The Effect of Recessions on Potential Output Estimates: Size, Timing, and Determinants

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Motivation

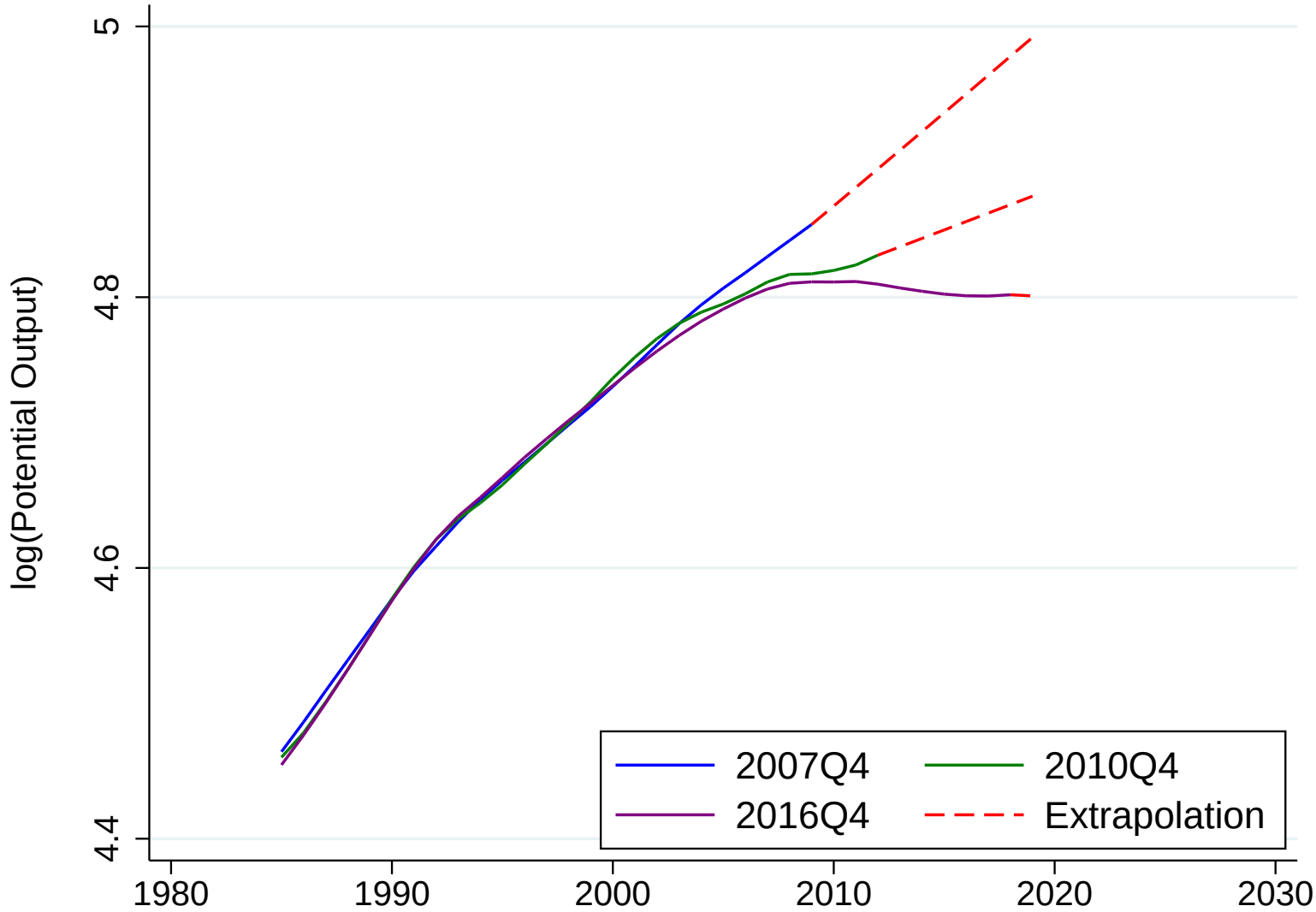
- Slow recovery from Great Recession:
  - Estimates of potential output have been revised downwards
  - New interest in reliability of PO estimates
  - New interest in issues of hysteresis

- Re-assessment of PO/growth outlook has major implications for fiscal policy (e.g., cyclically adjusted budget balances) and monetary policy (influence of output gap estimates)

- Unreliability of PO estimates known for a long time:
  - We want to focus explicitly on the effects of recessions
  - Learn more about factors behind revisions

Motivation

Relevance of Potential Output (PO) Revisions for Italy



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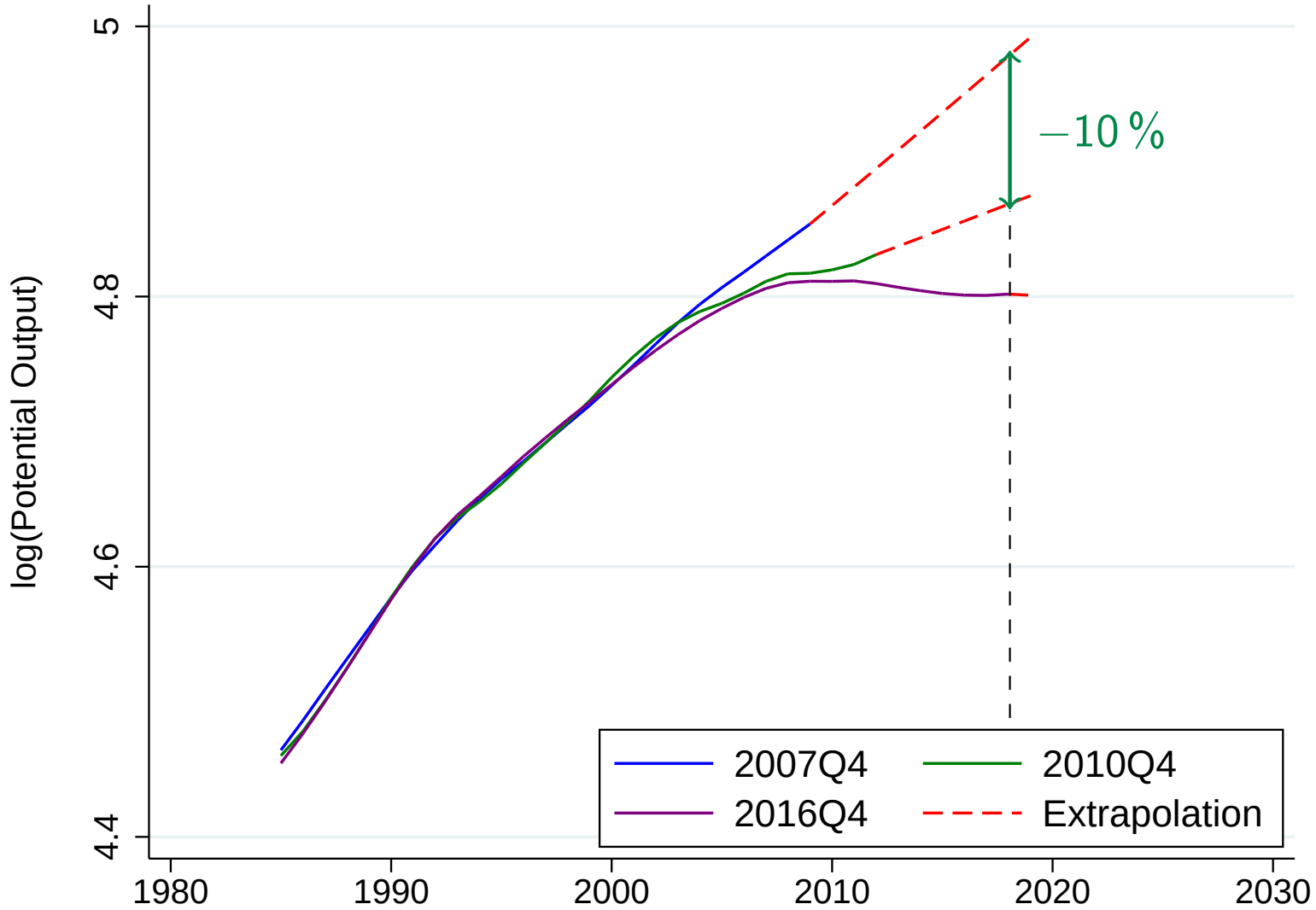

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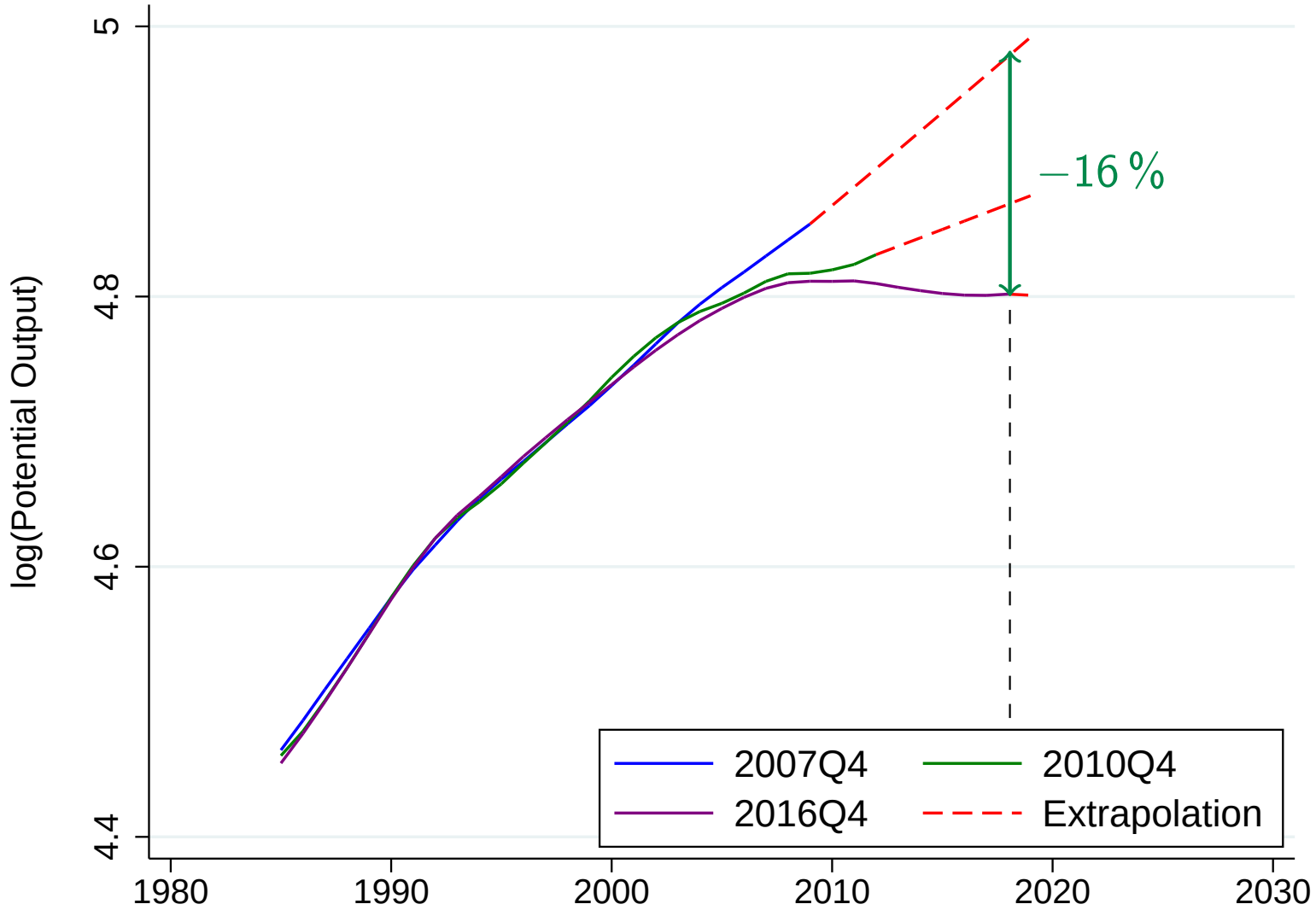


Research Questions

- Main research questions:
  - Do recessions have a long-lasting impact on the level of potential output estimates?
  - When are revisions made?
  - Can we identify evidence about why estimates are revised?

- Our contributions:
  - Study effects of recession on *level* of potential output estimates based on real-time data
  - Large sample (vintage data covering 27 countries and 38 years)
  - Connecting potential output revisions to a broader set of macroeconomic factors
  - Separating supply- and demand-driven recessions

Agenda

1. Literature
2. Theoretical Background
3. Data
4. Empirical Analysis
5. Conclusion

Literature

- Reliability of PO/OG estimates
  - Orphanides and van Norden (2002), Borio et al. (2017)
- Effect of financial crises on *output growth*
  - Cerra and Saxena (2008), Reinhart and Rogoff (2009), Fatás and Summers (2016)
- Impact on *potential output growth* by ...
  - ... *recessions*: Haltmaier (2012)
  - ... *financial crises*: Furceri and Mourougane (2012)
- Literature on *hysteresis* effects
  - Blanchard and Summers (1986, 1987), Lindbeck and Snower (1986), Stadler (1990)

Possible Reasons for Link

What can explain downward revisions of PO estimates after recessions?

- Option 1: Recession is caused by **permanent shocks** (e.g., technology shocks) as, e.g., in the "RBC world"
- Option 2: Temporary shocks (e.g., monetary policy shocks) induce **hysteresis effects**
- Option 3: PO has been **overestimated before the recession** (for instance, because financial developments were not taken into account)
- Option 4: **Reverse causality** that makes shocks to expected trend growth triggering recessions (Blanchard et al., 2015)

Data

Vintages from the OECD Economic Outlook

- OECD Economic Outlook:
  - Semi-annual publication (Q2/Q4)
  - 56 data vintages from 1989 to 2016
  - Data for 27 advanced economies
  - Historical data + OECD forecasts for two years
  - We add (linear) extrapolation for PO for another 10 years
- OECD follows the "production function approach" (assuming a Cobb-Douglas function) to construct PO estimates
- We use Harding and Pagan (2002) adaption of the Bry-Boschan procedure to identify recessions:
  - Based on last vintage of MEI
  - 95 recessions are identified

Data

Notation

- Each recession has ...
  - ... a first-recession year denoted as 1
  - ... a first-recession vintage denoted as v_0
- Example – the Great Recession in the US:
  - Recession starts in 2008 Q1 (NBER: Dec 2007)
  - First recession vintage v_0 is then the next publication 2008–1
  - We use the following notation

$$PO_{2008}^{2008-1} \rightarrow PO_1^{v_0} \qquad PO_{2009}^{2008-1} \rightarrow PO_2^{v_0}$$

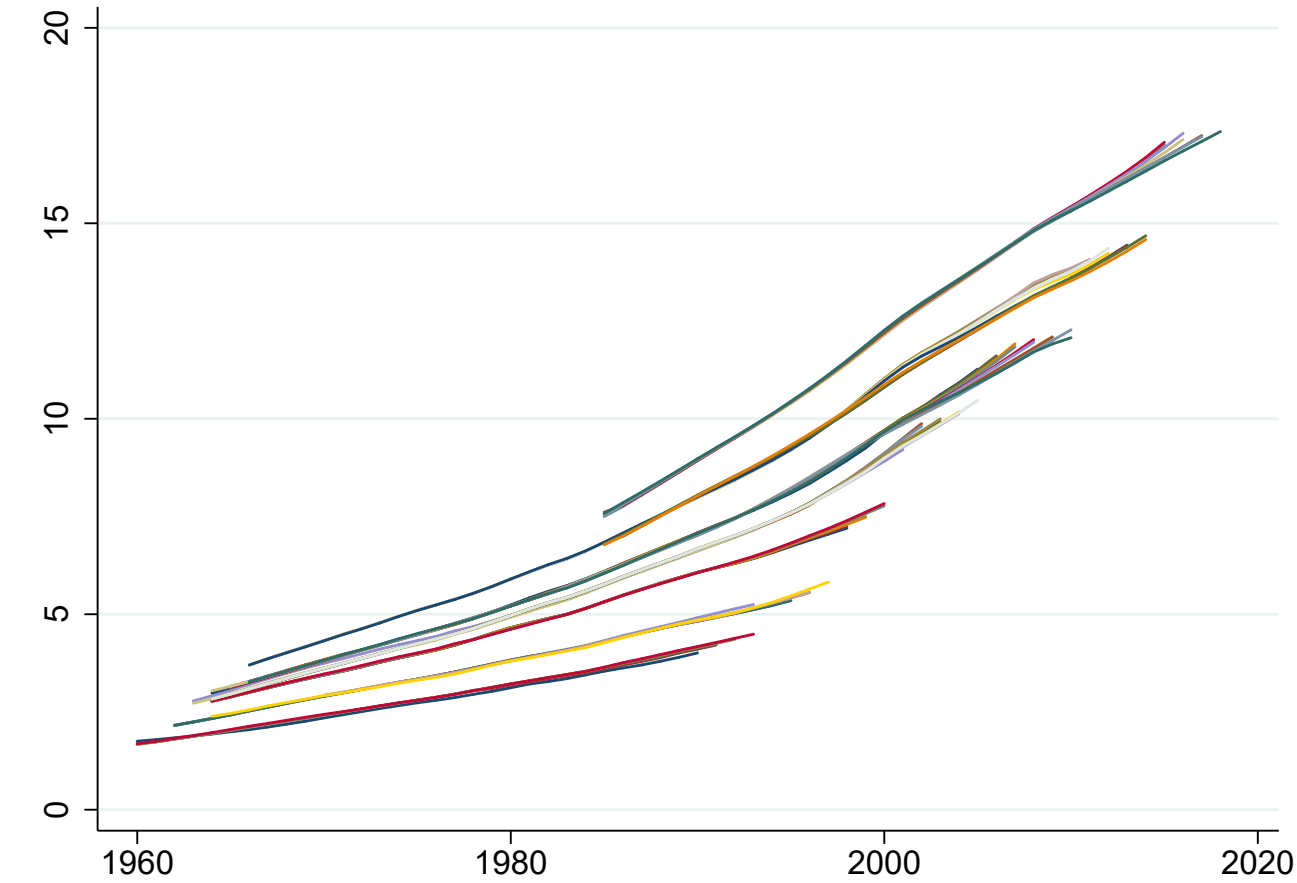
$$PO_{2008}^{2008-2} \rightarrow PO_1^{v_1}$$

$$\vdots$$

$$PO_{2008}^{2010-1} \rightarrow PO_1^{v_4}$$

Data

Base Year Problem → Normalization



Notes: The plot shows OECD estimates for (real) potential output in the US from different Economic Outlook vintages. Values are in trillions of real USD (different base years).

Data

Base Year Problem → Normalization

- Normalization using GDP vintage data:

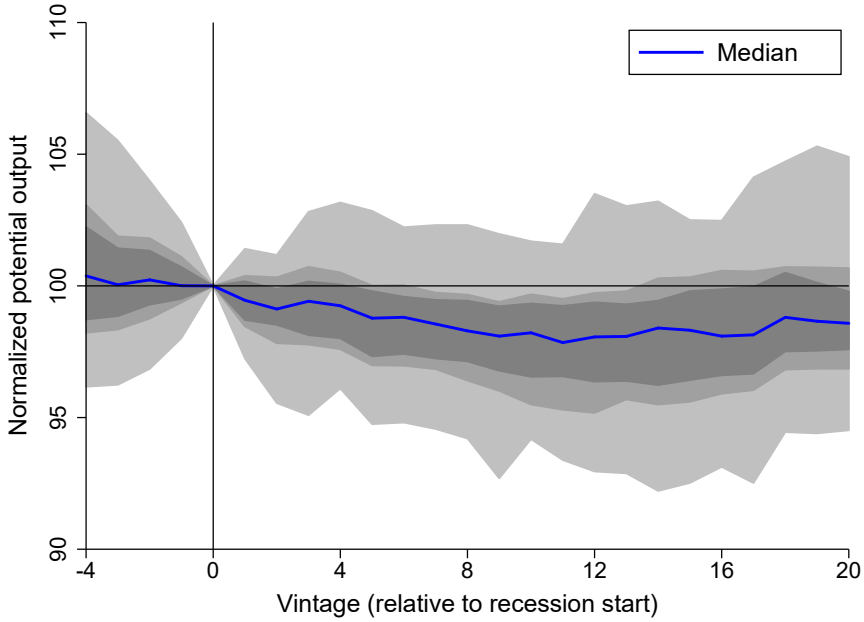
$$\bar{y}_t^{v_{0+k}} = PO_t^{v_{0+k}} \times \frac{GDP_{-5}^{v_0}}{GDP_{-5}^{v_{0+k}}}$$

- Why dividing by GDP?
  - Changing base years and/or units
- Why GDP_{-5}?
  - Need to normalize also for vintages with $k < 0$
  - Do not want to use forecast data for normalization

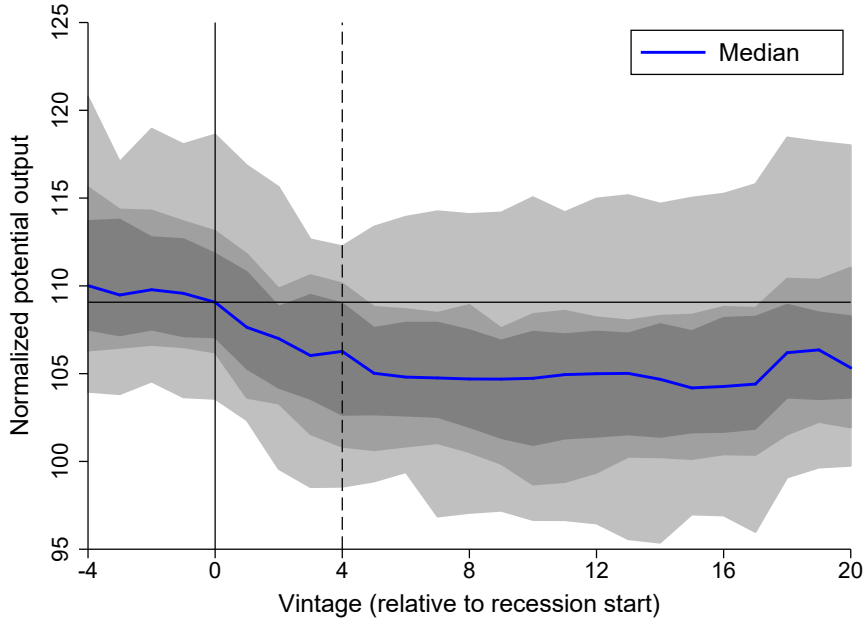
PO Estimates around Recessions

OECD Revisions for Selected Years over Time

(a) First year of recession



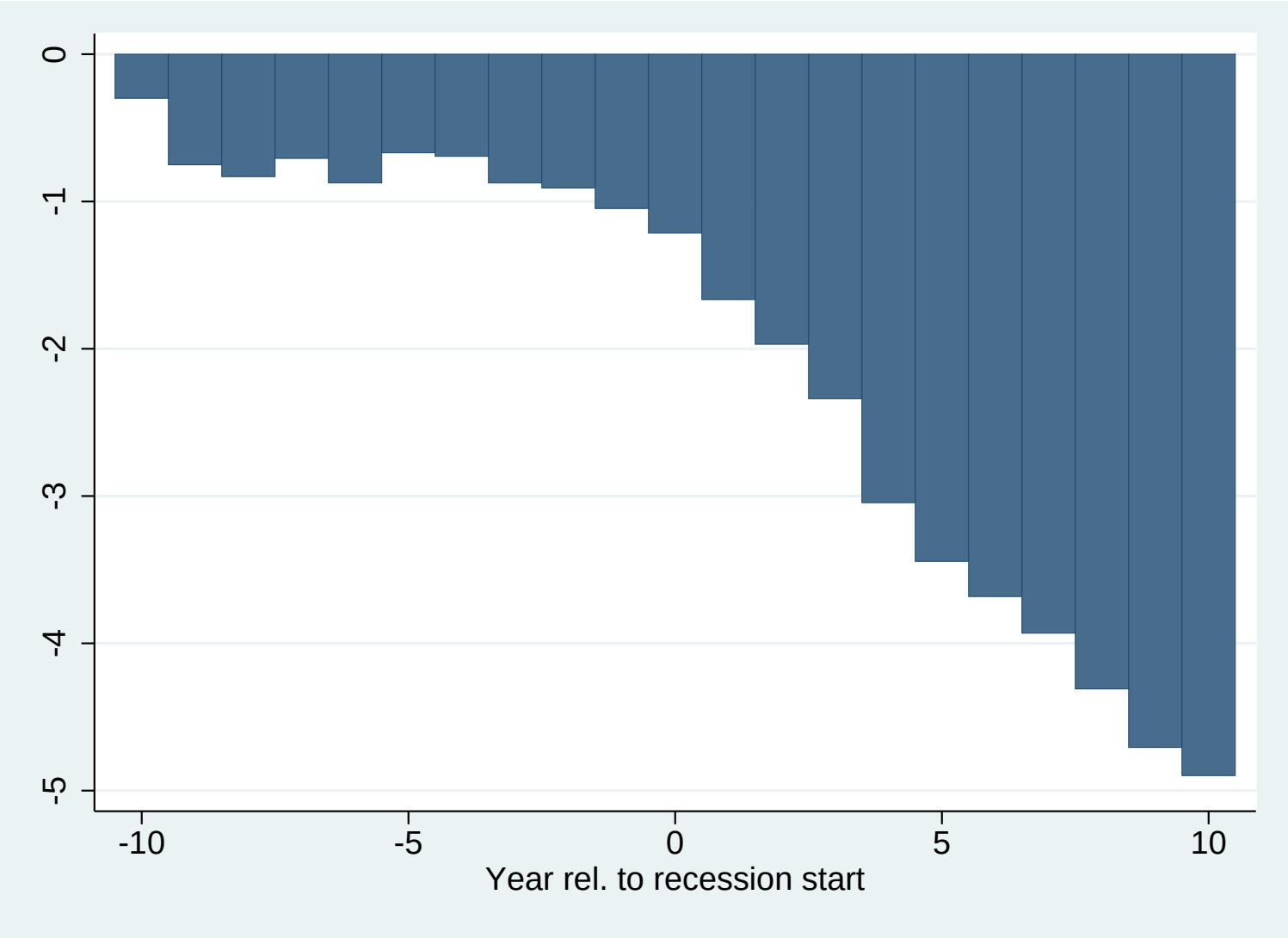
(b) Fifth year after recession start



Notes: Values on the left side of the dashed vertical line depend on our extrapolation of the OECD potential output estimates. Grey shaded areas represent the 5th to 95th percentile, the 17th to 83th percentile, and the interquartile range. The data are normalized such that potential output in the first year of a recession as estimated in the first vintage following the start of a recession is equal to 100.

PO Estimates around Recessions

OECD PO Revisions for Different Years from v_0 to v_{20}



Notes: The plot shows the median deviation from "initial" estimates in %.

Predictors of PO Revisions

Dep. variable:	$\tilde{y}_1^{v10} - \tilde{y}_1^{v0}$					$\tilde{y}_5^{v10} - \tilde{y}_5^{v0}$				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Recession length	−0.089					−0.159				
	(−0.65)					(−0.65)				
Recession depth	0.201*				0.222***	0.681***				0.672***
	(1.77)				(3.92)	(3.29)				(5.94)
Length of prev. boom	−0.031**				−0.015	−0.077***				−0.048**
	(−2.30)				(−1.53)	(−3.17)				(−2.40)
$\bar{y}_1^{v0} - \bar{y}_1^{v-3}$	−0.043					−0.058				
	(−0.39)					(−0.29)				
Trade openness (t-1)		−0.005					−0.018			
		(−0.81)					(−1.12)			
Chinn-Ito index (t-1)		0.155					0.385			
		(0.41)					(0.43)			
Δ CA (t-1)		0.286***			0.256**		0.747***			0.616***
		(2.78)			(2.61)		(3.12)			(3.16)
Primary balance (t-1)			0.084					0.180		
			(1.12)					(1.03)		
(Net) public debt (t-1)			0.001					0.004		
			(0.22)					(0.31)		
dIRS			0.146					0.304		
			(0.94)					(0.84)		
Δ Credit/GDP (t-1)			−0.035***		−0.023***			−0.086***		−0.051***
			(−3.59)		(−2.78)			(−3.78)		(−3.15)
Economic Freedom (t-1)				−0.057					0.066	
				(−0.70)					(0.37)	
EoDB index (t-1)				−0.029					−0.050	
				(−1.03)					(−0.82)	
EP(dis) (t-1)				−0.576					−0.872	
				(−1.00)					(−0.70)	
EP(temp) (t-1)				0.626*	0.322*				1.566**	0.408
				(1.76)	(1.83)				(2.04)	(1.16)
Constant	−0.053	−2.014**	−1.593***	3.016	−1.290***	0.413	−4.434*	−3.787***	−9.063	−1.513
	(−0.09)	(−2.09)	(−3.89)	(0.42)	(−2.72)	(0.38)	(−1.98)	(−3.95)	(−0.59)	(−1.60)
N	78	78	70	77	76	78	78	70	77	76
R^2	0.25	0.10	0.19	0.06	0.44	0.46	0.12	0.20	0.06	0.59

Notes: Numbers in parenthesis are t-statistics. ***, **, and * correspond to significance levels of 1 %, 5 %, and 10 %, respectively. We indicate by $t-1$ that we use values of the variables from the year before the first recession year.

What to Expect?

A Simulation Study

- Comparing two extremes ▸ Sim. design
  - Only permanent shocks (DS process)
  - Only temporary shocks without hysteresis effects (TS process)

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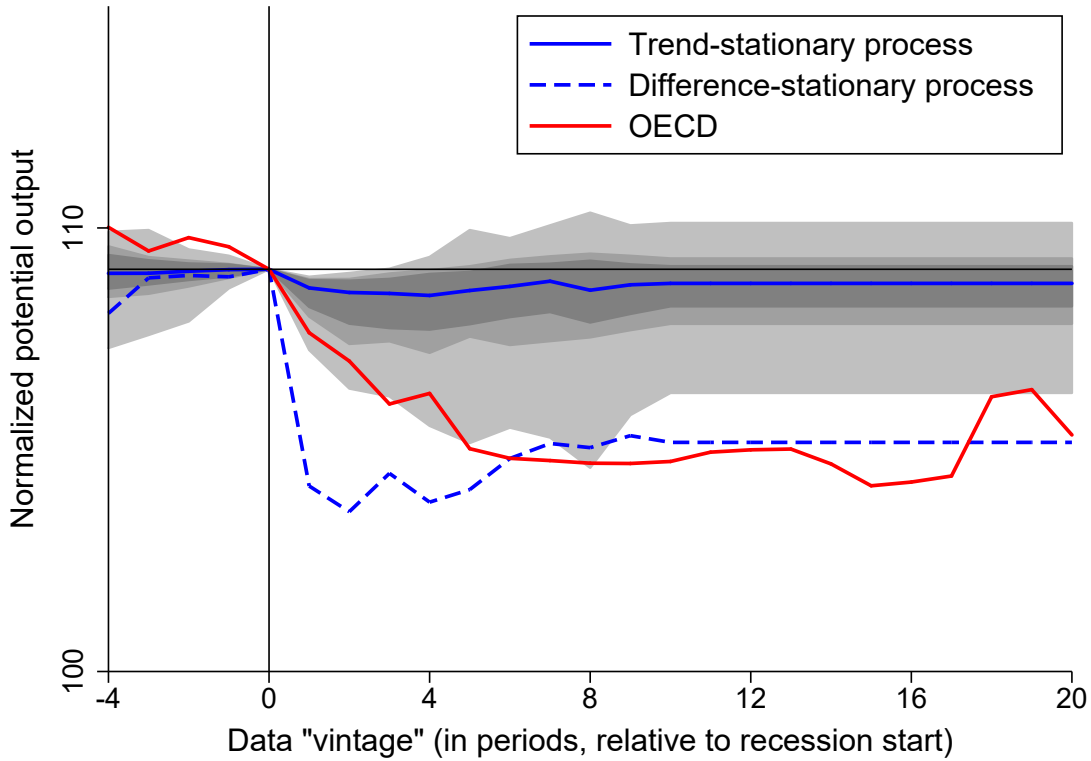


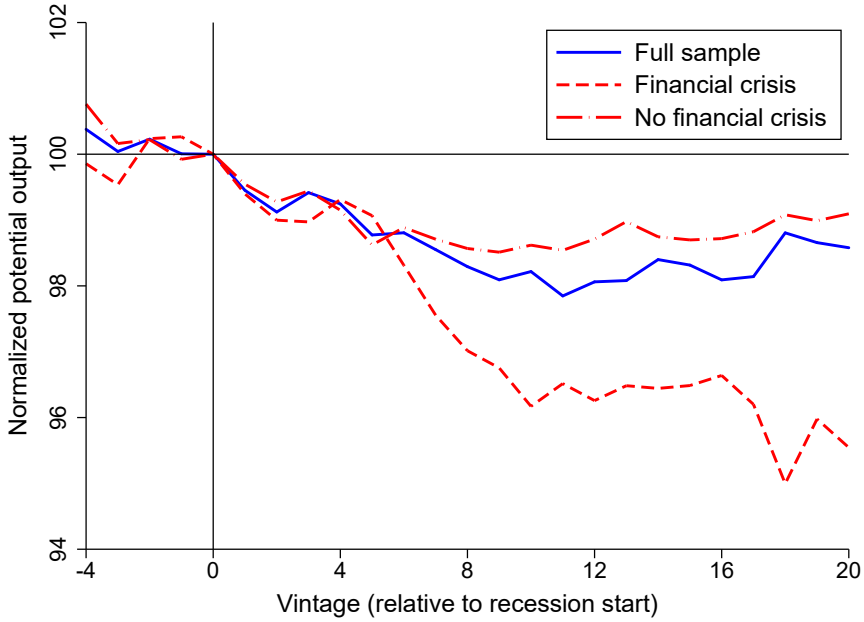
Supply- vs. Demand-driven Recessions

- Of course, not possible to obtain a clear-cut classification . . . but we try
- We take two different approaches from Blanchard et al. (2015) to group recessions into two groups:
  - Financial crises vs. "normal" recessions
  - Recessions with increasing inflation vs. those with disinflation
- Compare size/timing of PO revisions following recessions across groups

Supply- vs. Demand-driven Recessions

Financial crises

(a) First year of recession



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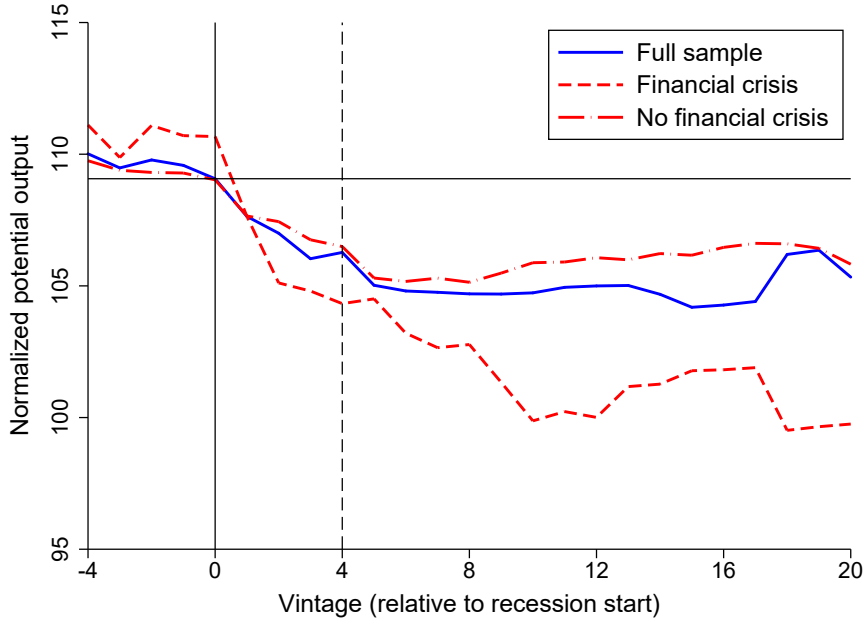
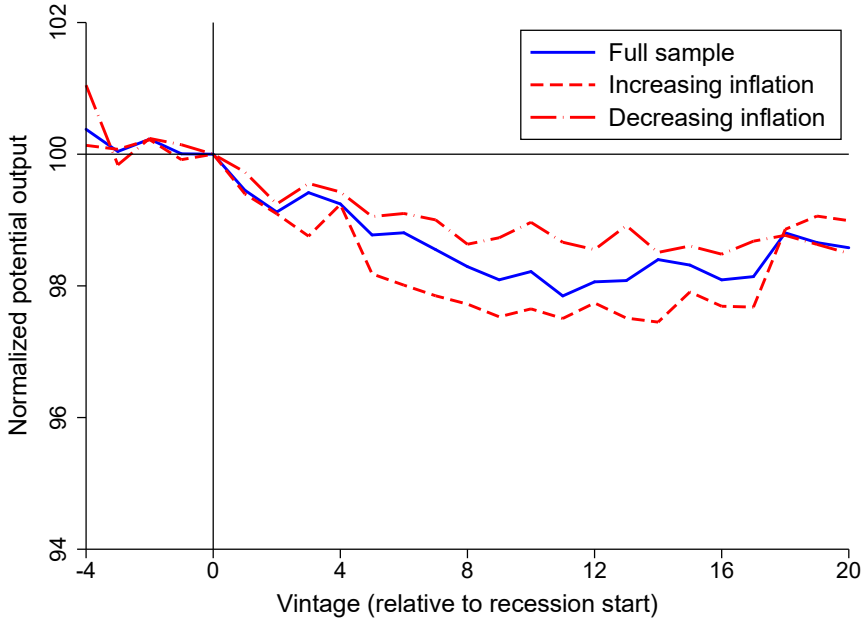


Notes: The plots show the median of OECD potential output estimates across different vintages around the start of recessions for different subsamples. Values on the left side of the dashed vertical line depend on our extrapolation of the OECD potential output estimates. The data are normalized such that potential output in the first year of a recession as estimated in the first vintage following the start of a recession is equal to 100.

Supply- vs. Demand-driven Recessions

Increasing Inflation

(a) First year of recession



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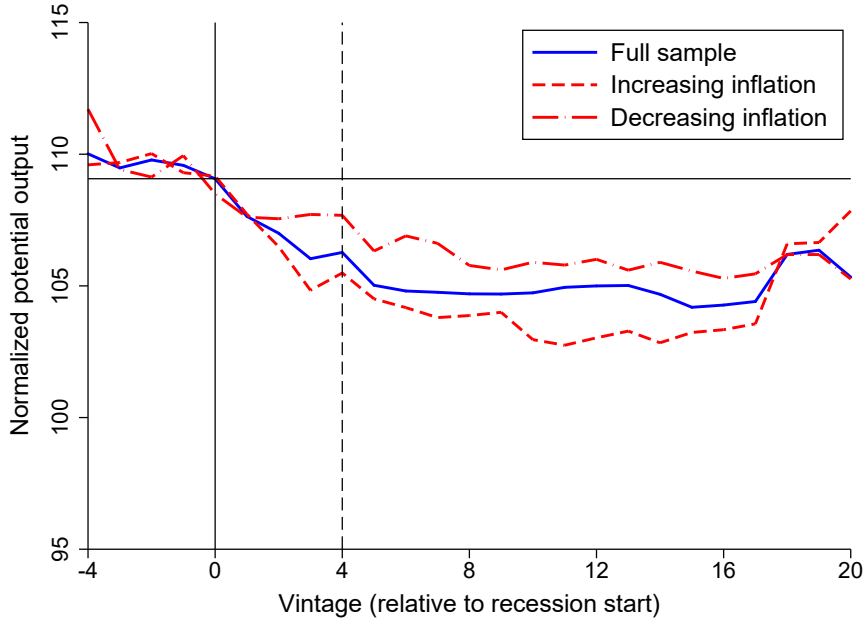

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IRFs of PO estimates to Structural Shocks

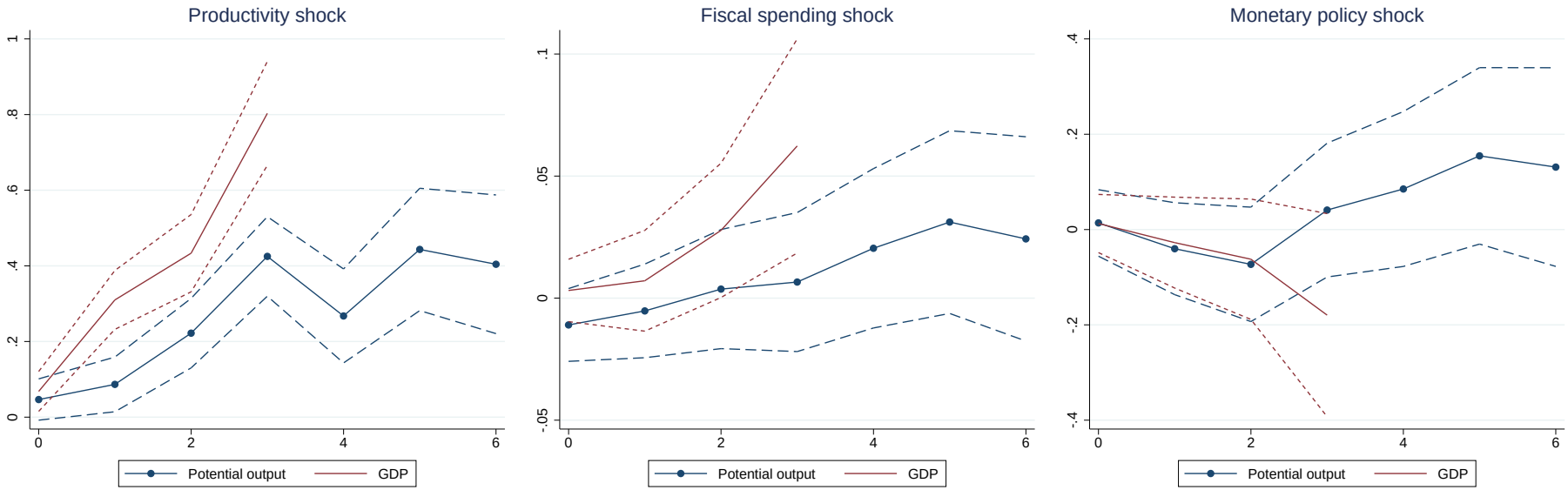
Estimating Structural Shocks/IRFs

- Supply shock:
  - **Productivity shocks**: labor productivity shocks as in Coibion et al. (2017), based on AR models
- Demand shocks:
  - **Fiscal spending shocks**: identification as suggested by Auerbach and Gorodnichenko (2012), difference between expectations and realised spending
  - **Monetary policy shocks**: based on recursive structural vectorautoregressive models as in Coibion et al. (2017)

- Use local projections to estimate the IRFs (regressing cumulative PO revisions on shocks)

IRFs of PO estimates to Structural Shocks

Cumulative PO revisions after Structural Shocks



Conclusion

- Substantial downward revisions of PO estimates after recessions
- Results suggest permanent effects of shocks that cause the recessions
  - Supply-driven recessions leave stronger permanent scars (Opt. 1)
  - Demand shocks don't seem to have effects on PO estimates (Opt. 2)
- Correlation of revisions with length of prev. boom, change in credit volume and change in current account balance (Opt. 3)
- No major downward revisions before recessions (Opt. 4)
- Next steps:
  - Look at revisions to components of PO
  - Analyze more closely the impact of monetary and fiscal policy shocks during recessions on potential output estimates

References I

Auerbach, A. J. and Gorodnichenko, Y. (2012). Measuring the output responses to fiscal policy. *American Economic Journal: Economic Policy*, 4(2):1–27.

Blanchard, O., Cerutti, E., and Summers, L. (2015). Inflation and activity – Two explorations and their monetary policy implications. NBER Working Papers 21726, National Bureau of Economic Research, Inc.

Blanchard, O. J. and Summers, L. H. (1986). Hysteresis in unemployment. NBER Working Papers 2035, National Bureau of Economic Research, Inc.

Blanchard, O. J. and Summers, L. H. (1987). Hysteresis in unemployment. *European Economic Review*, 31(1-2):288–295.

References II

Borio, C., Disyatat, F. P., and Juselius, M. (2017). Rethinking potential output: Embedding information about the financial cycle. *Oxford Economic Papers*, forthcoming.

Cerra, V. and Saxena, S. C. (2008). Growth dynamics: The myth of economic recovery. *American Economic Review*, 98(1):439–57.

Coibion, O., Gorodnichenko, Y., and Ulate, M. (2017). The cyclical sensitivity in estimates of potential output. NBER Working Papers 23580, National Bureau of Economic Research, Inc.

Fatás, A. and Summers, L. H. (2016). The permanent effects of fiscal consolidations. NBER Working Papers 22374, National Bureau of Economic Research, Inc.

References III

Furceri, D. and Mourougane, A. (2012). The effect of financial crises on potential output: New empirical evidence from OECD countries. *Journal of Macroeconomics*, 34(3):822–832.

Haltmaier, J. (2012). Do recessions affect potential output? International Finance Discussion Papers, Board of Governors of the Federal Reserve System (U.S.) 1066, Board of Governors of the Federal Reserve System (U.S.).

Harding, D. and Pagan, A. (2002). Dissecting the cycle: A methodological investigation. *Journal of Monetary Economics*, 49(2):365 – 381.

Lindbeck, A. and Snower, D. J. (1986). Wage setting, unemployment, and insider-outsider relations. *American Economic Review*, 76(2):235–39.

References IV

Orphanides, A. and van Norden, S. (2002). The unreliability of output-gap estimates in real time. *The Review of Economics and Statistics*, 84(4):569–583.

Reinhart, C. M. and Rogoff, K. S. (2009). The aftermath of financial crises. *American Economic Review*, 99(2):466–72.

Stadler, G. W. (1990). Business cycle models with endogenous technology. *American Economic Review*, 80(4):763–78.

Design of Simulation Study

- Generate data with two extreme views about persistence of shocks:
  - Fit AR(2) model to GDP growth in US $\rightarrow$ DS process

$$\Delta y_t = \alpha + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + \varepsilon_t \tag{1}$$

  - Fit linear trend plus AR(2) model to (log) GDP $\rightarrow$ TS process

$$y_t = \alpha + \gamma t + \eta_t, \quad \eta_t = \beta_1 \eta_{t-1} + \beta_2 \eta_{t-2} + \varepsilon_t \tag{2}$$

- Apply (one-sided) HP filter to estimate "potential output" in real time
- Apply the same recession identification algorithm
- Look at evolution of trend estimates in real time

Back