Non Inflationary Business Cycles

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New Directions for Inflation Forecasting Paris

Most of the material is taken from joint projects with Paul Beaudry, Dana Galizia and Sev Hou.

Some material is preliminary or speculative

References

- Putting the Cycle Back into Business Cycle Analysis, 2020, Paul Beaudry, Dana Galizia and Franck Portier, American Economic Review, Vol. 110, no 1, pp 1-47
- Duration dependence in US expansions: A re-examination of the evidence, 2019, Paul Beaudry and Franck Portier, Economics Letters, Volume 183, October.
- The Instability of Market Economies, 2018, in Wither The Economy, and Franck Portier, Revue de l'OFCE, No 155, pages 225-33
- Is the Macroeconomy Locally Unstable and Why Should We Care?, 2016, Paul Beaudry, Dana Galizia and Franck Portier, NBER Macroeconomics Annual, University of Chicago Press, vol. 30
- Understanding Noninflationary Demand-Driven Business Cycles, 2014, P. Beaudry and Franck Portier, NBER Macroeconomics Annual, University of Chicago Press, vol. 28(1), pages 69 -130.

0. Motivations

- I don't know much about *inflation forecasting*.
- Here I will discuss of the link between inflation and the business cycle.
- My point is that, contrarily to what "Keynesian PHILLIPS curve" analysis suggests, there is not much connection between the business cycle and inflation.
- Nothing here about the current inflation upsurge, that has to my opinion not much to do with "normal" business cycles.
- (I will almost exclusively look at US data)

Roadmap

1. The Cyclicality of the Business Cycle
2. Inflation Cycles are not at Business Cycle Frequencies
3. The Trouble with Inflation in New Keynesian Models
4. A Cost Channel View of Inflation

Roadmap

1. The Cyclicality of the Business Cycle
2. Inflation Cycles are not at Business Cycle Frequencies
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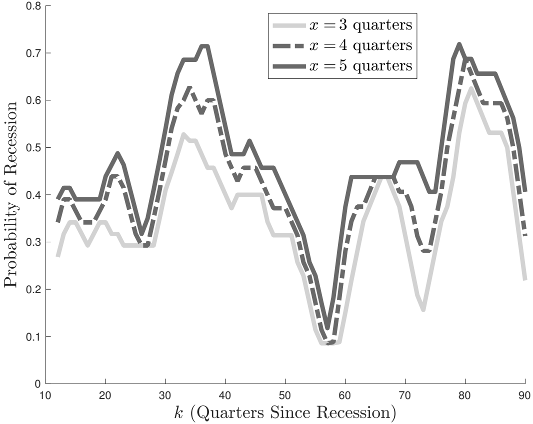
4. A Cost Channel View of Inflation

1. The Cyclicality of the Business Cycle

- Cycles are "recurrent movements in economic activity"
- Booms and busts
- Can be thought as the consequence of shocks hitting an otherwise stable economy...
- ... Or as the very indication that that market (capitalist) economies are intrinsically unstable.
- Let's try to see what's in the data.
- Start with the NBER series of 1 and 0 for expansions and recessions.
- Compute the probability of being in a recession in k quarters *conditional* on being in a recession today.

1. The Cyclicality of the Business Cycle

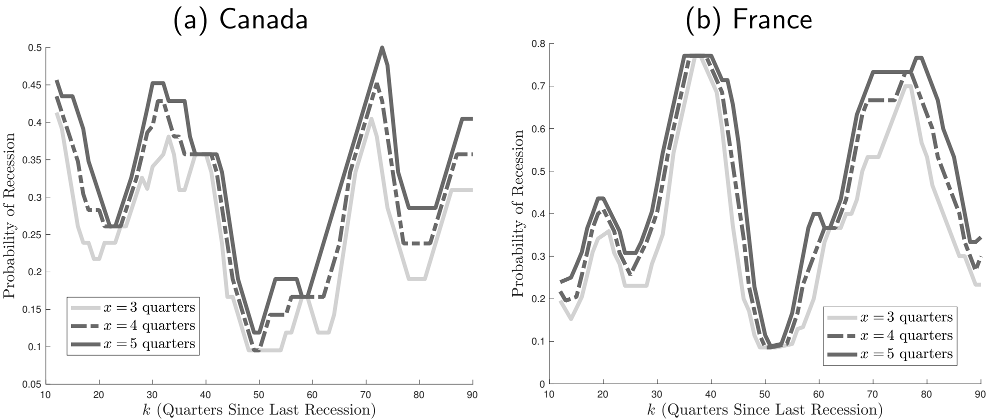
Figure 1: Conditional Probability of Being in a Recession (US)



Notes: This shows the fraction of time the economy was in a recession within an x-quarter window around time $t + k$, conditional on being in a recession at time t, where x is allowed to vary between 3 and 5 quarters.

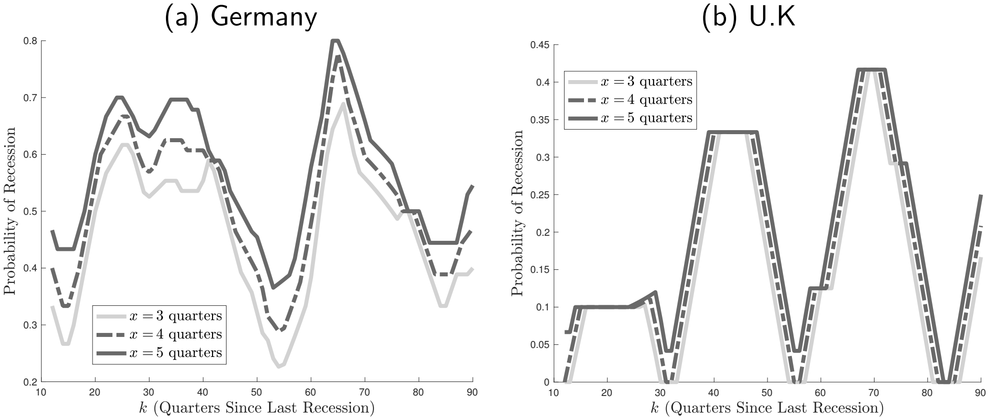
1. The Cyclicality of the Business Cycle

Figure 2: Conditional Probability of Being in a Recession



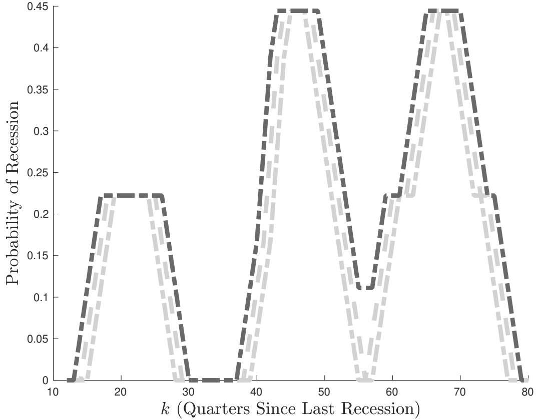
1. The Cyclicality of the Business Cycle

Figure 3: Conditional Probability of Being in a Recession



1. The Cyclicality of the Business Cycle

Figure 4: Conditional Probability of Being in a Recession (France, Comité de Datation des Cycles de l'Économie Française de l'AFSE)



1. The Cyclicality of the Business Cycle

- What is meant by cyclicality?
  - If activity is high today,
  - at say $N/2$ period in the future, economic activity is expected to be low (below trend),
  - and then at N expected to be high again and so on.
- This translates in cyclicality in the auto-covariance or equivalently in peaks in the spectral density.
- Note: *nothing deterministic* about this definition, its only about conditional expectations.
- Different from the more standard "auto-regressive" (AR(1)) view.
  - If activity is high today,
  - we expect it to return to mean.

Figure 5: Absence of Cyclicality

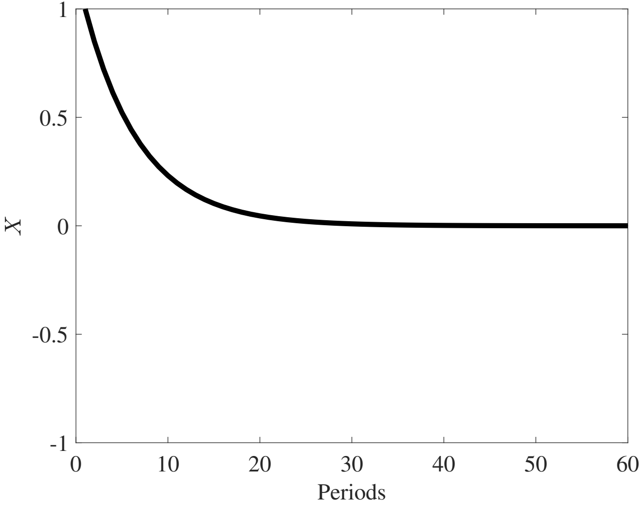


Figure 6: Cyclicality

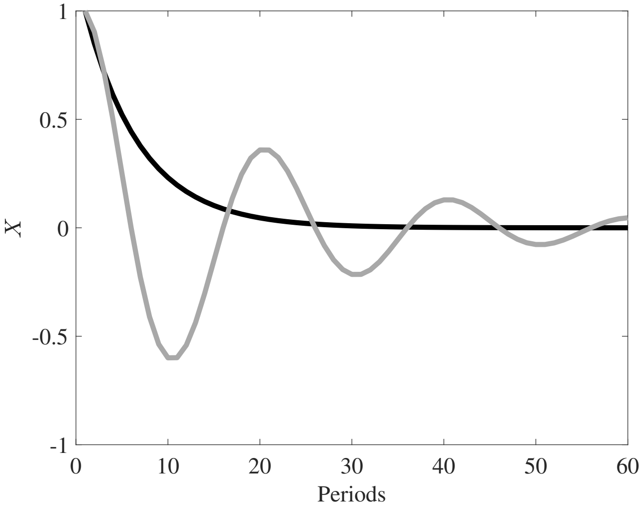
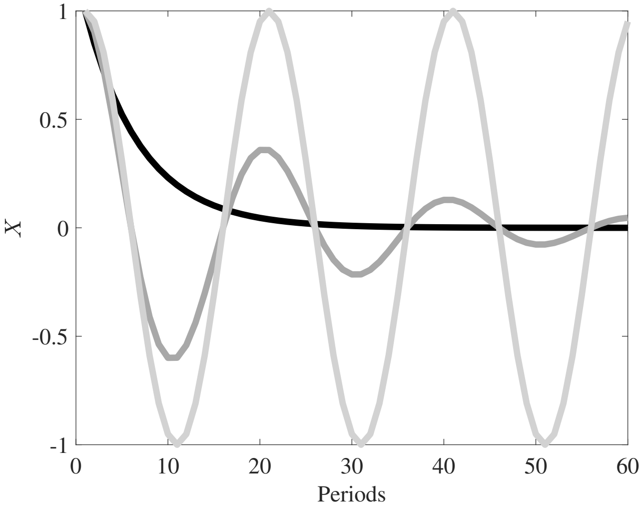


Figure 7: “Strong” Cyclicality



- The two views differ on whether or not we should worry about big booms.
- Janet Yellen, Dec. 2015 " *... I think it's a myth that expansions die of old age. I do not think they die of old age. So the fact that this has been quite a long expansion doesn't lead me to believe that ... its days are numbered.*"
- See also Diebold & Rudebusch
- In a cyclical world, expansions do die of old age.

Figure 8: Prob. of an expansion ending the next year, year and a half or the next two years

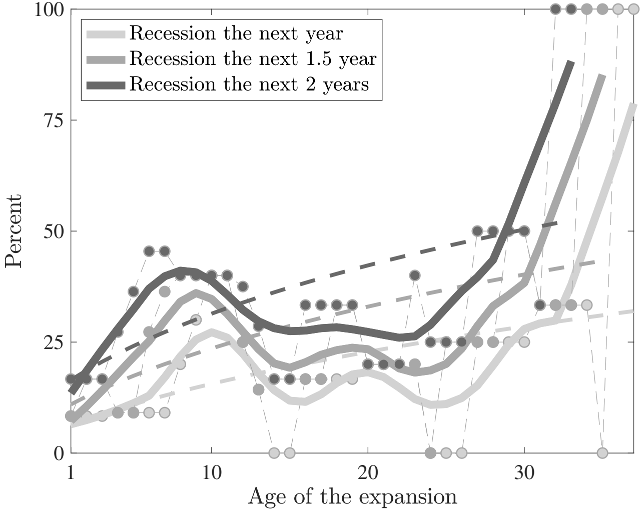


Figure 9: A successful forecast ☺

The next US recession is likely to be around the corner

Franck Portier 03 May 2019

Business economists argue that the length of an expansion is a good indicator of when a recession will hit. Using both parametric and non-parametric measures, this column finds strong support for the theory from post-WWII data on the US economy. The findings suggest there is good reason to expect a US recession in the next two years.

This summer, the current US expansion, which started in June 2009, is likely to break the historical post-WWII record of 120 months long, which is currently held by the March 1991-March 2001 expansion. It is already longer than the post-WWII average of 58 months. Should we be worried? Is the next recession around the corner?

Yes, according to business economists. For example, according to the semi-annual National Association for Business Economics survey released last February, three-quarters of the panellists expect an economic recession by the end of 2021. While only 10% of panellists expect a recession in 2019, 42% say a recession will happen in 2020, and 25% expect one in 2021.

Related

The slope of the term structure and recessions in the UK
Terence Mills, Forrest Capie, Charles Goodhart

Predicting recessions using term spread at the zero lower bound
Ralf Fendel, Nicola Mai, Oliver Mohr

The term structure and recessions before the Fed
Stefan Gerlach, Rebecca Stuart

Franck Portier
Professor, University College London and CEPR Research Fellow

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Events

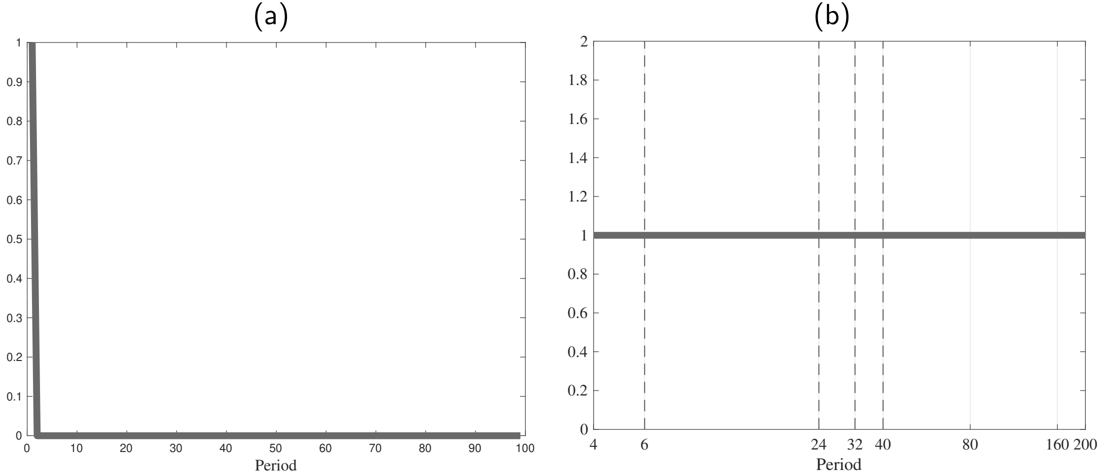
Online book launch: Procurement in Focus: Rules, Discretion, and

- A way to look at cyclicality is to look at spectral density
- Spectral density tells us the share of the total variance of a series that is accounted by a sine wave of different periodicities.

1. The Cyclicality of the Business Cycle

$x_t = \varepsilon_t$

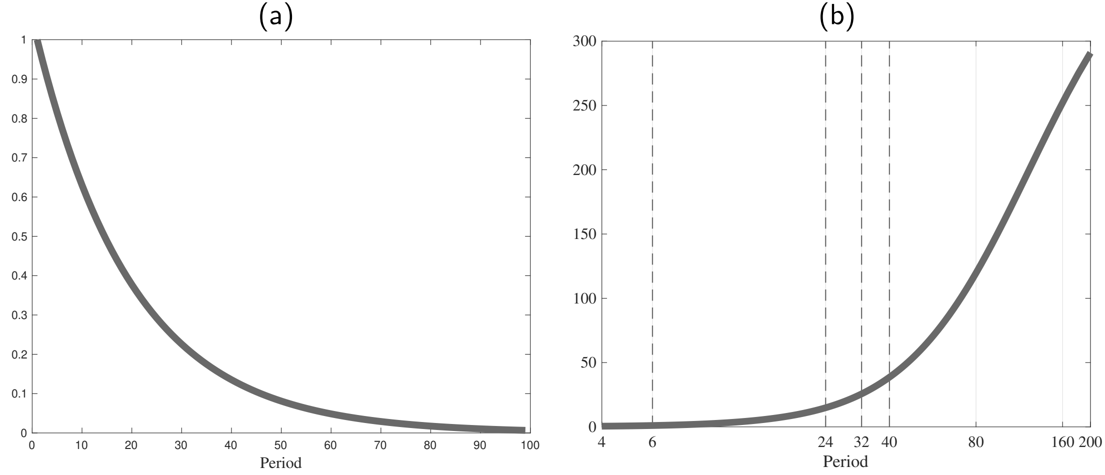
Figure 10: (a) IRF and (b) Spectrum



1. The Cyclicality of the Business Cycle

$x_t = .95x_{t-1} + \varepsilon_t$

Figure 11: (a) IRF and (b) Spectrum



1. The Cyclicality of the Business Cycle

$x_t = 1.92x_{t-1} - .95x_{t-2} + \varepsilon_t$

Figure 12: (a) IRF and (b) Spectrum

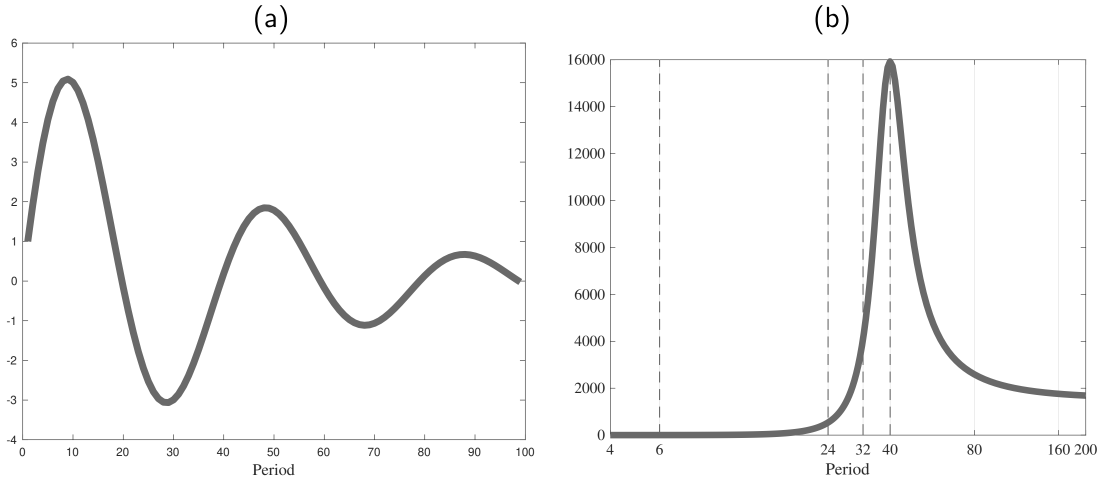


Figure 13: Conventional Wisdom-Granger [1969]

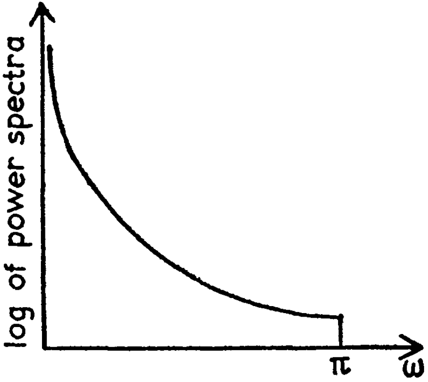


FIGURE 1.—Typical spectral shape.

Figure 14: Conventional Wisdom-Granger [1969]

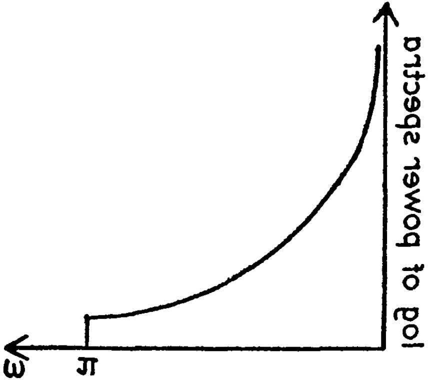
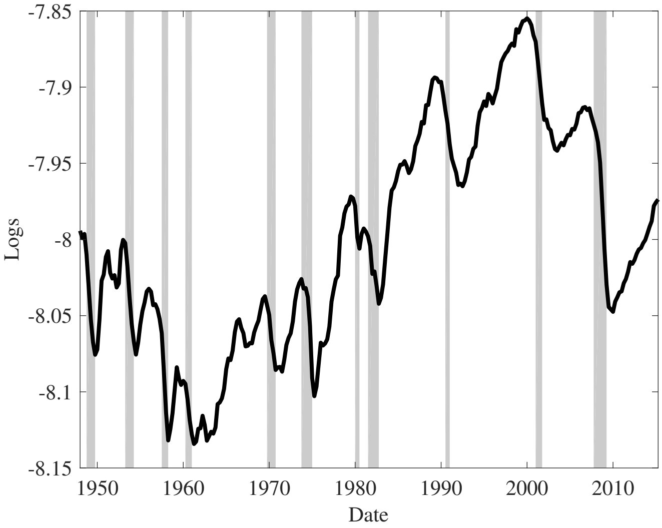


FIGURE 1.—Typical spectral shape.

- Estimating spectral density requires stationary series $\rightsquigarrow$ *not output*, unless filtered (but how?)
- Key idea: Look at “stationary” (at least not obviously trending) series
- Hours per capita, unemployment, spreads, capacity utilization rates, investment/output ratio, etc...

Figure 15: Non-Farm Business (NFB) Hours Per Capita



1. The Cyclicality of the Business Cycle

Figure 16: Non Farm Business Hours per Capita Spectrum

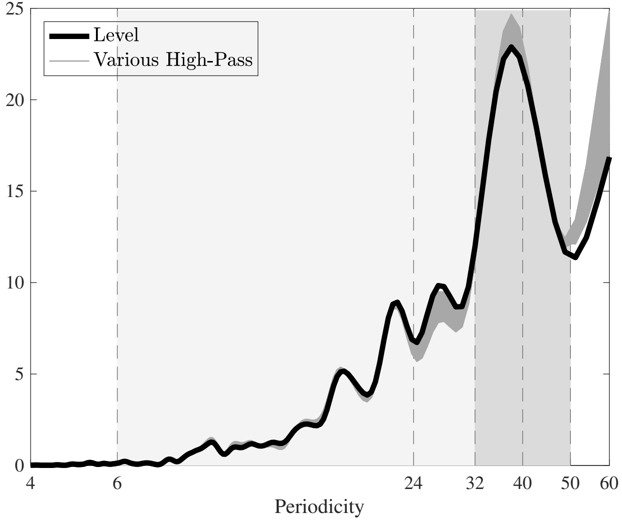
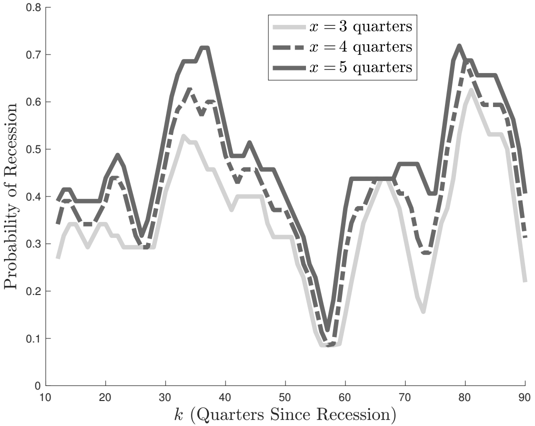


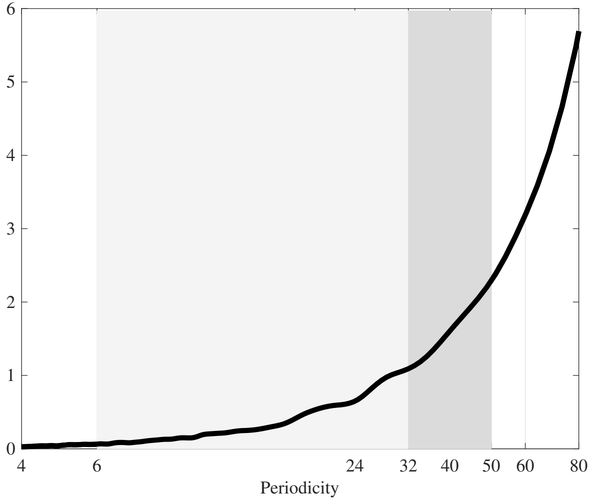
Figure 17: Conditional Probability of Being in a Recession (US)



Notes: This shows the fraction of time the economy was in a recession within an x-quarter window around time $t+k$, conditional on being in a recession at time t, where x is allowed to vary between 3 and 5 quarters.

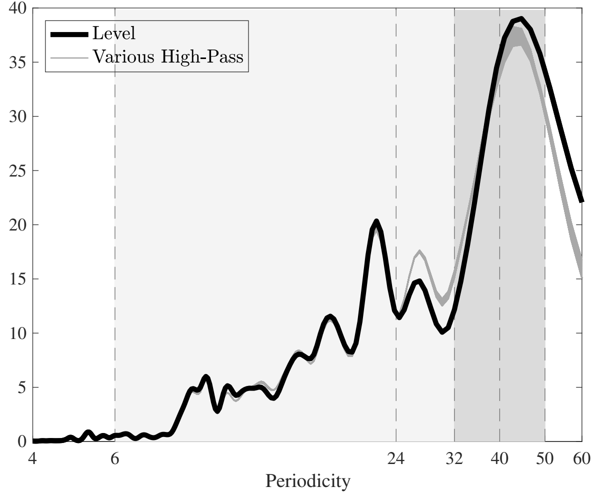
1. The Cyclicality of the Business Cycle

Hours Spectrum in Smets & Wouters' Model



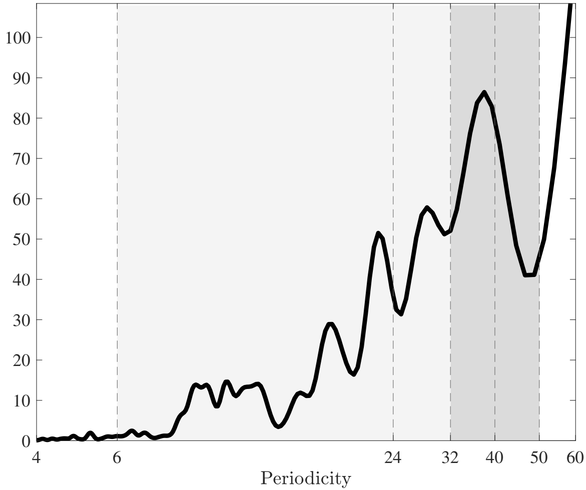
1. The Cyclicality of the Business Cycle

Capacity Utilization Spectrum



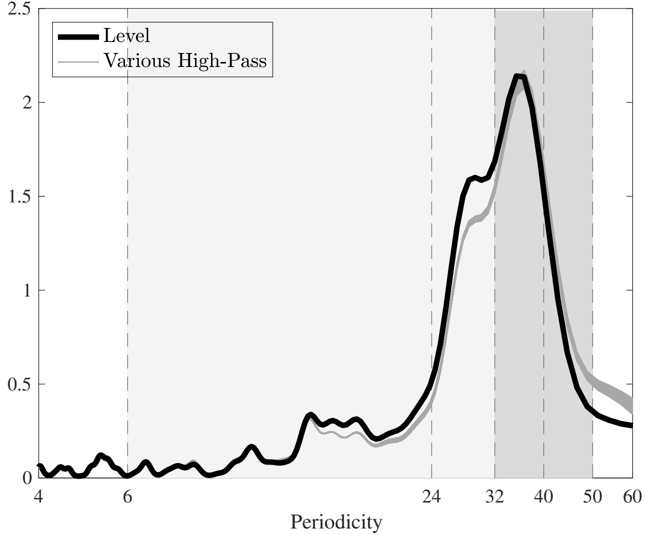
1. The Cyclicality of the Business Cycle

Investment-Output ratio



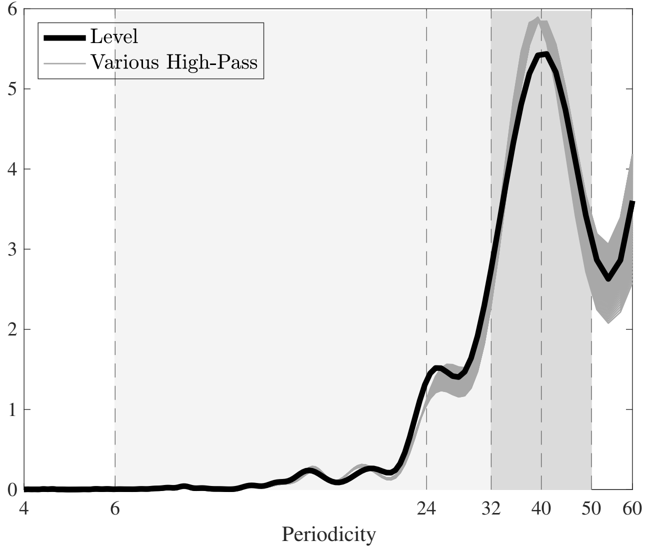
1. The Cyclicality of the Business Cycle

Chicago Fed National Financial Conditions Index



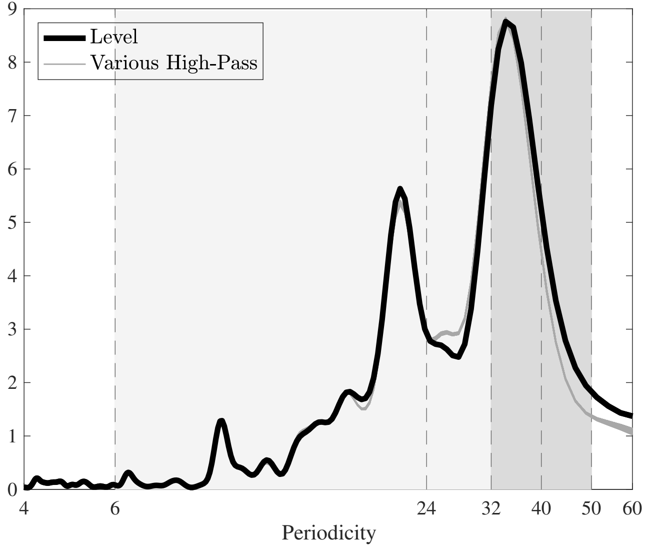
1. The Cyclicality of the Business Cycle

Delinquency Rate



1. The Cyclicality of the Business Cycle

Spread (BBA bonds-FFR)



1. The Cyclicality of the Business Cycle
A forecasting model

- This suggests a specific way of looking at the data
- h: Total Hours Worked per Capita, U.S.A., 1960-2015
- High-Pass Filtered, 80 quarters
- "Minimal" model

$$\begin{cases} h_t &= \alpha_0 + \alpha_1 h_{t-1} + \alpha_2 h_{t-2} + \alpha_3 H_{t-1} + \alpha_4 h_{t-1}^3 + \varepsilon_t \\ H_t &= \sum_{j=0}^{N} (1-\delta)^j h_{t-j} \end{cases}$$

$$\begin{cases} h_t &= -0.00 + 1.42\ h_{t-1} - 0.48\ h_{t-2}, \\ h_t &= -0.01 + 1.31\ h_{t-1} - 0.34\ h_{t-2} - 0.25\ H_{t-1}, \\ h_t &= -0.02 + 1.39\ h_{t-1} - 0.34\ h_{t-2} - 0.27\ H_{t-1} - 0.01\ h_{t-1}^3. \end{cases}$$

- "Minimal" Non-linear model
- Non-linear term is significant
- Non-linear term enters with a *minus*
-

	$AR(2)$	H Linear	H Non-linear
R^2	0.94	0.94	0.94
Max eig.	0.86	0.96	1.01

- R^2 is not much improved
- But max eigenvalue (in modulus) crosses 1 with the nonlinear term
- SS is unique, unstable

1. The Cyclicality of the Business Cycle
Estimated Reduced Form - Hours

Figure 18: The Limit Cycle - Simulation as of $T_0 = 1961$

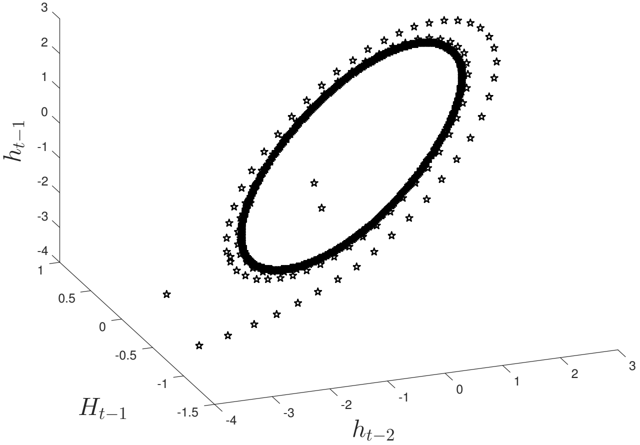


Figure 19: The Limit Cycle

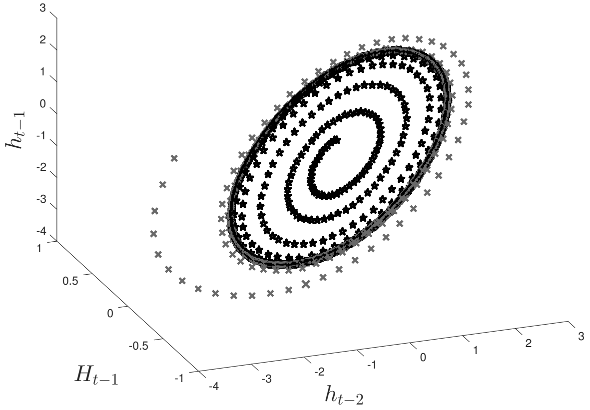
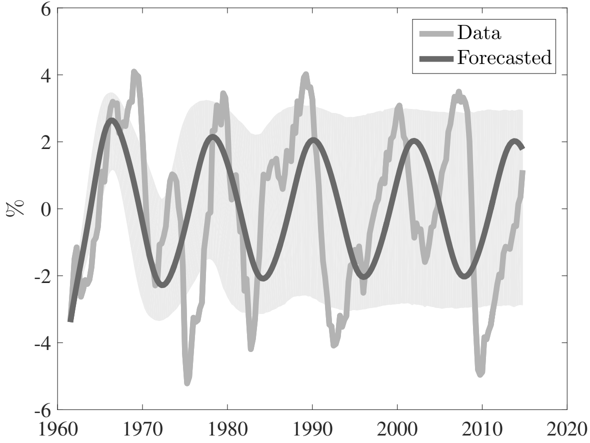


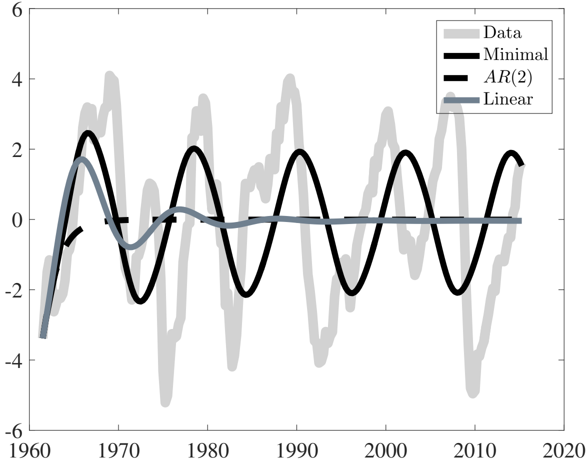
Figure 20: Forecasted Path as of 1961Q3 with the Minimal Model, Total Hours



1. The Cyclicality of the Business Cycle

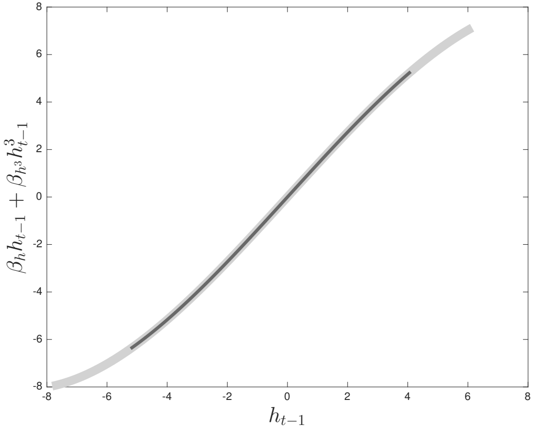
Estimated Reduced Form - Hours

Figure 21: Forecasted Path as of 1961Q3, Total Hours



1. The Cyclicality of the Business Cycle
Estimated Reduced Form - Hours

Figure 22: Nonlinearities in the Minimal Model, Total Hours



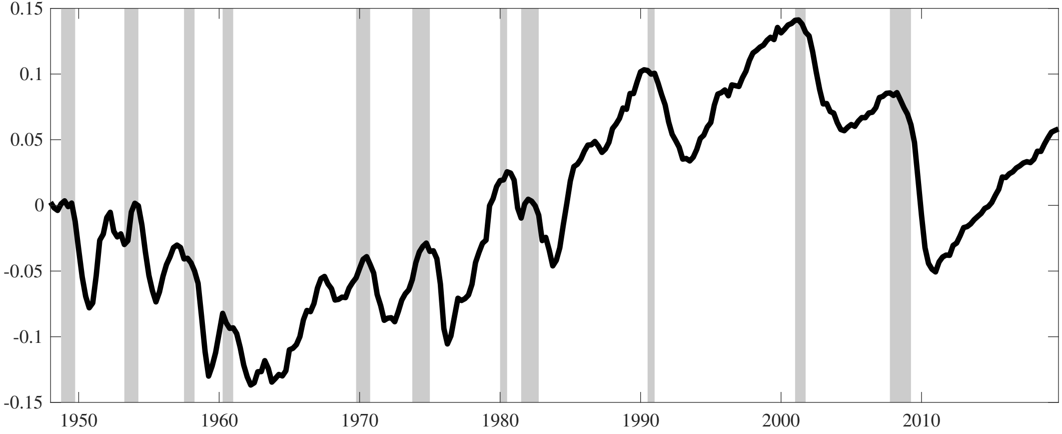
$$h_t = -0.02 + 1.39\ h_{t-1} - .34\ h_{t-2} - .27 H_t - .01\ h_{t-1}^3 + \epsilon_t$$

Roadmap

1. The Cyclicality of the Business Cycle
2. Inflation Cycles are not at Business Cycle Frequencies
3. The Trouble with Inflation in New Keynesian Models
4. A Cost Channel View of Inflation

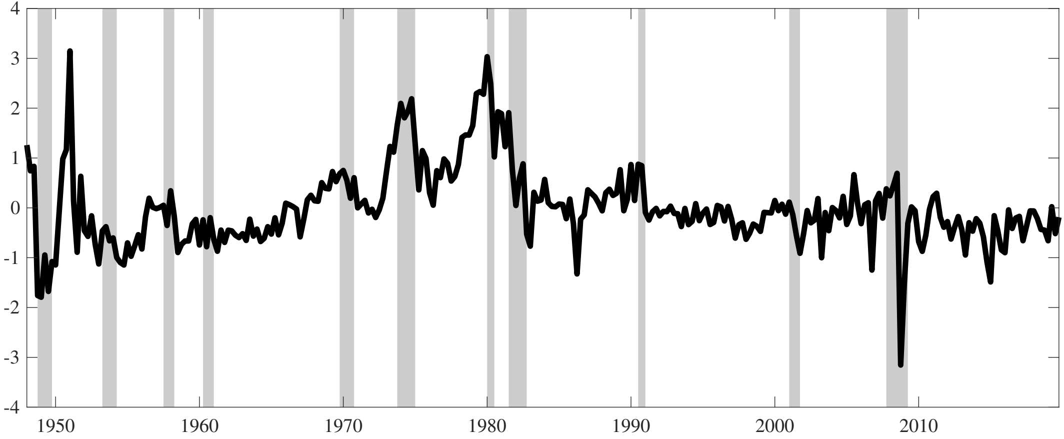
2. Inflation Cycles are not at Business Cycle Frequencies

Figure 23: Hours



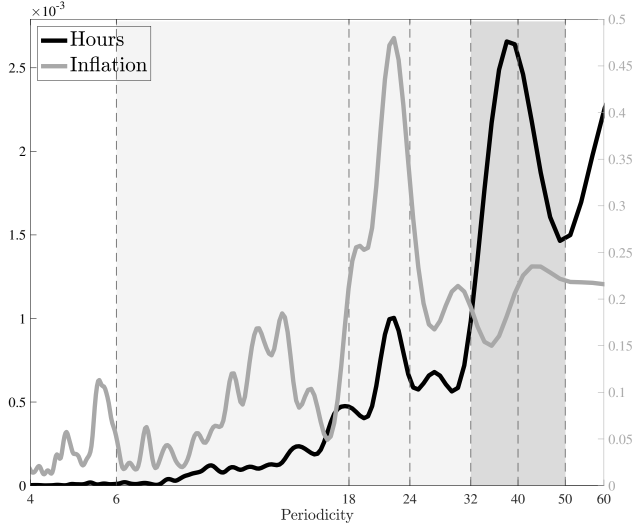
2. Inflation Cycles are not at Business Cycle Frequencies

Figure 24: Inflation (CPI)



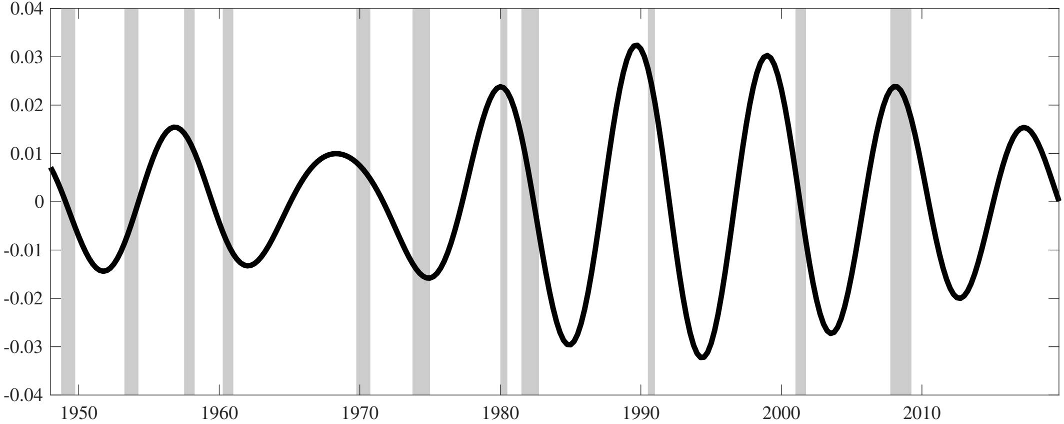
2. Inflation Cycles are not at Business Cycle Frequencies

Figure 25: Spectral Density of Hours and Inflation



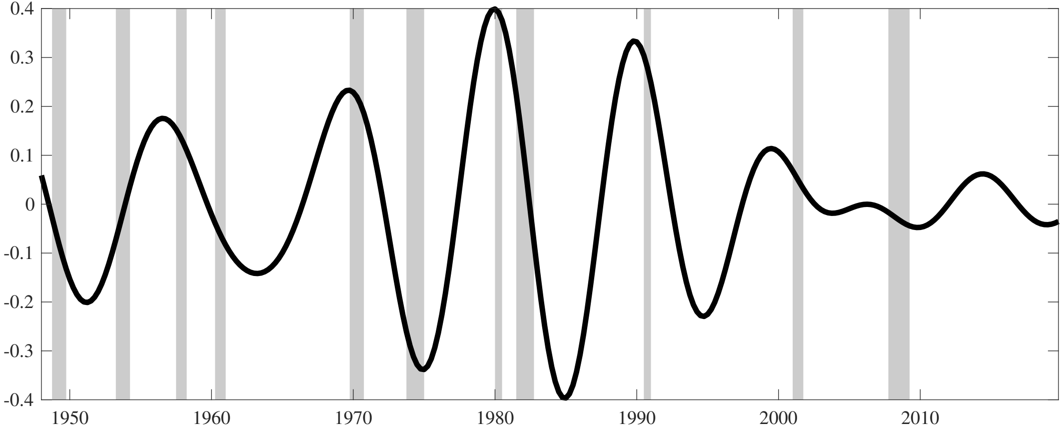
2. Inflation Cycles are not at Business Cycle Frequencies

Figure 26: Hours - Bandpass (32-50)



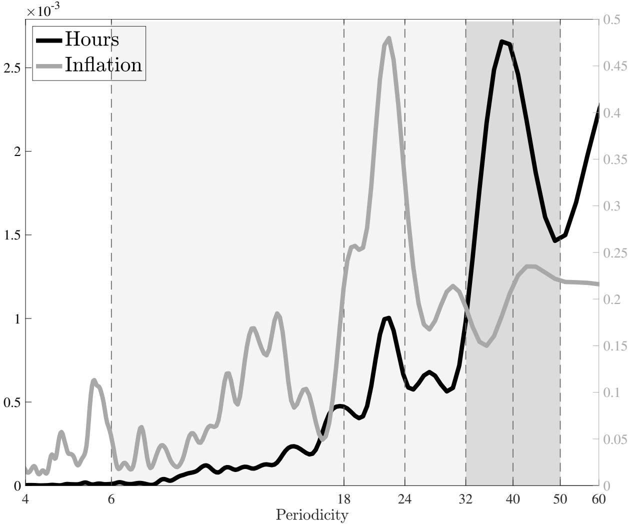
2. Inflation Cycles are not at Business Cycle Frequencies

Figure 27: Inflation - Bandpass (32-50)



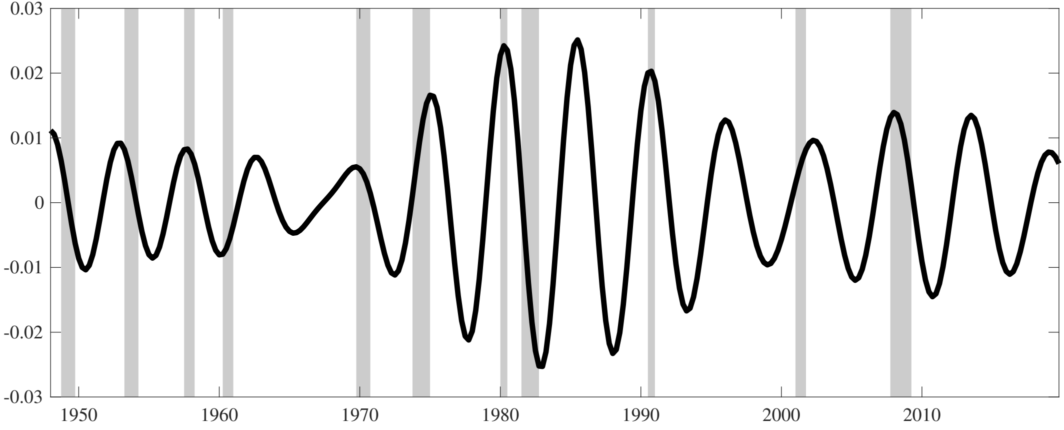
2. Inflation Cycles are not at Business Cycle Frequencies

Figure 28: Spectral Density of Hours and Inflation



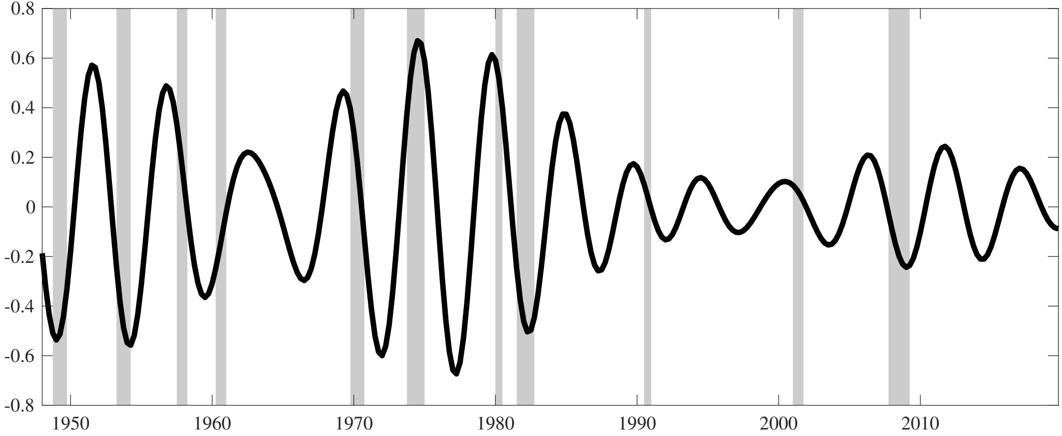
2. Inflation Cycles are not at Business Cycle Frequencies

Figure 29: Hours - Bandpass (18-26)



2. Inflation Cycles are not at Business Cycle Frequencies

Figure 30: Inflation - Bandpass (18-26)



2. Inflation Cycles are not at Business Cycle Frequencies

- The bulk of inflation is not at Business Cycle frequency
- Inflation does not comove much with hours at its peak frequency

	18-26 Q	32-50 Q
V. of hours	100	230
V. of inflation	100	36
Correlation	.39	.75

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3. The Trouble with Inflation in New Keynesian Models

- New Keynesian Model is the core narrative of inflation fluctuations at BC frequencies.
- Output moves because the output gap moves (demand shocks), and inflation moves because of the Phillips curve.
- The core NK model is quantitatively off target.
- Take the Jordi Galí's textbook New Phillips curve

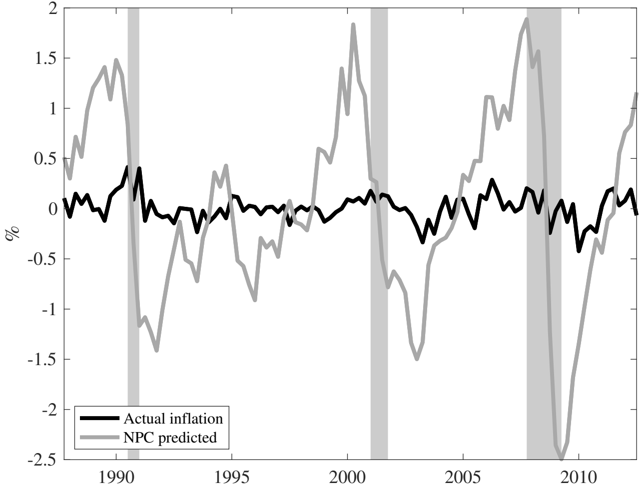
$$\pi_t = \beta E_t \pi_{t+1} + \kappa \widetilde{y}_t + u_t$$

- Assume that the output gap is AR(1) with persistence ρ and solve forward.

$$\pi_t = \frac{\kappa}{1-\beta\rho} \widetilde{y}_t + u_t$$

- Take Galí's textbook calibration (including a mean duration of prices of 3 quarters).
- Assume that the output gap is measured by the HP cycle of output.
- Feed it into this last equation and deduct the implied inflation, killing cost-push shocks.

3. The Trouble with Inflation in New Keynesian Models



- Post Volcker, NPC implies that s.d. of inflation is **350%** of the actual one

3. The Trouble with Inflation in New Keynesian Models

- Estimated models "solve" the problem by having big and countercyclical "markup shocks".
- I believe it rather suggests the absence of a PHILLIPS Curve.
- It makes it difficult to understand inflation and the effect of monetary policy.
- Need to augment the PHILLIPS curve

Roadmap

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- Theoretical exploration of a model in which the PHILLIPS curve of the type

$$y_t = E_t[y_{t+1}] - \alpha_r \underbrace{(i_t - E_t[\pi_{t+1}])}_{r_t} + d_t \qquad \text{Euler Equation (EE)}$$

$$\pi_t = \beta E_t[\pi_{t+1}] + \underbrace{(\gamma_y y_t + \gamma_r (i_t - E_t \pi_{t+1}))}_{\text{“marginal cost”}} + \mu_t \qquad \text{PHILLIPS Curve (PC)}$$

- We find interesting theoretical results when "γ_y is small as compared to γ_r"
- In that case, the direct effect on π of increasing i dominates the indirect effect (through discouraged demand along the Euler equation $\rightsquigarrow$ Contractionary monetary policy increases inflation.

The ZLB Trap

- The ZLB is quasi inevitable following a persistent fall in demand.
  - Initial negative demand shock $\rightsquigarrow$
  - Low activity and low inflation $\rightsquigarrow$
  - Monetary expansion stimulus $\rightsquigarrow$
  - Lower i and lower inflation $\rightsquigarrow$
  - More monetary expansion $\rightsquigarrow$
  - Even lower i $\rightsquigarrow$
  - Hit the zero lower bound.
- Typically what will happen under price level targeting

4. A Cost Channel View of Inflation

$$\pi_t = \beta E_t[\pi_{t+1}] + \left(\gamma_y y_t + \gamma_r (i_t - E_t[\pi_{t+1}])\right)$$

- ... but is "γ_y is small as compared to γ_r" empirically relevant?

- Careful limited information estimation of a PHILLIPS curve of the type

$$\pi_t = \beta E_t[\pi_{t+1}] + \Big(\gamma_y y_t + \gamma_r (i_t - E_t[\pi_{t+1}])\Big)$$

- Result: $\gamma_y \approx 0$, $\gamma_r > 0$

- Full information estimation of an extended NK model with a Phillips curve of the type

$$\pi_t = \beta E_t[\pi_{t+1}] + \kappa\Big(\gamma_y y_t + \gamma_r(i_t - E_t[\pi_{t+1}])\Big)$$

- Result: $\gamma_y \approx 0$ and $\gamma_r > 0$

$$\pi_t = \beta\pi^e_{t+1} + \gamma_y x_t + \gamma_r(i_t - \pi^e_{t+1}) + \theta z_t + \mu_t$$

- π_t: Headline CPI
- π^e_t: University of Michigan Survey of Consumers
- x_t: *minus* Unemployment gap from U.S. Congressional Budget Office
- z_t: Oil price

$$\pi_t = \beta\pi^e_{t+1} + \gamma_y x_t + \gamma_r(i_t - \pi^e_{t+1}) + \theta z_t + \mu_t$$

	OLS
β	$0.99^{\star\star\star}$
γ_y	$0.17^{\star\star\star}$
γ_r	

- × Controlling for oil price,
- × Sample: 1969Q1-2017Q4,
- × Newey & West correction for heteroskedasticity and autocorrelation,

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$$\pi_t = \beta\pi^e_{t+1} + \gamma_y x_t + \gamma_r(i_t - \pi^e_{t+1}) + \theta z_t + \mu_t$$

	OLS	IV gap
β	$0.99^{\star\star\star}$	$0.98^{\star\star\star}$
γ_y	$0.17^{\star\star\star}$	$0.15^{\star\star}$
γ_r		

- × Controlling for oil price,
- × Sample: 1969Q1-2017Q4,
- × Newey & West correction for heteroskedasticity and autocorrelation,
- × x_t instrumented with its two first lags ,

$$\pi_t = \beta \pi^e_{t+1} + \gamma_y x_t + \gamma_r (i_t - \pi^e_{t+1}) + \theta z_t + \mu_t$$

	OLS	IV gap	IV rate
β	$0.99^{\star\star\star}$	$0.98^{\star\star\star}$	$0.96^{\star\star\star}$
γ_y	$0.17^{\star\star\star}$	$0.15^{\star\star}$	-0.01
γ_r			$0.20^{\star\star\star}$

× Controlling for oil price,
× Sample: 1969Q1-2017Q4,
× Newey & West correction for heteroskedasticity and autocorrelation,
× x_t instrumented with its two first lags ,
× $i_t - \pi^e_{t+1}$ instrumented with 6 lags of Romer & Romer shocks and their square

$$\pi_t = \beta\pi^e_{t+1} + \gamma_y x_t + \gamma_r(i_t - \pi^e_{t+1}) + \theta z_t + \mu_t$$

	OLS	IV gap	IV rate	IV both
β	0.99***	0.98***	0.96***	0.95***
γ_y	0.17***	0.15**	-0.01	0.02
γ_r			0.20***	0.20***

× Controlling for oil price,
× Sample: 1969Q1-2017Q4,
× NEWEY & WEST correction for heteroskedasticity and autocorrelation,
× x_t and $i_t - \pi^e_{t+1}$ instrumented with two first lags of x and 6 lags of ROMER & ROMER shocks and their square

PHILLIPS Curve Estimation: also Instrumenting π^e

$$\pi_t = \beta\pi^e_{t+1} + \gamma_y x_t + \gamma_r(i_t - \pi^e_{t+1}) + \theta z_t + \mu_t$$

	Michigan Survey
β	0.96***
γ_y	0.04
γ_r	0.18***

- × Controlling for oil price,
- × Sample: 1969Q1-2017Q4,
- × NEWEY & WEST correction for heteroskedasticity and autocorrelation,
- × Instruments: two first lags of x_t, 6 lags of ROMER & ROMER [2004] shocks and their square, two lags of π_t

Phillips Curve Estimation: also Instrumenting π^e

$$\pi_t = \beta\pi^e_{t+1} + \gamma_y x_t + \gamma_r(i_t - \pi^e_{t+1}) + \theta z_t + \mu_t$$

	Michigan Survey	Rational Expectation
β	0.96***	0.86***
γ_y	0.04	0.04
γ_r	0.18***	0.22***

× Controlling for oil price,

× Sample: 1969Q1-2017Q4,

× Newey & West correction for heteroskedasticity and autocorrelation,

× Instruments: two first lags of x_t, 6 lags of Romer & Romer [2004] shocks and their square, two lags of π_t

4. A Cost Channel View of Inflation

Phillips Curve Estimation: Hybrid

$$\pi_t = \beta_{+1}\pi^e_{t+1} + \beta_{-1}\pi_{t-1} + \gamma_y x_t + \gamma_r(i_t - \pi^e_{t+1}) + \theta z_t + \mu_t$$

- We obtain similar results.

4. A Cost Channel View of Inflation

Phillips Curve Estimation: 1969–1992

- Period 1969–1992 is often thought to be a period with a steeper Phillips curve,
- We obtain similar results.

$$\pi_t = \beta\pi^e_{t+1} + \gamma_y x_t + \gamma_r(i_t - \pi^e_{t+1}) + \theta z_t + \mu_t$$

	OLS	IV gap	IV rate	IV both
β	0.83***	0.77***	1.13***	1.1***
γ_y	0.41**	0.49***	-0.16	-0.08
γ_r			0.30***	0.29***

× Controlling for oil price,
× Sample: 1969Q1-2017Q4,
× Instruments: two first lags of x and 6 lags of Romer & Romer [2004] shocks and their square