"Meet your lecturer" series

Cyclical Fluctuations

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- I am a Macro professor at UCL
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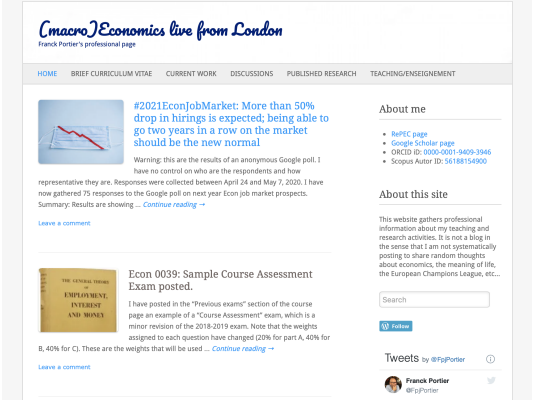
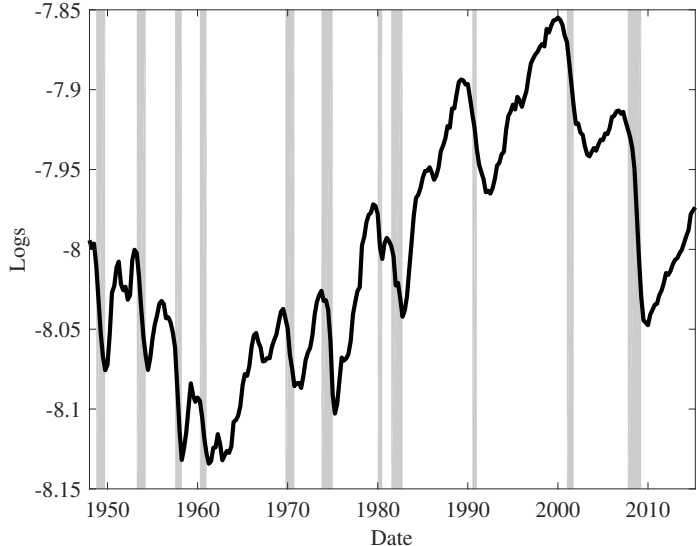


Based on my work with Paul Beaudry (now deputy-governor of the Bank of Canada) & Dana Galizia (now professor at Carleton University)

- The economy is quite cyclical *(to be defined)*
- This has implications for modelling and policy.

Figure 1: Cyclical fluctuations : U.S. Non-Farm Business Hours Per Capita



Roadmap

I. Cyclicality
II. Instability
III. Implications for Modelling and Policy

Roadmap

I. Cyclicality
II. Instability
III. Implications for Modelling and Policy

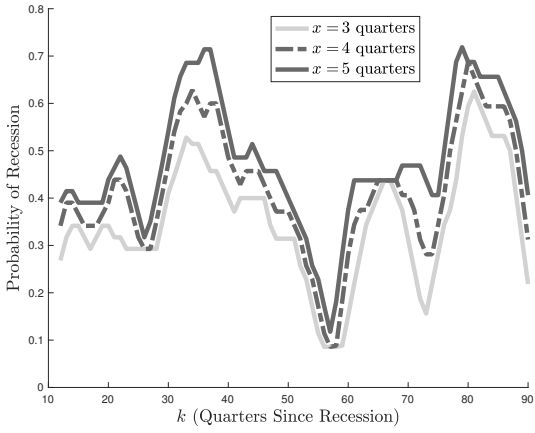
I. Cyclicality

Table 1: Recent U.S. Business Cycles, as identified by the NBER's Business Cycle Dating Committee

BUSINESS CYCLE REFERENCE DATES		DURATION IN MONTHS			
Peak	**Trough**	**Contraction**	**Expansion**	**Cycle**	
Quarterly dates are in parentheses		*Peak to Trough*	*Previous trough to this peak*	*Trough from Previous Trough*	*Peak from Previous Peak*
April 1960(II)	February 1961 (I)	10	24	34	32
December 1969(IV)	November 1970 (IV)	11	106	117	116
November 1973(IV)	March 1975 (I)	16	36	52	47
January 1980(I)	July 1980 (III)	6	58	64	74
July 1981(III)	November 1982 (IV)	16	12	28	18
July 1990(III)	March 1991(I)	8	92	100	108
March 2001(I)	November 2001 (IV)	8	120	128	128
December 2007 (IV)	June 2009 (II)	18	73	91	81

I. Cyclicality

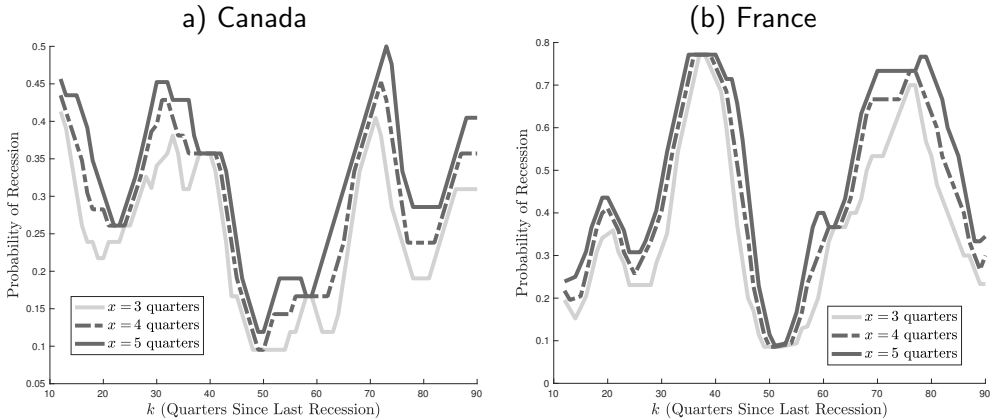
Conditional Probability of Being in a Recession (US)



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.

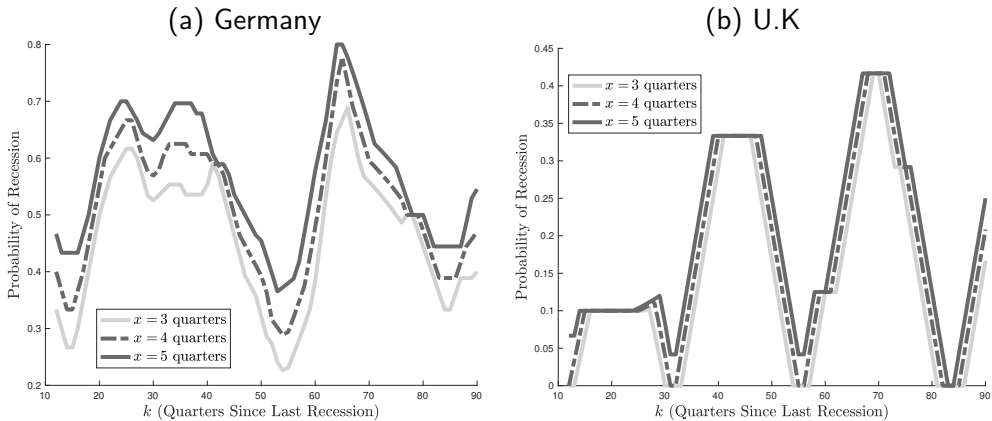
I. Cyclicality

Conditional Probability of Being in a Recession



I. Cyclicality

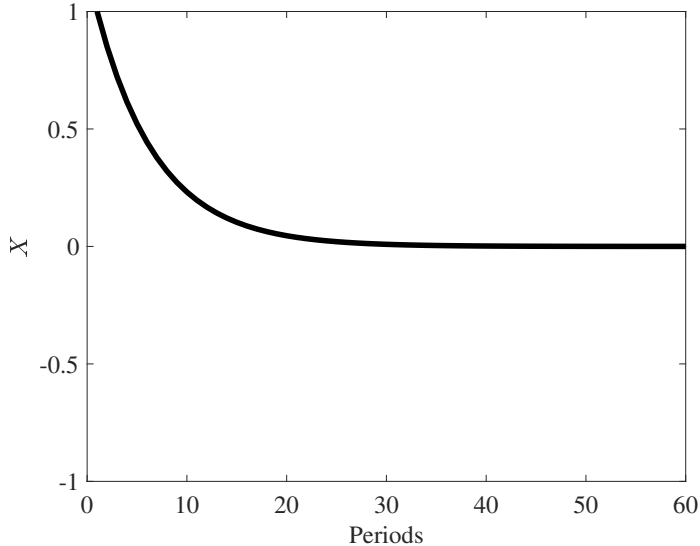
Conditional Probability of Being in a Recession



- I now can be more precise about what I mean by cyclicality
  - × If activity is high today,
  - × in, say, 20 periods in the future, economic activity is expected to be low,
  - × and then in 40 period expected to be high again and so on.
- Different from the more standard view (by standard, I mean in most macro models):
  - × If activity is high today,
  - × we expect it to return to the mean.
- The two views differ on whether or not we should worry about big booms.

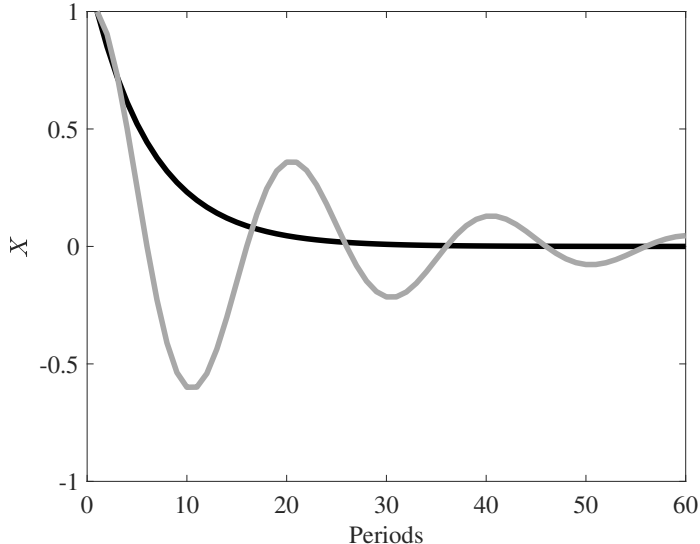
I. Cyclicality

Absence of Cyclicality



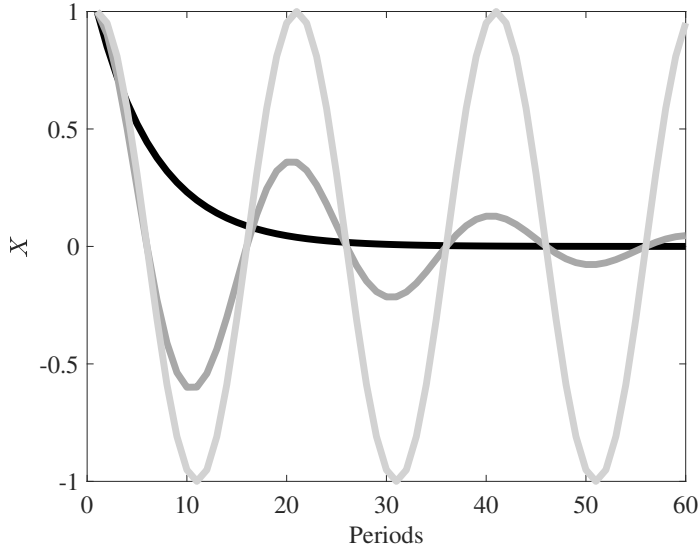
I. Cyclicality

Cyclicality



I. Cyclicality

"Strong" Cyclicality



- One way to check if there is cyclicality is to look for a peak in spectral density
- Spectral density:
  - × Decompose a series into a sum of sine waves of different periods
  - × Look at the weight of each sine wave in explaining the series fluctuations

Figure 2: Process: $x_t = \varepsilon_t$

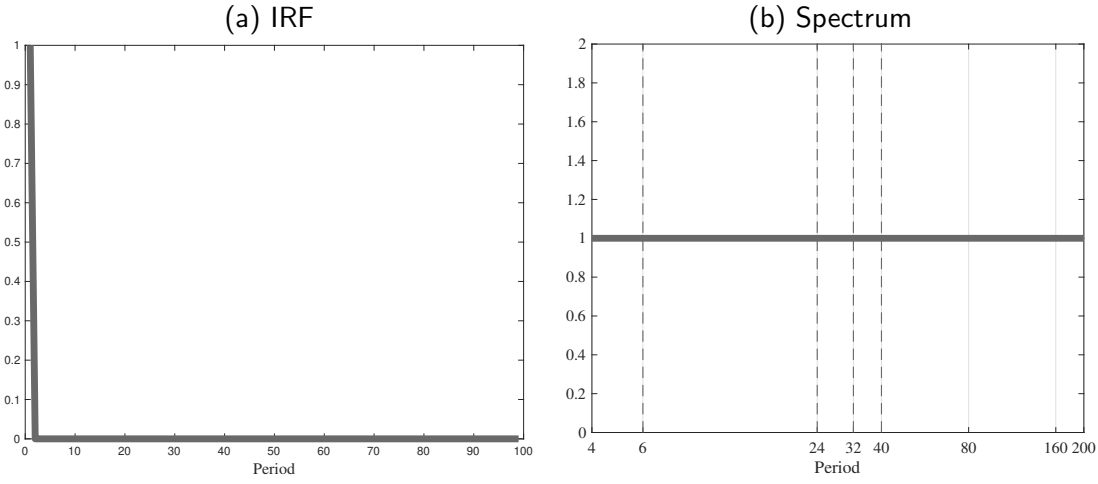


Figure 3: Process: $x_t = .95x_{t-1} + \varepsilon_t$

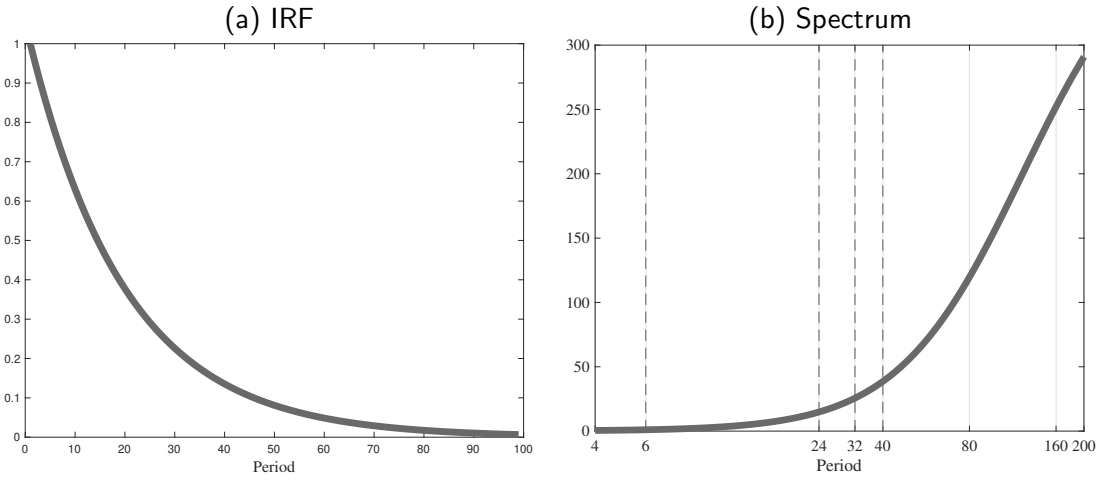
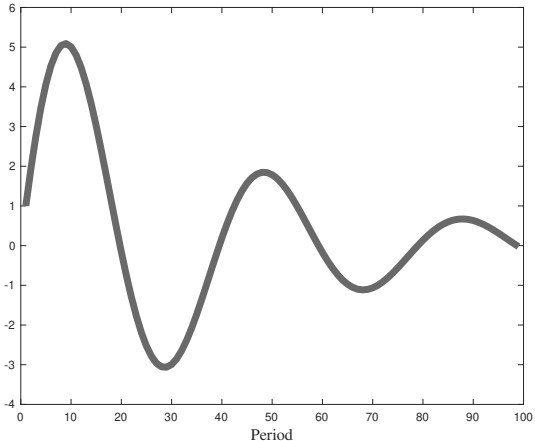
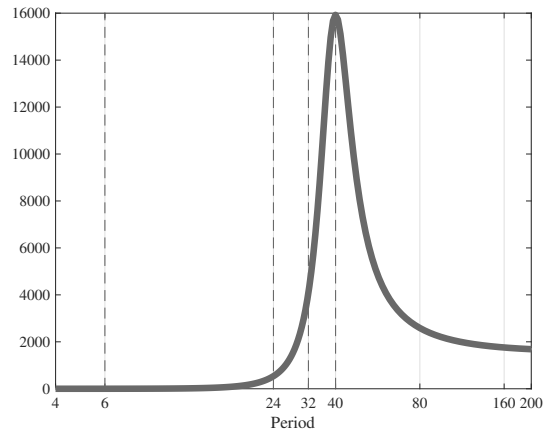


Figure 4: Process: $x_t = 1.92x_{t-1} - .95x_{t-2} + \varepsilon_t$

(a) IRF

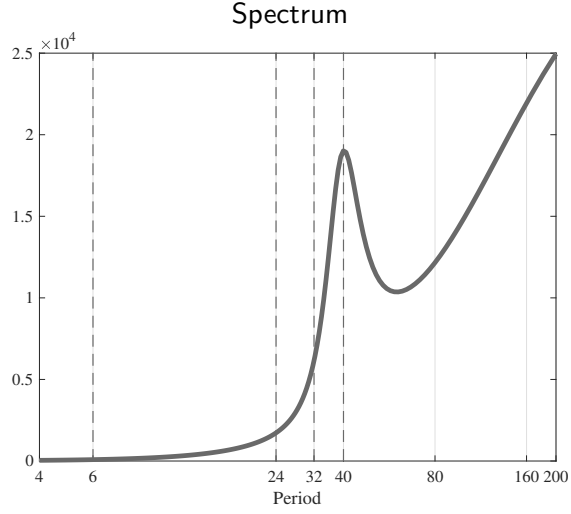


(b) Spectrum



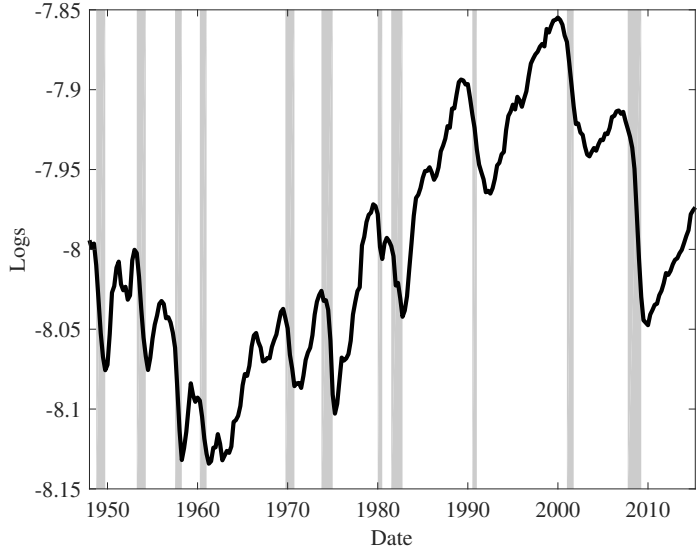
1. Motivating Observations

Figure 5: Process: $x_t = x_{1t} + x_{2t}$, $x_{1t} = 1.92x_{1t-1} - .95x_{1t-2} + \varepsilon_{1t}$, $x_{2t} = .95x_{2t-1} + \varepsilon_{2t}$



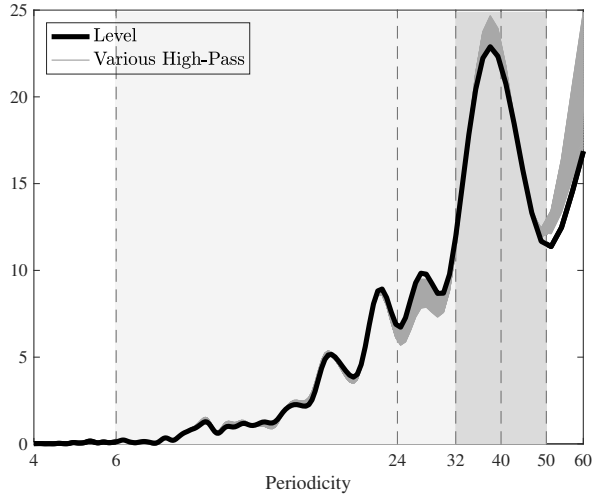
I. Cyclicality

Non-Farm Business (NFB) Hours Per Capita



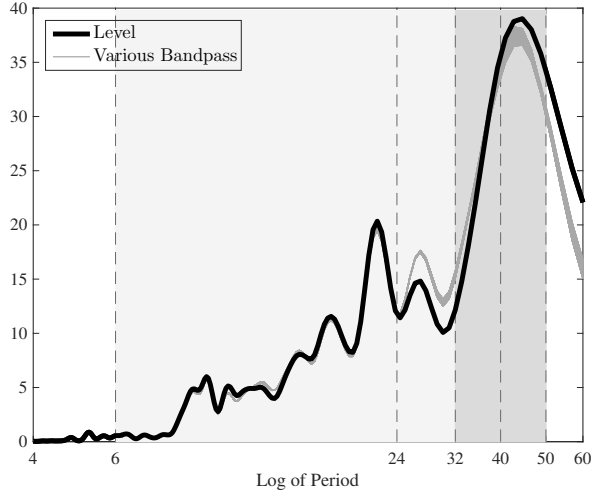
1. Motivating Observations

Non Farm Business Hours per Capita Spectrum



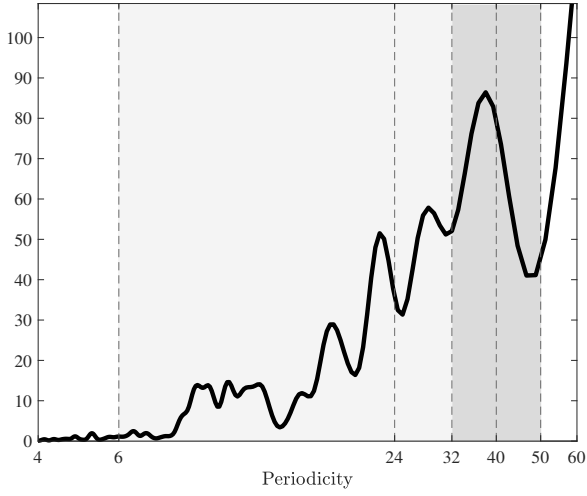
1. Motivating Observations

Capacity Utilization Spectrum



1. Motivating Observations

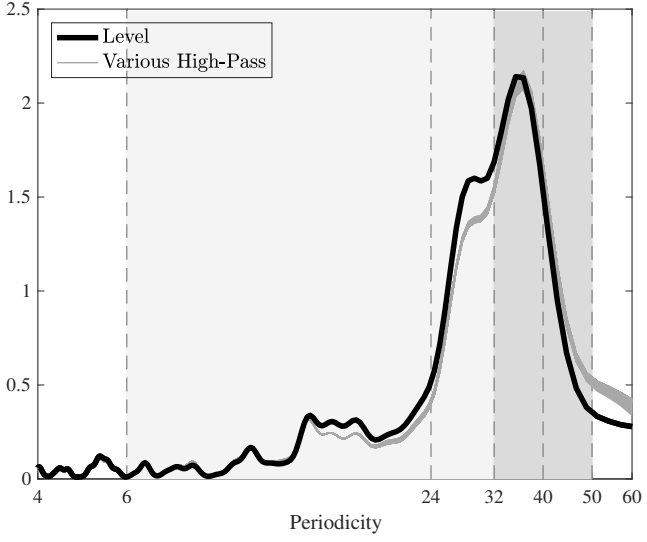
Investment-Output ratio



- The cycle is also a financial cycle

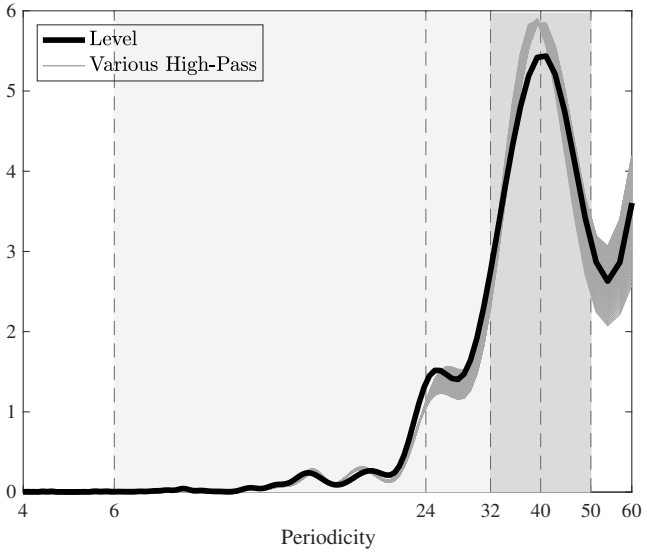
1. Motivating Observations

Chicago Fed National Financial Conditions Index



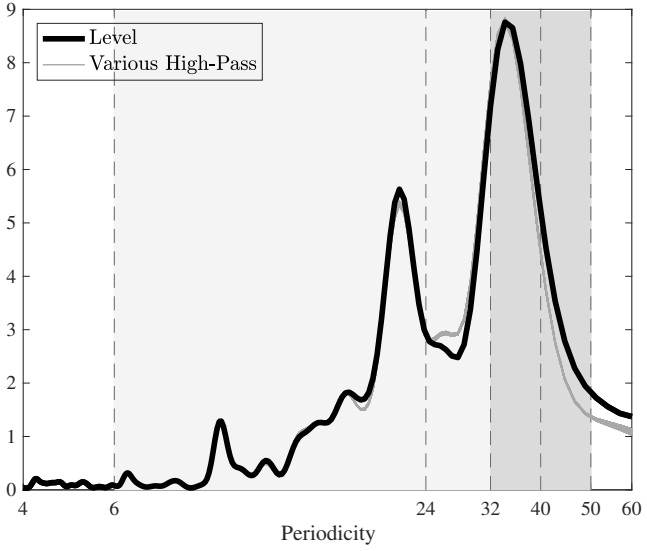
1. Motivating Observations

Delinquency Rate



1. Motivating Observations

Spread (BBA bonds-FFR)



- Data seems to tell us that there is indeed cyclicality

Roadmap

I. Cyclicality
II. Instability
III. Implications for Modelling and Policy

- Macro variables dynamics (removing trend) is well explained by AR(3) linear models
- Assume

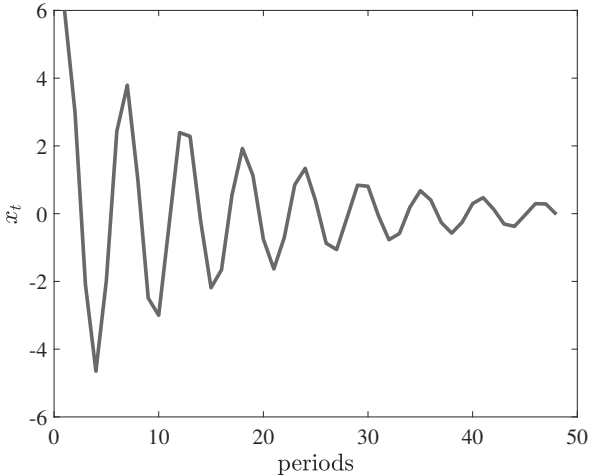
$$x_t = \alpha x_{t-1} - 0.6x_{t-2} - 0.3x_{t-3} + \epsilon_t, \tag{1}$$

and $\alpha = 0.5$

II. Instability

An example

Figure 6: Impulse Response, $\alpha = 0.5$

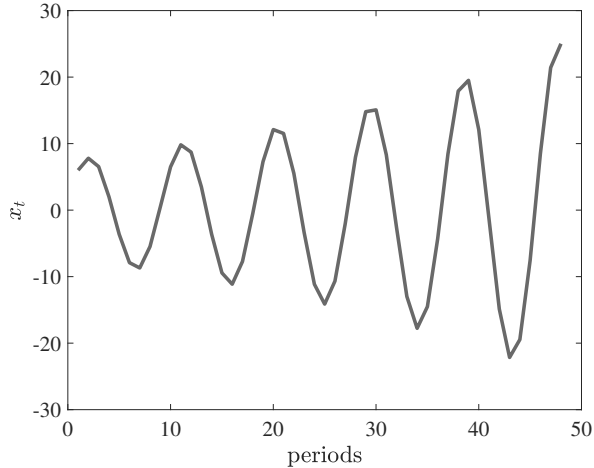


$$x_t = \alpha x_{t-1} - 0.6x_{t-2} - 0.3x_{t-3} + \epsilon_t,$$

II. Instability

An example

Figure 7: Impulse Response, $\alpha = 1.3$

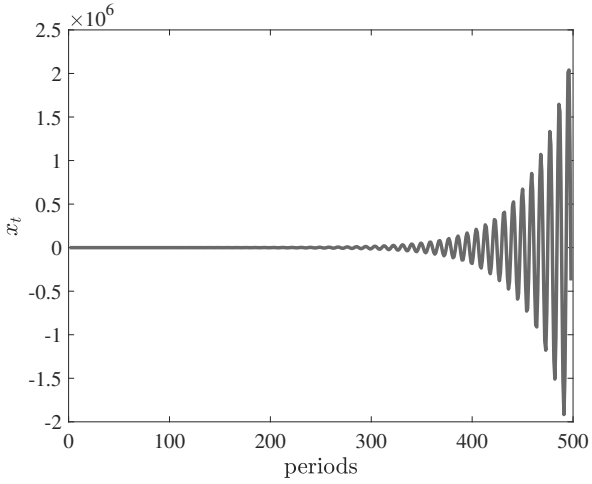


$$x_t = \alpha x_{t-1} - 0.6x_{t-2} - 0.3x_{t-3} + \epsilon_t,$$

II. Instability

An example

Figure 8: Impulse Response, $\alpha = 1.3$



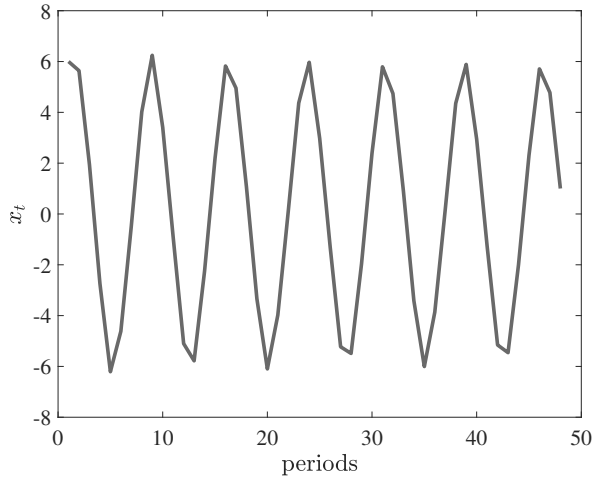
$$x_t = \alpha x_{t-1} - 0.6x_{t-2} - 0.3x_{t-3} + \epsilon_t,$$

- Assume instead

$$x_t = \alpha x_{t-1} - 0.6 x_{t-2} - 0.3 x_{t-3} - 0.01 x_{t-1}^3 + \epsilon_t, \tag{2}$$

- and keep $\alpha = 1.3$

Figure 9: Impulse Response with $-0.01x_{t-1}^3$

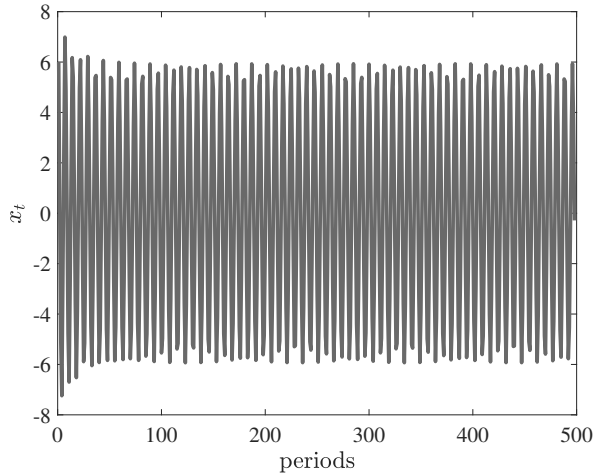


$$x_t = 1.3x_{t-1} - 0.6x_{t-2} - 0.3x_{t-3} - 0.01x_{t-1}^3 + \epsilon_t,$$

II. Instability

Introductory example: a Limit Cycle

Figure 10: Impulse Response with $-0.01x_{t-1}^3$

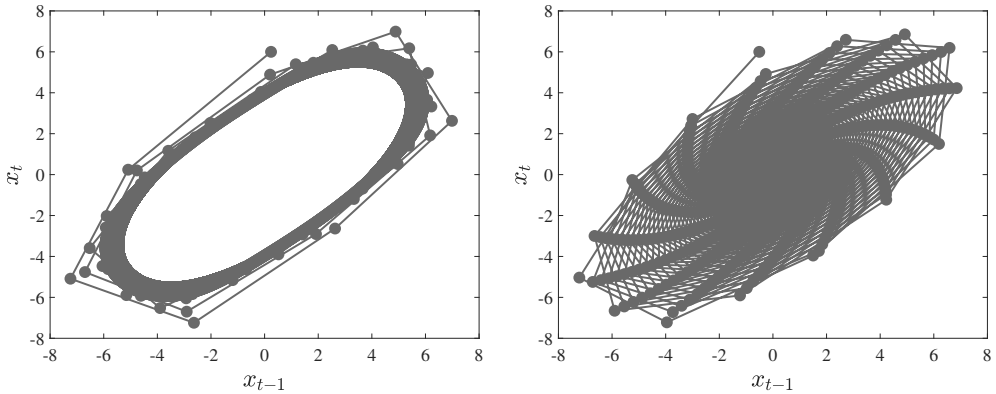


$$x_t = 1.3x_{t-1} - 0.6x_{t-2} - 0.3x_{t-3} - 0.01x_{t-1}^3 + \epsilon_t,$$

II. Instability

Introductory example

Figure 11: In the (x_t, x_{t-1}) plance with $-0.01x_{t-1}^3$ and $\alpha = 1.3$ or with $\alpha = 0.5$ nand no cubic term.



$$x_t = \alpha x_{t-1} - 0.6x_{t-2} - 0.3x_{t-3} - 0.01x_{t-1}^3 + \epsilon_t,$$

- Working with linear model rules out local instability because it implies explosion.
- Therefore, the economic system is seen as stable, fluctuating only because of shocks
- Adding nonlinearities opens the door to *local* instability.
- Market economies can be intrinsically unstable, but not explosive
- Fluctuations are not caused by good and bad luck (shocks), but are inherent to market forces.

Roadmap

I. Cyclicality
II. Instability
III. Implications for Modelling and Policy

- Assume that agents actions depend on
  - × what they have done in the past
  - × what the other are doing
- What is the impact impact of what the others are doing on what I do?
  - × negative (*substitutabilities*): typically the case of Walrasian equilibrium
  - × positive (*complementarities*): example consumption with unemployment risk.

- The more *substitutabilities*, the more stable and acyclical the dymamics is.
- There is always a degree of *complementarities* such that the model will become locally unstable
- With non-linearities, a limit cycle will appear.

Figure 12: With substitutabilities

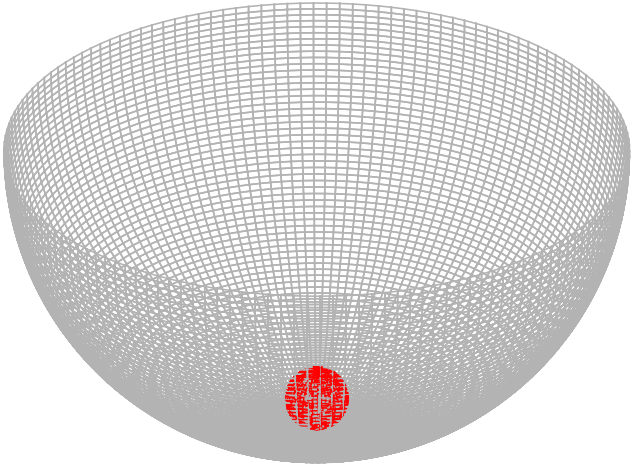


Figure 13: With enough complementaries in a linear world

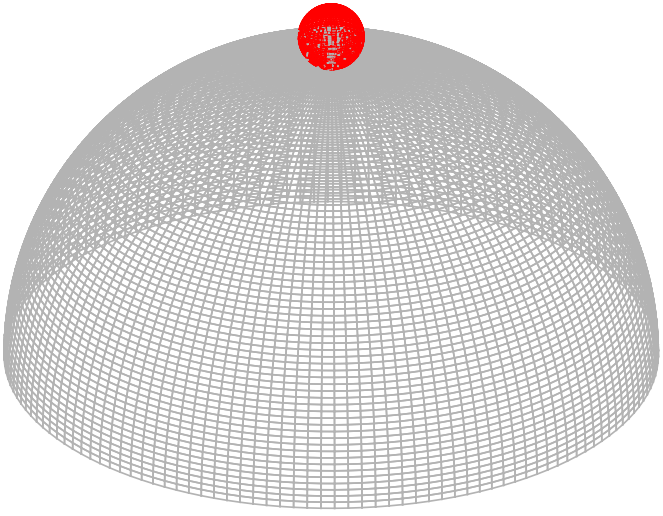


Figure 14: With substitutabilities

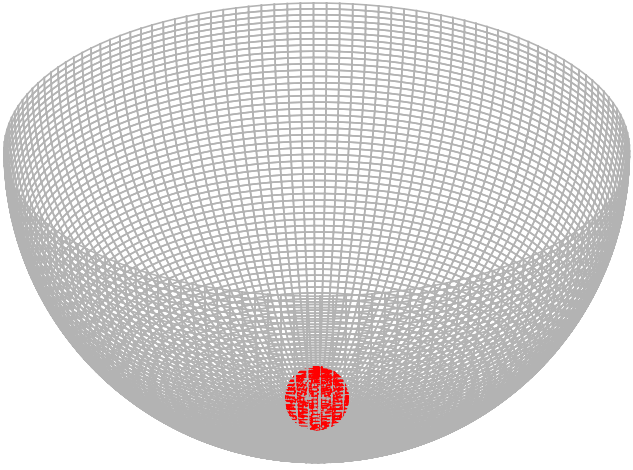
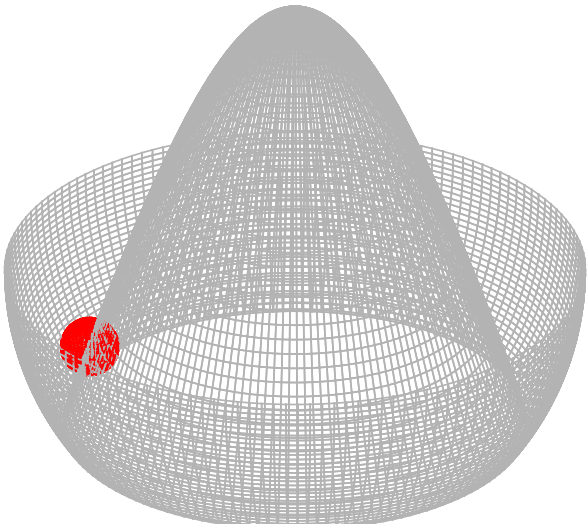


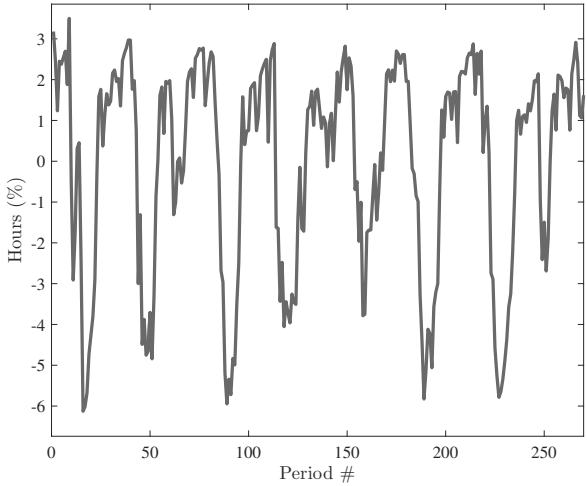
Figure 15: With enough complementarities but in a nonlinear world



- Main mechanism:
  - × in booms, less defaults
  - × $\rightsquigarrow$ cheap credit
  - × $\rightsquigarrow$ more borrowing to buy goods (in particular durable goods and houses) $\rightsquigarrow$ even less defaults $\rightsquigarrow$ even cheaper credit
  - × $\rightsquigarrow$ the boom is even bigger
- But at some point, satiation (lot of houses, TV sets, etc...), so that demands goes down
  - × $\rightsquigarrow$ less sales $\rightsquigarrow$ defaults increase
  - × $\rightsquigarrow$ credit becomes more expensive $\rightsquigarrow$ less demand $\rightsquigarrow$ more default etc...
- Can this mechanism be strong enough to create cycles when estimated?
- Note: Expansion sows the seed of the next recession.

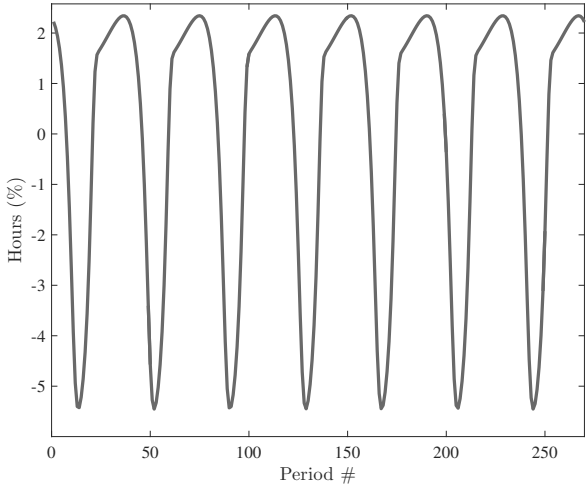
III. Implications for Modelling and Policy

Sample Draw for Hours



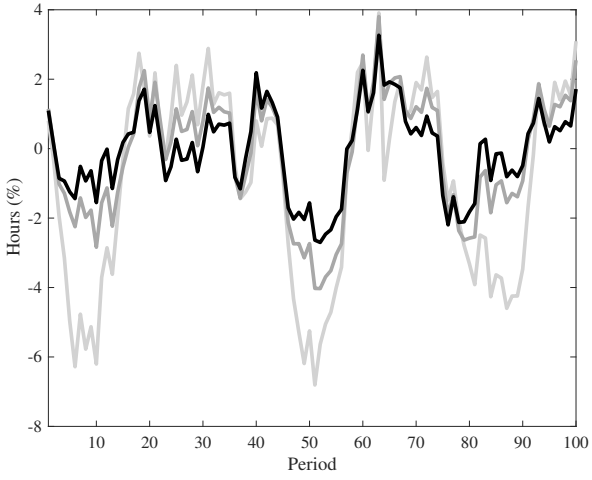
III. Implications for Modelling and Policy

Sample Draw for Hours, no shocks



III. Implications for Modelling and Policy

Policy experiment - Hours, One Stochastic Simulation, Increasing Monetary policy Reactivity



III. Implications for Modelling and Policy

Policy experiment -Hours Deterministic Simulation, Increasing Monetary policy Reactivity