

Monetary Policy and The Maturity Structure of Public Debt

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Motivation

- Does the maturity of public debt matter for monetary policy transmission?

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- Ambiguous ex-ante: valuation, rollover, higher fiscal spending.
- High debts following Covid and heterogeneous maturity.

This Paper

- Propose metric to study insurance properties of long debt.
- Test conditional effect of public debt maturity on monetary policy transmission on US and UK data.

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- Propose metric to study insurance properties of long debt.
- Test conditional effect of public debt maturity on monetary policy transmission on US and UK data.
- Narrative account of maturity choices. Exogenous with respect to the monetary policy cycle.
- Model with financial accelerator and primary market friction.
- Friction microfounded and estimated with novel high frequency identification.

Main Results

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- Direct evidence: exogenous decrease in public debt supply decreases government and corporate yields.

Main Results

- Model matches empirical result with small friction.
- Complementarity between financial accelerator and primary market friction.
- Maturity is key.
- Increasing rates is not as costly to fight inflation with long maturity.
- Segmented asset markets are crucial for transmission of monetary policy.

Literature

- State dependent effect of monetary policy and debt maturity: (Ippolito, Ozdagli and Perez-Orive, 2018; Darmouni, Giesecke and Rodnyansky, 2020; Jungherr et al., 2020; Bräuning, Fillat and Wang, 2020; Fabiani, Falasconi and Heineken, 2021; Calza, Monacelli and Stracca, 2013; Garriga, Kydland and Šustek, 2017; Beraja et al., 2019; Wong, 2021; Auclert, 2019; Sterk and Tenreyro, 2018).
- Public debt supply and asset prices: (Vayanos and Vila, 2021; Greenwood, Hanson and Stein, 2010; Greenwood and Vayanos, 2010, 2014; Greenwood, Hanson and Stein, 2015; Krishnamurthy and Vissing-Jorgensen, 2012)
- Interaction between public debt and monetary regimes: (Hall and Sargent, 2011; Giannitsarou and Scott, 2008; Hilscher, Raviv and Reis, 2021; Krause and Moyen, 2016; Leeper, 1991; Cochrane, 2001, 2020)
- Public debt maturity and distortionary taxes: (Bohn, 1988; Missale, 1997; Angeletos, 2002; Faraglia, Marcet and Scott, 2010; Faraglia et al., 2013, 2018; Debortoli, Nunes and Yared, 2017; Bhandari et al., 2017, 2021; Bigio, Nuño and Passadore, 2019).
- Long maturity debt in macro models: (Kydland, Rupert and Šustek, 2016; Gomes, Jermann and Schmid, 2016; Hatchondo and Martinez, 2009; Arellano and Ramanarayanan, 2012; Krause and Moyen, 2016)
- Financial accelerator: (Bernanke, Gertler and Gilchrist, 1999; Christiano, Motto and Rostagno, 2014; Dmitriev and Hoddenbagh, 2017)

Duration-to-GDP

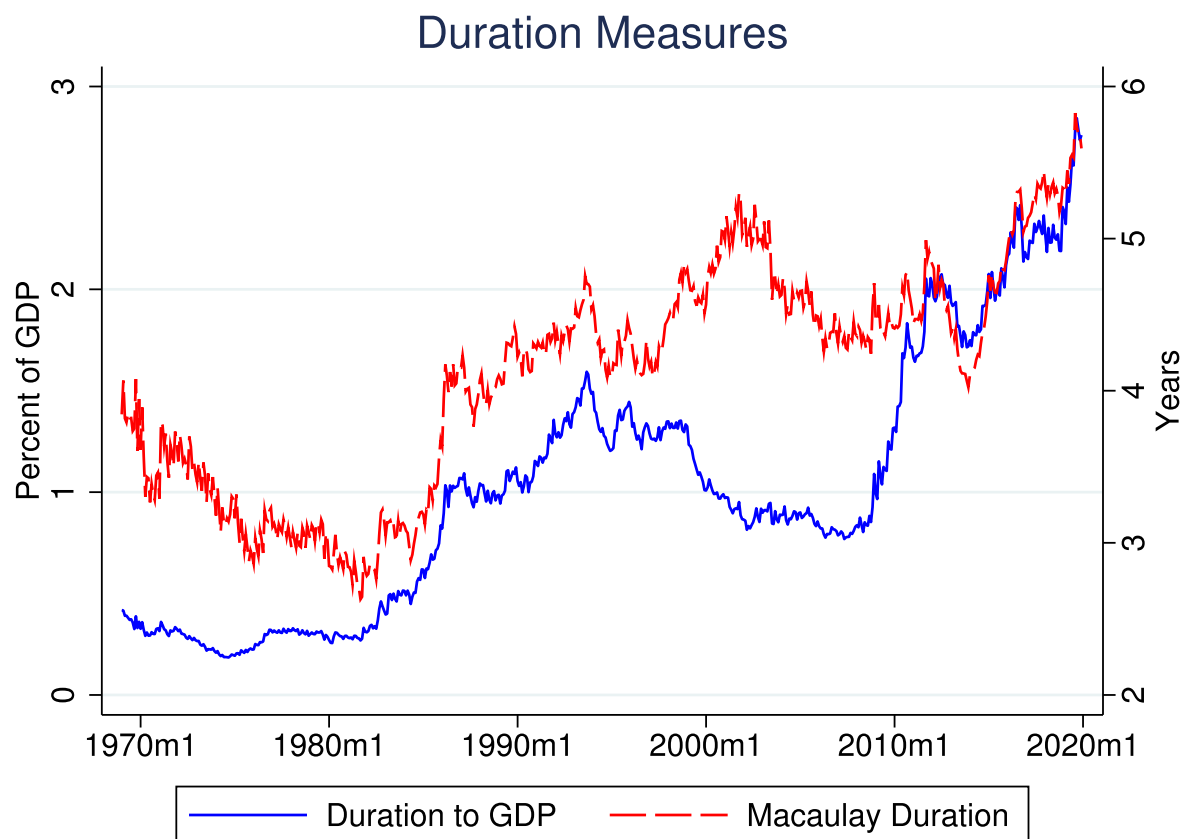
- Take one country with 100% of public debt to GDP and no further financing needs.
- 1 percentage point permanent increase in interest rates.

Debt Maturity	New Debt Market Value	Debt Servicing Cost Change
10 years	90% of GDP	0% of GDP
Overnight	100% of GDP	10% of GDP

- DEFINITION Duration-to-GDP: how much the market value of public debt to GDP declines following a one percent increase in interest rates.
- PROPOSITION: If change is permanent, duration-to-GDP is the NPV of debt servicing costs savings compared with overnight debt on existing debt.

$$DurGDP_t = \frac{\sum_{j=1}^{\infty} \frac{j}{12} q_{t,j} b_{t,j}}{GDP_t}$$

Duration-to-GDP in the US



- Long regimes.
- Negatively correlated with UK measure
- Build from bond data: marketable, held by the private sector.
- Alternative duration metrics

Narrative Account of Maturity Choices in the US

- Political and legal constraint made the maturity structure choices *exogenous* with respect to the monetary policy cycle.
- In 1918, a law instituted a 4.25% rate ceiling on long bonds.
- Gradual repeal from the early 70s up to 1988.
- Change in objective in 1993 (more focus on costs) and in mid aught (more focus on insurance).

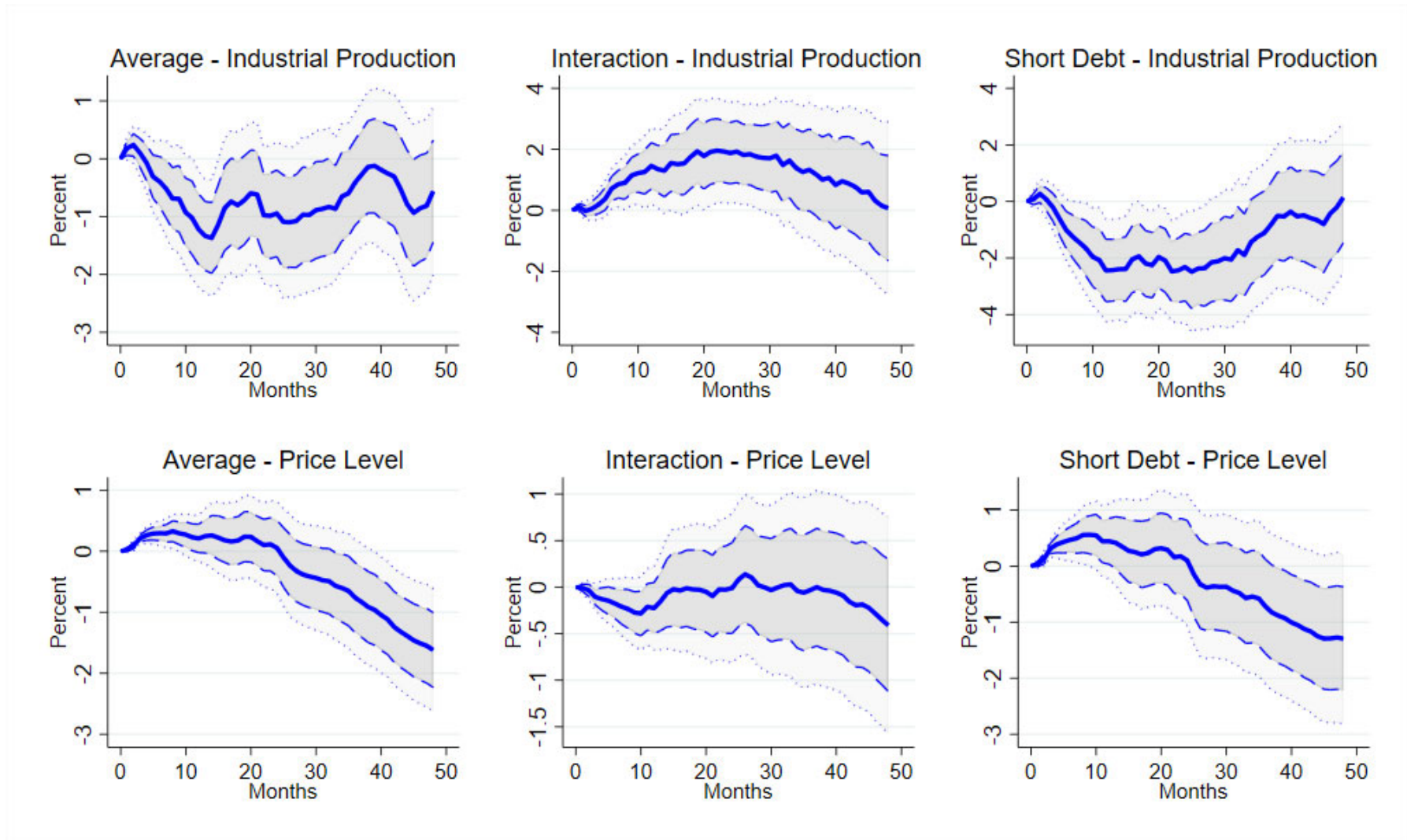
Empirical Methodology

- Non-linear univariate local projections à la Jordà.
- Reduced form regressions

$$y_{t+h} = \beta_{0,h} + \beta_{1,h} Shock_t + \beta_{2,h} Shock_t DurGDP_{t-1} + \beta_{3,h}(L)' W_t + \varepsilon_{t+h}$$

- Identification of monetary policy shocks: narrative, high frequency, and recursive.

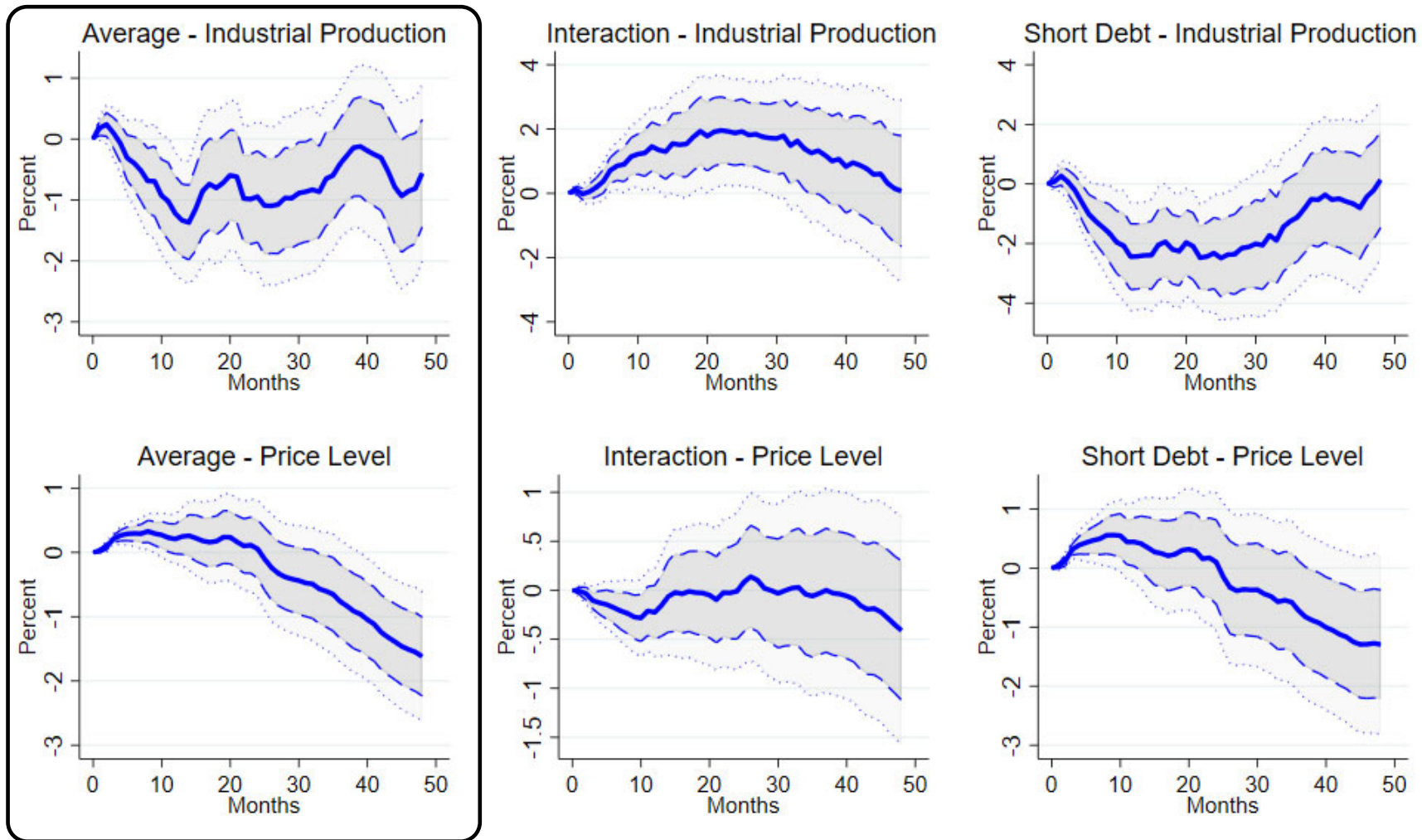
Baseline Results US



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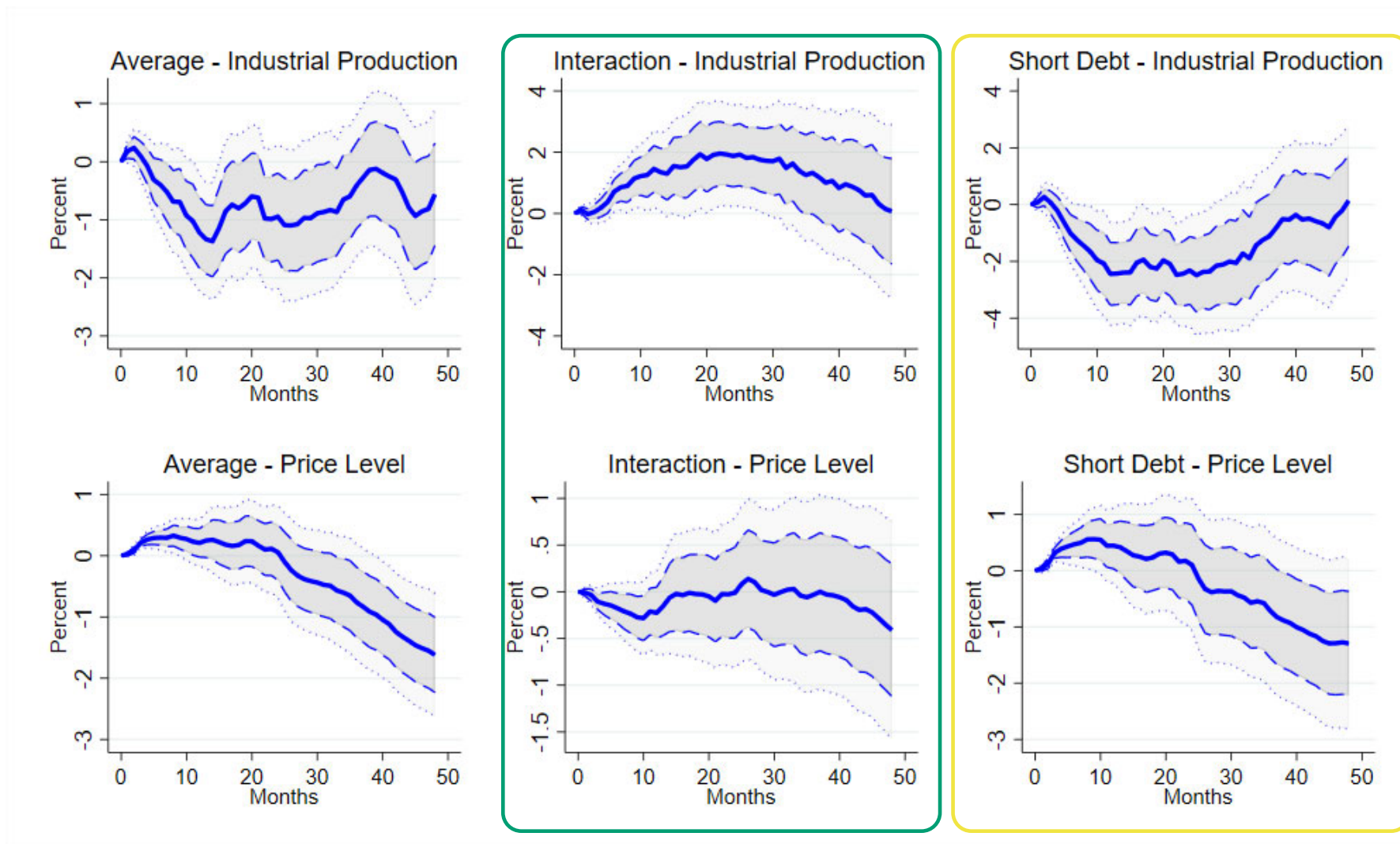
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Sensitivity

- Quarterly results.
- Econometric Method:
 - LP-IV results.
 - Lag-Augmentation.
- Measuring debt maturity:
 - Macaulay duration.
 - Inclusion of inflation linked debt.
 - Face Value Debt.
 - Also FED Holdings.
 - Long debt over GDP.
 - Smooth Transition.
- Identification of monetary policy:
 - High frequency identification.
 - No Recursiveness assumption.
 - Recursive/Cholesky identification.
 - Original Romer and Romer (2004) shock.
- Identification of maturity structure:
 - Narrative Account.
 - Confounding factors and IV approach.

Economic Mechanism

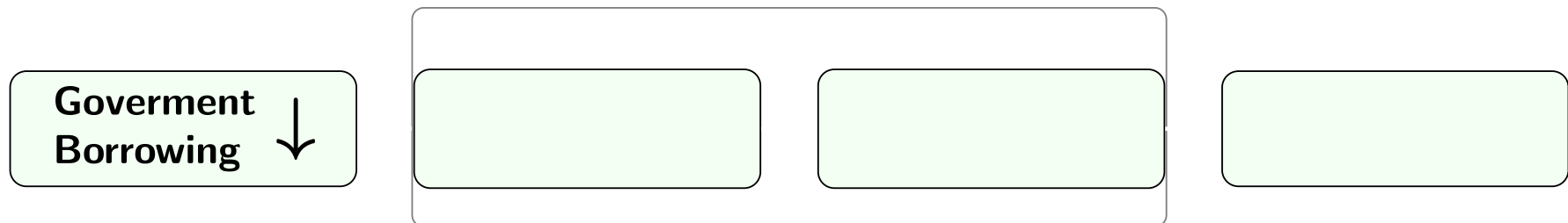
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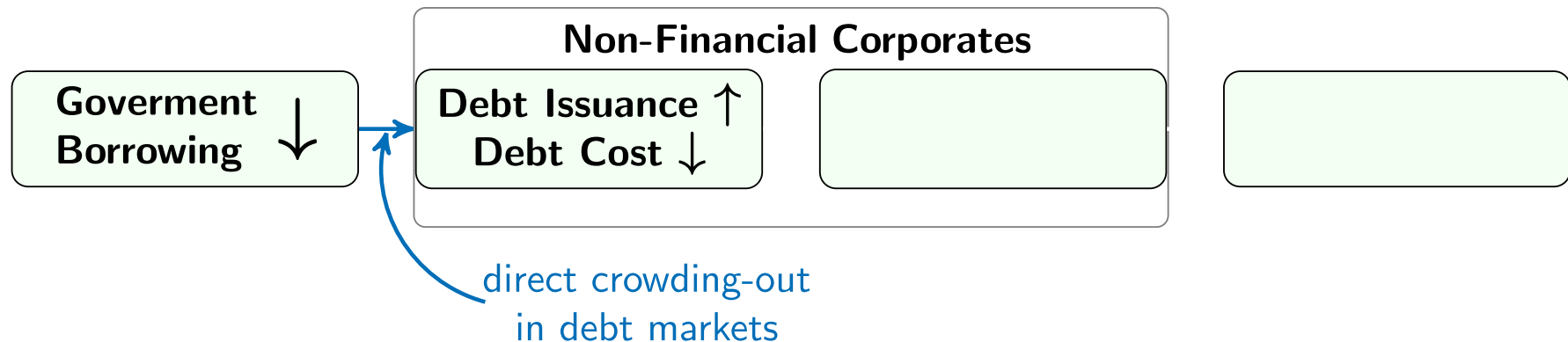
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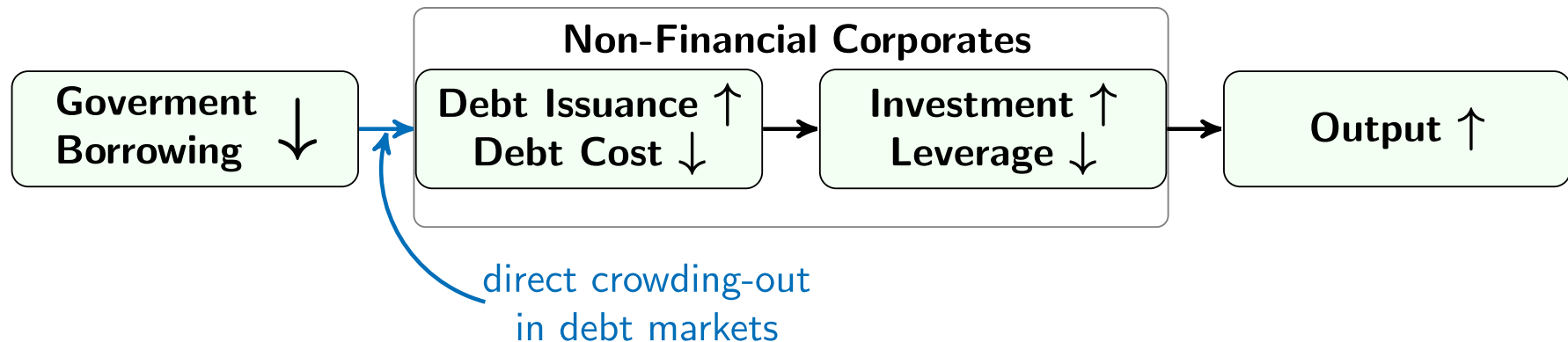
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Model of the Financing Channel

- Build on New Keynesian model with financial accelerator, from Bernanke, Gertler and Gilchrist (1999).
 - Firms' balance sheets matter.
 - Mapping between spreads, leverage, and investment.

Model of the Financing Channel

- Build on New Keynesian model with financial accelerator, from Bernanke, Gertler and Gilchrist (1999).
- Long maturity fixed nominal interest rate government debt.
 - Parsimonious and keep track of only 2 state variables.
 - Good fit on data.

Model of the Financing Channel

- Build on New Keynesian model with financial accelerator, from Bernanke, Gertler and Gilchrist (1999).
- Long maturity fixed nominal interest rate government debt.
- Financial friction on primary market dealers.
 - Congestion effects.
 - Microfounded.
 - Estimated with new high frequency identification on exogenous public debt supply shocks.

Model of the Financing Channel

- Build on New Keynesian model with financial accelerator, from Bernanke, Gertler and Gilchrist (1999).
- Long maturity fixed nominal interest rate government debt.
- Financial friction on primary market dealers.
- Counterfactual analysis.
 - Effect of contractionary monetary policy shock.
 - Compare short (1 quarter) vs long (4 years) maturity regimes.

Model Results

- Prove in close form duration-to-GDP equivalence.
 - Market value \longleftrightarrow debt servicing costs.
 - \Rightarrow For a permanent increase in interest rates, duration-to-GDP measures:
 1. Decline in market value in public debt to GDP.
 2. Net present value of debt servicing cost saving to GDP that the current maturity allows on existing debt compared to a one period debt maturity.

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- Complementarity between primary market friction and financial accelerator.
 - Small primary market friction in partial equilibrium
 - Large macro effects in general equilibrium.

Model Results

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- With low maturity debt more amplification.
- Complementarity between primary market friction and financial accelerator.
- Maturity is key.
 - Experiment: fix debt, vary maturity.

Debt (% of GDP)	Maturity	Difference in output
40%	From 4 years to 1 quarter	31%

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Debt (% of GDP)	Maturity	Difference in output
40%	From 4 years to 1 quarter	31%
From 0% to 700%	4 years	31%

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Impact on activity, not on price level.

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How? Crowding-out in debt markets: *financing channel*.
Small primary market friction.
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Conclusion

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What? From long to short debt: monetary policy on output $\times 2$.
Impact on activity, not on price level.

How? Crowding-out in debt markets: *financing channel*.
Small primary market friction.
Maturity is key.

So what? With longer maturity, not as costly to increase rates on output.
Segmented asset markets are crucial for monetary policy.

Thank You!

Angeletos, George-Marios. 2002. “Fiscal policy with noncontingent debt and the optimal maturity structure.” *The Quarterly Journal of Economics*, 117(3): 1105–1131.

Arellano, Cristina, and Ananth Ramanarayanan. 2012. “Default and the maturity structure in sovereign bonds.” *Journal of Political Economy*, 120(2): 187–232.

Auclert, Adrien. 2019. “Monetary policy and the redistribution channel.” *American Economic Review*, 109(6): 2333–67.

Beraja, Martin, Andreas Fuster, Erik Hurst, and Joseph Vavra. 2019. “Regional heterogeneity and the refinancing channel of monetary policy.” *The Quarterly Journal of Economics*, 134(1): 109–183.

Bernanke, Ben S, Mark Gertler, and Simon Gilchrist. 1999. “The financial accelerator in a quantitative business cycle framework.” *Handbook of macroeconomics*, 1: 1341–1393.

Bhandari, Anmol, David Evans, Mikhail Golosov, and Thomas J Sargent. 2017. “Fiscal policy and debt management with incomplete markets.” *The Quarterly Journal of Economics*, 132(2): 617–663.

Bhandari, Anmol, David Evans, Mikhail Golosov, and Thomas Sargent. 2021. “Managing public portfolios.”

Bigio, Saki, Galo Nuño, and Juan Passadore. 2019. “Debt-Maturity Management with Liquidity Costs.” National Bureau of Economic Research.

Bohn, Henning. 1988. “Why do we have nominal government debt?” *Journal of Monetary Economics*, 21(1): 127–140.

- Bräuning, Falk, José L Fillat, and J Christina Wang.** 2020. “Corporate Debt Maturity and Monetary Policy.” *Federal Reserve Bank of Boston Research Paper Series Current Policy Perspectives Paper*, , (88967).
- Calza, Alessandro, Tommaso Monacelli, and Livio Stracca.** 2013. “Housing finance and monetary policy.” *Journal of the European Economic Association*, 11(suppl_1): 101–122.
- Christiano, Lawrence J, Roberto Motto, and Massimo Rostagno.** 2014. “Risk shocks.” *American Economic Review*, 104(1): 27–65.
- Cochrane, John H.** 2001. “Long-Term Debt and Optimal Policy in the Fiscal Theory of the Price Level.” *Econometrica*, 69(1): 69–116.
- Cochrane, John H.** 2020. “A Fiscal Theory of Monetary Policy with Partially-Repaid Long-Term Debt.” National Bureau of Economic Research.
- Darmouni, Olivier, Oliver Giesecke, and Alexander Rodnyansky.** 2020. “The Bond Lending Channel of Monetary Policy.”
- Debortoli, Davide, Ricardo Nunes, and Pierre Yared.** 2017. “Optimal time-consistent government debt maturity.” *The Quarterly Journal of Economics*, 132(1): 55–102.
- Dmitriev, Mikhail, and Jonathan Hoddenbagh.** 2017. “The financial accelerator and the optimal state-dependent contract.” *Review of Economic Dynamics*, 24: 43–65.
- Fabiani, Andrea, Luigi Falasconi, and Janko Heineken.** 2021. “Monetary Policy and Corporate Debt Maturity.” Working papers.
- Faraglia, Elisa, Albert Marcet, and Andrew Scott.** 2010. “In search of a theory of debt management.” *Journal of Monetary Economics*, 57(7): 821–836.

- Faraglia, Elisa, Albert Marcet, Rigas Oikonomou, and Andrew Scott.** 2013. “The impact of debt levels and debt maturity on inflation.” *The Economic Journal*, 123(566).
- Faraglia, Elisa, Albert Marcet, Rigas Oikonomou, and Andrew Scott.** 2018. “Government Debt Management: The Long and the Short of It.” *Review of Economic Studies*.
- Garriga, Carlos, Finn E Kydland, and Roman Šustek.** 2017. “Mortgages and monetary policy.” *The Review of Financial Studies*, 30(10): 3337–3375.
- Giannitsarou, Chryssi, and Andrew Scott.** 2008. “Inflation implications of rising government debt.” 393–442, University of Chicago Press.
- Gomes, Joao, Urban Jermann, and Lukas Schmid.** 2016. “Sticky leverage.” *American Economic Review*, 106(12): 3800–3828.
- Greenwood, Robin, and Dimitri Vayanos.** 2010. “Price pressure in the government bond market.” *American Economic Review*, 100(2): 585–90.
- Greenwood, Robin, and Dimitri Vayanos.** 2014. “Bond supply and excess bond returns.” *The Review of Financial Studies*, 27(3): 663–713.
- Greenwood, Robin, Samuel G Hanson, and Jeremy C Stein.** 2015. “A comparative-advantage approach to government debt maturity.” *The Journal of Finance*, 70(4): 1683–1722.
- Greenwood, Robin, Samuel Hanson, and Jeremy C Stein.** 2010. “A Gap-Filling Theory of Corporate Debt Maturity Choice.” *The Journal of Finance*, 65(3): 993–1028.

- Hall, George J, and Thomas J Sargent.** 2011. “Interest rate risk and other determinants of post-WWII US government debt/GDP dynamics.” *American Economic Journal: Macroeconomics*, 3(3): 192–214.
- Hatchondo, Juan Carlos, and Leonardo Martinez.** 2009. “Long-duration bonds and sovereign defaults.” *Journal of International Economics*, 79(1): 117–125.
- Hilscher, Jens, Alon Raviv, and Ricardo Reis.** 2021. “Inflating Away the Public Debt? An Empirical Assessment.” *The Review of Financial Studies*.
- Ippolito, Filippo, Ali K Ozdagli, and Ander Perez-Orive.** 2018. “The transmission of monetary policy through bank lending: The floating rate channel.” *Journal of Monetary Economics*, 95: 49–71.
- Jungherr, Joachim, Matthias Meier, Timo Reinelt, and Immo Schott.** 2020. “Corporate Debt Maturity Matters For Monetary Policy.”
- Krause, Michael U, and Stéphane Moyen.** 2016. “Public debt and changing inflation targets.” *American Economic Journal: Macroeconomics*, 8(4): 142–76.
- Krishnamurthy, Arvind, and Annette Vissing-Jorgensen.** 2012. “The aggregate demand for treasury debt.” *Journal of Political Economy*, 120(2): 233–267.
- Kydland, Finn E, Peter Rupert, and Roman Šustek.** 2016. “Housing dynamics over the business cycle.” *International Economic Review*, 57(4): 1149–1177.
- Leeper, Eric M.** 1991. “Equilibria under ‘active’ and ‘passive’ monetary and fiscal policies.” *Journal of monetary Economics*, 27(1): 129–147.
- Missale, Alessandro.** 1997. “Managing the public debt: The optimal taxation approach.” *Journal of Economic Surveys*, 11(3): 235–265.

- Romer, Christina D, and David H Romer.** 2004. “A new measure of monetary shocks: Derivation and implications.” *American Economic Review*, 94(4): 1055–1084.
- Sterk, Vincent, and Silvana Tenreyro.** 2018. “The transmission of monetary policy through redistributions and durable purchases.” *Journal of Monetary Economics*, 99: 124–137.
- Vayanos, Dimitri, and Jean-Luc Vila.** 2021. “A preferred-habitat model of the term structure of interest rates.” *Econometrica*.
- Wong, Arlene.** 2021. “Refinancing and the transmission of monetary policy to consumption.” *Unpublished manuscript*, 20.