Trust and Monetary Policy

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Trust and macroeconomic models

- Very large shocks and trust are somehow linked
- Since the oil crisis shock in 1970s, economists recognized credibility of inflation target and reputation of the central bank play an important role in effectiveness of monetary policies (Barro and Gordon (1983)).
- Nowadays, macroeconomic models incorporate a central bank announcing inflation target in the Taylor rule.

Second dimension of trust: confidence in the future.

- Trust also means a belief that future economic activity will be strong.
- A lack of trust means that there is pessimism about future economic activity.
- During the global financial crisis and the economic recession, public trust in the ECB significantly declined in the Euro area (Wälti (2012), Ehrmann and Stracca (2013), Roth, et al. (2016)).
- Trust in the central bank can be undermined when it is perceived to fail in maintaining macroeconomic stability

Behavioural model

- We make analysis of trust in macroeconomic modeling more systematically.
- We use a behavioural macroeconomic model (see De Grauwe(2012, and De Grauwe and Ji(2019))
- This model assumes that agents have cognitive limitations.
- In such models with imperfect information, we will show trust becomes of great importance to understand how shocks are transmitted and how monetary policies affect the economy.
- We analyse trust under very large shocks such as the pandemic shock.

Basic Model structure: New Keynesian

- **Aggregate demand**

$$y_t = a_1 \tilde{\mathrm{E}}_t y_{t+1} + (1 - a_1) y_{t-1} + a_2 \left(r_t - \tilde{\mathrm{E}}_t \pi_{t+1} \right) + v_t$$

  - Forward and backward looking term (habit formation)
  - ~ above *E* means: non rational expectation

- **Aggregate supply**: New Keynesian Phillips curve

$$\pi_t = b_1 \widetilde{\mathrm{E}}_t \pi_{t+1} + (1 - b_1)\pi_{t-1} + b_2 y_t + \eta_t$$

- **Taylor rule** describes behavior of central bank

$$r_t = (1 - c_3)\left[c_1(\pi_t - \pi^*) + c_2 y_t\right] + c_3 r_{t-1} + u_t$$

when $c_2 = 0$ there is strict inflation target, c2 measures the effort of output stabilization

Cognitive limitation

- In a world of extreme uncertainty, agents have cognitive limitations and do not understand the whole picture (the underlying model).
  - they only understand small bits and pieces of the whole model
  - and use simple rules to guide their forecasts.

- Rationality is introduced through a selection mechanism in which agents evaluate the performance of the rule they are following
- and decide to switch or to stick to the rule depending on how well the rule performs relative to other rules.

Introducing heuristics: output forecasting

- Two possible forecasting rules
- Fundamentalist rule: agents forecast output gap to return to steady state (negative feedback rule)

$$\tilde{\mathrm{E}}_{\mathrm{t}}^{\mathrm{f}} y_{\mathrm{t}+1} = 0$$

- Extrapolative rule: agents extrapolate past output gap (positive feedback rule)

$$\tilde{\mathrm{E}}_{\mathrm{t}}^{\mathrm{e}} y_{\mathrm{t}+1} = y_{t-1}$$

Inflation forecasting

- Follow Brazier et al. (2006), we have two inflation forecasting rules.
  - One rule is based on the announced inflation target which provides anchor

$$\widetilde{\mathrm{E}}_t^f \pi_{t+1} = \pi^*$$

  - the other rule extrapolates inflation from the past into the future.

$$\widetilde{\mathrm{E}}_t^e \pi_{t+1} = \pi_{t-1}$$

- Market forecasts are weighted average of fundamentalist and extrapolative forecasts

$$\tilde{\mathrm{E}}_{\mathrm{t}} y_{t+1} = \alpha_{f,t} \tilde{\mathrm{E}}^{\mathrm{f}}_{\mathrm{t}} \mathrm{y}_{\mathrm{t+1}} + \alpha_{e,t} \tilde{\mathrm{E}}^{\mathrm{e}}_{\mathrm{t}} \mathrm{y}_{\mathrm{t+1}}$$

$$\tilde{\mathrm{E}}_{\mathrm{t}} \pi_{t+1} = \beta_{f,t} \tilde{\pi}^{\mathrm{f}}_{\mathrm{t}} \mathrm{y}_{\mathrm{t+1}} + \beta_{e,t} \tilde{\pi}^{\mathrm{e}}_{\mathrm{t}} \mathrm{y}_{\mathrm{t+1}}$$

$\alpha_{f,t}$ $\beta_{f,t}$ = probability agents choose fundamentalist rule

$\alpha_{e,t}$ $\beta_{e,t}$ = probability agents choose extrapolative rule

Agents select the rule that forecasts best, they switch from the bad to the good forecasting rule

Applying discrete choice theory

Agents compute **mean squared forecast errors**:

MSE_{ft} and MSE_{et}

Utility of using particular rule is defined as

$$U_{ft} = -\text{MSE}_{ft} \text{ and } U_{et} = -\text{MSE}_{ft}$$

Probability of using these rules becomes:

$$\alpha_{f,t} = \frac{exp(\gamma U_{f,t})}{exp(\gamma U_{f,t}) + exp(\gamma U_{e,t})}$$

$$\alpha_{e,t} = \frac{exp(\gamma U_{e,t})}{exp(\gamma U_{f,t}) + exp(\gamma U_{e,t})}$$

- when forecast performance(utility) of extrapolators improves relative to that of fundamentalists agents are more likely to choose extrapolating rule about the output gap.
- γ intensity of choice parameter

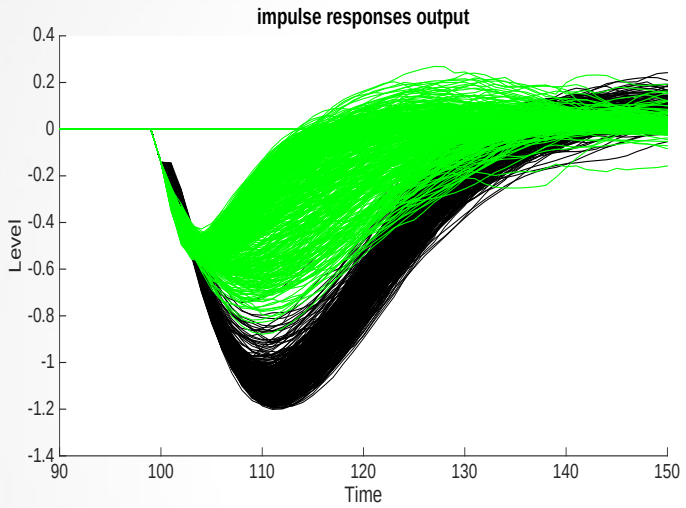
Defining trust

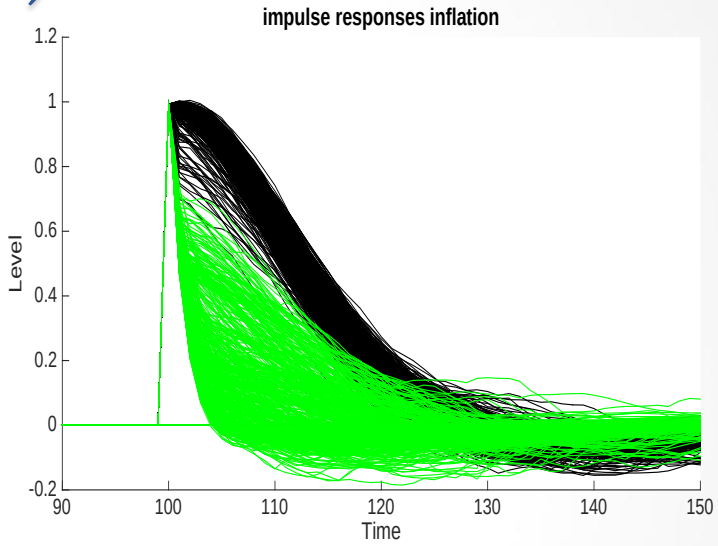
- The first dimension is an institutional one. It is the trust in the central bank that has announced an inflation target. The institutional trust is measured by the fraction of agents $\beta_{f,t}$ using the inflation target as their forecasting rule.
- A second dimension is trust in the future. We will measure this by the degree of optimism or pessimism about future economic activity.
  - We use an index of market sentiments S_t, called "animal spirits" which will form the basis for our analysis of trust. This index can change between -1 and +1.

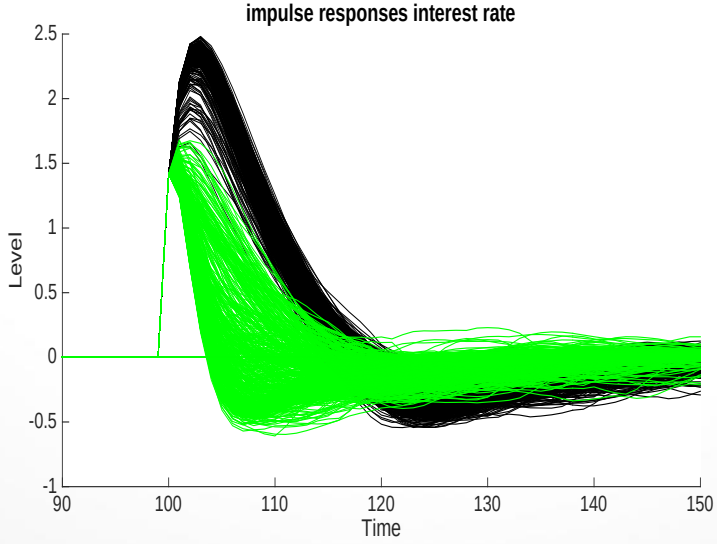
Impulse responses to supply shocks

- calibrate the model using numerical values to the parameters that are often found in the literature
- compute 1000 impulse responses to a large supply shock
- Each impulse response is computed for different realizations of the stochastic shocks in the model
- Impulse responses are expressed as multipliers, i.e. they are divided by the shock
- We will see that the initial conditions matter
- A very large shock, i.e. a 10 standard deviation shock. It corresponds to the size of the shock observed in early 2020 when GDP dropped by 10% to 20% in many countries as a result of the worldwide shutdown of production.

Impulse responses: Large supply shock (10 std)

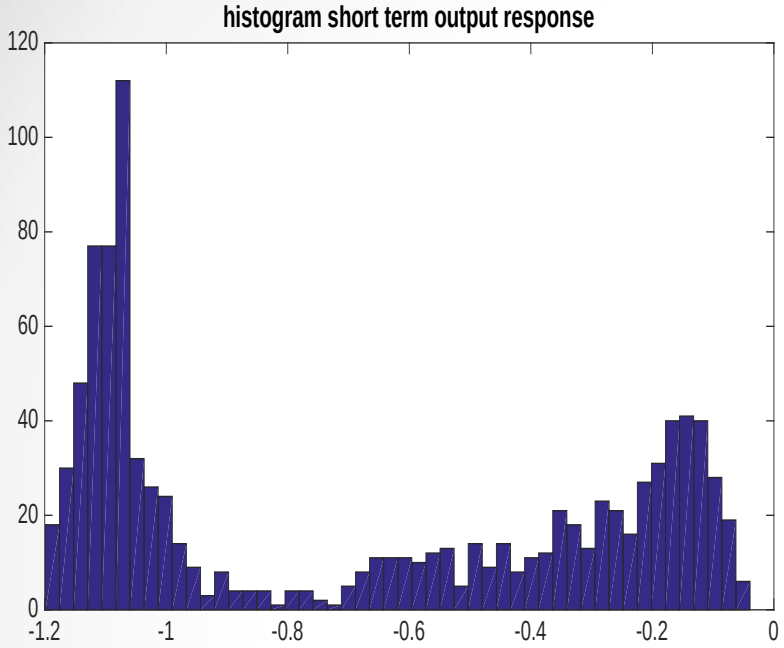


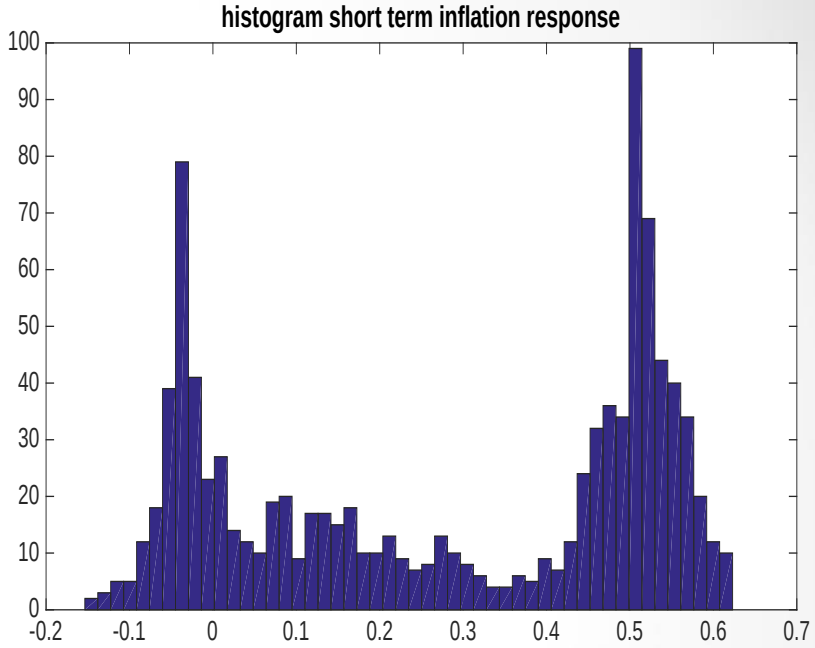


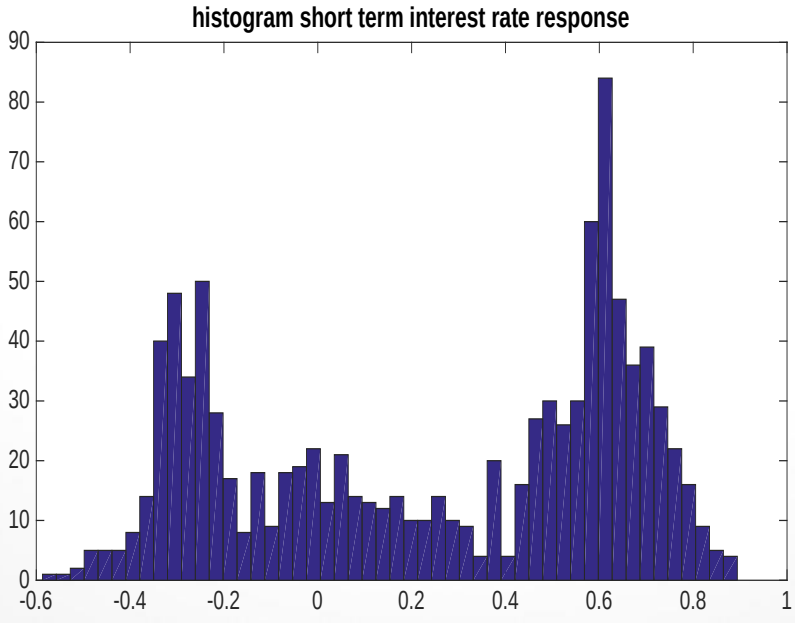


- Large differences in the trajectories of the endogenous variables after the supply shock.
- Over time these impulse responses tend to converge, but it takes a long time for convergence to be reached.
- We observe the existence of two trajectories.
  - A “good” trajectory (colored green), implies a relatively small decline of the output gap and a relatively quick return to the steady state value;
  - A “bad” one (colored black), follows a very deep decline in output and a slower recovery

Frequency distribution of impulse responses (12 periods after shock)







Why do bifurcations occur?

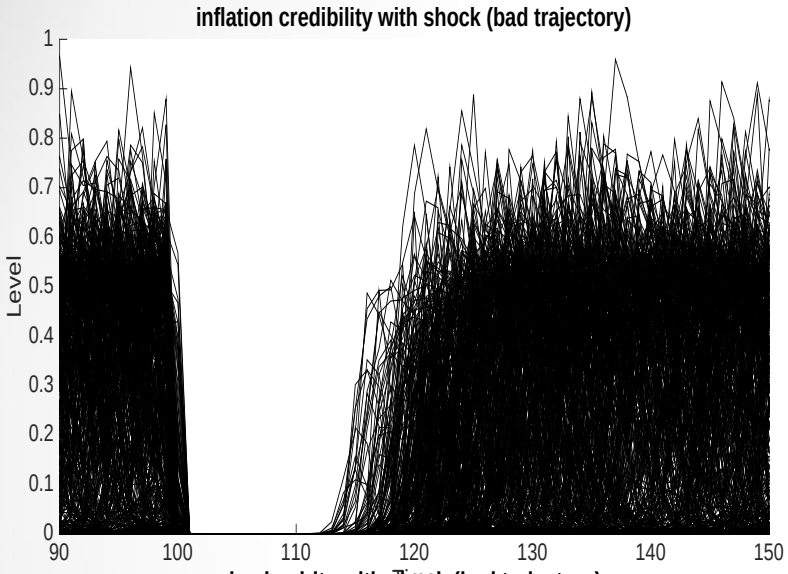
- The bad trajectory is characterized by the fact that immediately after the shock we obtain a limit solution,
  - the inflation credibility drops to zero and animal spirits drop to -1.
  - This means that the mean reverting processes in the expectations formations are switched off and only the extrapolating dynamics is left over.
  - This creates a destabilizing dynamics that keeps the output gap low and the inflation high.

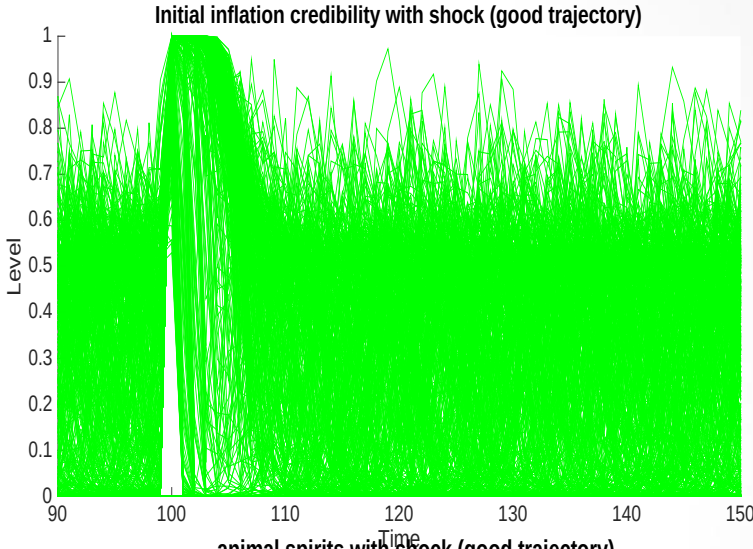
- For example, when credibility is zero, there are no agents anymore who expect the inflation to return to the target set by the central bank.
- As a result, the inflation dynamics is driven by extrapolative behaviour.
- The same holds for the output gap.

How are these trajectories connected to our measures of trust?

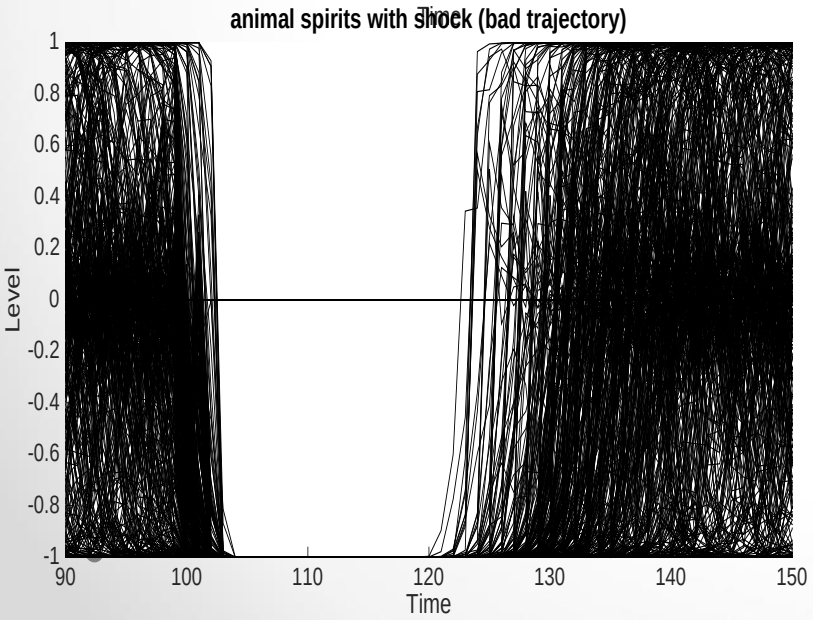
- We show the answer in next figure.
- This presents the evolution of the animal spirits and credibility before and after the supply shock
- Since we run the model 1000 times we obtain 1000 trajectories for these two variables.

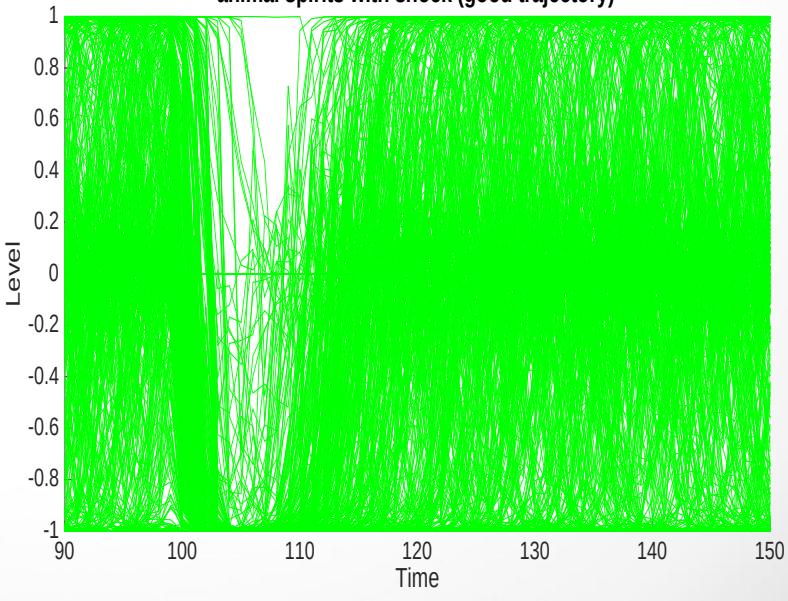
Trust: Inflation credibility and animal spirits with large supply shock





Bad trajectories (in black); Good trajectories (in green).





Interpretation

- Let us concentrate first on the inflation credibility.
- After the supply shock inflation credibility quickly drops to zero in all the bad trajectories.
  - Thus, when the economy is in a bad trajectory this coincides with a collapse of credibility.
  - No single agent trusts the central bank anymore:
  - the fraction of agents that use the inflation target as their forecasting rule drops to zero and they all use the extrapolative rule to make inflation forecasts.
- This feature is absent in the good trajectories: very little loss of credibility

- We obtain a similar result with animal spirits.
  - When the economy is pushed into a bad trajectory animal spirits drop to -1,
  - i.e. all agents have a pessimistic outlook on the future of economic activity.
  - In the good trajectory we also observe some deterioration of animal spirits but this is much less extreme and much shorter.

Role played by initial conditions

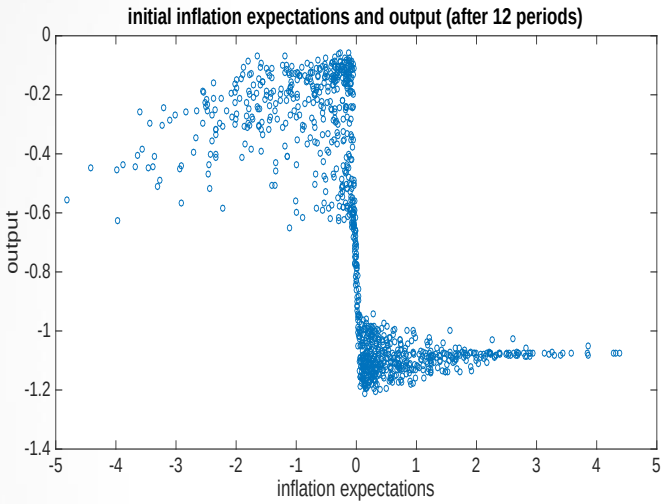
- In order to get stuck into bad trajectory, initial conditions must be bad:
  - high inflation expectations and low output.
  - these bad initial conditions make it possible for the large negative shock to push the system towards the limits of zero credibility and extreme pessimism.

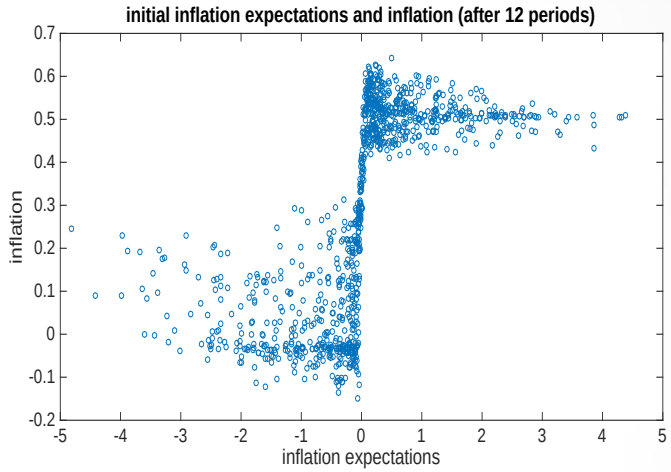
- When initial conditions are favorable :
  - low inflation expectations and optimism about the economy
  - same negative supply shock does not push credibility and animal spirits against its limits.
  - **Mean reverting** processes continue to do their work of softening the impact of the supply shock and one ends up in a good trajectory.
- Thus, favourable initial conditions work as a **buffer** preventing large shocks from hitting the boundaries and preventing a collapse of trust.
- Thus, trust is key in smoothly returning the economy to equilibrium.

The power of initial conditions: supply shock

- In next Figure we present one of the initial conditions, (i.e. inflation expectations prevailing just before the shock), on the horizontal axes,
- and the output gap and inflation 12 periods after the supply shock on the vertical axes.

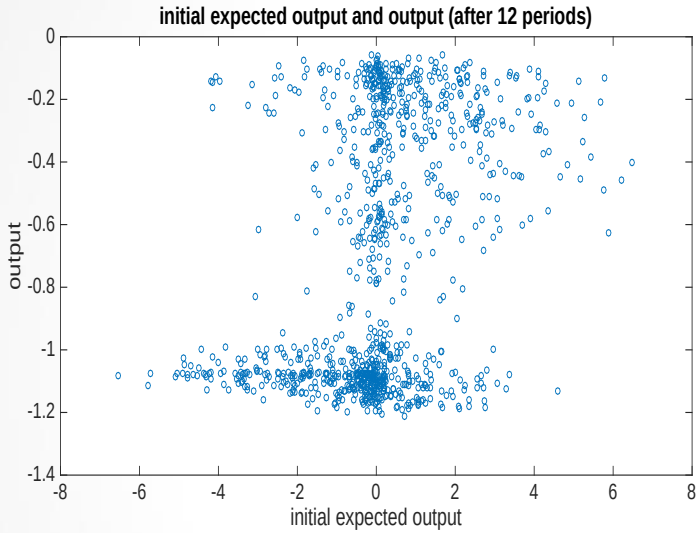
Initial inflation expectations, and output gap and inflation 12 periods after shock

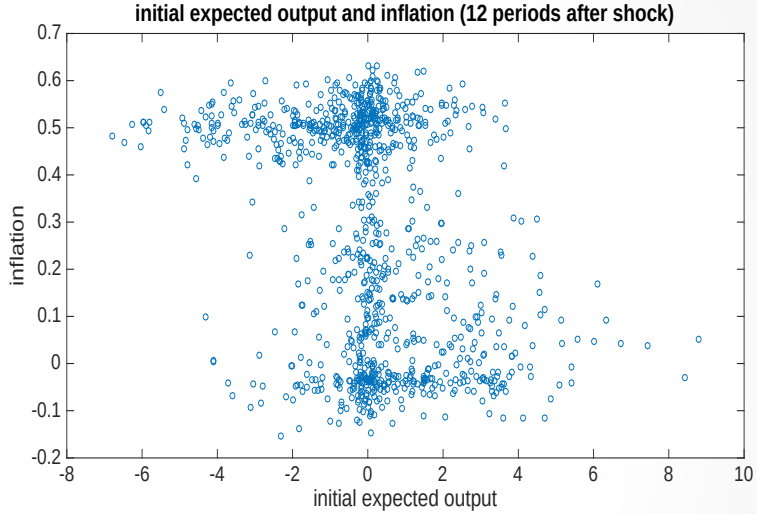




- Initial expectations of inflation area very good predictor of the subsequent trajectory of the output gap and inflation
- Favorable initial inflation expectations (negative numbers) lead to the trajectory of low inflation high output 12 periods later.
- With unfavorable inflation expectations the economy is forced onto the high inflation and low output trajectory.

Initial output expectations, and output gap and inflation 12 periods after shock

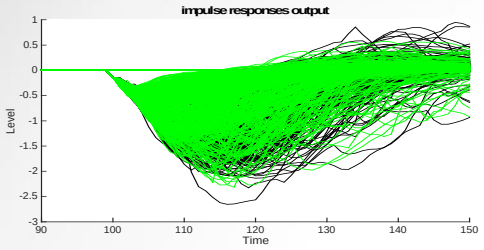


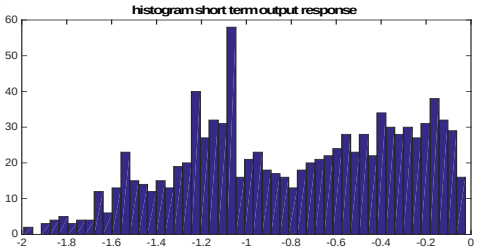


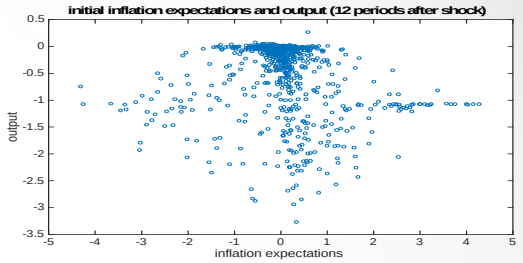
- Predictive power of the initial output forecasts is less strong
- Optimistic forecasts of the output gap lead to both a good and bad subsequent trajectory.
- Similarly optimistic output forecasts lead to both low and high inflation outcomes.

Sensitivity analysis

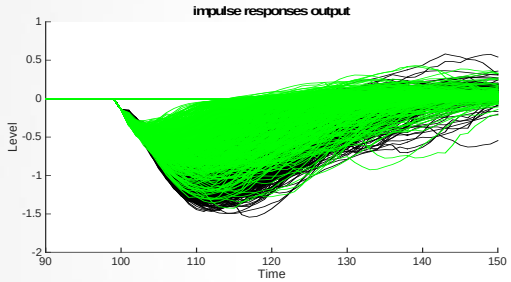
Supply shock = 1

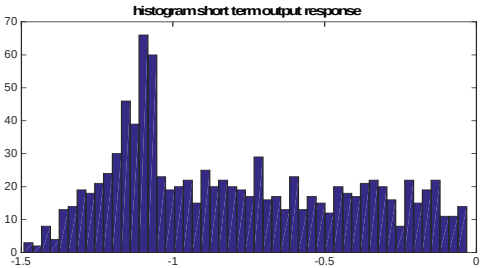


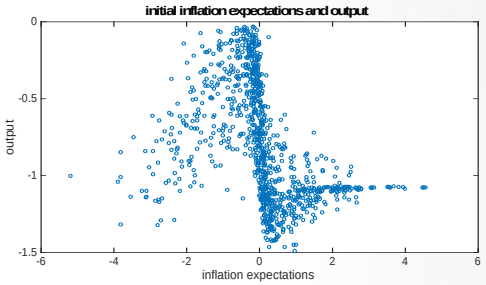




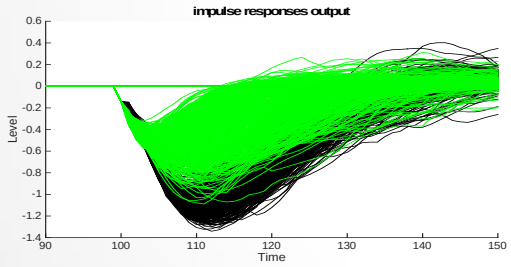
Supply shock = 3

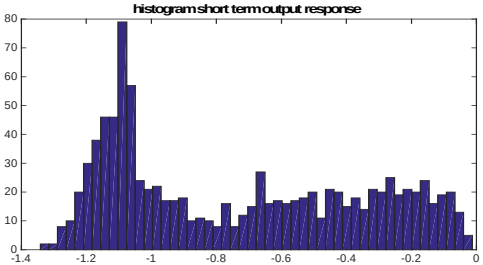


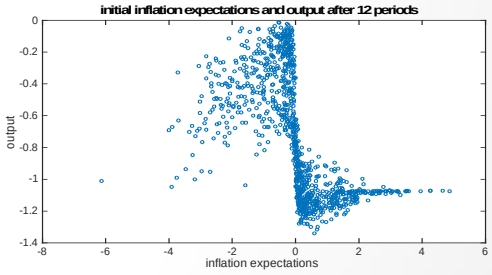




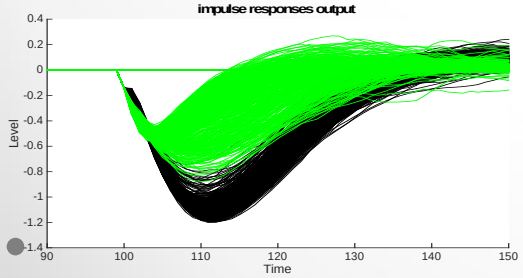
Supply shock = 5

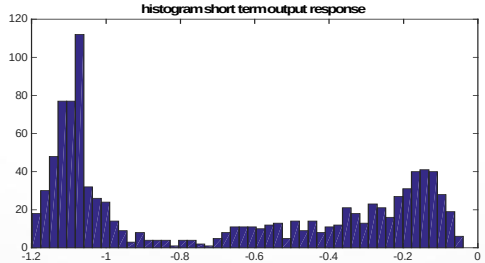


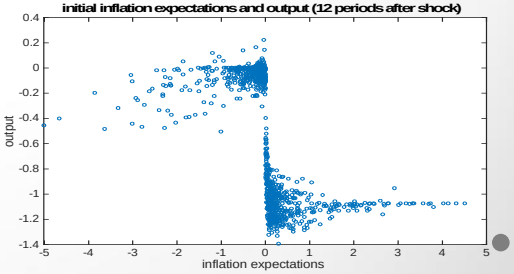




Supply shock = 10





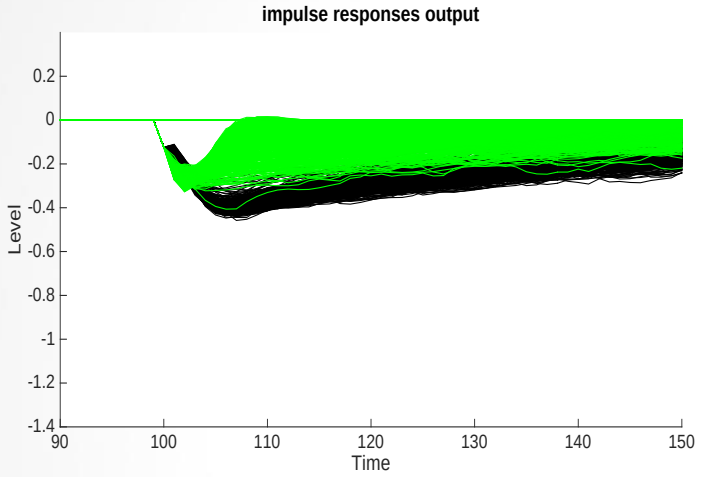


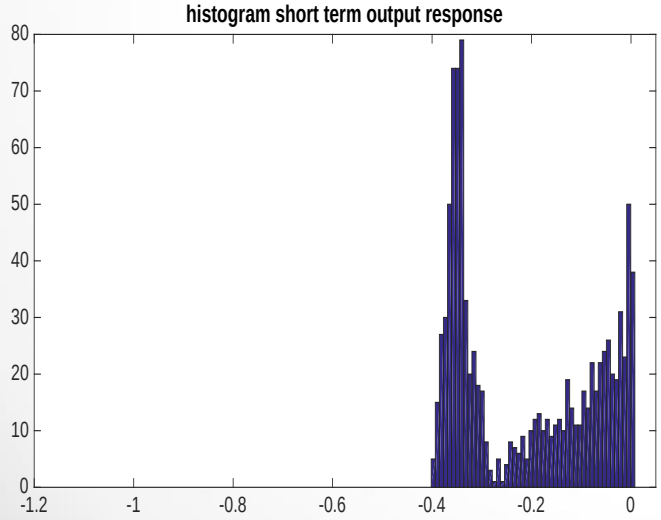
The power of output stabilization: supply shock

- As will be remembered the intensity of output stabilization is measured by the c2 parameter in the Taylor rule equations.
- We have set c2 routinely equal to 0.5 in the previously reported results.
- Here we ask the question of how a stronger stabilization effort affects the transmission of a large supply shock.
- We distinguish two output stabilization intensities,
  - a strong one (c2=2)
  - and a normal one (c2=0.5).

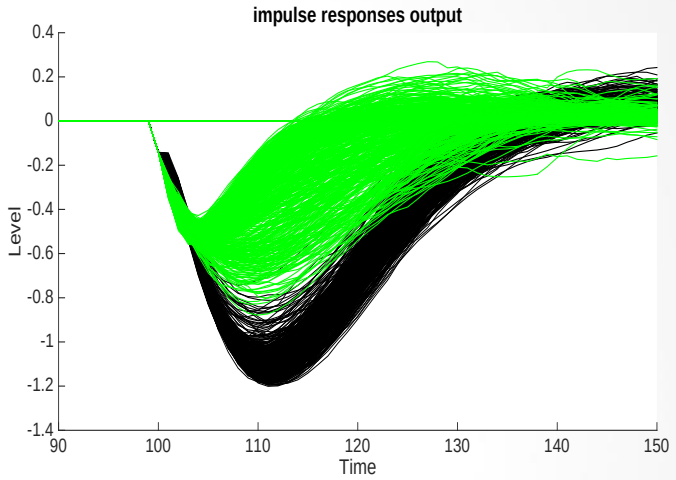
Transmission of large supply shock under strong and normal stabilization

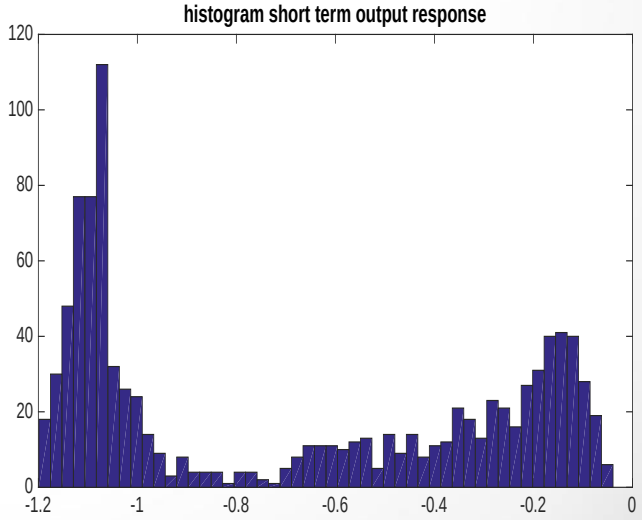
Strong stabilization (c2=2)





Normal stabilization(c2=0.5)

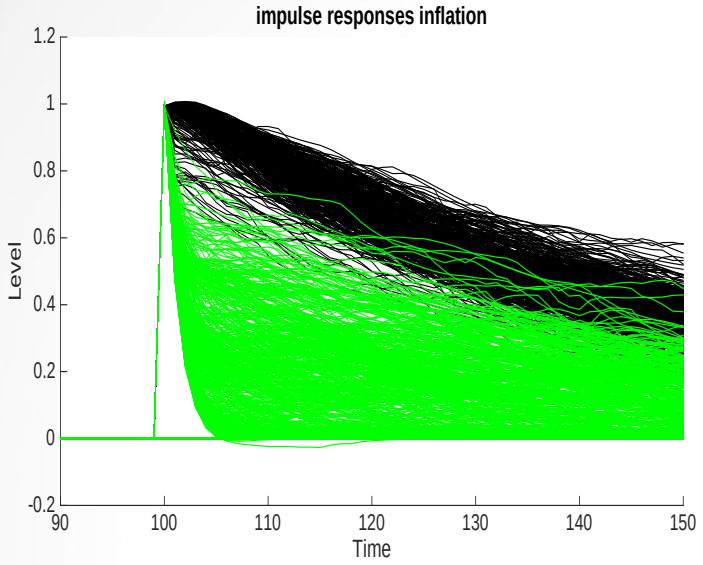


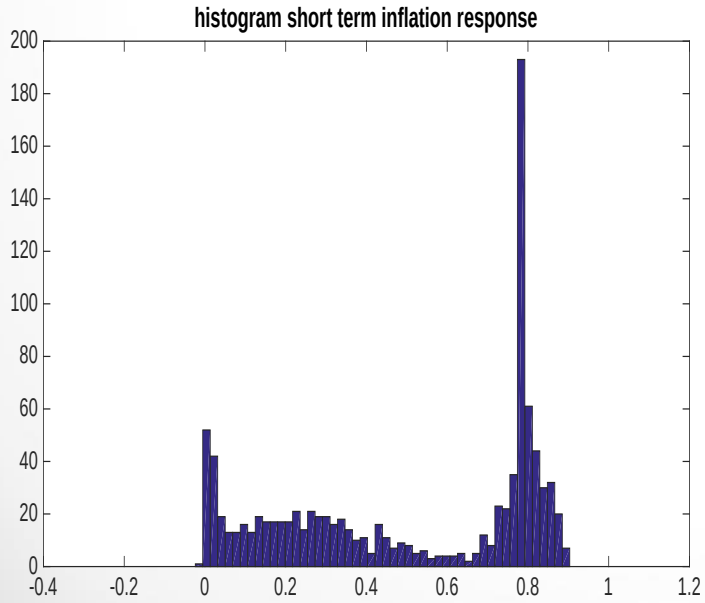


Interpretation

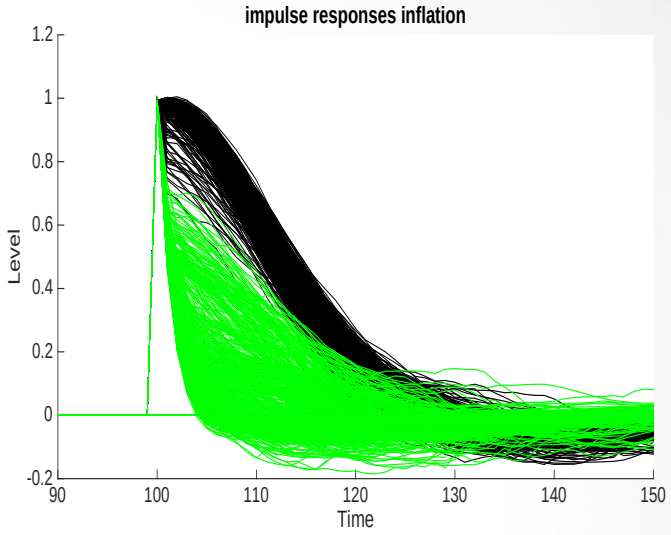
- By increasing the intensity of output stabilization the central bank ensures that the bad trajectory becomes significantly less bad.
- The good trajectory is pretty much unchanged when stabilization is strong.
- Histograms of the output gap:
  - Under strong stabilization the peaks of the bimodal distribution are closer to each other,
  - this is achieved by a movement of the "bad peak" to the right and closer to the "good peak".
- Thus stronger stabilization achieves a less severe downturn in the bad trajectory.
- All this comes at a price:

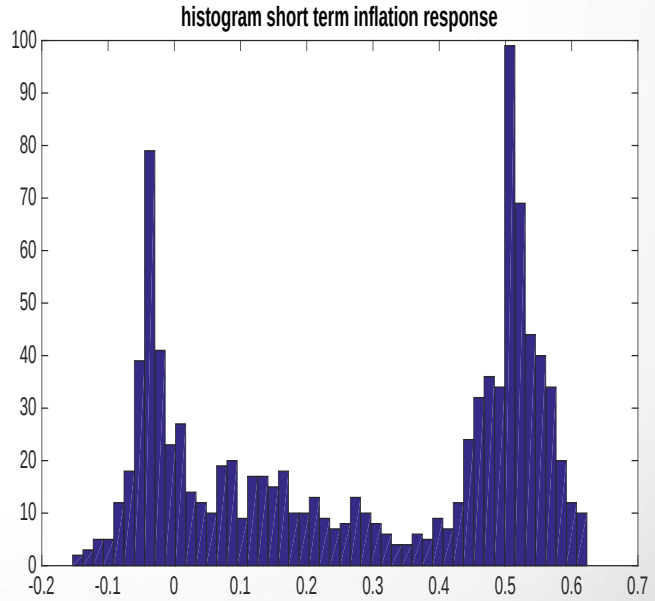
Strong stabilization (c2=2)





Normal stabilization(c2=0.5)





Interpretation

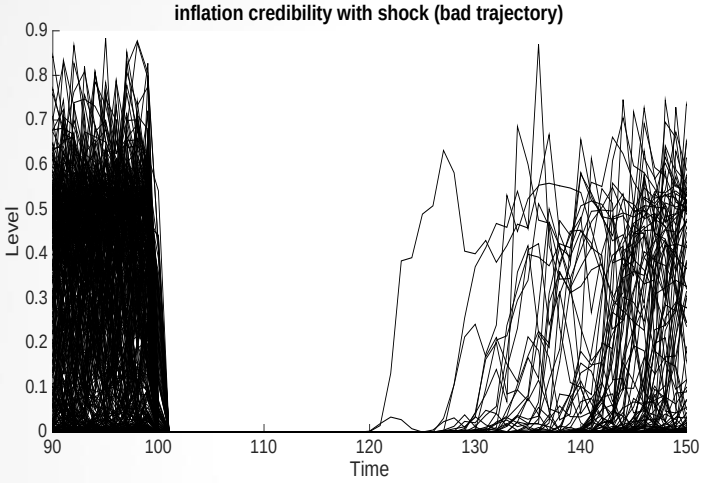
- When output stabilization is strong, the bad and the good inflation trajectories produce an inflation trajectory that is more protracted.
- In other words, stronger output stabilization leads to inflation that lasts longer after a supply shock.

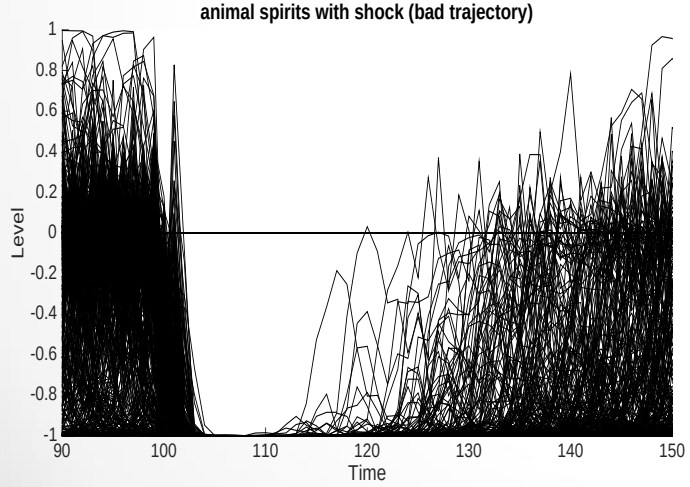
Output stabilization and trust

- We have seen that large shocks endanger trust of economic agents in two dimensions, i.e. institutional (trust in the central bank) and in the economy.
- We found that breakdown of trust in these two dimensions is more likely when large supply shocks hit the economy
- How can the central bank affect trust after large shocks?
- This is the question we pursue now.

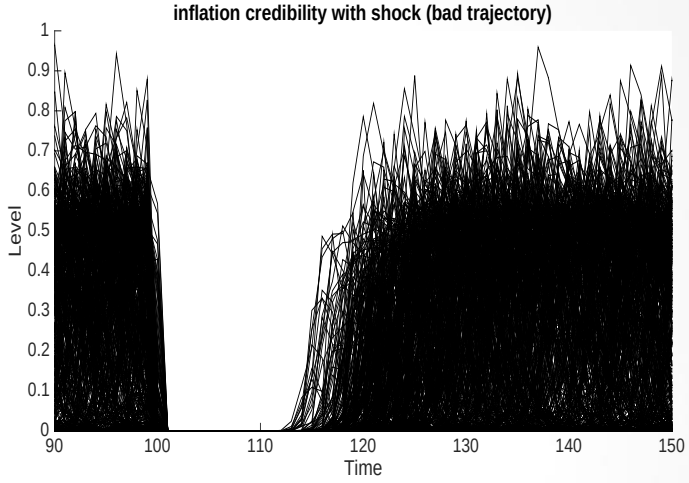
Trust under strong and normal stabilization (large supply shock)

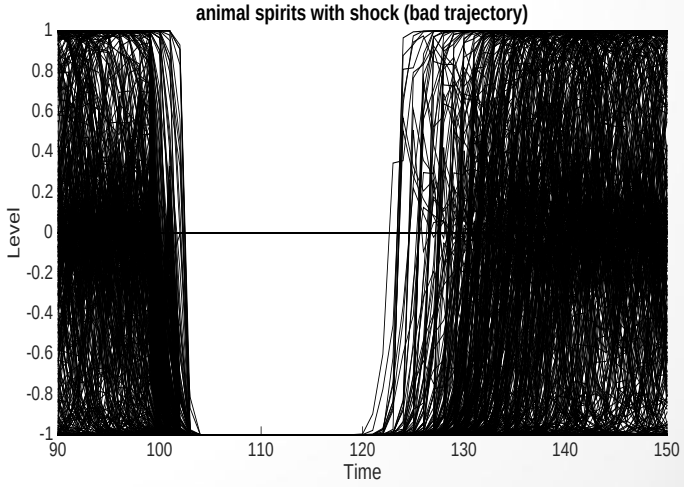
Strong stabilization (c2=2)





Normal stabilization (c2=0.5)





Interpretation

- When central bank increases ambition to stabilize output (c2 increases from 0.5 to 2) trust declines significantly after the supply shock.
  - after the supply shock inflation credibility drops to 0 in both cases
  - but it remains stuck at zero longer when output stabilization is strong.
  - The same holds with animal spirits after the shock.
- Thus, when large negative supply shocks occur a central bank that aggressively pursues output stabilization will suffer a loss of trust longer than a central bank that pursues output stabilization more cautiously.

Conclusion

- We conclude that negative supply shocks create important threats to trust in the central bank and in the economy,
- all the more so when central banks pursue aggressive policies of output stabilization.
- We have also studied demand shocks (not shown in this lecture)
  - Negative demand shocks are a much weaker threat to trust.
  - Moreover, in this case more aggressive output stabilization reduces the threat of losses in trust.

- This is due to the fact that when a negative demand shock hits, the central bank can reduce both the negative effects on output and inflation
- and therefore is perceived as being successful,
- while with a supply shock central banks are in a dilemma situation that prevents them from successfully stabilizing the economy.
- Trying harder only makes matters worse.

- Our results have some relevance to understand the experience of the 1970s with the large supply shocks and the recent covid supply shock.
- Preceding the supply shocks of the 1970s there had been a buildup of inflation and inflationary expectations.
- Our model predicts that with these initial conditions, the recovery would take a long time. This is also what happened for many countries with a prior history of significant inflation, especially after the second oil shock of 1979.

- According to the World Bank(2021) the world GDP growth rate took five years to return to its pre-1979 level of 4.2%.
- This growth rate was only reached in 1984 again.
- The trajectory of this protracted recovery also followed the prediction of our model: given the inflationary environment the supply shock of 1979 "forced" many central banks, in particular the US Federal Reserve under Paul Volcker, to raise the interest rates thereby intensifying the economic downturn.

- The Covid supply shock of 2020 was preceded by a period of low inflation and low inflationary expectations.
- Our model predicts that this should make a quick recovery possible, mainly because the central banks did not worry about the inflationary consequences and therefore could actually follow expansionary monetary policies.
- It appears today that a relatively quick recovery occurred during 2021.
- Unfortunately, a new shock occurred in 2022… Ukraine

- Our analysis implies that history matters.
- A history of high inflation and expectations of inflation condition the impact of a supply shock and is likely to produce bad outcomes of this shock. Trust may deteriorate quickly and stay low for some time.

- In contrast a history of price stability makes it possible for the economy to follow a more benign trajectory after the same supply shock.