

# Estimating Hysteresis Effects

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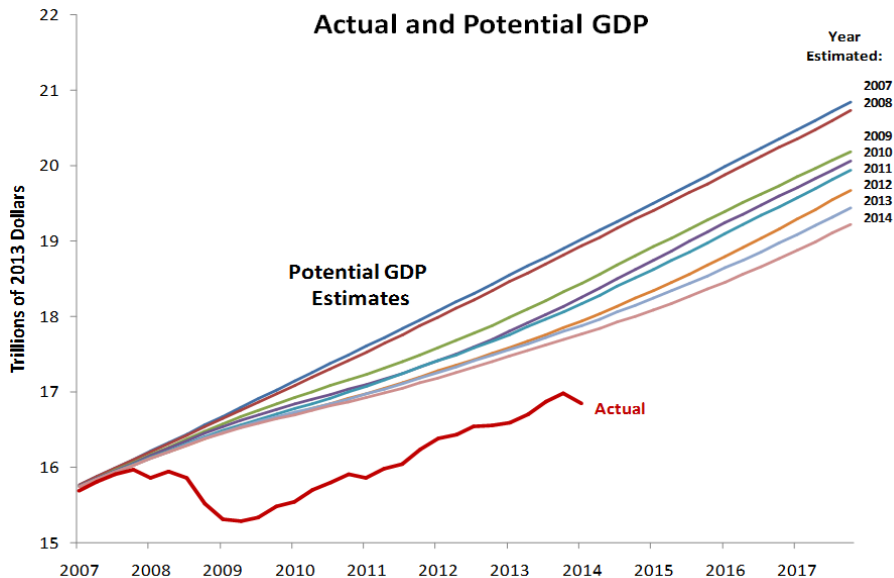
# The independence assumption

- The natural rate of unemployment (and potential output) is independent of monetary policy
  - *'...the "natural rate hypothesis" quickly became widely accepted and has been the dominant paradigm in macroeconomics ever since. It is embodied in the thinking and models used by central banks, and it is the basis of the inflation-targeting framework...'*  
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(Blanchard, 2018)
- The assumption has been challenged by theories of hysteresis
  - Hysteresis in European unemployment in the 80s (Blanchard and Summers, 1986)
  - Great Moderation
  - Great Recession

# Alternative interpretations: Summers vs Fernald



# The independence assumption in empirical work

- Blanchard and Quah (1989): There are two types of shocks
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- Coibion, Gorodnichenko and Ulate (2018): Counterfactual output driven only by permanent shocks is interpreted as potential output
- Blanchard (2019):
  - There may be supply shocks with temporary effects
  - There may be demand shocks with permanent/long lasting effects

# Our approach

- Our goal: identify demand shocks with potentially permanent effects on output. This tells us something about the empirical relevance of hysteresis effects.
- Combine short-term (sign) and long-term (zero) restrictions in a VAR model (Arias, Rubio-Ramirez and Waggoner, 2019)
- Two types of demand shocks
  - A demand shock with temporary effect on output
  - A demand shock with potentially permanent effect on output
- Two types of supply shocks
  - A supply shock with temporary effect on output
  - A supply shock with potentially permanent effect on output



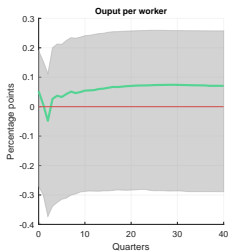
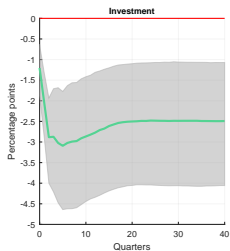
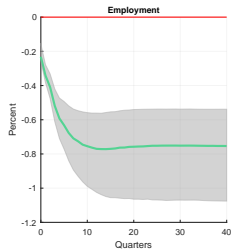
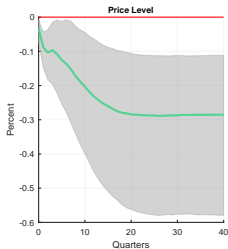
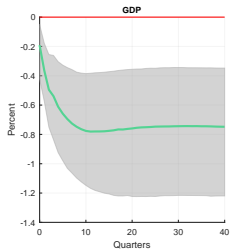
# Benchmark model

- US data, 1983Q1-2019Q2
- Variables:
  - Real GDP per capita
  - PCE deflator
  - Employment-population ratio
  - **Investment per capita**
- First differences
- 3 lags (BIC)
- Non-informative priors (Jeffreys)

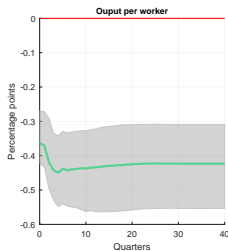
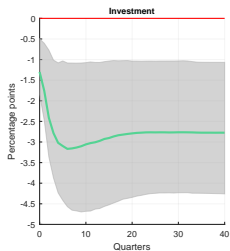
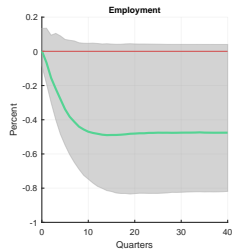
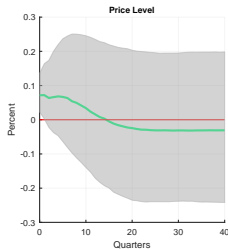
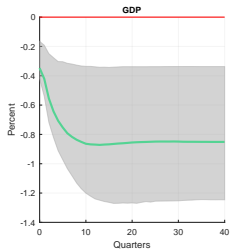
# Identification

	<b>Demand - permanent</b>		<b>Supply - permanent</b>		<b>Demand - temporary</b>		<b>Supply - temporary</b>	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
GDP	-		-		-	0	-	0
Inflation	-		+		-		+	
Employment						0		
Investment								0

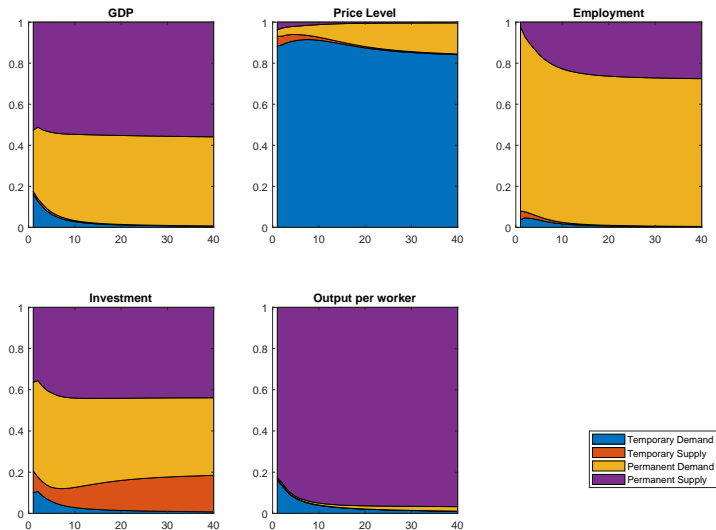
# A demand shock with permanent effect on output



# A supply shock with permanent effect on output



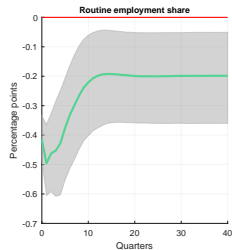
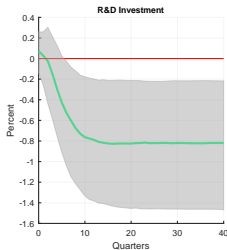
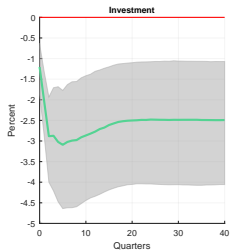
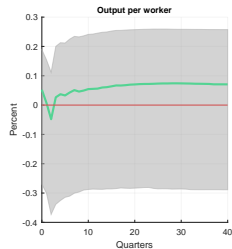
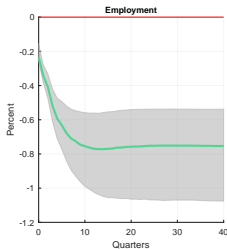
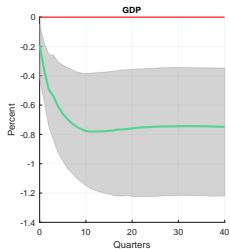
# Variance decomposition



# Channels for hysteresis

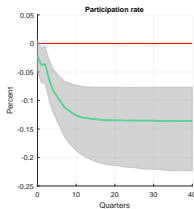
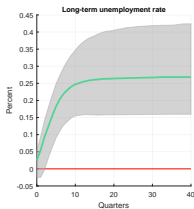
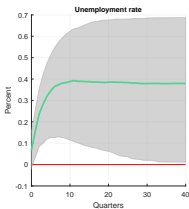
- Through employment:
  - Insider/outsider effects (Blanchard and Summers, 1986, Gali, 2016)
  - Skill depreciation: unemployment duration reduces employability (Krueger et al., 2014, Abraham et al., 2016)
  - Labor force participation hysteresis (Yagan, 2019)
  - Disability insurance (applications and acceptances)
  
- Through labor productivity:
  - Persistent drop in investment (Benigno and Fornaro, 2017)
  - Spending in research and development (Moran and Queralto, 2018)
  - Speed of technology adoption (Anzaotegui et al., 2018)
  - Composition effects: larger effects on less productive firms (Caballero and Hammour, 1994)
  - Composition effects: larger effects on low skilled workers (Charles et al., 2016)

# Investigating the channels

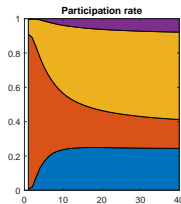
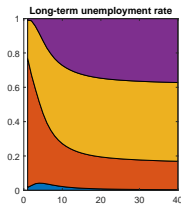
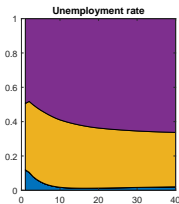


# Unemployment and participation

Permanent demand shock:



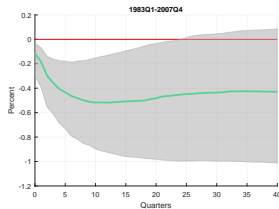
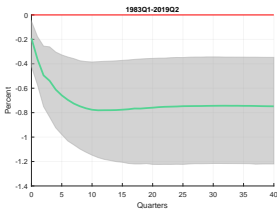
Variance decomposition:



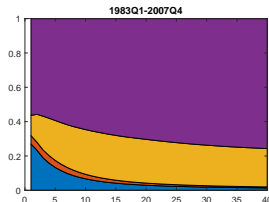
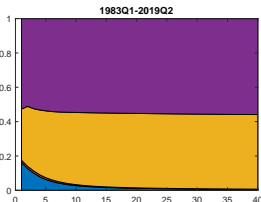


# Robustness: Are the results driven by the great recession?

Permanent demand shock:



Variance decomposition:



- Main results so far:
  - Demand shocks with potentially permanent effects are important
  - Propagation through employment
- Gali and Hammour (1993): Cholesky identification scheme
  - Demand shocks have long-run effects
  - Negative shocks increase productivity in the long run

# What kind of demand shocks generate hysteresis effects?

- Monetary policy shocks (Jorda, Singh and Taylor, 2019)
- Fiscal shocks (Fatas and Summers, 2018)
- Financial shocks (Guerron-Quintana and Jinnai, 2019)

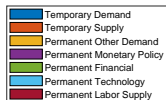
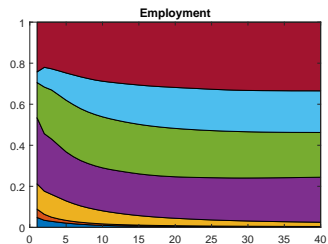
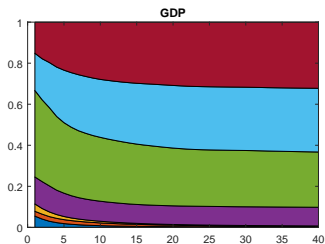
# Extending the model to 7 variables and 7 shocks

- Extend the benchmark model to include:
  - Real wages
  - Fed funds rate/shadow rate (Wu and Xia, 2016)
  - Participation rate
- 5 shocks with potentially permanent effects on output
  - 3 demand shocks:
    - Monetary policy shock
    - Financial shock
    - Other demand shocks
  - 2 supply shocks:
    - Technology shock
    - Labor supply shock
- 2 shocks with temporary effects on output
  - Demand shock
  - Supply shock

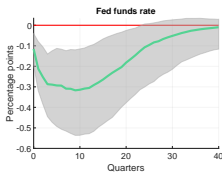
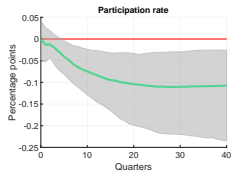
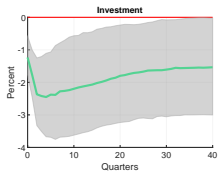
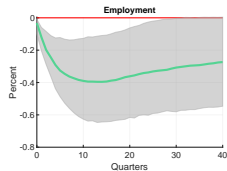
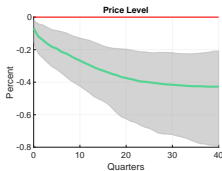
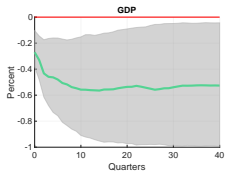
# Identification

	Demand - permanent			Supply - permanent		Demand - temp.		Supply - temp.	
	Other demand	Monetary policy	Financial	Tech.	Labor supply	Demand - temp.		Supply - temp.	
	Short-term	Short-term	Short-term	Short-term	Short-term	Short-term	Long-term	Short-term	Long-term
GDP	-	-	-	-	-	-	0	-	0
Inflation	-	-	-	+	+	-		+	
Employment							0		
Investment/GDP	+		-						0
Fed funds rate	-	+	-						
Real wage				-	+				

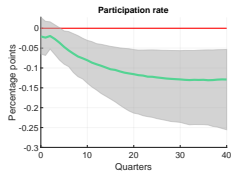
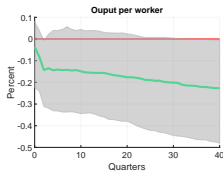
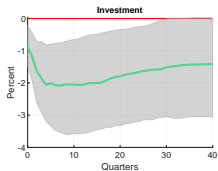
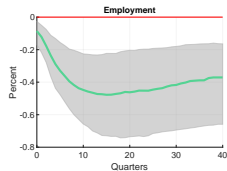
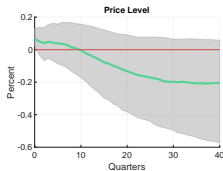
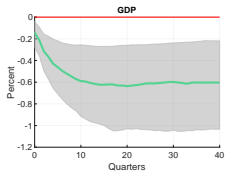
# Variance decomposition



# A financial shock with permanent effect on output

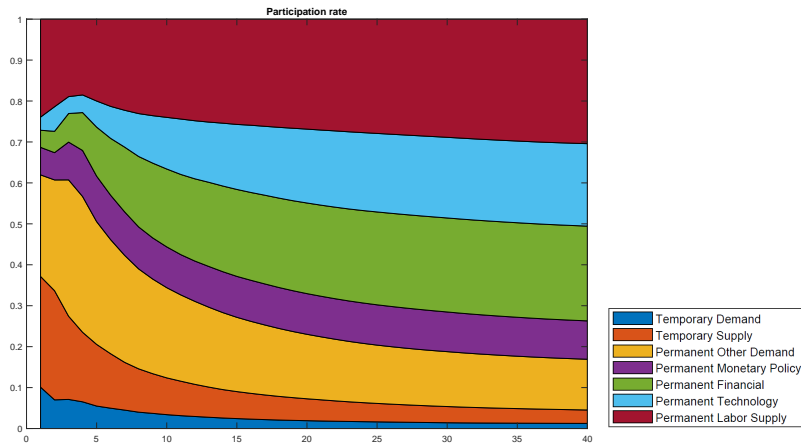


# A labor supply shock with permanent effect on output





# Variance decomposition: Participation rate

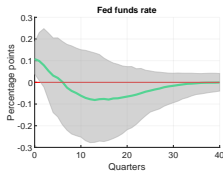
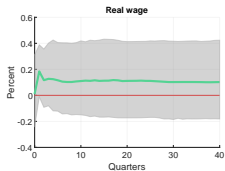
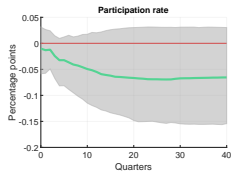
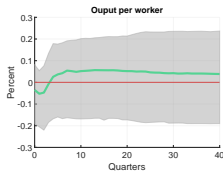
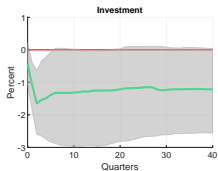
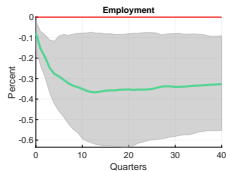
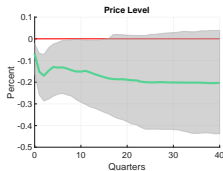
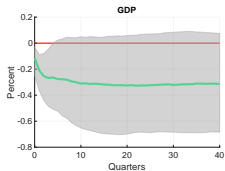


# Conclusion

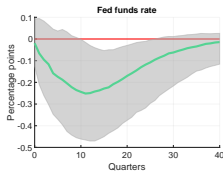
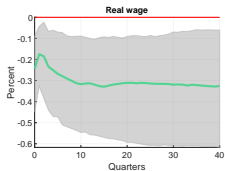
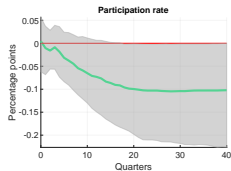
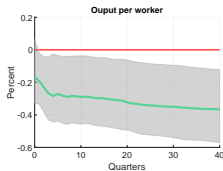
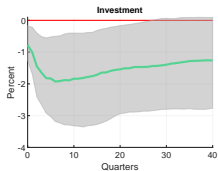
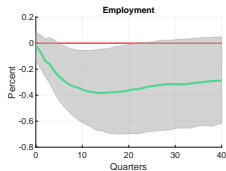
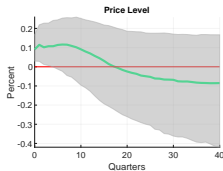
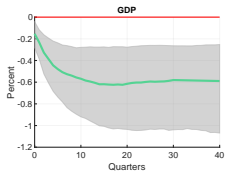
- We identify demand shocks that have sizeable long lasting effects on output
- These shocks affect output primarily through the employment channel
- In a larger model, financial shocks seem to explain a significant amount of the variation in output, employment and labor productivity in the longer term
- Implications for policy: overshooting of inflation (Rudebusch and Williams, 2016) , "run the economy hot" to reverse the damage caused by high unemployment (Yellen, 2016)

# EXTRA

# A monetary policy shock with permanent effect on output



# A technology shock with permanent effect on output



- GDP: Real Gross Domestic Product, Billions of Chained 2012 Dollars, Quarterly, Seasonally Adjusted Annual Rate
- Population: Population, Thousands, Monthly, Not Seasonally Adjusted
- Inflation: Personal consumption expenditures (implicit price deflator), Index 2012=100, Quarterly, Seasonally Adjusted
- Employment: All Employees: Total Nonfarm Payrolls, Thousands of Persons, Monthly, Seasonally Adjusted
- Investment: Real Gross Private Domestic Investment, Billions of Chained 2012 Dollars, Quarterly, Seasonally Adjusted Annual Rate
- R&D investment: Real Gross Domestic Product: Research and Development, Billions of Chained 2012 Dollars, Quarterly, Seasonally Adjusted Annual Rate
- Participation rate: Civilian Labor Force Participation Rate, Percent, Monthly, Seasonally Adjusted
- Unemployment rate: Civilian Unemployment Rate, Percent, Monthly, Seasonally Adjusted
- Long-term unemployed: Civilians Unemployed for 27 Weeks and Over, Thousands of Persons, Monthly, Seasonally Adjusted
- Real wage: Employed full time: Median usual weekly real earnings: Wage and salary workers: 16 years and over, 1982-84 CPI Adjusted Dollars, Quarterly, Seasonally Adjusted
- Fed funds rate: Effective Federal Funds Rate, Percent, Monthly, Not Seasonally Adjusted