Expectations and Financial Instability

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Introduction

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    1. Frequency of default crises [Guzman (2013)]
    2. Macroeconomic fluctuations [Guzman and Stiglitz (2014)]
2. How is the relationship of the stability of output growth expectations and the severity of financial crises? [Gluzmann, Guzman, and Howitt (2013)]

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Section 1:

Average Expectations and Frequency of Crises

Expectations and Frequency of Crises (Guzman 2013)

Why do default crises occur?

- My paper stresses the importance of expectations and learning for understanding frequency of default crises
- Comparative analysis: learning schemes contribute more for explaining the frequency of crises in emerging economies than in developed economies

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Illustrating the role of learning

Why does learning make crises more likely?

Why is the increase in the likelihood of crises bigger in emerging economies?

- Crises occur when there are sufficiently large negative shocks to expected permanent income
- A high frequency of crises requires a large variance of the permanent component of productivity shocks
- Learning leads to a bigger variance of beliefs on the permanent component of productivity shocks
- The above effect is bigger for more volatile economies

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Outline of section 1 (volatility of expectations and frequency of crises)

1. A baseline model of overborrowing crises
2. Formation of beliefs I: Full Information Rational Expectations
3. Introducing learning
    - Formation of beliefs II: Kalman filter learning
    - Formation of beliefs III: Stochastic-gain learning
4. Description of main results

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Basic framework follows Eaton and Gersowitz (1981) and Aguiar and Gopinath (2006)

- Model of strategic default
- The default is the crisis

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A baseline model of overborrowing crises: Environment

- Small and open economy of a representative agent that receives an exogenous and stochastic flow of output featured by transitory and permanent shocks to productivity:

$$Y_t = e^{z_t}\Gamma_t$$

with $\Gamma_t = e^{g_t}\Gamma_{t-1}$

- Description of shocks:

$$z_t = \rho_z z_{t-1} + \epsilon_t^z$$

$$g_t = (1-\rho_g)\mu_g + \rho_g g_{t-1} + \epsilon_t^g$$

with $\rho_z \in (0,1)$, $\rho_g \in (0,1)$, $\epsilon_t^z \sim N(0,\sigma_z^2)$ and $\epsilon_t^g \sim N(0,\sigma_g^2)$

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- CRRA utility function:

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A baseline model of overborrowing crises: Decisions

In every period, the agent decides whether she pays the debt or defaults

- If she pays, she is in "good standing" and her "value function" is

$$V^G(d_t, \tilde{z}_t, \tilde{g}_t) = max_{\{c_t\}}\{u(c_t) + \beta E_t V(d_{t+1}, \tilde{z}_{t+1}, \tilde{g}_{t+1})\}$$

  s.t $c_t = y_t - d_t + q_t d_{t+1}$ and transversality condition

- If she defaults, she is in "bad standing" and her "value function" is

$$\begin{aligned} V^B(\tilde{z}_t, \tilde{g}_t) = u[(1-\delta)y_t] + \beta[\lambda E_t V(0, \tilde{z}_{t+1}, \tilde{g}_{t+1}) \\ +(1-\lambda)E_t V^B(\tilde{z}_{t+1}, \tilde{g}_{t+1})] \end{aligned}$$

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A baseline model of overborrowing crises: Equilibrium condition

- Default function:
  $D(d_t, z_t, g_t) = 1$ *if* $V^B(z_t, g_t) > V^G(d_t, z_t, g_t)$ and zero otherwise

- Capital market is composed of risk-neutral international investors whose opportunity cost is the risk-free interest rate $r^\star$

- Equilibrium condition in the capital market:

$$q(d_{t+1}, z_t, g_t) = \frac{E_t(1 - D_{t+1})}{1 + r^\star}$$

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Formation of beliefs I: Full Information Rational Expectations (FIRE)

- FIRE in this context means that the agent can perfectly identify whether a shock to output is permanent (g-type) or transitory (z-type)
- Agent knows $Pr(z_{t+1} = z_i / z_t = z_j)$ and $Pr(g_{t+1} = g_i / g_t = g_j)$

$$E_t(z_{t+1}) = \rho_z z_t$$

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- Fact: frequency of default crises in emerging economies cannot be explained under FIRE beliefs

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Introducing learning about output trend

Two questions that motivate to introduce learning:

- Do data support the FIRE hypothesis?
- How does learning accelerate the volatility of expectations in different type of economies?

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Testing the assumption of full information rational expectations

Is the hypothesis of FIRE consistent with data on GDP growth expectations?

- Let g^y be the GDP growth rate. Under FIRE, we must have

$$g^y_{t+1} = E_t g^y_{t+1} + \epsilon_{t+1}$$

and

$$E(\epsilon_{t+1}) = 0 \;\;\&\;\; E(\epsilon_t \cdot \epsilon_{t+1}) = 0 \;\forall t > 0$$

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1. In emerging market economies the sample mean of forecasting errors differs significantly from zero. This is not true for the majority of developed countries.
2. First order autocorrelations of forecast errors are positive and significant for the cases of Argentina (0.89) and Mexico (0.25). I found no developed country for which this is true. Interpretation: if the current GDP growth forecast is above (below) the actual realization, next period growth will probably be overestimated (under) again.

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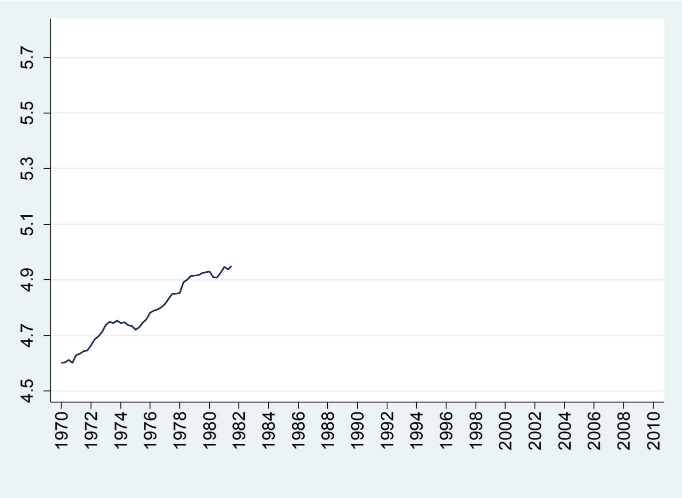

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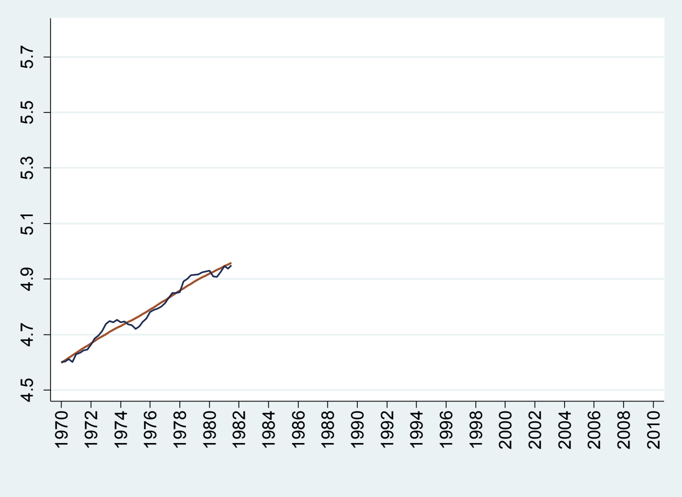

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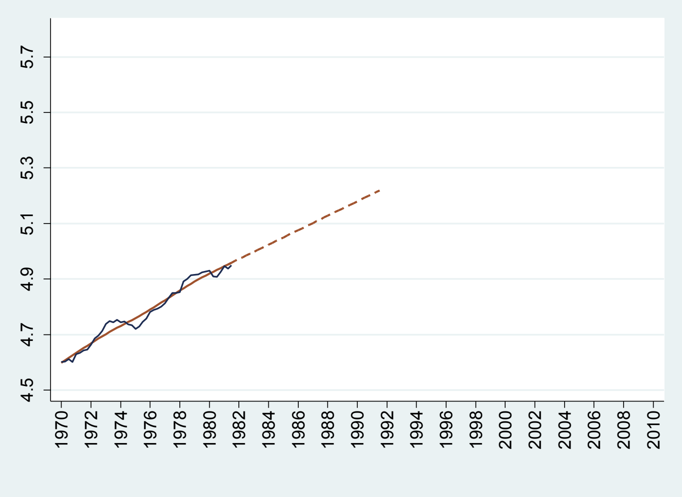

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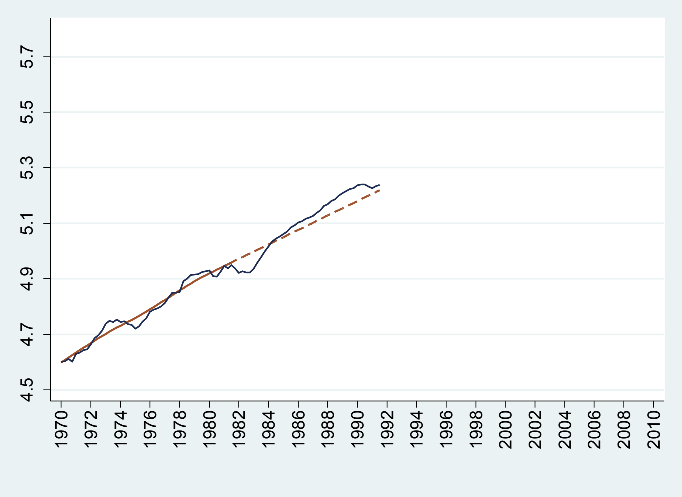

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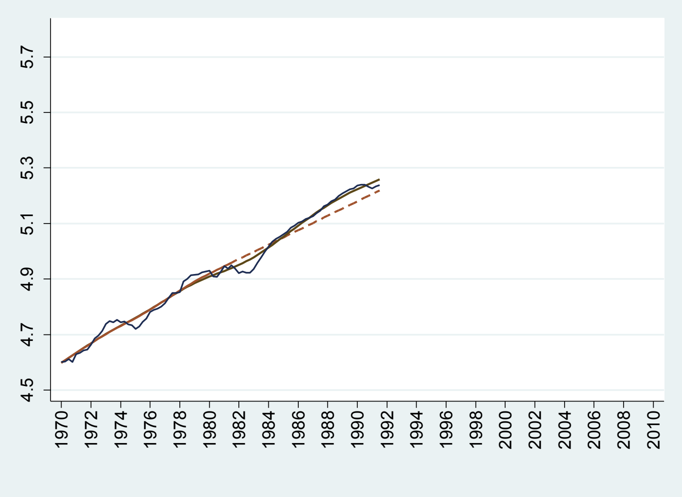

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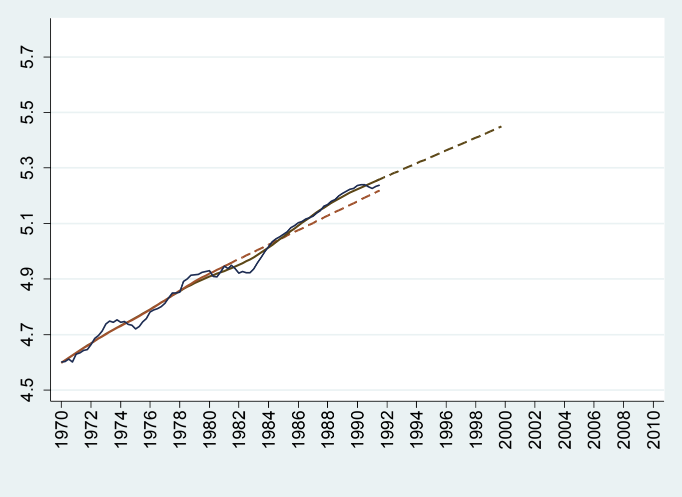

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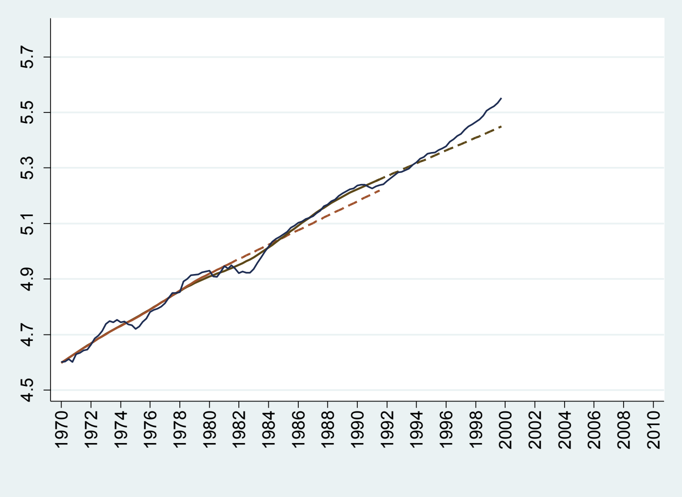

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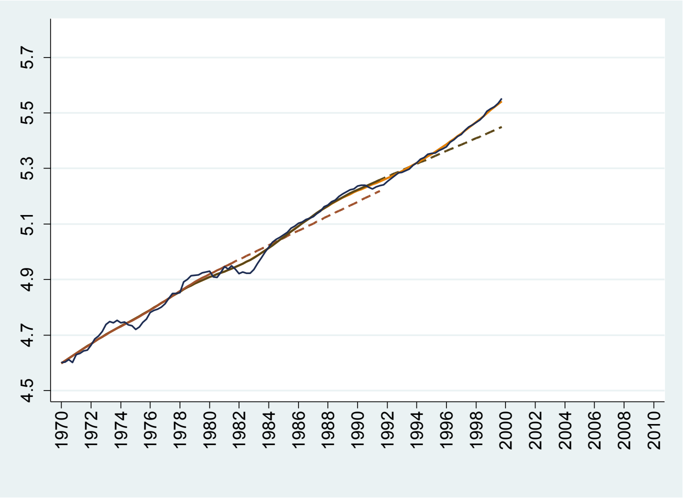

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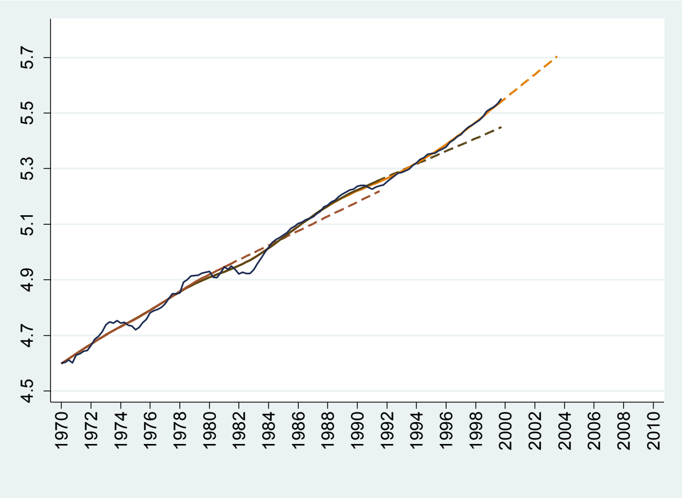

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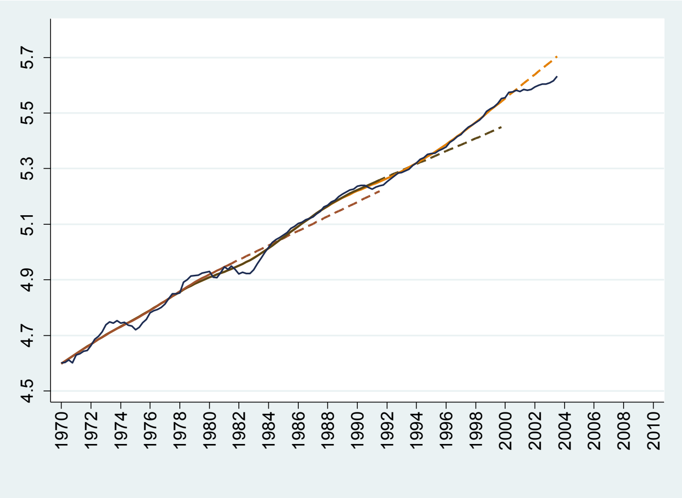

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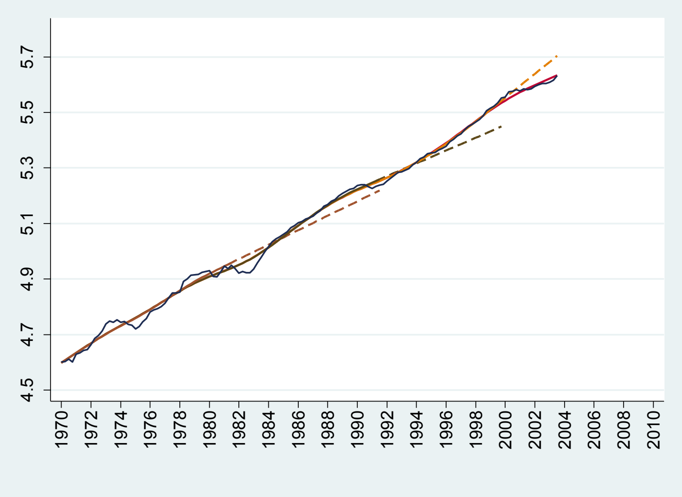

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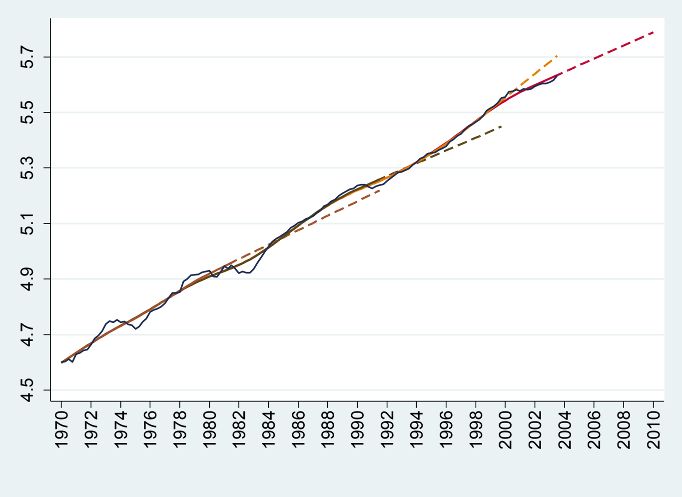

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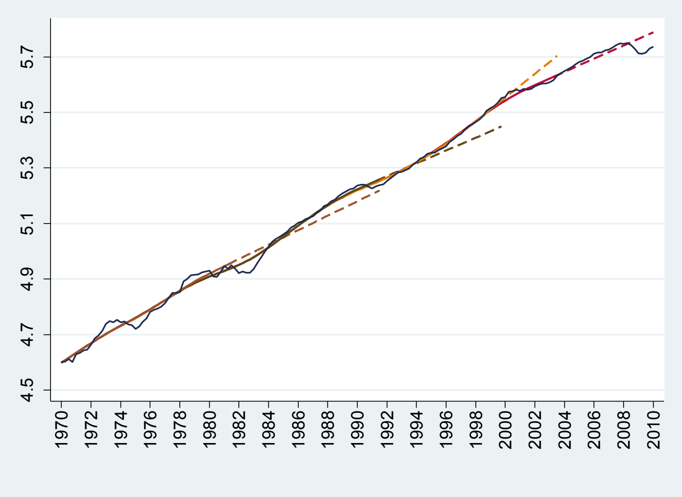

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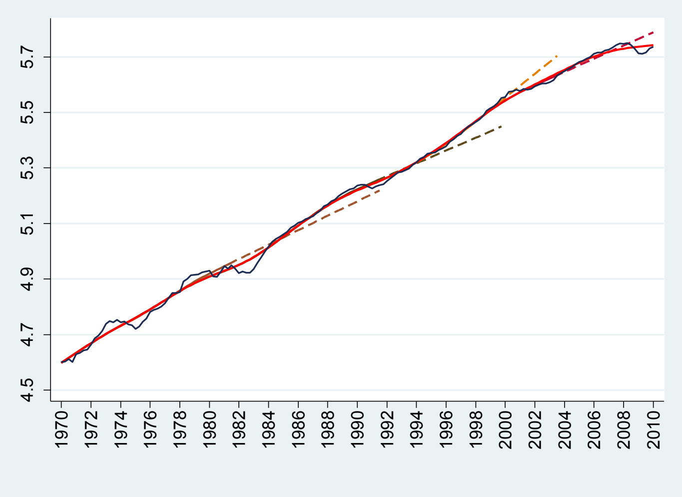

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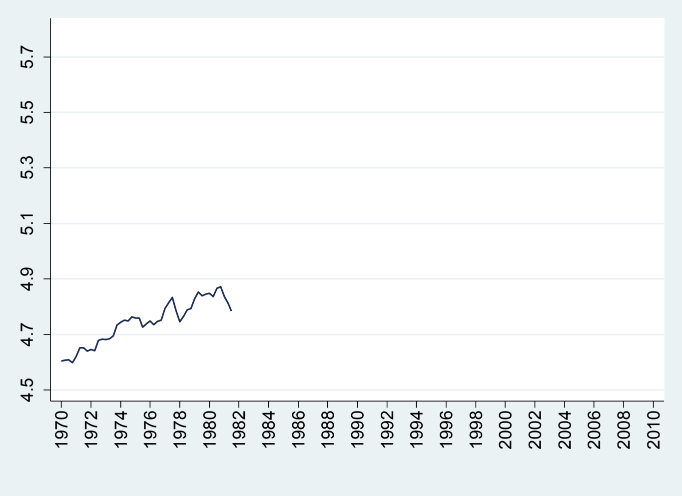

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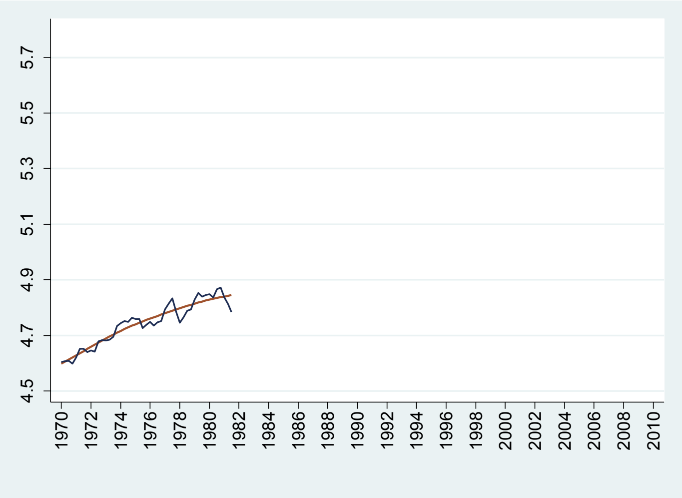

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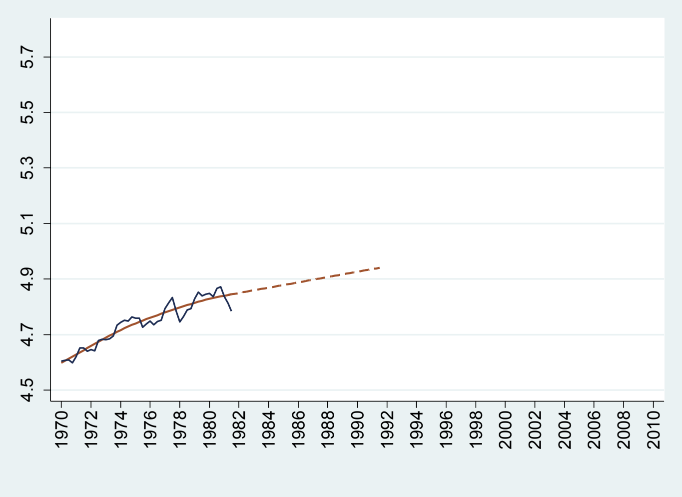

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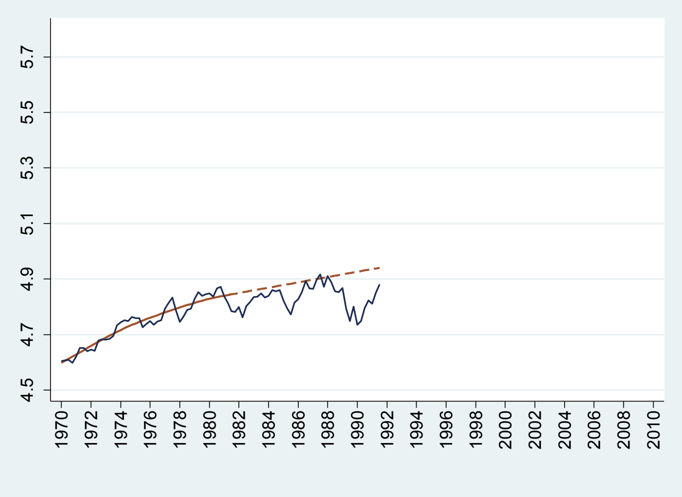

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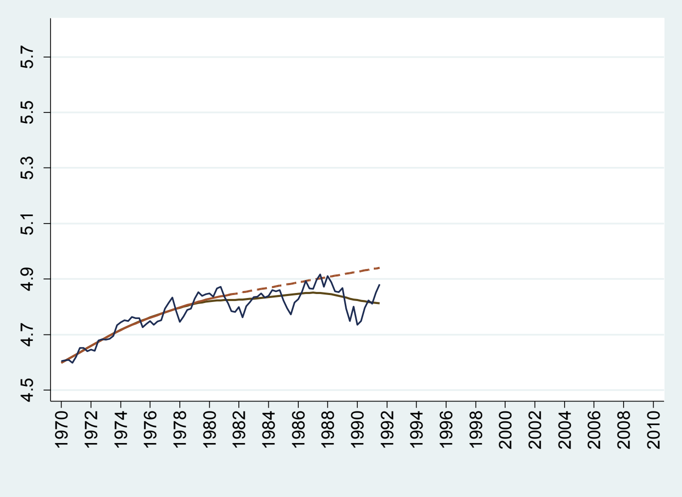

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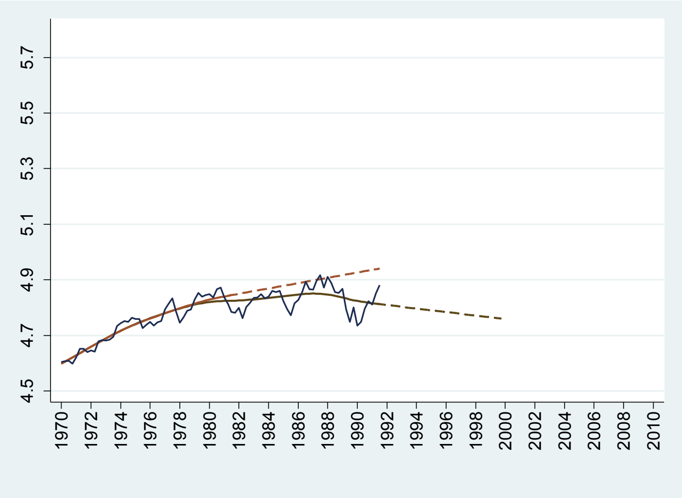

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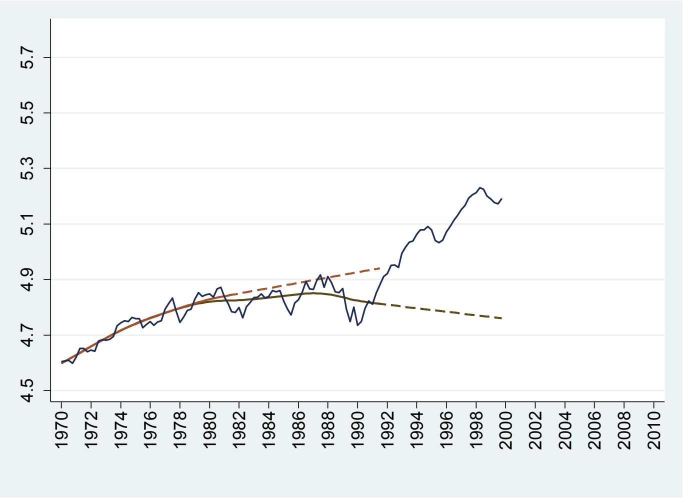

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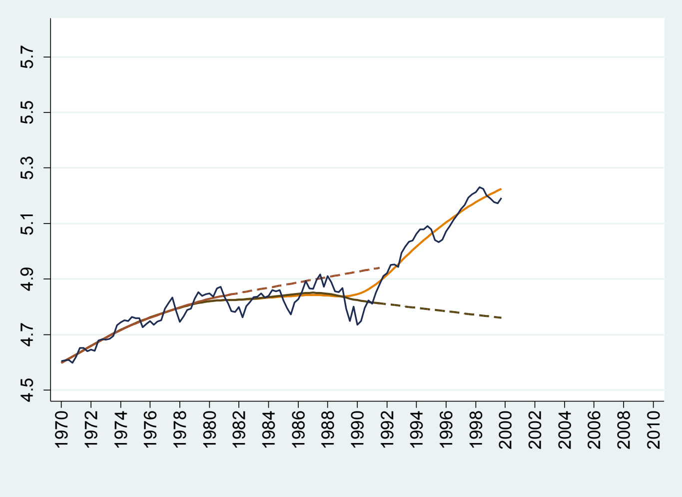

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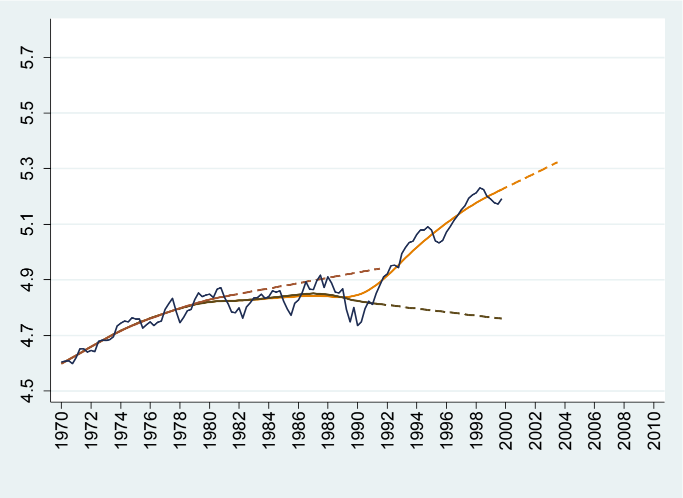

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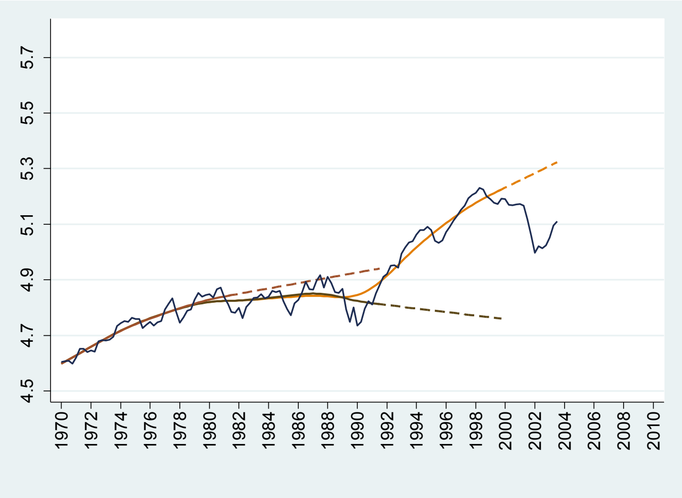

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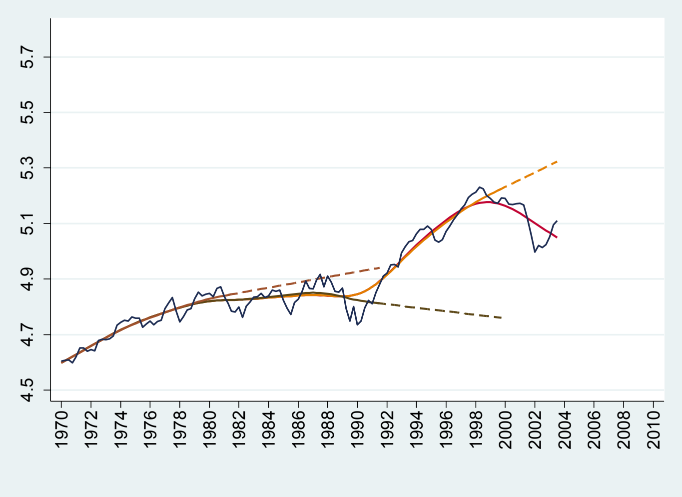

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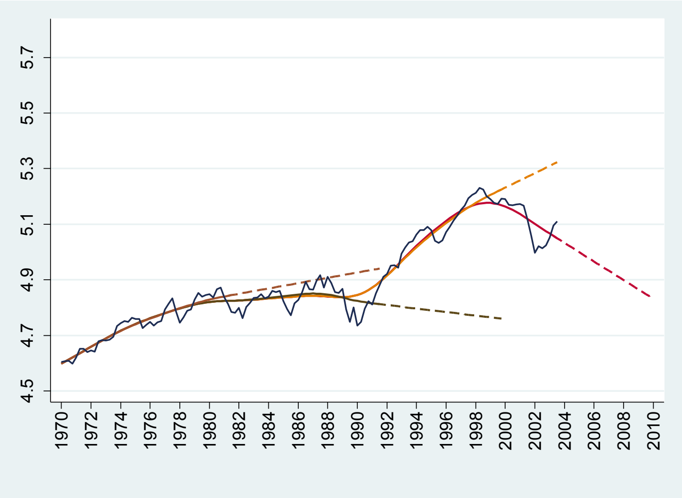

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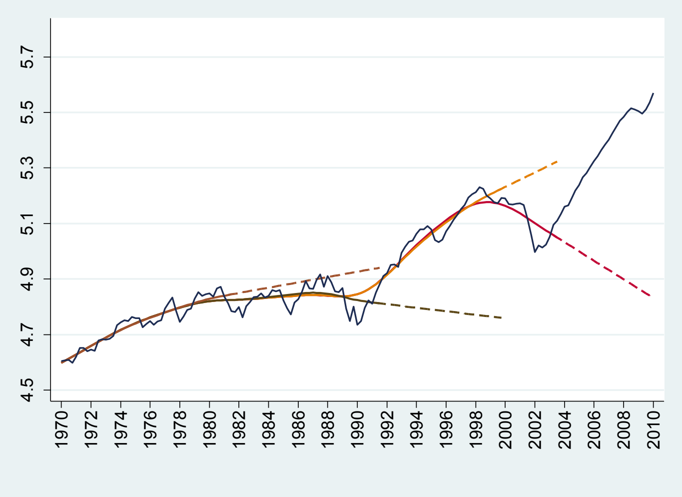

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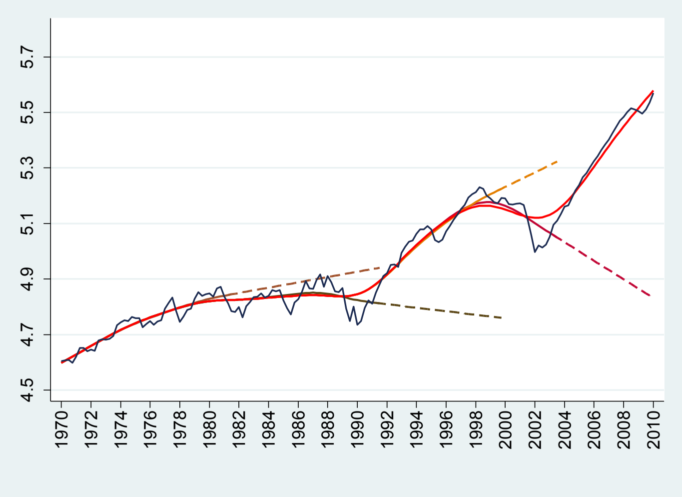

Introducing learning about the output trend

I explore two types of learning:

1. Kalman filter (Bayesian learning)
2. Stochastic-gain learning (Non-Bayesian learning)

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Rational expectations approach in a context of imperfect information on the nature of shocks (problem of extraction of signals)

- General idea: The individual attempts to identify whether changes in output are due to transitory or permanent shocks

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The goal is to estimate $\alpha_t = \begin{bmatrix} z_t & z_{t-1} & g_t \end{bmatrix}'$ optimally

- Given normality of errors, the optimal estimator $a_t = E(\alpha_t / I_t)$ is linear
- The Kalman coefficients are the parameters of an adaptive rule for the posterior a_t that is a linear combination of previous beliefs and the new signal:

$$a_t = k_1 a_{t/t-1} + k_2 g_t^Y$$

  where Kalman coefficients depend on parameters that govern productivity processes

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How does Kalman filter learning affect the likelihood of crisis?

Key for increase in variance of expected permanent income: Kalman filter learning is characterized by an additional layer of uncertainty with respect to FIRE

- Kalman filter assigns higher probability than FIRE to the permanent component
- This probability is higher the higher the variance of permanent shocks

Hence, Kalman filter learning increases the variance of beliefs on permanent shocks by more in emerging than in developed economies

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General idea: If forecast errors are small, the individual adjusts her expectations by using a decreasing gain parameter. However, if forecast errors are large, the individual suspects there was a change of regime, hence she assigns more importance to information of the present and the gain parameter becomes constant

- In this learning scheme, the individual does not take into account the fact that in the subsequent periods she will keep updating her expectations

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$$E_t g_{t+1}^y = E_{t-1} g_t^y + \kappa_t (g_t^y - E_{t-1} g_t^y)$$

$$\kappa_t = \begin{cases} 1/t \quad if \quad \frac{1}{S}\sum_{s=0}^{S}(\mid g_{t-s}^y - E_{t-s-1} g_{t-s}^y \mid) < v_t^y \\ \\ \kappa \quad if \quad \frac{1}{S}\sum_{s=0}^{S}(\mid g_{t-s}^y - E_{t-s-1} g_{t-s}^y \mid) \geq v_t^y \end{cases}$$

- v_t^y is the mean absolute deviation of historical forecast errors, which is recursively updated
- When the agent switches back to a decreasing-gain parameter, the parameter is reset to $\frac{1}{\kappa^{-1}+t}$ (t starts from one after the switch)

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Why do I explore stochastic-gain learning?

- Two reasons
  1. Empirical reason: Good match with survey data on expectations
  2. Theoretical reason: It satisfies certain desirable conditions

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Empirical reason: What theoretical expectations have a better fit to actual expectations?

- Three mechanisms:

  1. FIRE represented by perfect foresight
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Result: SGL has the best performance in most of emerging economies, performance of the three is about the same in developed economies

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- Good forecasts in the limit
- Good forecasts along the transition

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$$E_t g_{t+1}^y = E_{t-1} g_t^y + \kappa_t (g_t^y - E_{t-1} g_t^y)$$

Two sources for higher amplification of volatility of expectations in more volatile economies:

1. Average forecast errors of larger size
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Results

- Better match of frequencies of crises in emerging economies with SGL than Bayesian learning than FIRE (for example, annual theoretical frequencies for Argentina are 0.044, 0,0026, 0, respectively, while empirical frequency since WWII is 0.078)
- Similar match in industrial economies
- No big cost in terms of explaining other moments

Section 2:

Disagreement on expectations and Financial Instability

Pseudo-wealth and Macroeconomic Fluctuations (Guzman and Stiglitz (2014))

Basic premises:

- Disagreement of beliefs can lead to higher expected wealth
- Changes in the distribution of beliefs will have wealth effects that will affect economic decisions
- Hence, effects on macroeconomic fluctuations, with potential disruptive effects on stability

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Pseudo-wealth and Macroeconomic Fluctuations
Basic model

- Two sectors, 1 and 2
- Probability λ from Poisson distribution of innovation in sector 1
- If there is an innovation in sector 1, no further innovation is possible until there is innovation in sector 2
- Two agents: $i = \{W, B\}$, infinite horizon
- Innovation leads to growth in income of both agents: $g^i = \frac{Y_{i,S} - Y_{i,0}}{Y_{i,0}}$
- Disagreement on value of λ: $\lambda^W > \lambda^B$
- There is a market for bets (b) (bets as a metaphor)
- Price of bet: p. If innovation occurs, W receives $1 - p$, otherwise pays p

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Pseudo-wealth and Macroeconomic Fluctuations
Basic model

- Decisions: choose consumption and bets in order to maximize expected discounted value of utility
- Utility function is CRRA
- Consumption will depend on "pseudo-wealth"

$$PW^W = [\lambda^W - \sigma g^W/2 - p]$$

$$PW^B = [p + \sigma g^B/2 - \lambda^B]$$

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Pseudo-wealth and Macroeconomic Fluctuations
Basic model

- General equilibrium solution displays consumption and price-quantities of bets as function of beliefs and parameters
- Realization of innovations lead to changes in aggregate pseudo-wealth, hence changes in aggregate consumption

Section 3:

Volatility of expectations and severity of crises

Volatility of expectations and severity of crises (Gluzmann, Guzman, and Howitt (2013))

- Motivation: Minsky Financial Instability Hypothesis (FIH)
  - "Stability leads to instability"
- Stability of expectations associated with more severe crises (correlations)
  - Stability of expectations as a measure of overconfidence

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Volatility of expectations and severity of crises: Empirical analysis

- Insufficient survey data on expectations
- Then, we build series of expectations by using forecasting algorithm (SGL) that has best fit with survey data from Survey of Professional Forecasters

Volatility of expectations and severity of crises: Empirical analysis

Change in expectations. $CE_{t-1,t}$ is the change in output growth expectations from period $t-1$ to t,

$$CE_{t-1,t} = |E_t g^y_{t+1} - E_{t-1} g^y_t|$$

Volatility of expectations. $VOE(i)$ is a measure of the stability of expectations between crisis $i-1$ and i:

$$VOE(i) = \frac{1}{t(i) - t(i-1)} \sum_{t=t(i-1)}^{t(i)} CE_{t-1,t}$$

where $t(i)$ is the year in which crisis i occurs

Volatility of expectations and severity of crises: Empirical analysis

- Severity of crises measured as output growth loss

$$Sev(t_0) = \sum_{t=t_0}^{t_n} (\tilde{g}_{t_0}^{y} - g_t^{y})$$

- No consensus on right measures, we use many

Volatility of expectations and severity of crises: Empirical analysis

- We firstly estimate the following model with pooled data

$$Sev_i = \alpha + \beta VOE_i + \gamma X_i + \epsilon_i$$

- Then, model with country-fixed effects
- If more stable expectations are associated to more severe crises, β should be negative

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Results

- For sovereign debt and banking crises, $\beta < 0 \rightarrow$ more stability of expectations associated with more severe crisis
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Conclusions

- Importance of assumptions on expectations for understanding financial and macroeconomic instability $\rightarrow$ Possibly more useful models for short-term forecasts
- Importance of evolution of beliefs for assessing probability and severity of crises
- Macro-based explanations vs. Political-economy based of macroeconomic instability $\rightarrow$ Complementary, non-mutually exclusive, explanations

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