Taylor Rules and Sudden Stops in Small Open Economies

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Introduction

Some questions:

- What is the relationship between monetary and financial stability in emerging economies?
- Does monetary policy reduce or increase the likelihood of a sudden stop in capital inflows?
- Is this impact on the occurrence of sudden stops quantitatively important?

Motivation I

- From a positive point of view, it is not obvious that monetary policy alone, by stabilizing output and inflation, unambiguously reduces the likelihood of a sudden stop in capital inflows.
- A key element of the analysis is the financial structure. See Caballero (2004)
- Under a very high degree of financial development, conclusions reached in closed economy monetary policy models are virtually isomorphic to those obtained in small open economies. See Gali et al. (2005)
- However, a very low degree of financial development leads to very different conclusions.
- Under incomplete financial markets macroeconomic volatility stimulates precautionary savings and improves the long-run net foreign asset (NFA) position of a small open economy. It in turn reduces the likelihood of a sudden stop.

Motivation II

- Therefore, incomplete markets + sticky prices give MP a role to affect long-run (NFA).
- Furthermore, the presence of occasionally binding constraints not fully internalized by agents may induce overborrowing and therefore increase the likelihood of a sudden stop.

MP Tradeoffs

- Stabilizing inflation by adjusting interest rates (through a Taylor rule, for instance) implies accepting higher output volatility.
- On the contrary, if monetary policy seeks to stabilize output it would have to accept higher inflation volatility.
- Hence, the relative weight that a central bank puts on inflation-output stabilization may play a crucial role on the likelihood of sudden stops when financial markets are incomplete and the economy faces nominal and financial frictions.

Goals

- Our paper seeks to investigate these mechanisms quantitatively. To our knowledge, this is a novel contribution to the literature.
- Our research project aims to set up a stochastic small open economy model with sticky prices in the NT sector, incomplete markets for foreign funding and occasionally binding constraints to make welfare evaluations of different Taylor Rules.
- At this stage of the project we have the quantitave model's results when there are not occasionally binding constraints.

Model I

Households

$$E_0\left[\sum_{t=0}^{\infty}\beta^t\frac{\left[c_t-\frac{h_t^{\omega}}{\omega}\right]^{1-\sigma}}{1-\sigma}\right]$$

subject to:

$$c_t+q_tb_t^{\star}(1+r_t^f)+Q_{t,t+1}b_{t+1}\leq w_th_t+\xi_t^N+y^T+q_tb_{t+1}^{\star}+b_t$$

$$c_t=\left(c_t^N\right)^{\gamma}\left(c_t^T\right)^{1-\gamma}$$

$$c_t^N=\left[\int_0^1 c_t^N(j)^{\frac{\theta-1}{\theta}}dj\right]^{\frac{\theta}{\theta-1}}.$$

Model II

Nontradable goods production

There is a representative firm producing a homogeneous nontradable good in a perfectly competitive environment, in which the NT firm's objective is to minimize the total cost:

$$w_t h_t + p_t^x m_t$$

subject to

$$y_t^N = A_t h_t^\alpha (m_t)^{1-\alpha}$$

Model III

Price-Setting

- There is a continuum of retailer firms which buy the homogeneous good from the perfectly competitive firms and transform this homogeneous good in a differentiated variety j.
- Therefore, each of these firms has monopoly power in their respective variety.
- We assume that there is Calvo price-stickiness: each retailer receives a random signal to adjust their prices with a probability $1-\varepsilon$, setting a price $\tilde{p}_t^N(j)$ to maximize:

$$E_t \sum_{i=0}^{\infty} \varepsilon^i \Lambda_{t,t+i} [p_t^N(j) y_{,t+i}^N(j) - \varphi_{t+i} y_{,t+i}^N(j)] \tag{1}$$

subject to:

$$y_t^N(j) = \left(\frac{p_t^N(j)}{p_t^N} \right)^{-\theta} y_t^N \tag{2}$$

- In case of not optimally adjusting prices as above, they have to adjust by using the following rule:

$$p_t^N(j) = (1+\bar{\pi})\, p_{t-1}^N$$

Model VI

Closing the model

- To guarantee the existence of a well-defined foreign debt distribution in incomplete markets models, we need to assume:

$$\beta\left(1+r^{*}\right)<1$$

- However, for local approximation solutions we use:
- $$r^{*}=r^{f}+\eta\log\left(\frac{q_{t}b_{t}^{\star}}{y_{t}}-\chi+1\right)$$

Model V

Central Bank

$$i_t = r_t^n + \bar{\pi} + \phi_\pi (\pi_t - \bar{\pi}) + \phi_y (y_t - y_t^n)$$

Market clearing conditions

$$p_t^N(j) = p_t^N \qquad y_t^N(j) = y_t^N$$

$$c_t^N = v_t y_t^N \qquad b_t = 0$$

$$p_t^T = q_t p_t^{T,\star} \qquad p_t^x = q_t p_t^{x,\star}$$

- From the model's BC and above EC, we have:

$$p_t^x m_t + p_t^T c_t^T + q_t b_t^\star (1 + r_t^f) + = p_t^T y_t^T + q_t b_{t+1}^\star. \tag{3}$$

Solution

- There is no analytical solution for this model, so we resort to a numerical approximation solution to study the quantitative properties of the model.
- We solve the model by perturbation methods, performing a second order approximation.
- This approximation allows us to capture the effects of volatility on the optimal decisions of economic agents. (*precautionary behavior*)
- At this stage of the paper, we assume that there are no occasionally binding constraints in order to understand the effect of uncertainty presence on the variables moments and probability distributions. Hence, sudden stop probabilities computed here are based on the assumption that households do not internalize the BC.

Calibration

- We use annualized quarterly frequency data from *the Colombian national statistics department, DANE* for the period 2000Q1 - 2016Q4.
- By using the deterministic steady state of this model consistent with a debt-to-output ratio of 30%, we calibrate the parameters α,γ,θ such that the model matches observed long-run ratios of $\frac{wh}{y}$, $\frac{p^N y^N}{p^T y^T}$, $\frac{c^T}{y^T}$ observed for Colombian economy.
- Unlike the first order approximation solution, the presence of uncertainty in the model makes that $E\left(\frac{q_t b_t^*}{y_t}\right)$ will be very far from χ (i.e. 30%). Therefore, we calibrate η to get $E\left(\frac{q_t b_t^*}{y_t}\right) = 0.3$
- The rest of the parameters were taken from small open economy models literature.

Experiments: Changes in risk aversion I

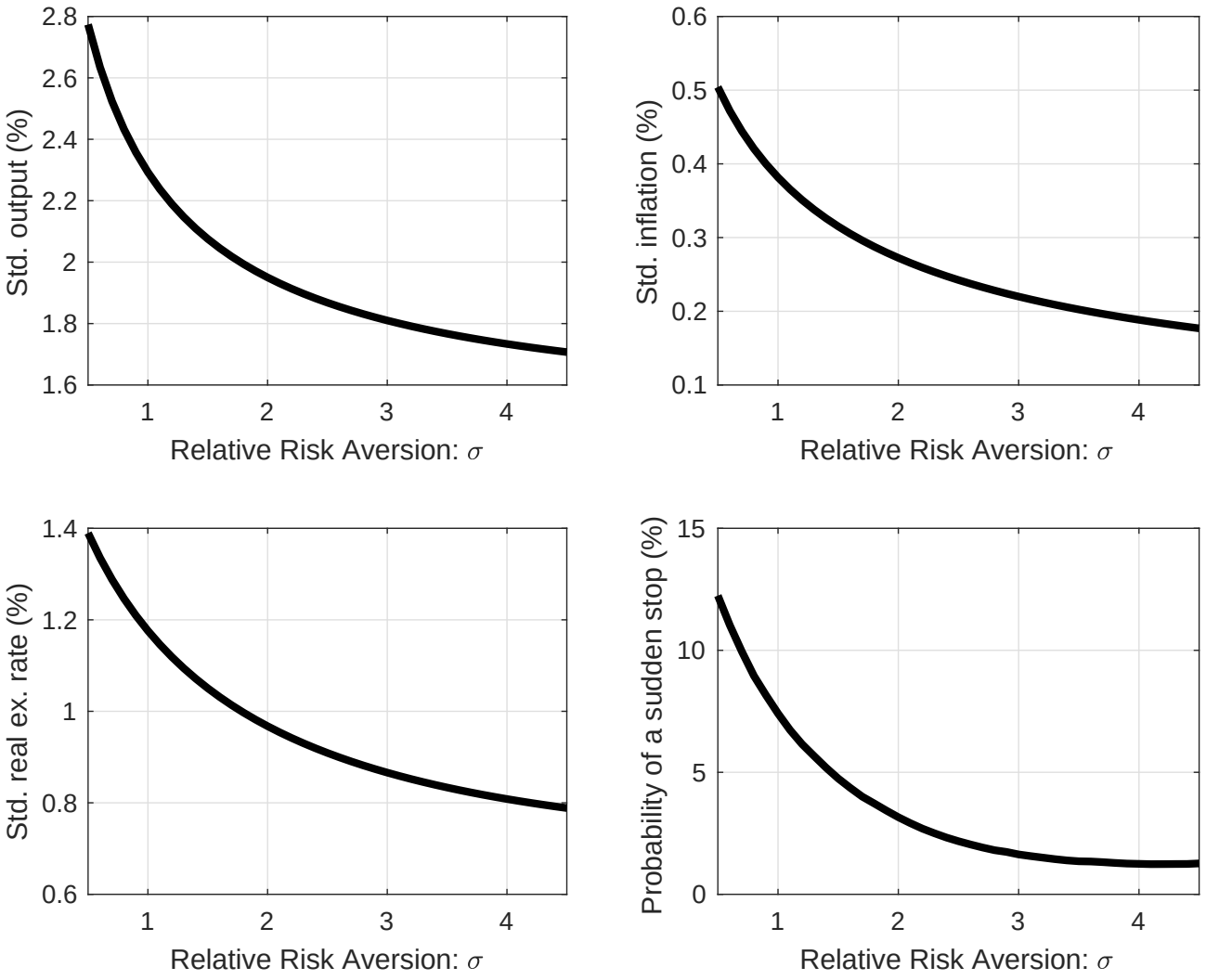

Figure: Probability of a sudden stop on changes in risk aversion

Experiments: Changes in risk aversion II

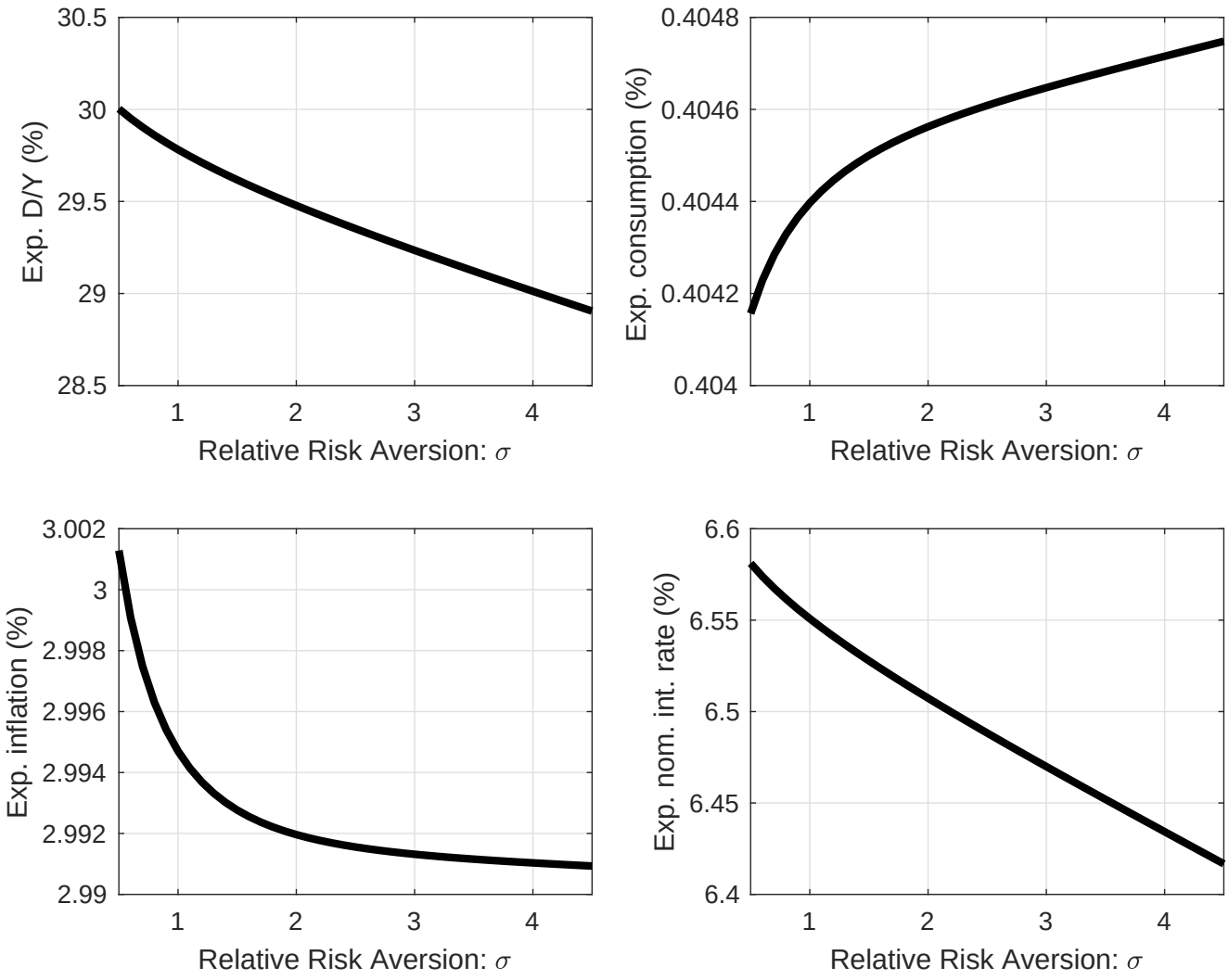

Figure: Expected debt-to-output on changes in risk aversion

Experiments: Changes in economy's openness I

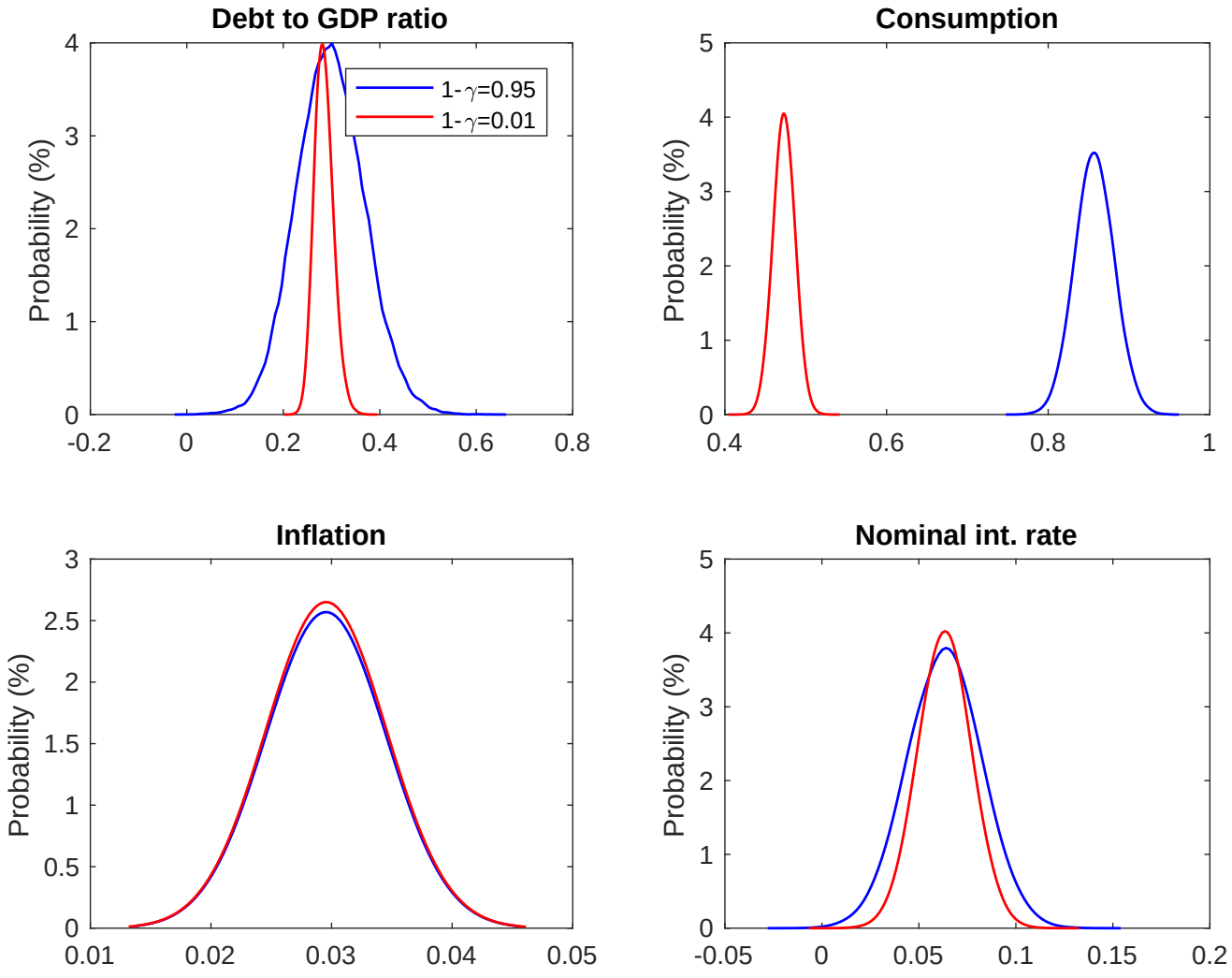

Figure: Debt to output ratio's distributions for two degrees of trade openness

Experiments: Changes in economy's openness II

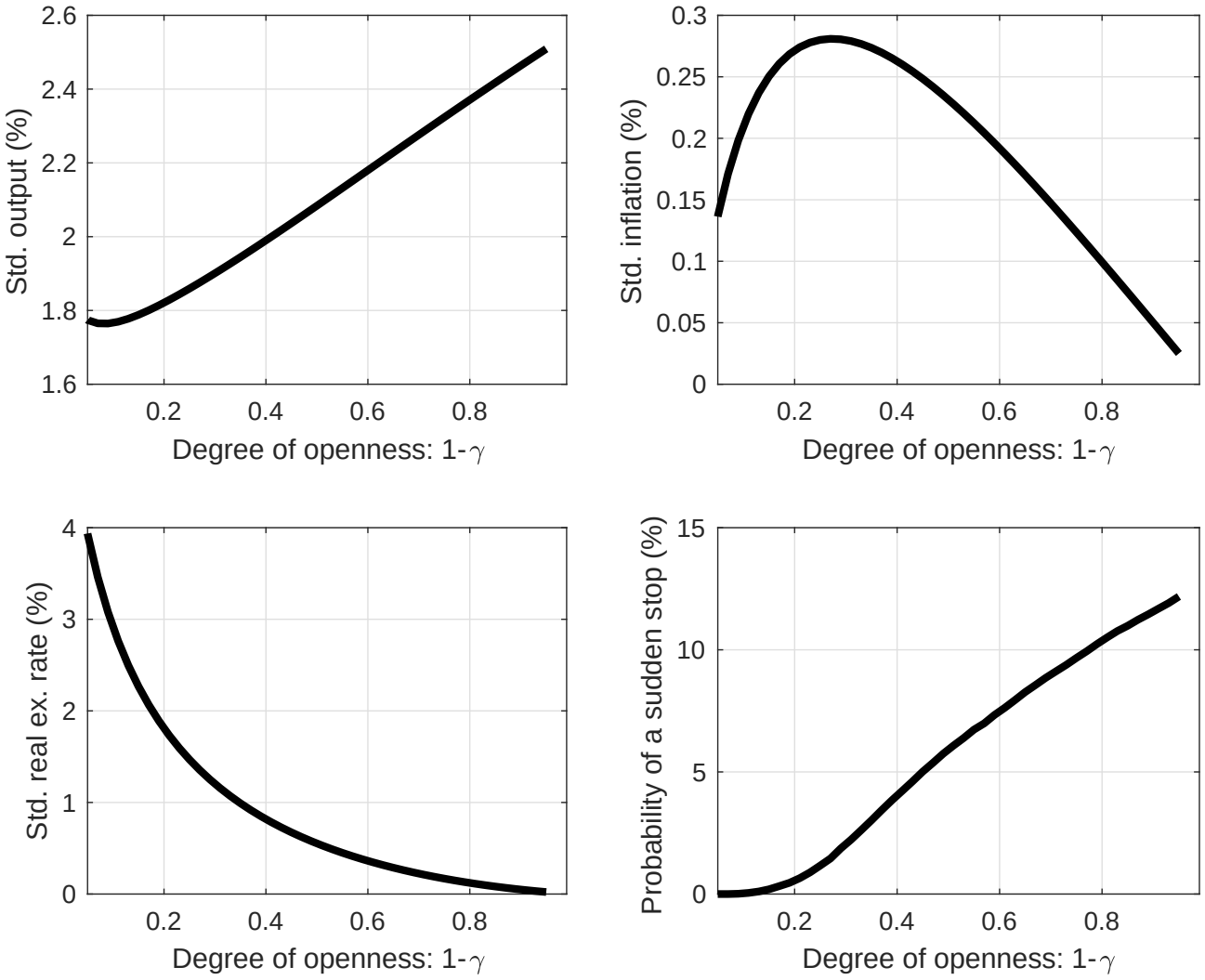

Figure: Probability of a sudden stop on changes in trade openness

Experiments: Changes in economy's openness III

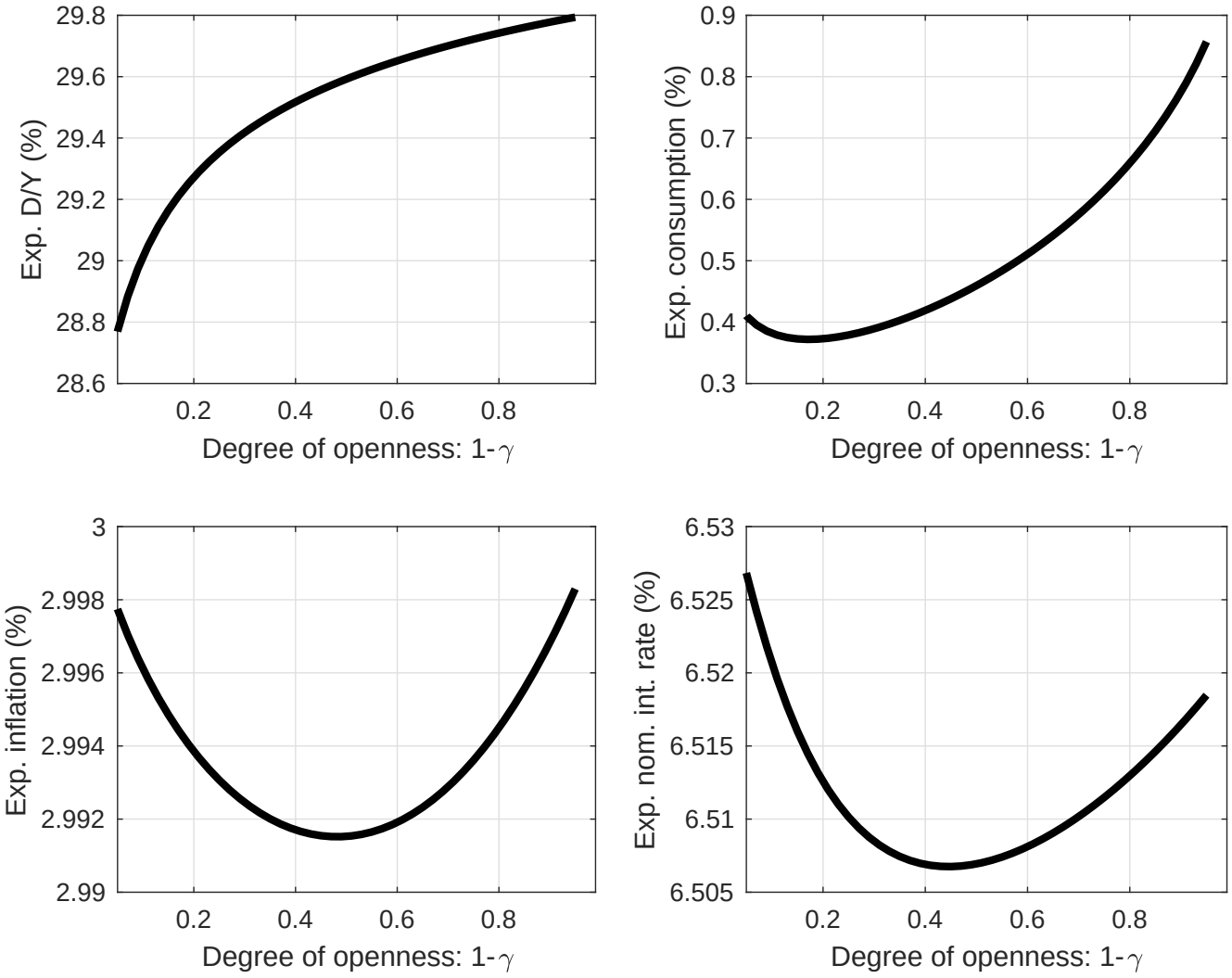

Figure: Expected debt-to-output on changes in trade openness

Experiments: Changes in price stickiness

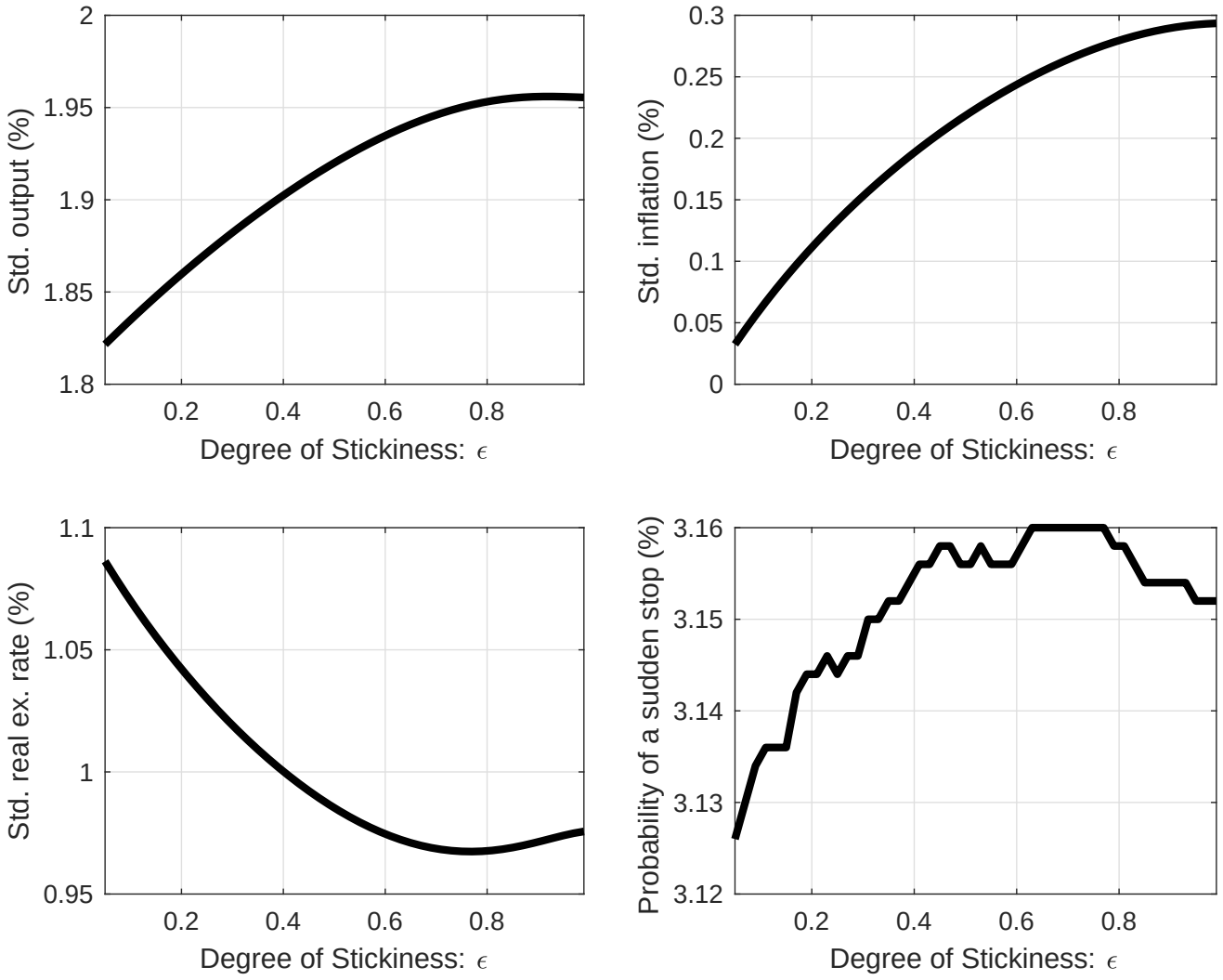

Figure: Probability of a sudden stop on changes in price stickiness

Experiments: Changes in monetary policy I

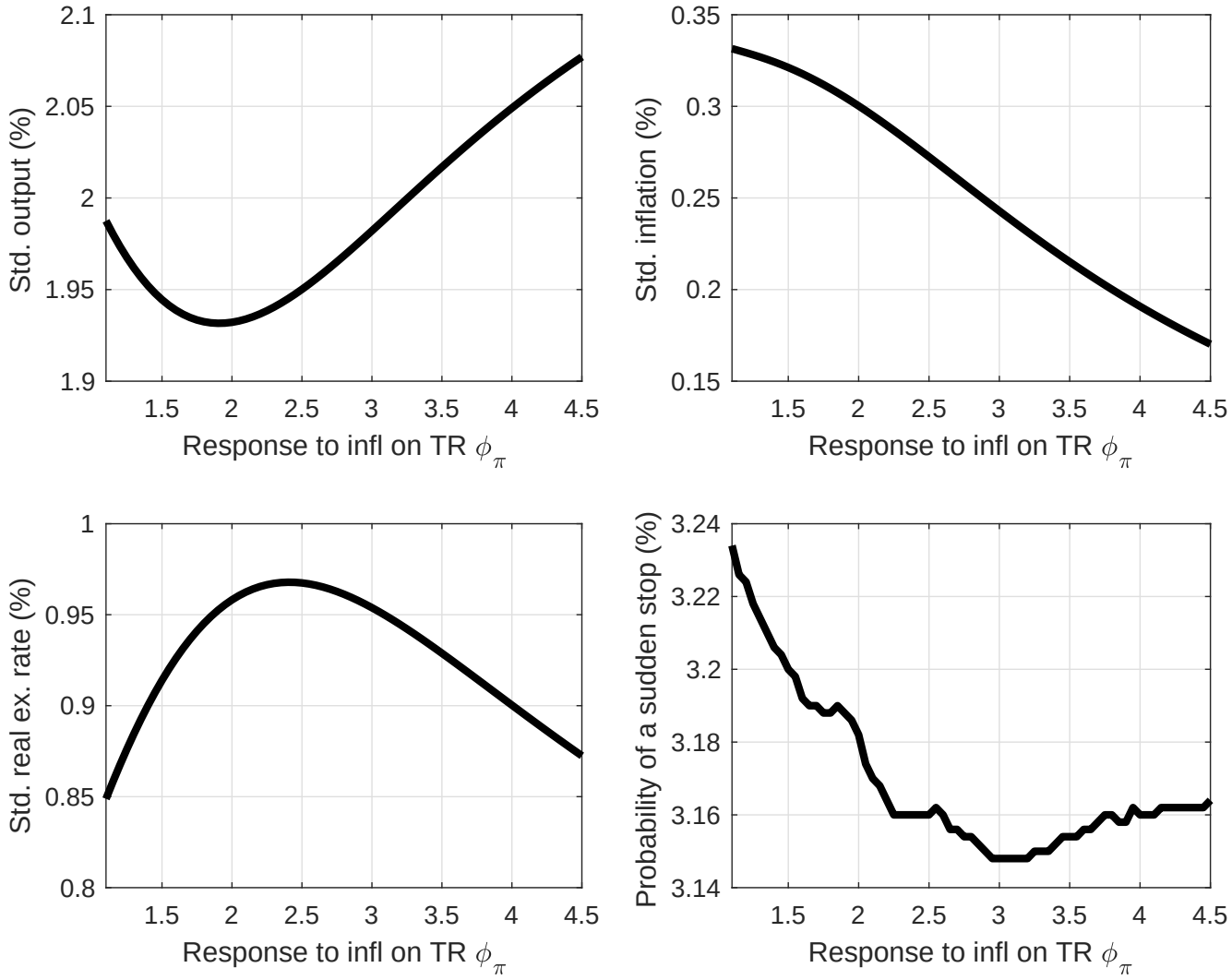

Figure: Probability of a sudden stop on changes in monetary policy reaction on inflation