t^2$$

s.t.:

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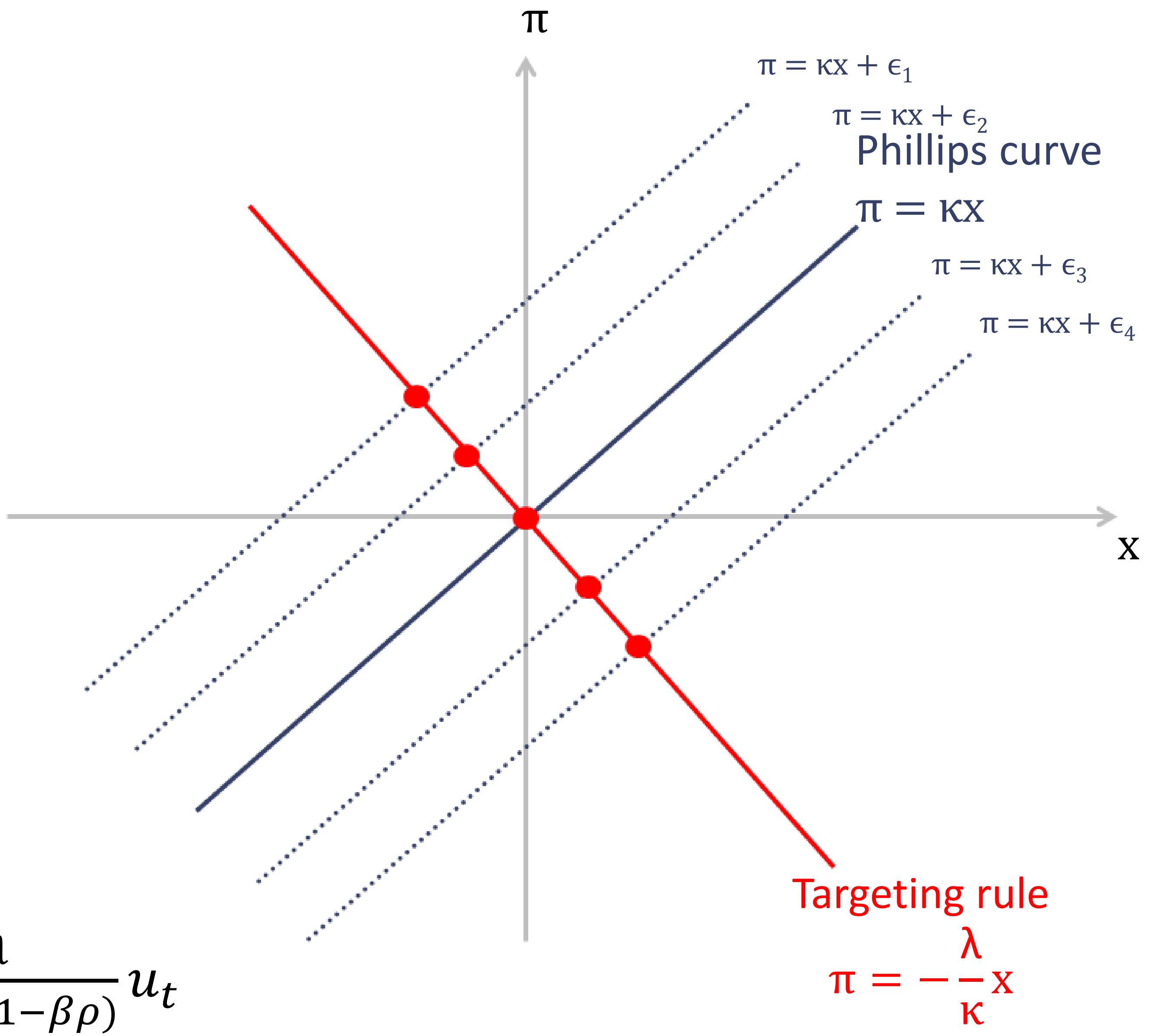
$$\pi_t = -\frac{\lambda}{\kappa} x_t \qquad \text{(TR)}$$

Observed Inflation inherits properties of exogenous shock process:

$$\pi_t = f(u_t)$$

$$If\ u_t = \rho u_{t-1} + v_t, \qquad \pi_t = \frac{\lambda}{\kappa^2 + \lambda(1-\beta\rho)} u_t$$



Identification under commitment

Under commitment:

$$\min E_0 \sum_{t=0}^{\infty} \beta^t (\pi_t^2 + \lambda x_t^2)$$

s.t.:

$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t + u_t \qquad \text{(PC)}$$

Solution: Targeting rule

$$p_t = -\frac{\lambda}{\kappa} x_t \qquad \text{(TR)}$$

Observed inflation: inherits properties of exogenous shock process:

$$\pi_t = f(u_t, u_{t-1}, u_{t-2} \ldots)$$

Remarks

- Framework implies that equilibrium inflation rates should be uncorrelated with slack, as long as central banks are doing a sensible job

- Challenge for econometricians, not for the model
- The point is distinct from most articulations of the "Fed view" on why the Phillips curve flattened (e.g. Williams, 2006; Mishkin, 2007; Bernanke, 2007, 2010).
  - They focus on the anchoring of inflation expectations weakening the reduced-form correlation between slack and inflation.
  - This paper: even in a setting in which expectations play no role, the structural relationship between slack and inflation can be masked by the conduct of monetary policy.
  - This is not to say that Fed policymakers were not aware of our point too, of course!

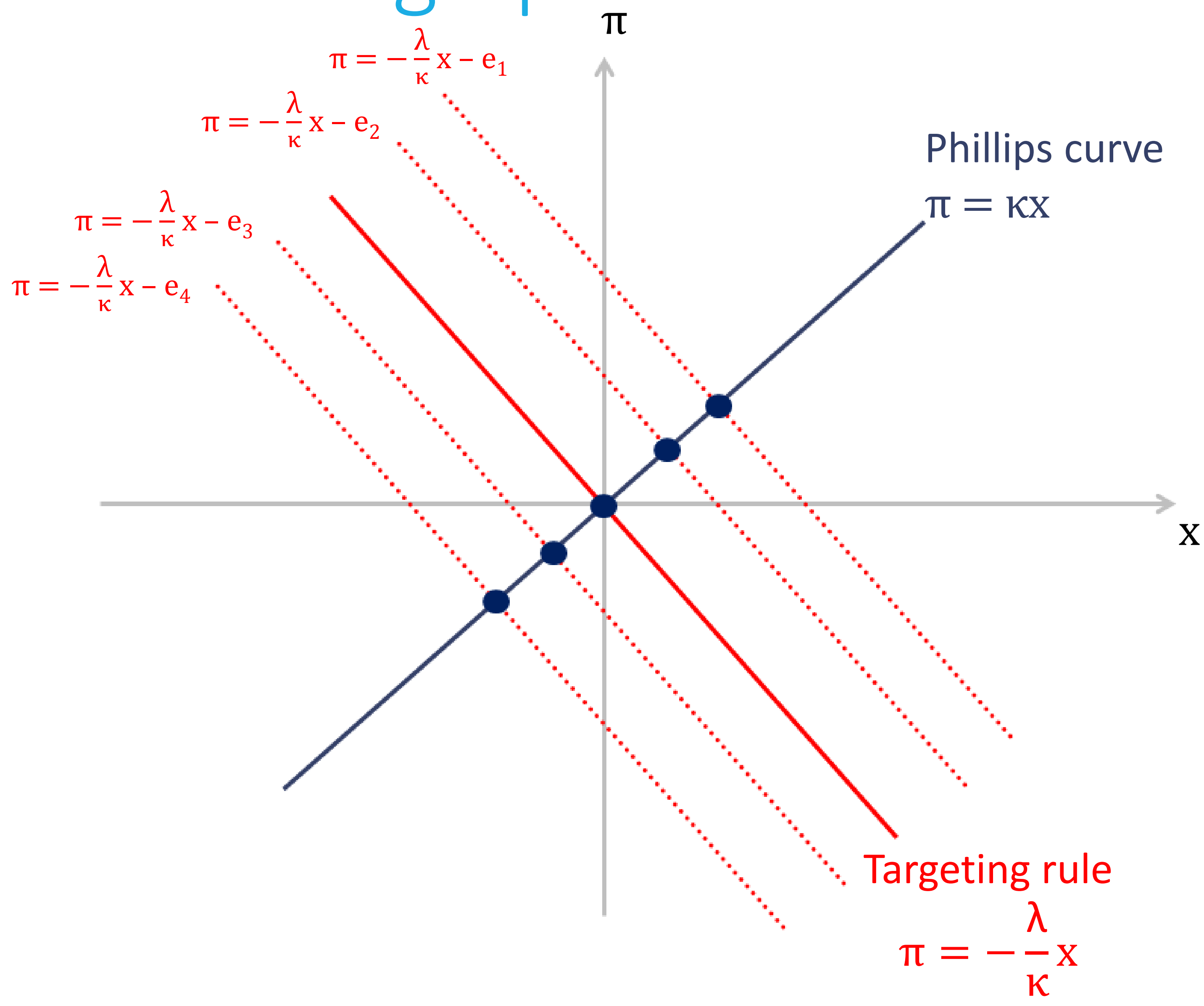
- Interestingly, many papers on the PC flattening do not mention monetary policy. If they do, only to the extent that it affects expectations. E.g. Coibion and Gorodnichenko (2015).

- Formulas: Barro and Gordon (1983)

Identification in graphs

$$\pi_t = -\frac{\lambda}{\kappa} x_t - e_t \quad \text{(TR)}$$

Identification improves as $\frac{\text{Var}(e_t)}{\text{Var}(u_t)}$ *increases*

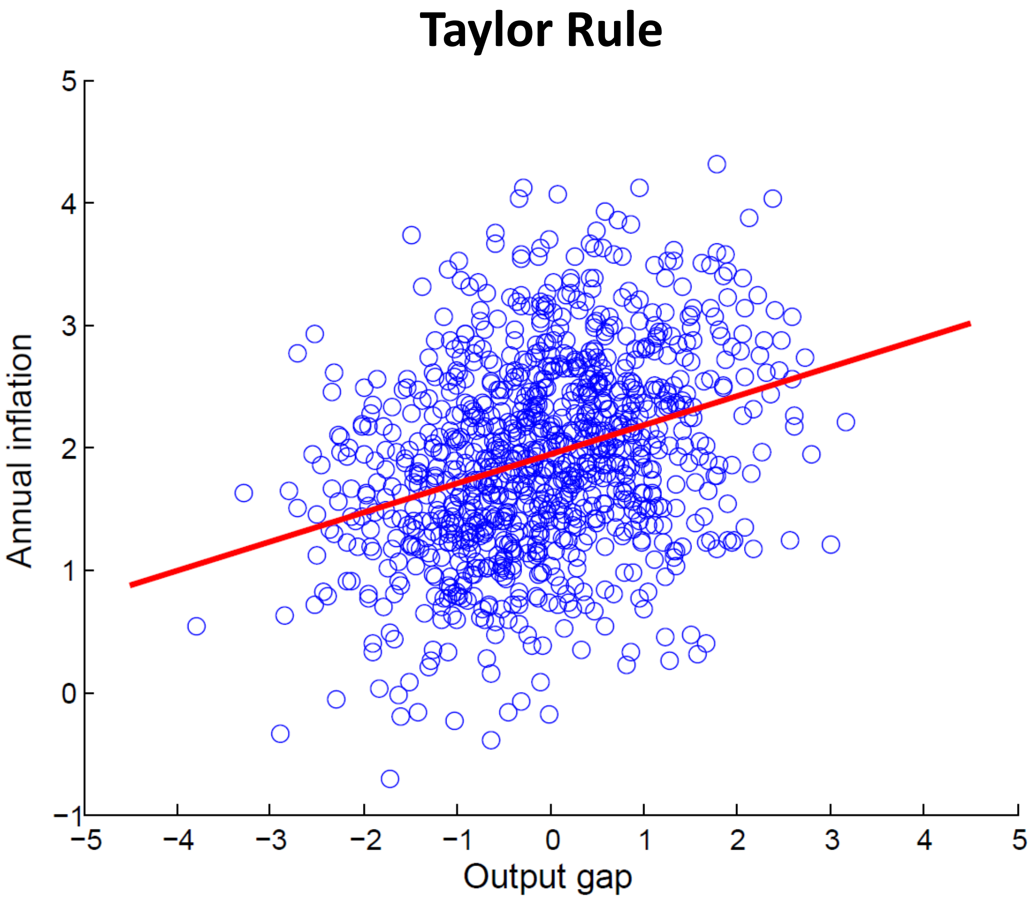


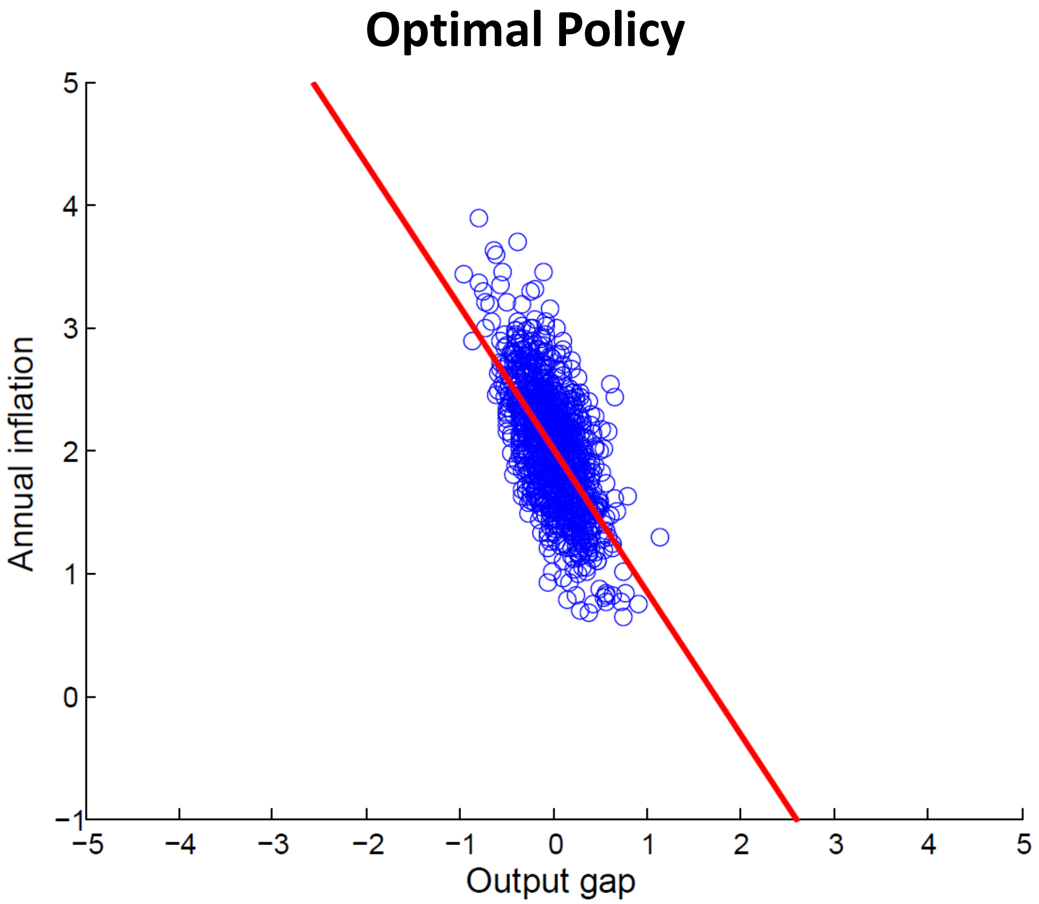
Identification in a big NK Model (COMPASS)

- **Big NK model at the BoE**
- There is no single structural PC relation between inflation and slack. Multiple PC.
  - ✓ Still helpful for a policy maker to think about an average PC relation following demand shocks.
  - ✓ There is an underlying structural aggregate supply relation in the larger model.
  - ✓ The average PC gets closer to the underlying structural supply relation in a way that is more robust to model specification.
- Within COMPASS, run a stochastic simulation using all (18) shocks in the model.
- Exercise: Naïve estimation of the Phillips curve
- Two possibilities: i) (estimated) Taylor rule

  ii) discretionary optimal monetary policy (minimises loss function)

Naïve Phillips Curve in a big NK Model (COMPASS)



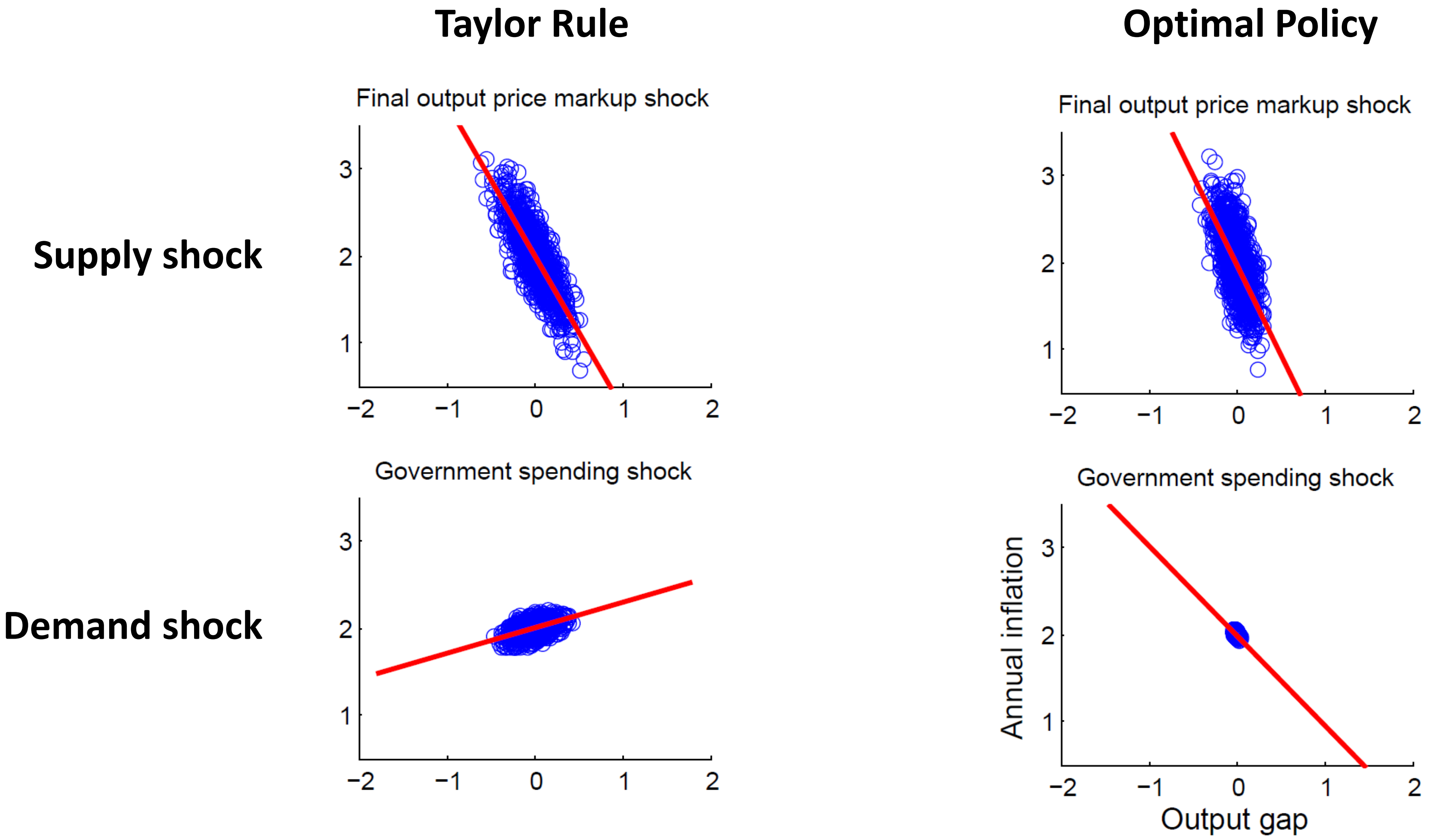


Phillips Curve in a big NK Model (COMPASS)

- Big NK model economy.
- Two assumptions on monetary policy
- **Separately conditioning on demand or supply shock**

	Taylor Rule	Optimal Monetary Policy
Supply Shock		
Demand Shock		

Naïve Phillips Curve in a big NK Model (COMPASS)



2. How can we tell? (or: how can we identify the slop of the PC in the data?)

- The Macro approach
- The Micro-Macro approach

Macro Approach: Identification strategies

❑ Control for supply shocks (Gordon, 1982)

✓ Neither simple nor sufficient

❑ Instrumental variables

✓ Lagged variables as instruments

✓ Monetary policy shocks (Christiano, Eichenbaum and Evans, 1999; Romer and Romer, 2004)

- Structural PC correlation can be recovered (Barnichon and Mesters, 2019)
- MP shocks ideal IV: move output gap; not fully undone by MP. But some limitations (Boivin and Giannoni 2006, Ramey 2016).

❑ Regional data (Fitzgerald and Nicolini, 2014; Kiley, 2015; Babb and Detmeister, 2017)

✓ MP does not offset regional demand shocks, so each region finds itself in a different segment of the PC.

✓ Time-FE can absorb aggregate demand and supply shocks (e.g., oil shocks) and area-FE, regional diffs.

From model to data

Note: unemployment gap instead of output gap.

PC in U_t is negatively sloped $U_t - U_t^* = - \theta x_t$

From model to data

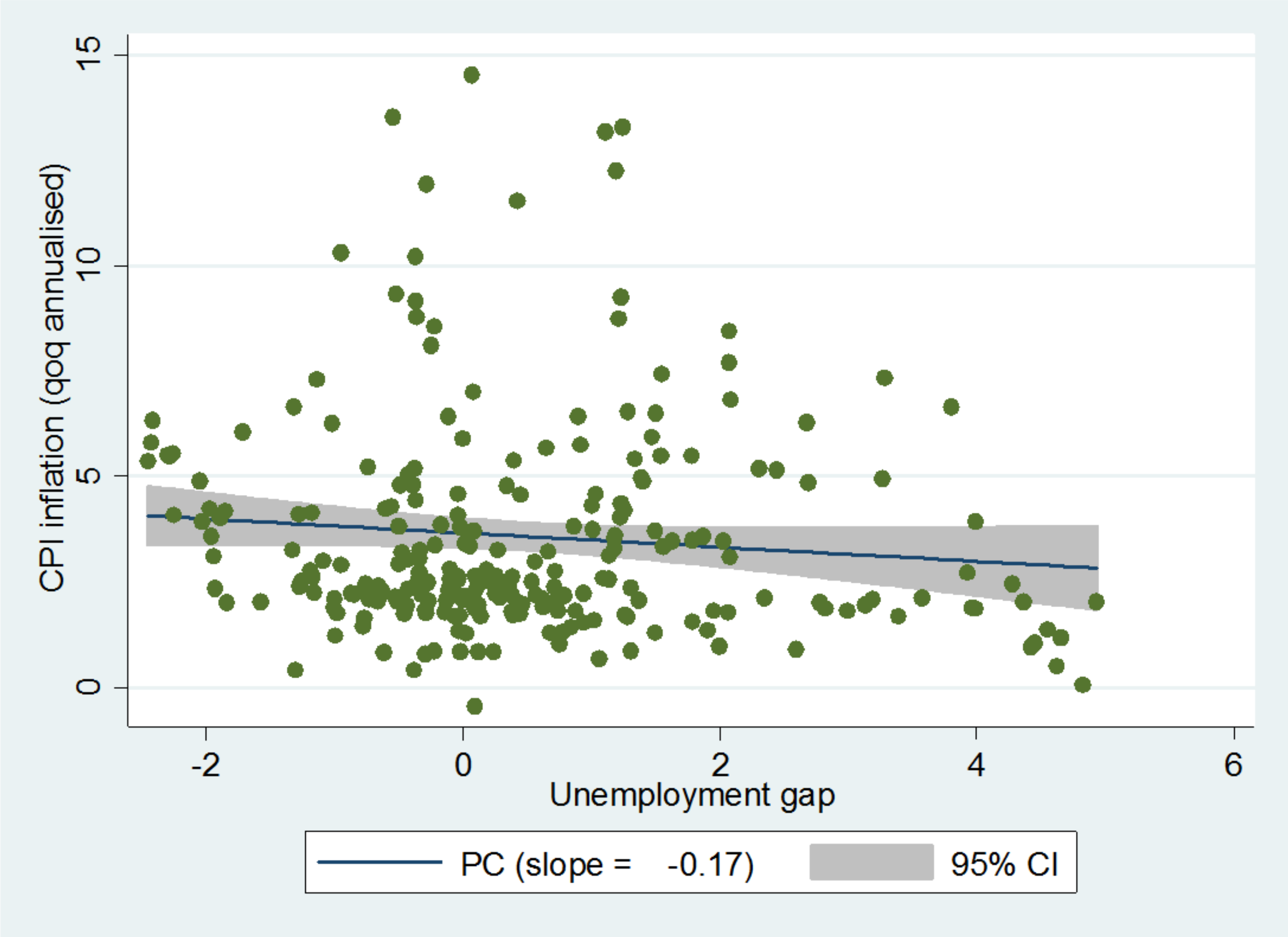
Note: unemployment gap instead of output gap.

PC in U_t is negatively sloped $U_t - U_t^* = -\theta x_t$

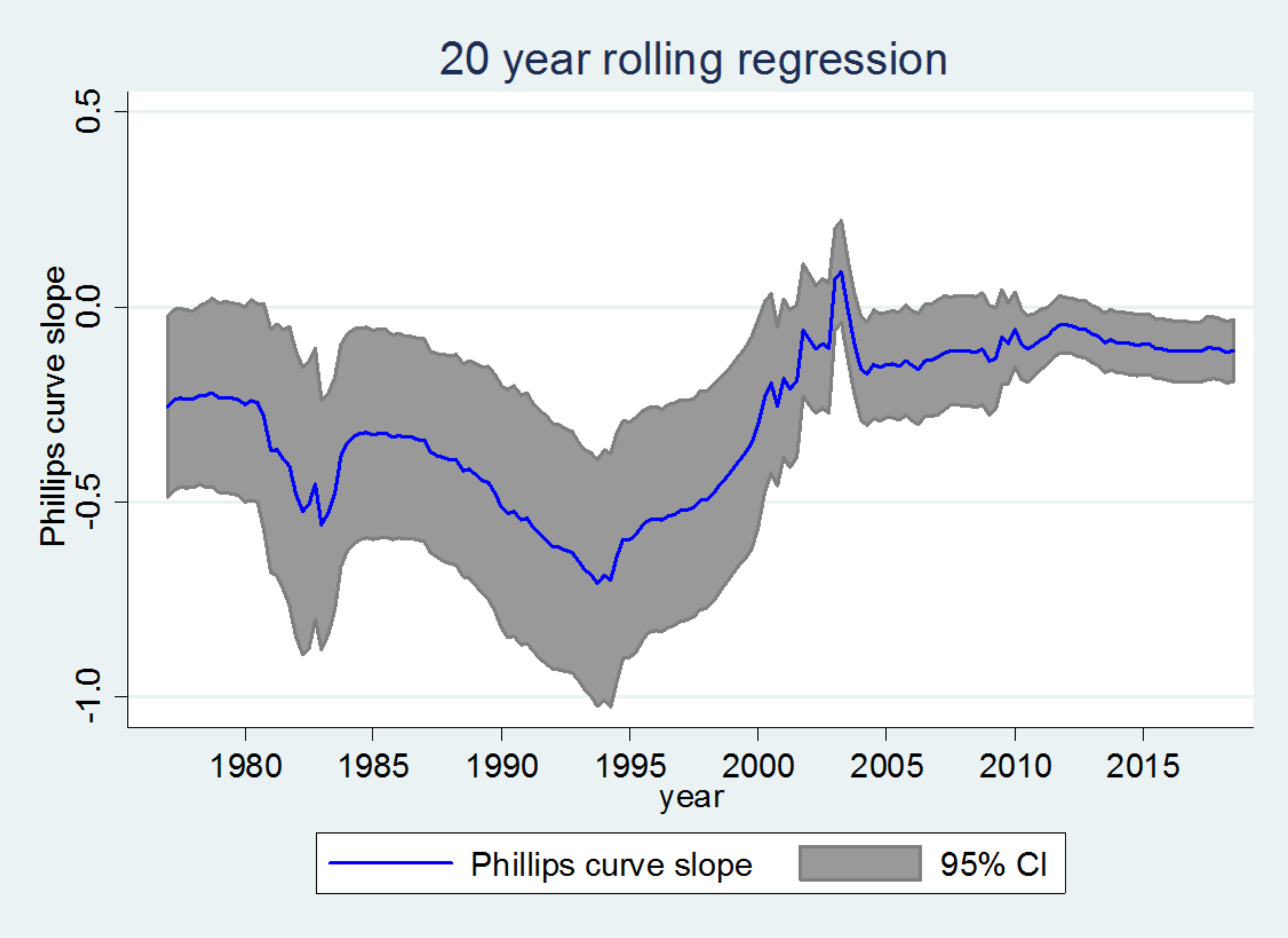
US DATA

For Europe, see Lane (2019) and Ball (2019)

The PC: Aggregate US Data (1957-2018)



The PC: Standard OLS estimates suggest flattening



OLS equation: $\pi_t = \alpha + \boldsymbol{\beta}(U_t - U_t^*) + \sum_{i=1}^{3} \gamma_i \pi_{t-i} + \xi_t$

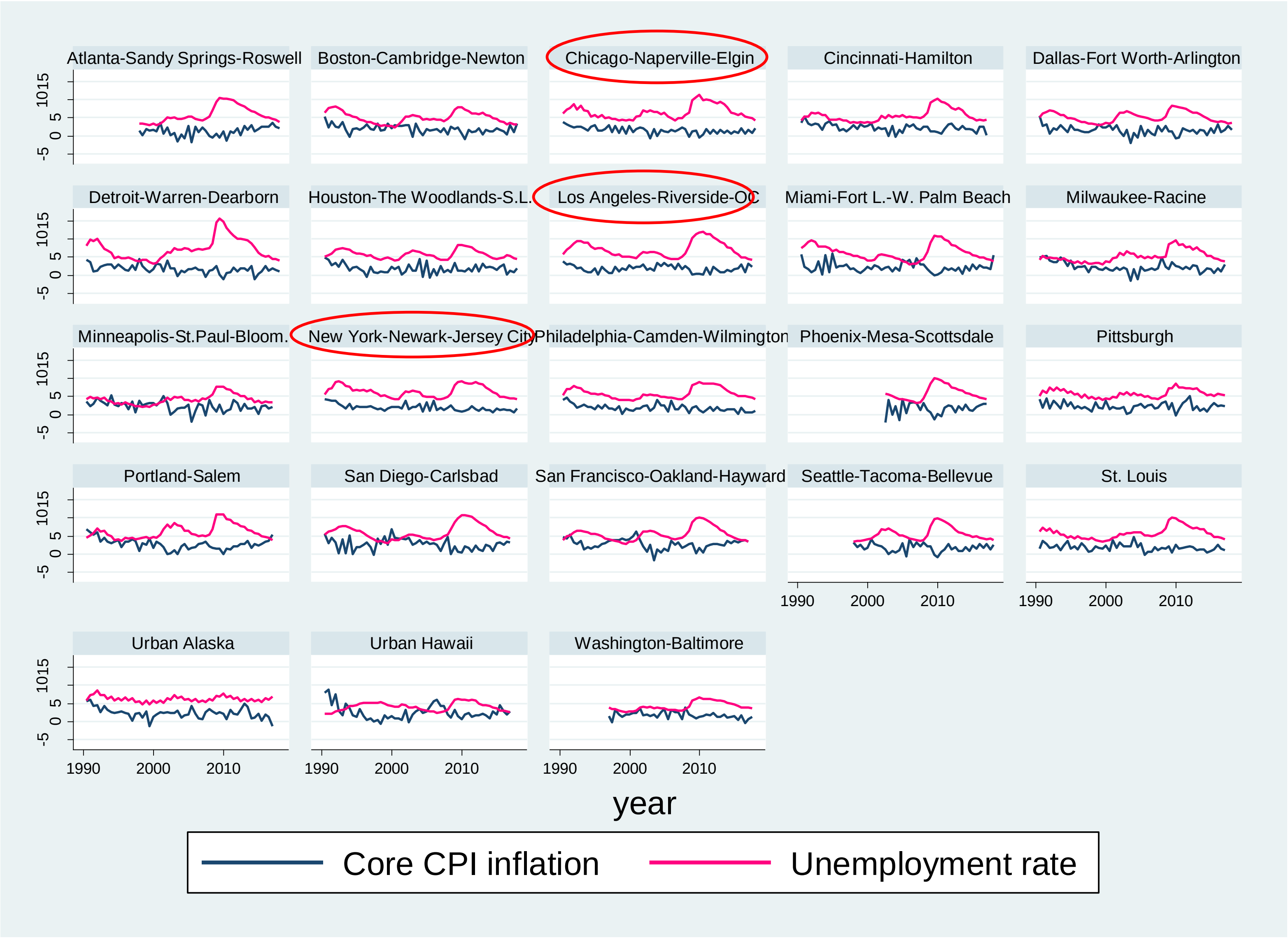
Regional panel data

- Use data on US cities: 23 metro areas; see also Kiley (2013); Babb and Detmeister (2017).
- Semi-annual data from 1990 H1 to 2018 H1 for most metro areas.

Data series	Description (and source)	Comments
Core inflation	Log change in CPI less food and energy (BLS via FRED).	NSA. Monthly data averaged over each half a year.
Unemployment rate	Unemployed as percentage of civilian labour force (BLS).	NSA. Monthly data averaged over each period. Some discrepancies in metro area definitions with CPI data.
Inflation expectations	12-month ahead price inflation expectations (Michigan Consumer Survey)	Geographical split into only 4 regions (North-Central, Northeast, South and West). Cities' expectations assumed to be equal to the region average.

Data I – inflation and unemployment

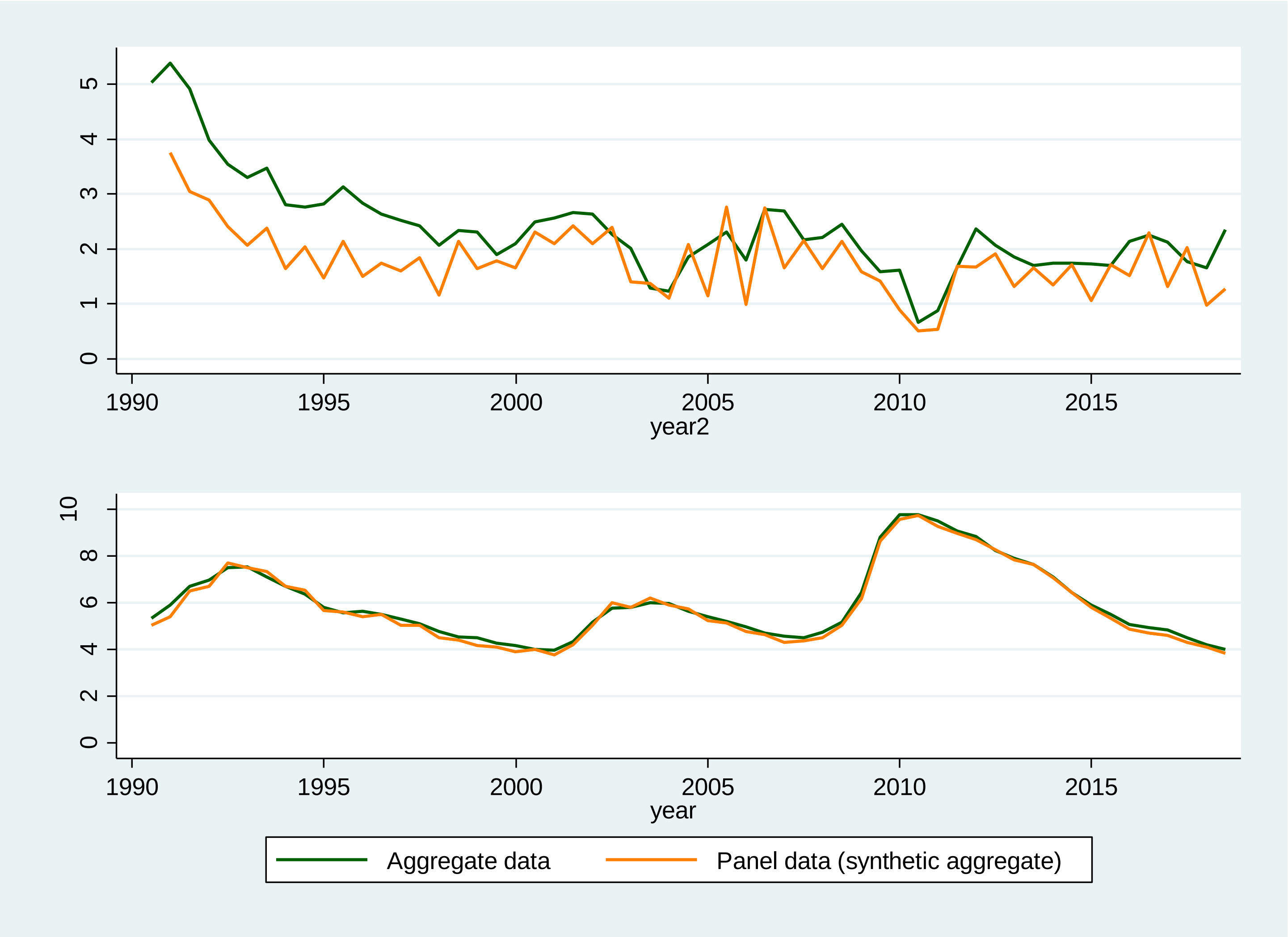
- Largest three metro areas make up 35% of the labour-force in the sample:
  - New York - 16%
  - Los Angeles - 11%
  - Chicago - 8%



Data II – panel versus aggregate

- Sample of cities covers around **one-third** of the US population (Babb and Detmeister, 2017).

- Weighted by labour force, the aggregated panel data broadly match up to the true aggregate.



Regional

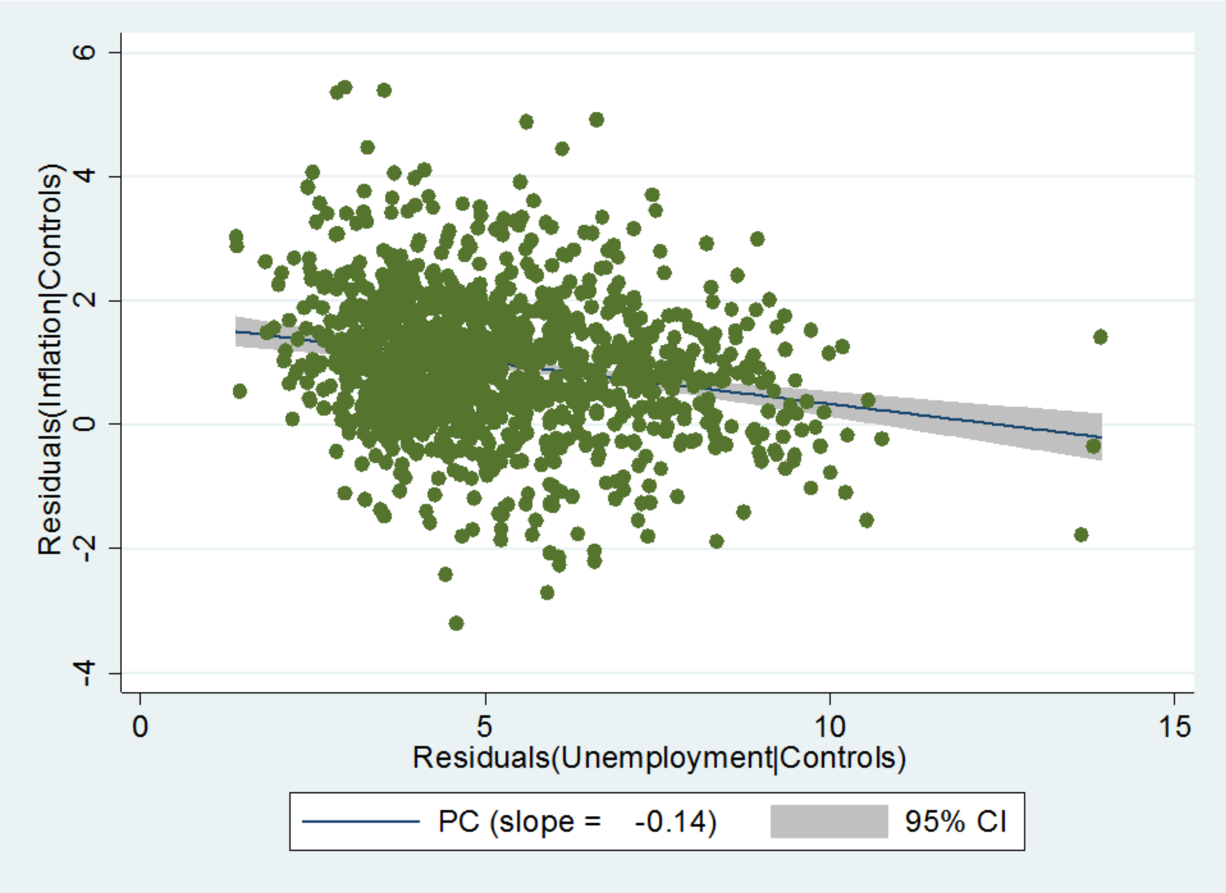
Table 3: *US Metro area Phillips curve: 1990-2018*

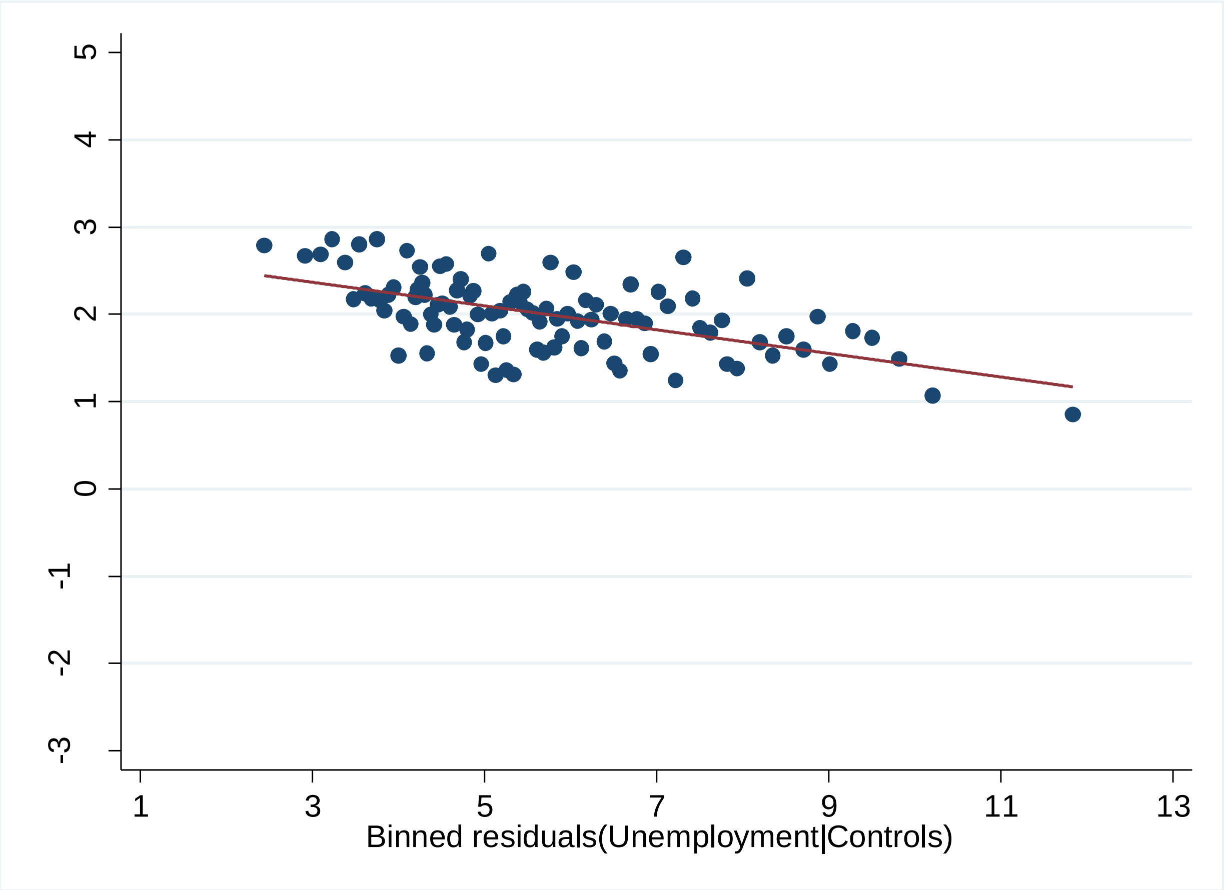
Regression	(1) Pooled OLS	(2) Metro area FE only	(3) Year FE only	(4) Year and Metro area FE
Unemployment rate	-0.136***	-0.148***	-0.271***	-0.367***
	[0.022]	[0.025]	[0.043]	[0.066]
Constant	1.708***	1.911***	5.435***	6.655***
	[0.277]	[0.296]	[0.606]	[0.776]
Inflation expectations	0.278***	0.273***	-0.027	-0.067
	[0.064]	[0.065]	[0.155]	[0.145]
Core CPI inflation				
First lag	0.280***	0.270***	0.110**	0.073
	[0.048]	[0.051]	[0.049]	[0.050]
Observations	1,174	1,174	1,174	1,174
R-squared	0.260	0.298	0.359	0.410
Metro area FE	No	Yes	No	Yes
Year FE	No	No	Yes	Yes
Seasonal dummies	Yes	Yes	Yes	Yes

Robust standard errors (clustered by metro area) in brackets
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

- Pooled OLS suggests flat Phillips curve.

Pooled data





- Pooled OLS gives more precision than aggregate data (Kiley, 2013), but slope still flat.

Regional

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- Metro area FE (different U* across regions).

Regional

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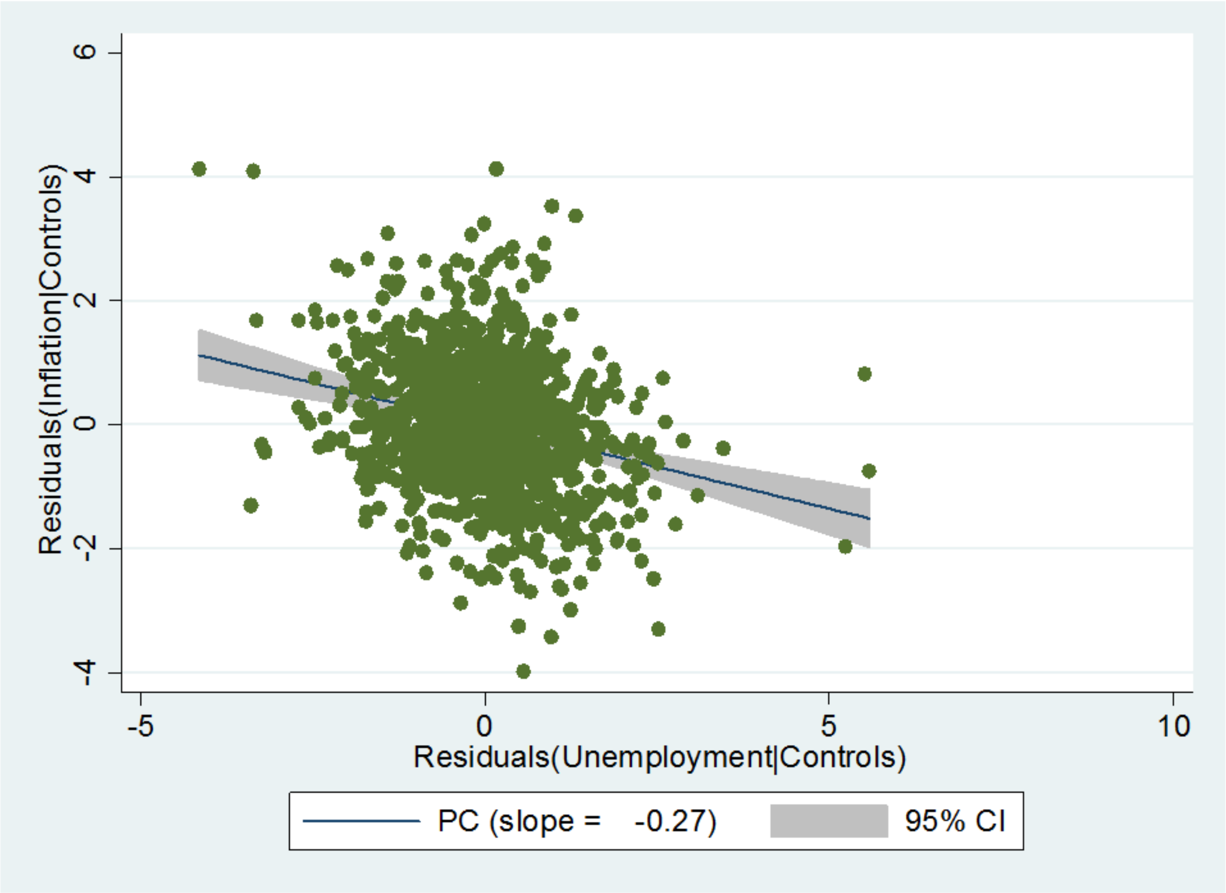
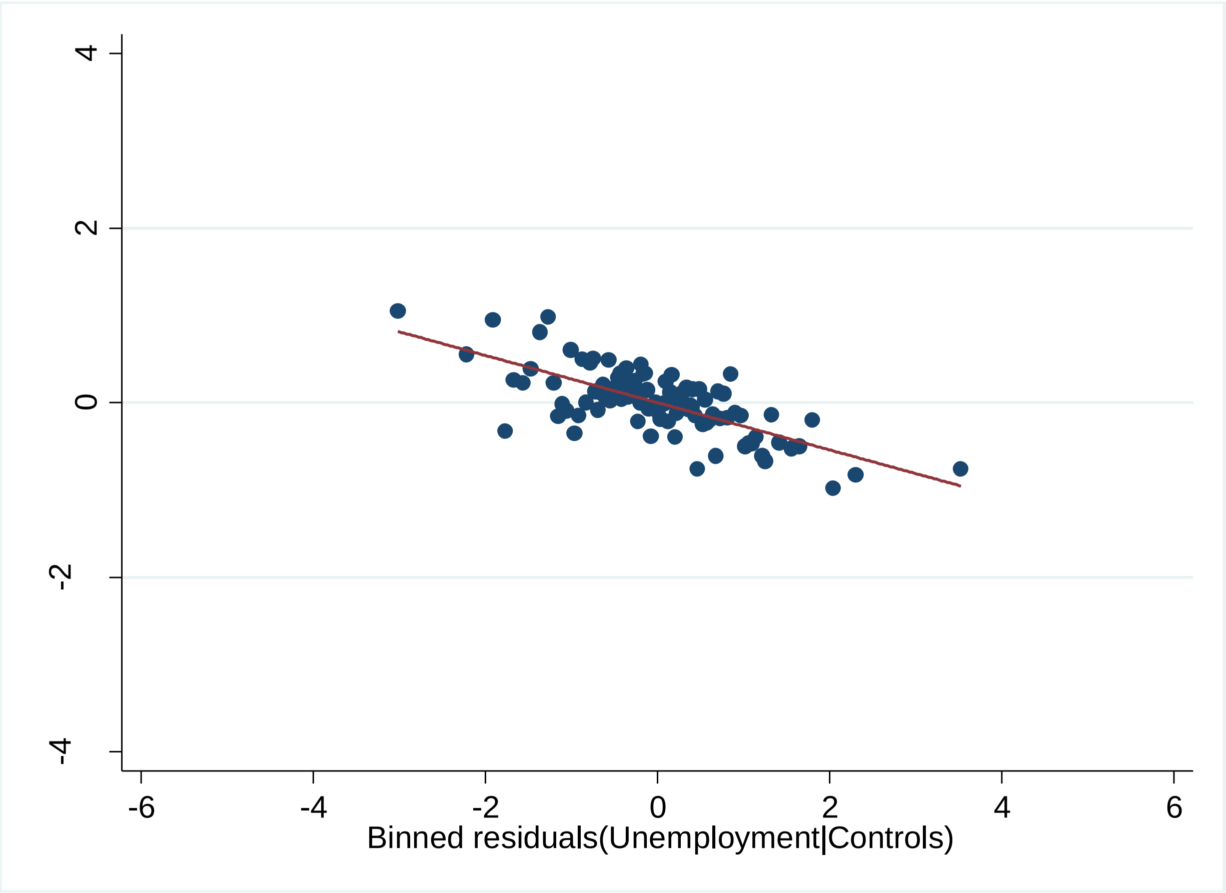
- Year FE: aggregate shocks.

Pooled with Time FE





- Steeper slope with year FE: controlling for aggregate monetary policy and supply shocks.

Regional

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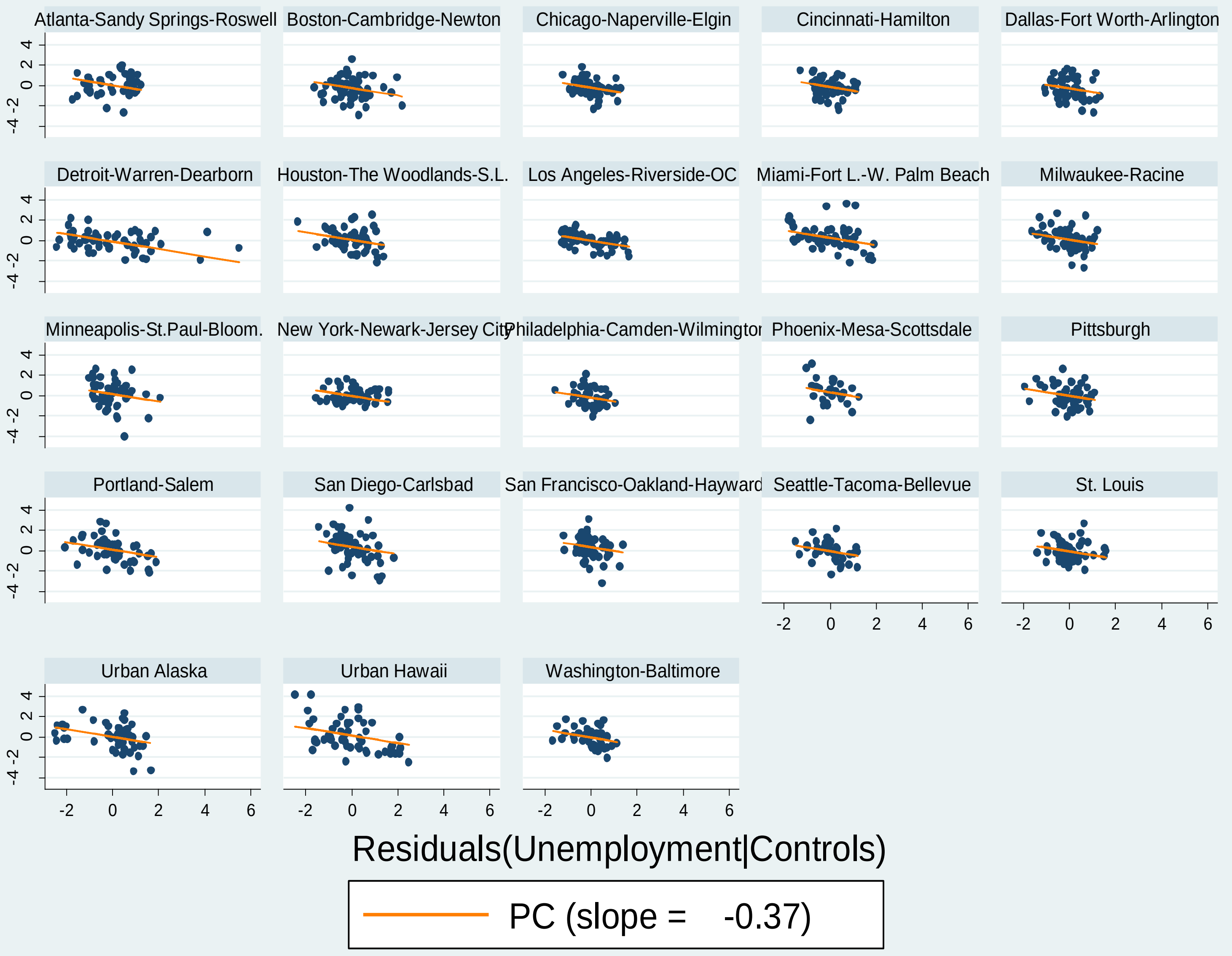
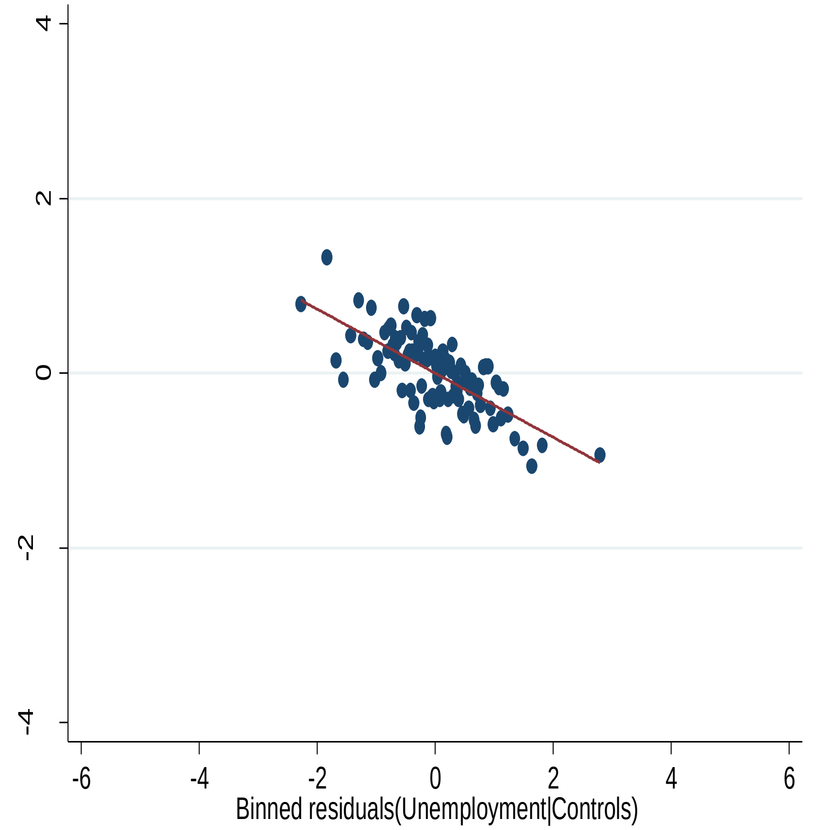
- Nearly **3 times** the naïve slope once area and time FE are included.

Time and metro-area FE



- Slope higher still with metro area fixed effects.
- Need both sets to also control for cross-sectional variation in U*.



Remarks II

- Of course everyone knows that the reduced-form PC depends on the mix of supply and demand shocks, and that monetary policy is one key factor that affects that mix.

- But much of the policy and academic discussion in recent years has ignored that, and estimated the PC by OLS. This led to unwarranted criticisms of the existing framework.

- Our paper is a call for a more careful identification that takes into account the endogenous monetary policy response.

- Encouragingly, new work doing so, e.g., Barnichon and Mesters; Galí and Gambetti; Jordà and Nechio.

✓Micro Approach

Key idea in monetary policy framework

- Short term nominal friction.
  - ✓ In the short term prices and wages do not <u>fully</u> adjust in response to a monetary policy intervention; hence quantities (e.g., output and employment) adjust to restore equilibrium in the economy.

- Phillips curve has a finite slope: it's not vertical; and it's not zero either.

3. Micro-approach: testing the NK mechanism

- Key friction to break monetary neutrality: nominal rigidity.
- Most micro-empirical analyses focused on price rigidity.
  - ✓ Yet DSGE models like Christiano Eichenbaum and Evans (CEE 2005) rely crucially on <u>wage rigidity</u>.
  - ✓ Price rigidity plays virtually no role in CEE (2005).
  - ✓ The crucial friction to generate quantitatively large effects from monetary policy on activity is <u>wage rigidity.</u>

Wage rigidity Olivei-Tenreyro (AER 2007)

- "Beige Book" survey of firms in New England:

i) How often do you change employees' compensation (base pay/health insurance)?; ii) Typically, in which month of the year is the decision to change compensation taken and iii) when does the change become effective?

- ✓90% of the firms made changes to compensation <u>once a year</u>
- ✓>50 % took decisions in the <u>fourth quarter</u>
- ✓Change effective in first quarter

- Radford Survey of IT companies:

- ✓90% of firms decide pay changes <u>once a year</u> at the <u>end of their fiscal year</u> (focal pay administration w/ annual reviews)
- ✓60% ends fiscal year in December

- 80% of the firms in Russell 3000: fiscal year ends in December (Audit Analytics, 2017)

Wage rigidity: Does it matter?

- Concentration of wage-setting decisions in the fourth quarter of the calendar year implies a differential degree of wage rigidity within the calendar year

  - High wage rigidity early in the year ➡ Monetary policy shocks should have large output effects
  - Low wage rigidity late in the year ➡ Monetary policy shocks should have small output effects

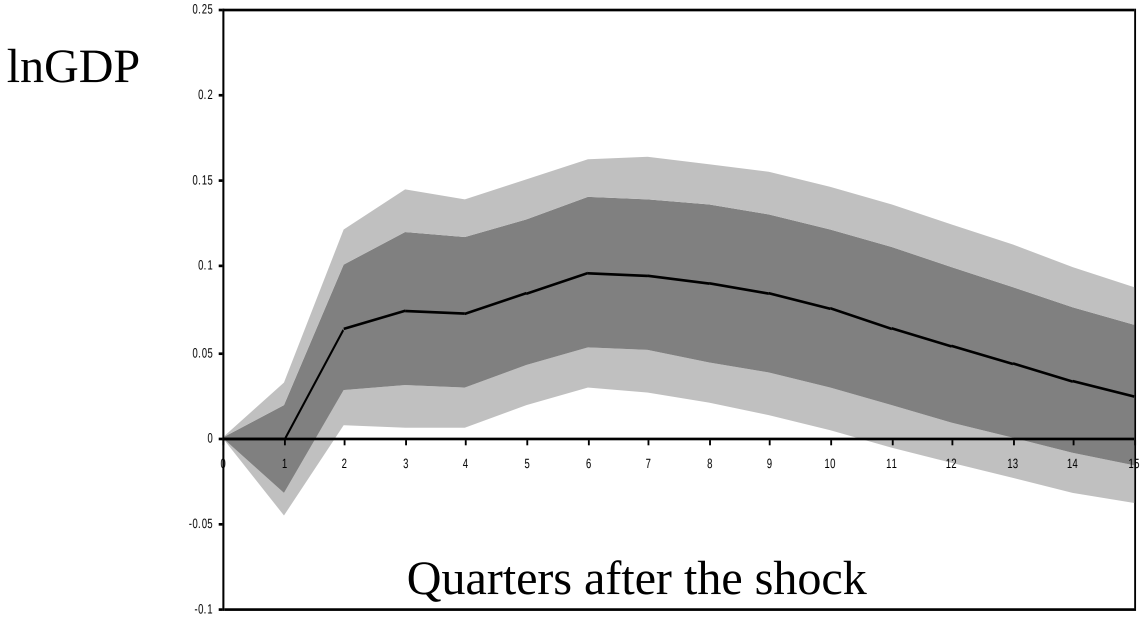
- In Olivei and Tenreyro (2007), we test this hypothesis and find it to be borne out by the data. Almost all of the empirical relation between monetary policy innovations and output is driven by the response to monetary interventions taking place in Q1 or Q2.

Empirical strategy.

Introduce “quarterly dependence” in an otherwise standard VAR (Recursive ID).

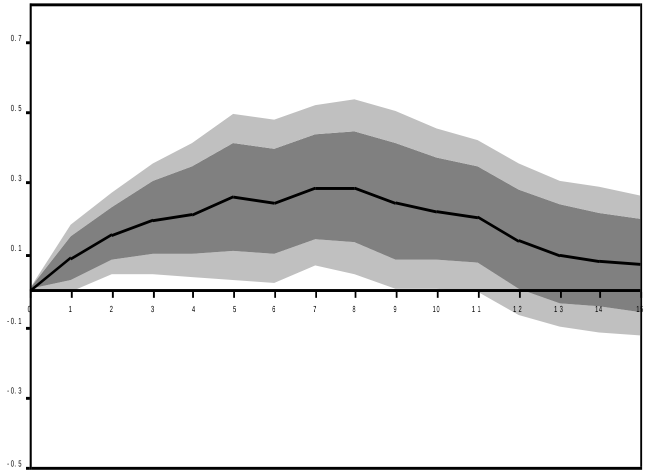
Response of GDP to 25bp fall in FFR

No quarterly dependence. Quarterly data. Standard model 1966 Q1-2002 Q4.

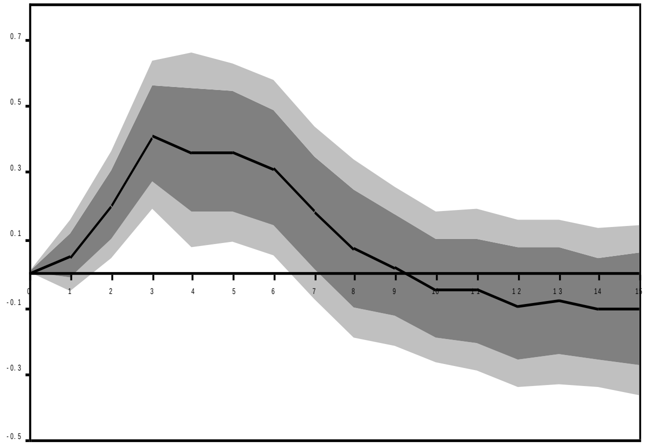


Response of GDP to 25bp fall in FFR Quarterly dependence.

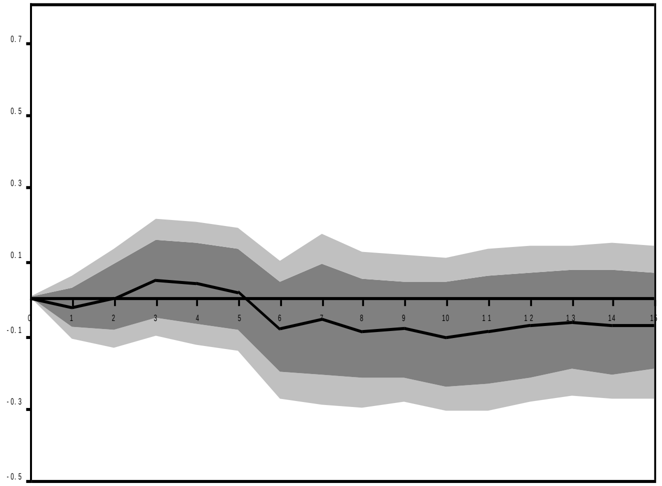
First-quarter shock



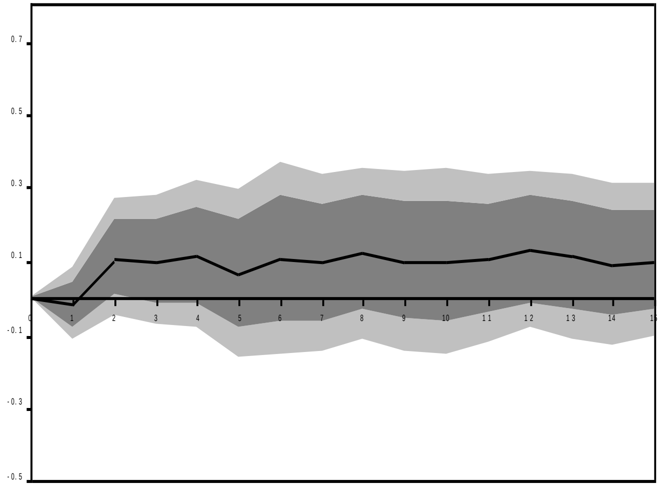
Second-quarter shock



Third-quarter shock

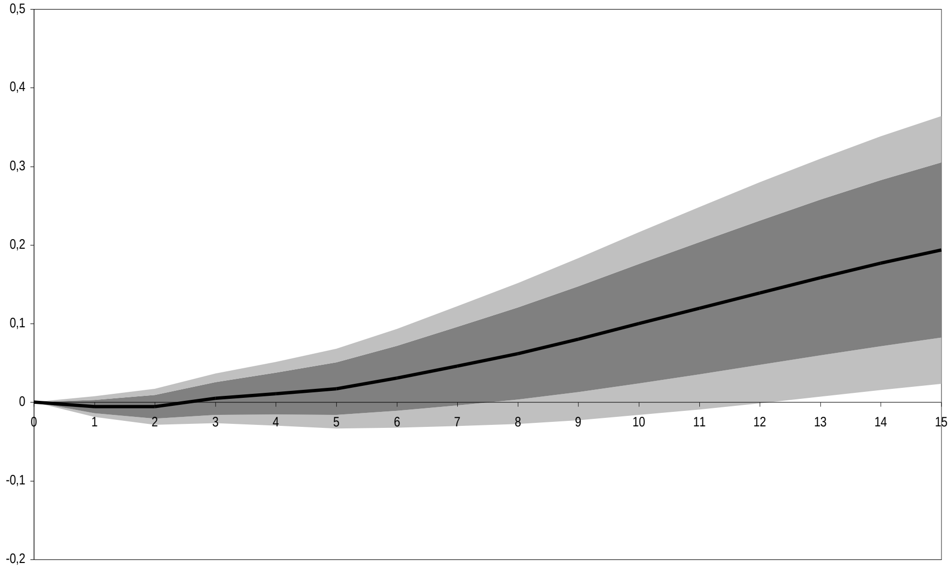


Fourth-quarter shock



Response of GDP Deflator to 25bp fall in FFR

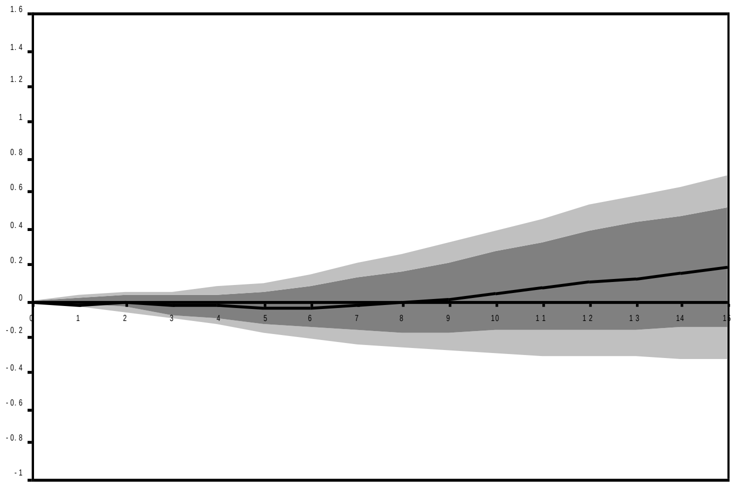
No quarterly dependence. Quarterly data. Standard model.



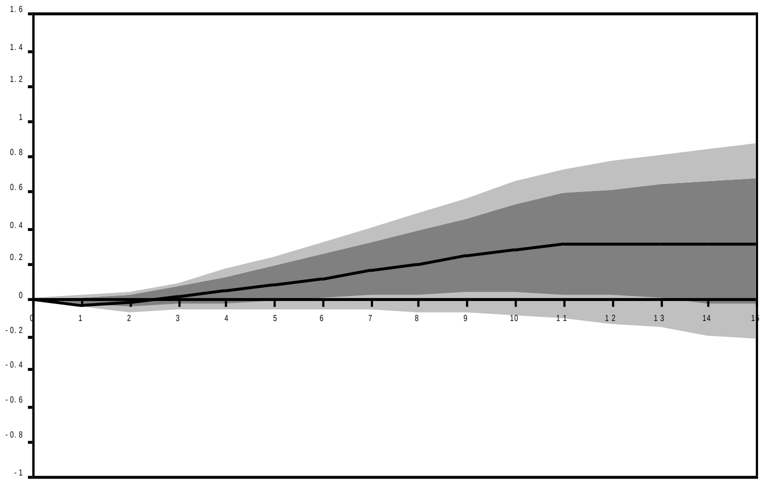
Quarters after the shock

Response of GDP Deflator to 25bp fall in FFR Quarterly dependence.

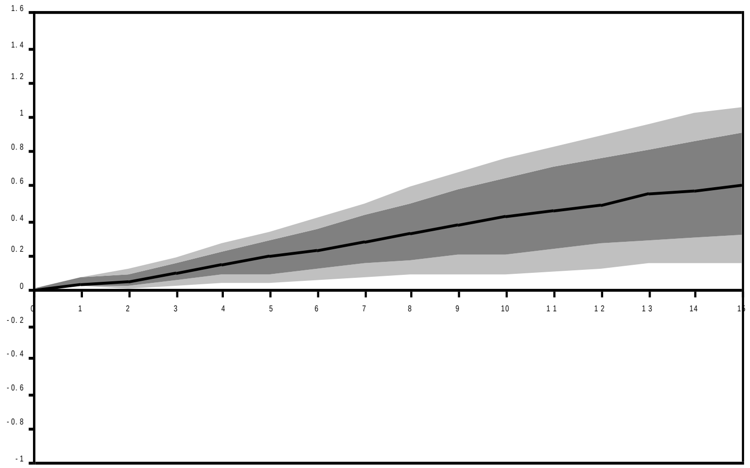
First-quarter shock



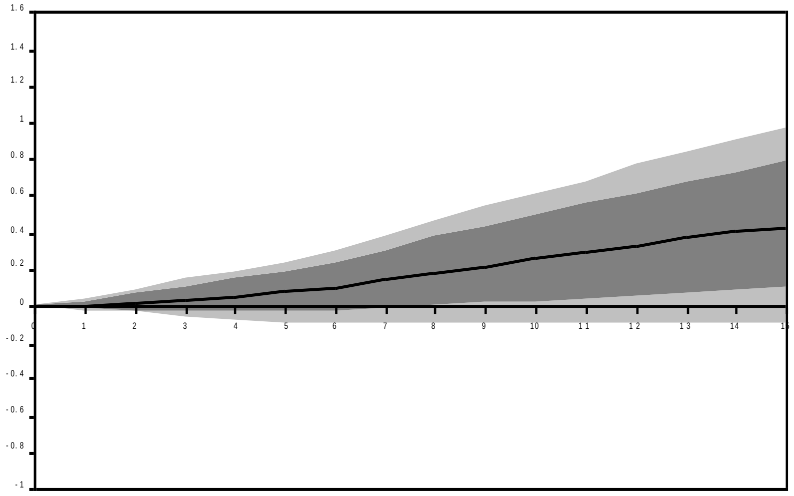
Second-quarter shock



Third-quarter shock



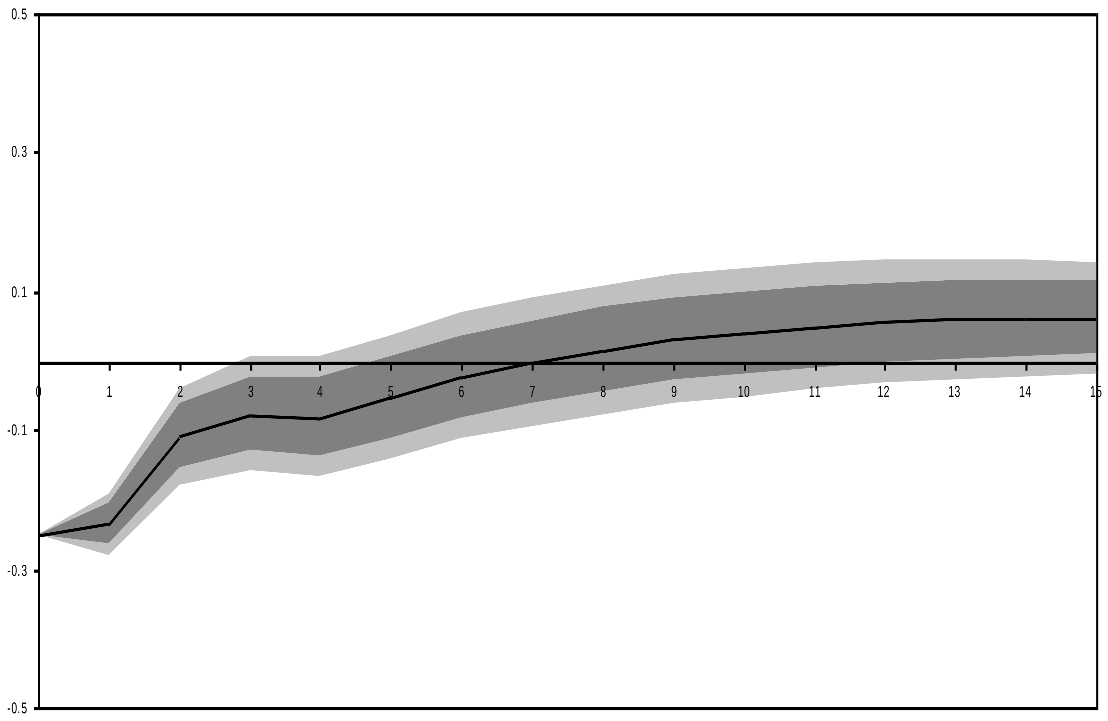
Fourth-quarter shock



Response of FFR to 25bp fall in FFR

No quarterly dependence. Quarterly data. Standard model.

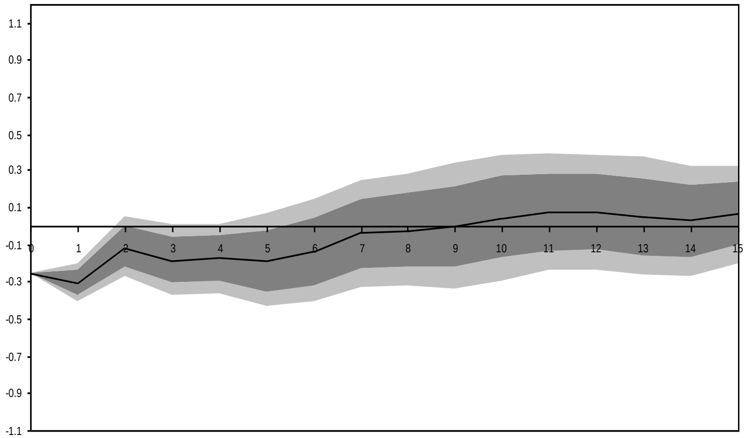
FFR



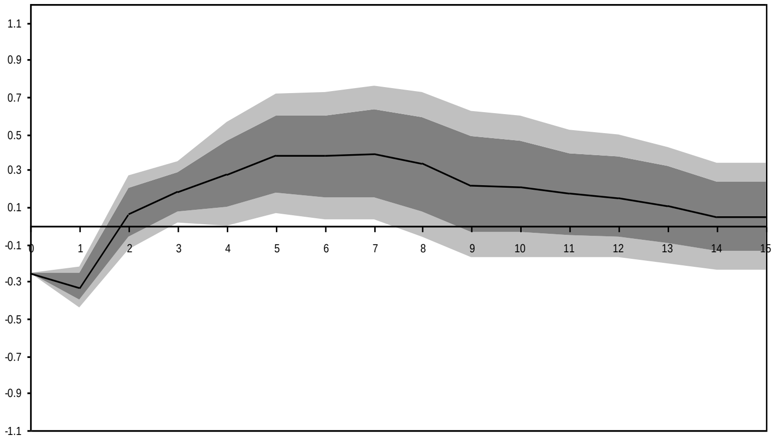
Quarters after the shock

Response of FFR to 25bp fall in FFR Quarterly dependence.

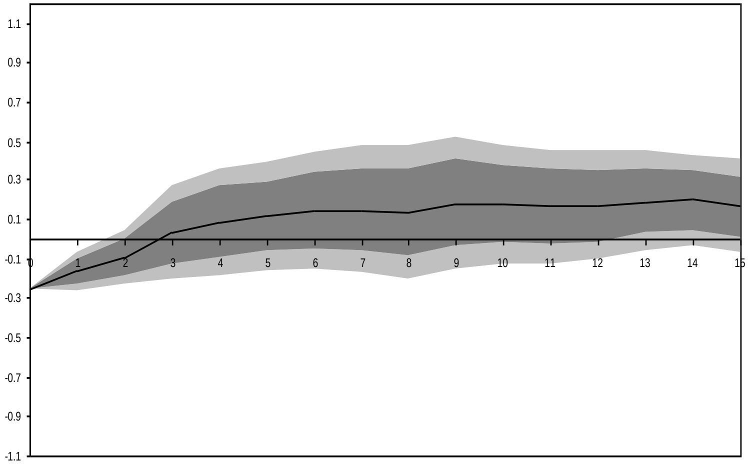
First-quarter shock



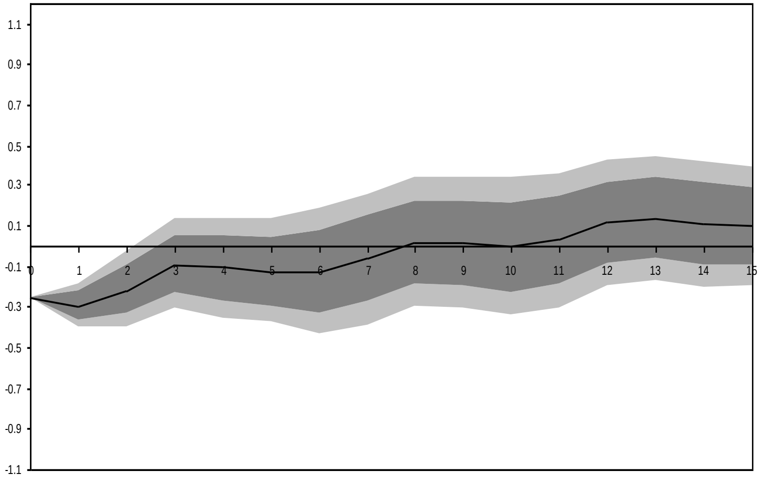
Second-quarter shock



Third-quarter shock



Fourth-quarter shock



DISTRIBUTION OF SHOCKS OVER QUARTERS

- Are monetary policy shocks different across quarters?
  - NO

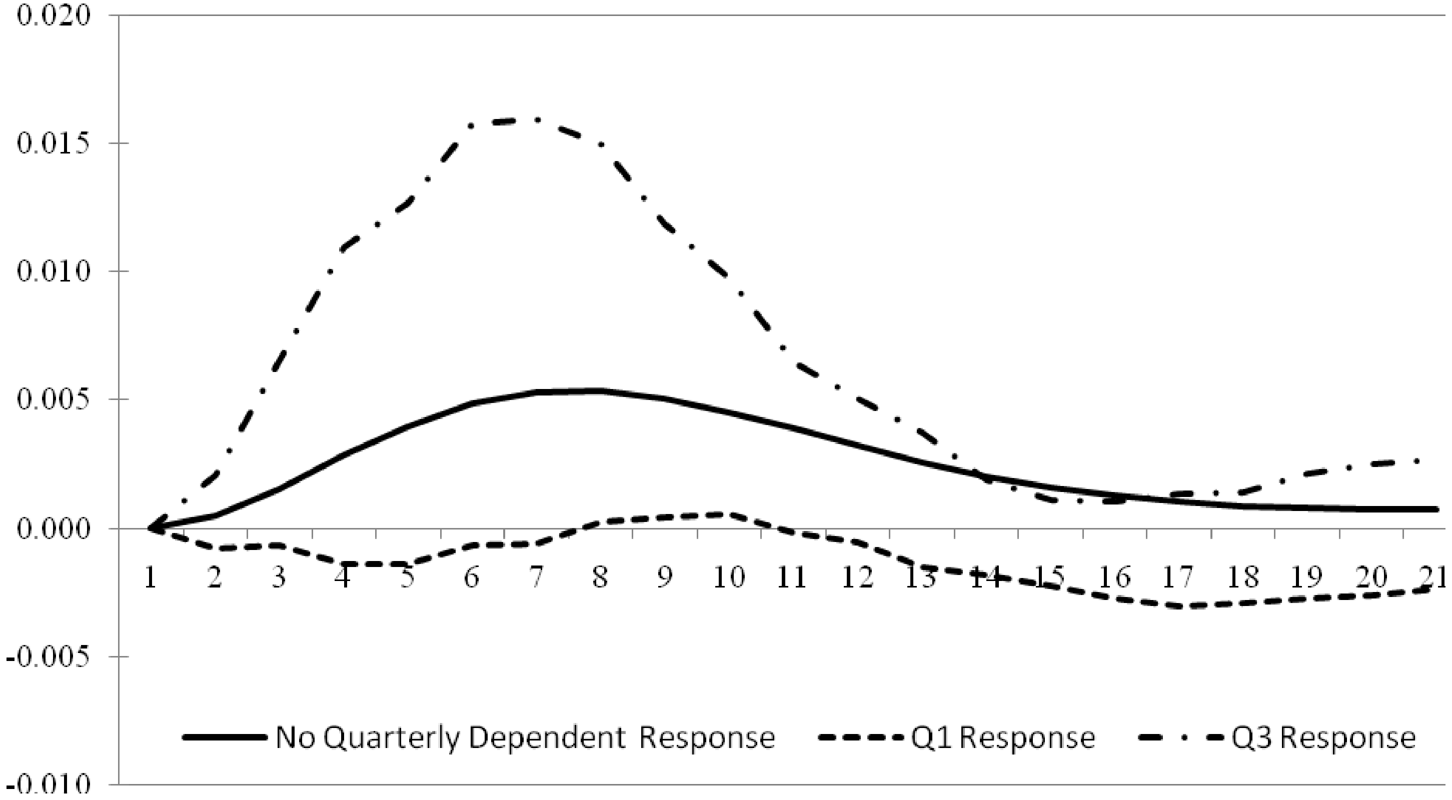
The null that the distribution of monetary policy shocks is the same across any two quarters cannot be rejected (Kolmogorov Smirnov test).

EVIDENCE FROM OTHER COUNTRIES (Olivei Tenreyro 2010)

- Japan: "Shunto" or spring offensive; wages at most <u>large</u> firms are set in the spring

Japan
25-Basis-Point Decline in Call Rate. 1963:Q1 to 1995:Q2

a. Response of Industrial Production

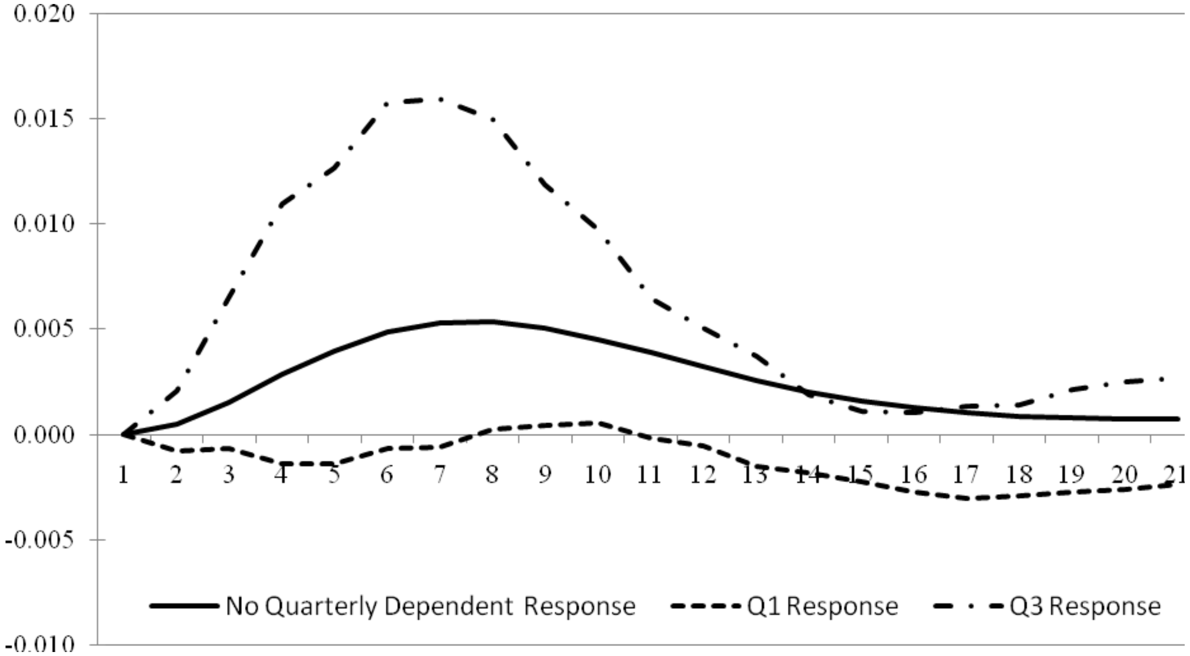


EVIDENCE FROM OTHER COUNTRIES (Olivei Tenreyro 2010)

- ❑ Japan: "Shunto" or spring offensive; wages at most large firms are set in the spring; smaller firms follow.

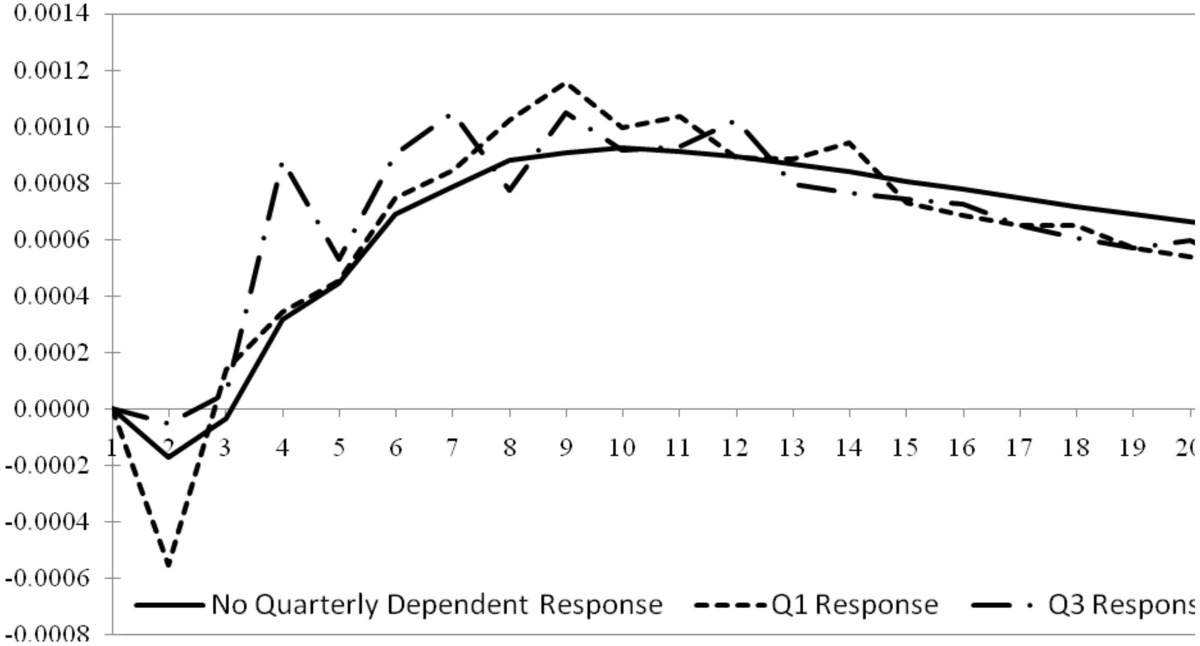
Japan
25-Basis-Point Decline in Call Rate. 1963:Q1 to 1995:Q2

a. Response of Industrial Production



France
25-Basis-Point Decline in Call Rate. 1963:Q1 to 1998:Q4

a. Response of GDP



- ❑ Europe (Germany, UK and France): more staggering on wage setting decisions; big lags between decision and implementation dates; higher prevalence of multi-year contracts (Germany).

Summary

- Monetary policy innovations have differential effects across and within countries, depending on the timing of the intervention.
- US:
  - ✓ GDP responds strongly to a monetary shock in Q1 or Q2 and little when the shock occurs in Q3 or Q4.
  - ✓ The response of nominal prices (and wages) is stronger when the shock occurs in Q3 or Q4; less precision.
- Japan:
  - ✓ GDP responds strongly when the shock takes place after the Shunto (Q3), and little before the Shunto (Q1), when wages are being set.
  - ✓ The response of nominal prices (and wages) is less precisely estimated, more positive response in Q1 and Q2.
- Germany, UK, France:
  - ✓ No significant differences across quarters within the year.
- Response of activity is consistent with a wage-rigidity explanation, the key assumption underlying the Phillips curve.

Taking stock

Is the Phillips Curve Dead?

Definitely not!

-Logical argument

-Macro and micro data