The Great Indian Savings Puzzle

[An Extended Abstract]

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In the last 50 years, the gross savings rate across most countries has been more or less stationary. Most, but not all. The notable exceptions have been India and China. Both these economies have witnessed secular rise in savings rate from 1970s to mid 2000s. See Figure 1. However, post 2007 for India and post 2010 for China, the savings rate in these two economies have declined.

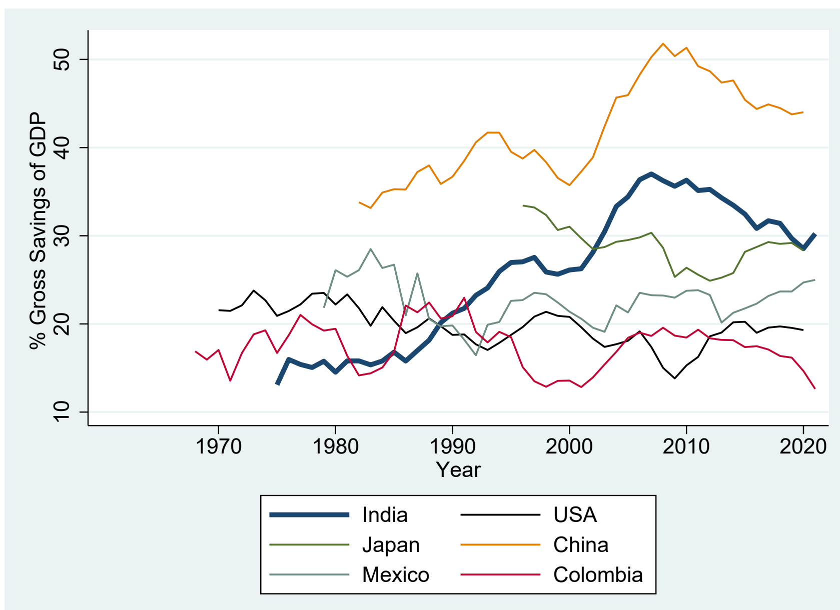


Figure 1: Cross Country Patterns of Savings Rate in Select Developed and Developing Nations

From 2009 to 2021, the Indian savings rate (% of GDP) has declined from 37% to 30.5%. In India, we find two key aspects of savings dynamics. First, household savings constitutes a large fraction of national savings and it, too,

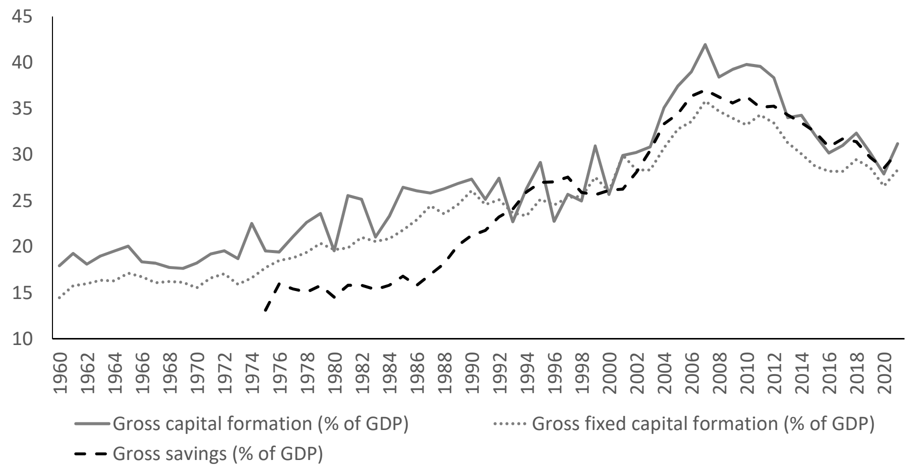


Figure 2: Investment and Savings Rates

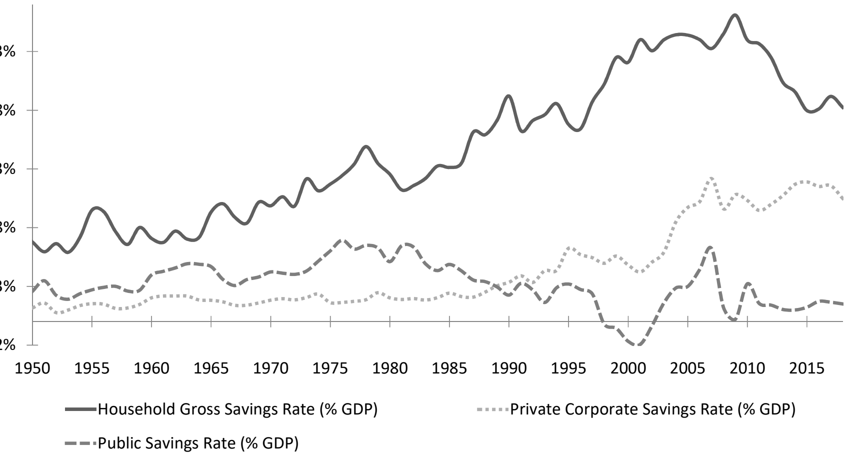
presents the same inverted-u shaped trajectory as national savings. Second, within household savings, savings in the form of physical assets has a more pronounced inverted-u shaped trajectory than financial assets savings. Given that the Indian savings pattern is driven by household savings in physical assets, we want to explain the following stylized facts:

1. The rise and the fall of savings rate from 1997-2017.

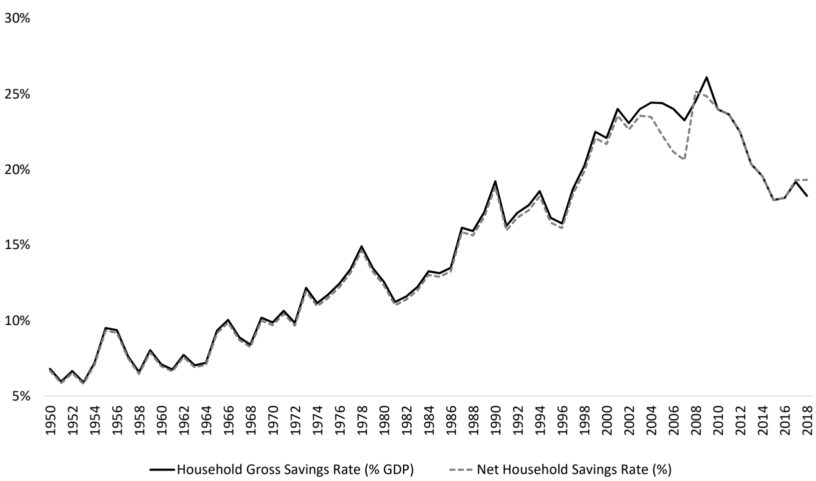
2. The monotonic increase in capital-output ratio.

Figure 3 depicts these patterns.

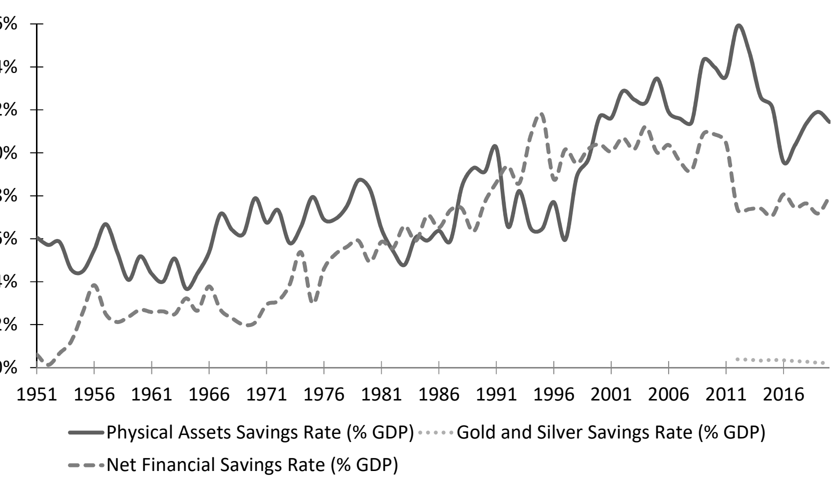
An increase in capital-output ratio would result in a decline in the interest rate, however the savings rate has an inverted u-shaped trajectory. In this paper, we ask, what explains the sudden decline in savings rate in India while capital to output ratio continues to rise?



(a) Composition of Gross National Savings



(b) Trends in Household Savings



(c) Composition of Household Savings

Figure 3: Stylized Facts

1 Existing Explanations of Savings Rate Trends

Chen et al. (2009) explain the decline in savings rate in the USA in the period 1960-2005 in terms productivity growth, population growth rates and fiscal policy. Fernández et al. (2019) explain savings rate pattern for 1970-2010, which appear to fluctuate around a constant level, for Latin American countries of Chile, Colombia and Mexico. Both papers find that TFP growth is the most important determinant for savings rate. In this section, build a neoclassical growth model based on Chen et al. (2009) and Fernández et al. (2019).

1.1 Benchmark Model

Let us consider a Ramsay model. The firm produces output using capital and labor in Cobb-Douglas technology: $Y_t = K_t^\theta (A_t H_t)^{1-\theta}$. Assuming this good to be the numeraire, the profit maximization conditions yield:

$$w_t = (1-\theta) A_t \left(\frac{K_t}{A_t H_t}\right)^\theta, \quad r_t = \theta \left(\frac{K_t}{A_t H_t}\right)^{-(1-\theta)}.$$

where $H_t = h_t N_t$. TFP and population grows at the rate g_{At} and n_t respectively, i.e. $A_{t+1}/A_t = g_{At}$ and $N_{t+1}/N_t = n_t$.

The representative household maximizes its lifetime discounted utility $\sum_{t=0}^{\infty} \beta^t N_t \left(\ln c_t + \alpha \ln(\bar{h} - h_t)\right)$ subject to the budget constraint $c_t N_t + K_{t+1} - (1-\delta)K_t \leq (1-\tau_{Lt}) w_t h_t N_t + (1-\tau_{Kt})(r_t - \delta)K_t + Z_t$. In Fernandez et al (IMFER 2019), tax is applied on the net capital returns $(r_t - \delta)$. The optimization conditions yield:

$$\frac{\tilde{c}_{t+1}}{\tilde{c}_t} = \frac{\beta}{g_t}\left[1 + (1-\tau_{Kt+1})\left(\theta\left(\frac{\tilde{k}_{t+1}}{h_{t+1}}\right)^{-(1-\theta)} - \delta\right)\right] \tag{1}$$

$$h_t = \bar{h} - \frac{\alpha \tilde{c}_t}{(1-\theta)(1-\tau_{Lt})}\left(\frac{\tilde{k}_t}{h_t}\right)^{-\theta} \tag{2}$$

where $\tilde{k}_t = K_t/(N_t A_t)$, $\tilde{c}_t = c_t/A_t$. The government budget is $G_t + Z_t = \tau_{Kt} r_t K_t + \tau_{Lt} w_t h_t N_t$. The economy wide resource constraint in normalized terms is:

$$\tilde{c}_t + g_{At} n_t \tilde{k}_{t+1} - (1-\delta)\tilde{k}_t + \chi_t = \tilde{k}_t^\theta h_t^{1-\theta} \tag{3}$$

where $\chi_t = G_t/Y_t$

Given exogenous variable g_{At}, n_t, G_t, τ_t and exogenous parameters $\bar{h}$, α, θ, δ we get the private savings rate equals:

$$s_t = \frac{Y_t - G_t - c_t N_t}{Y_t} = \frac{k_{t+1} g_t n_t - (1-\delta)k_t}{y_t}$$

In the long run, $\lim_{t\to\infty}[g_{At}, n_t, \chi_t, \tau_{Kt}, \tau_{Lt}] = [g_A^*, n^*, \chi^*, \tau_K^*, \tau_L^*]$. At the steady state, the resource constraint and the household optimization conditions yield:

$$\left(\frac{\tilde{k}^*}{h^*}\right)^{1-\theta} = \theta \left[\frac{1}{(1-\tau_K^*)}\left(\frac{g_A^*}{\beta} - 1\right) + \delta\right]^{-1}$$

$$\frac{\tilde{c}^*}{\tilde{y}^*} = \frac{(1-\theta)(1-\tau_L^*)}{\alpha}\frac{\bar{h} - h^*}{h^*}$$

$$\left(\frac{\tilde{k}^*}{h^*}\right)^{1-\theta}(g_A^* n^* - 1 + \delta) = 1 - \chi^* - \frac{\tilde{c}^*}{\tilde{y}^*}$$

1.2 Calibration

The time series of exogenous variables for India is shown in Figure 4. The parameters are assumed as are standard in the literature, in Table 1.

Parameter	Value	Description
β	0.98	Discount factor
θ	0.36	Capital share
δ	0.1	Capital depreciation rate
α	0.33	Disutility of labor
$\bar{h}$	1	Total endowed hours per person [arb]
n^*	1.0122	Employment growth for 2017-18, KLEMS India
χ^*	0.10205116	Share of government spending in GDP (Indian data, 2018)
τ_K^*	0.089	Capital tax rate (Indian data, 2019)
τ_L^*	0.1675	Labor income tax rate (Indian data, 2019)

Table 1: Baseline Calibration

Using shooting algorithm, we get the trajectory for the endogenous variables in the model. We find that the neoclassical growth model which explains the US and the Latin American savings rate patterns does not appear to explain the Indian savings data. A neoclassical closed economy growth model with Cobb Douglas production function predicts that the savings rate in a capital poor economy (i.e. where initial normalized capital is less than the steady state levels) will fall over time. Thus, the model presents a reasonable fit to Indian data post 2007 (see Figure 5). However, the model does not explain the growth in Indian savings rate in the period prior to 2007.

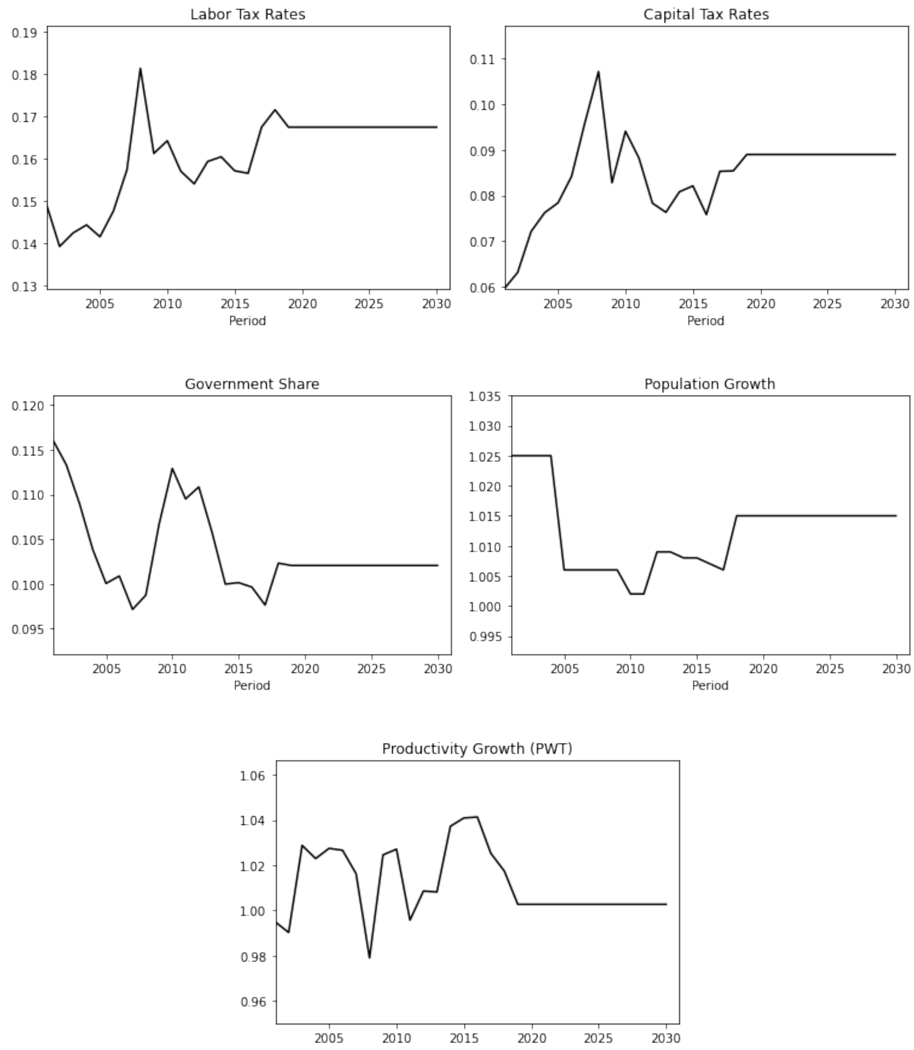


Figure 4: Trajectories of exogenous variables

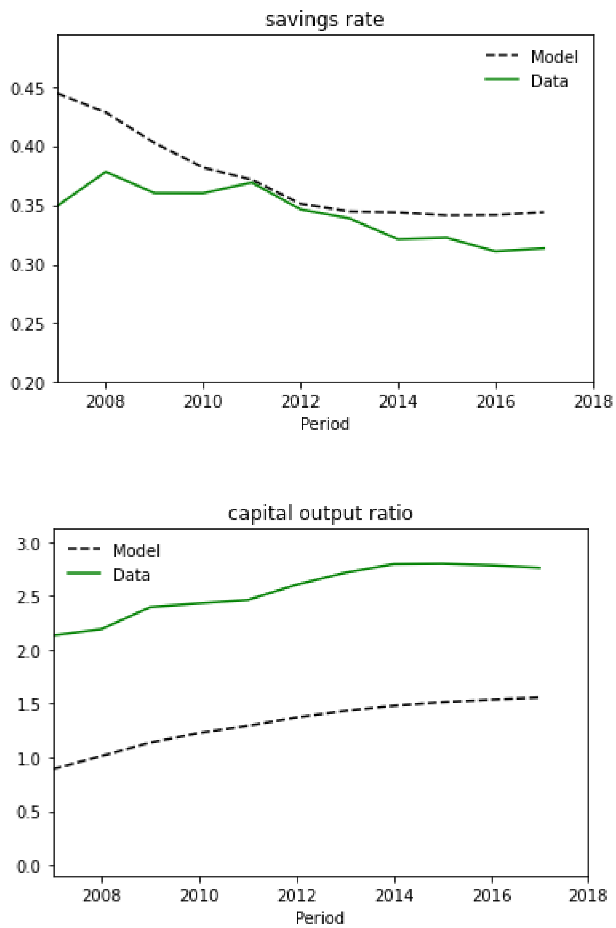


Figure 5: Fit on Indian data (2007-17): Benchmark Model

2 Alternative Model - 1

We now allow for risk averse household. We incorporate CRRA utility function with labor-leisure choice to see whether it can explain the rise in savings rate prior to 2007. The representative household maximizes its lifetime discounted utility

$$\sum_{t=0}^{\infty} \beta^t N_t \frac{\left(c_t^{1-\alpha}(\bar{h}-h_t)^{\alpha}\right)^{1-\gamma}-1}{1-\gamma}$$

subject to the budget constraint $c_t N_t + K_{t+1} - (1-\delta)K_t \leq (1-\tau_{Lt})w_t h_t N_t + (r_t - \tau_{Kt}(r_t-\delta))K_t + Z_t$. The optimization conditions yield:

$$\beta^t N_t (c_t^{1-\alpha}(\bar{h}-h_t)^{\alpha})^{-\gamma}(1-\alpha)c_t^{-\alpha} = \lambda_t N_t \tag{4}$$

$$\frac{1-\alpha}{\alpha}\frac{\bar{h}-h_t}{c_t} = \frac{1}{(1-\tau_{Lt})w_t} \tag{5}$$

$$\frac{\lambda_t}{\lambda_{t+1}} = 1 + (1-\tau_{Kt+1})(r_{t+1}-\delta) \tag{6}$$

where $\tilde{k}_t = K_t/\left(N_t A_t\right)$ and $\tilde{c}_t = c_t/A_t$. The lagrange multiplier grows at the same rate as $\beta^t c_t^{-(\alpha+(1-\alpha)\gamma)}$. The problem of the representative firm and the government budget is unchanged as in the previous model.

Given exogenous variable g_{At}, n_t, G_t, τ_t and exogenous parameters $\bar{h}$, α, θ, δ, γ we get the private savings rate equals:

$$s_t = \frac{Y_t - G_t - c_t N_t}{Y_t} = \frac{\tilde{k}_{t+1} g_{At} n_t - (1-\delta)\tilde{k}_t}{\tilde{y}_t}$$

where $\chi_t = G_t/Y_t$, $\frac{\tilde{y}_t}{\tilde{k}_t} = \frac{r_t}{\theta}$ and $r_t = \theta\left(\tilde{k}_t\right)^{-(1-\theta)}$.

Given exogenous variable g_{At}, n_t, G_t, τ_t and exogenous parameters $\bar{h}$, α, θ, δ, γ we get the private savings rate equals:

$$s_t = \frac{Y_t - G_t - c_t N_t}{Y_t} = 1 - \chi_t - \frac{\tilde{c}_t}{k_t^{\theta}} = \frac{\tilde{k}_{t+1} g_{At} n_t - (1-\delta)\tilde{k}_t}{\tilde{y}_t}$$

In the long run, $\lim_{t\to\infty}[g_{At}, n_t, \chi_t, \tau_{Kt}, \tau_{Lt}] = [g_A^*, n^*, \chi^*, \tau_K^*, \tau_L^*]$. At the steady state, the resource constraint and the household optimization conditions yield:

$$r^* = \frac{1}{(1-\tau_K^*)}\left(\frac{g_A^{*\,\gamma}}{\beta} - 1\right) + \delta$$

$$\tilde{k}^* = \left(\frac{r^*}{\theta}\right)^{-\frac{1}{1-\theta}}$$

$$\frac{\tilde{c}^*}{\tilde{k}^*} = (1-\chi^*)\frac{r^*}{\theta} + (1-\delta-g_A^* n^*)$$

2.1 Calibration

The only new additional parameter, relative to the previous section, is the CRRA risk aversion parameter which is estimated to be between 2 and 3 in the literature. We assume γ equals 2.87. We plot the model and the data fit in Figure 6

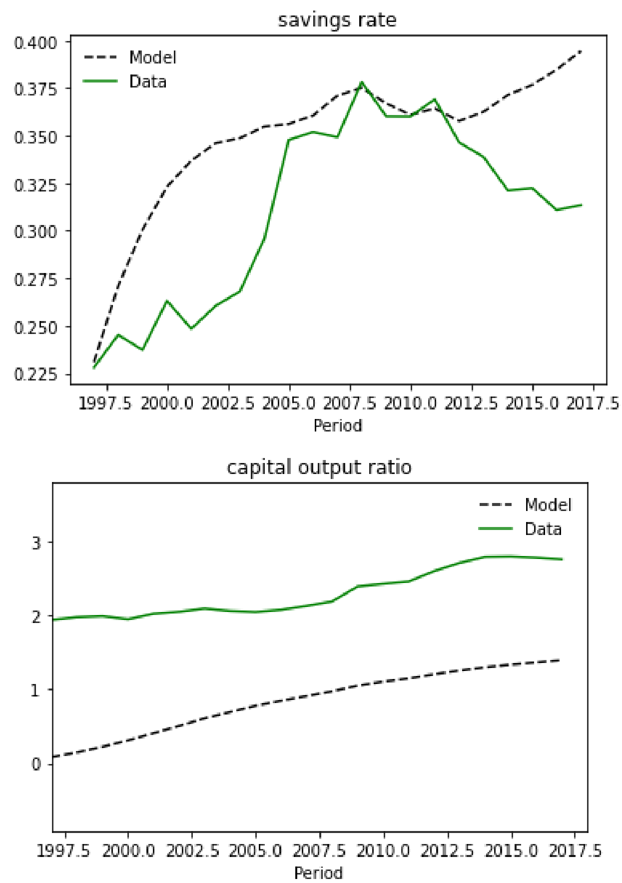


Figure 6: Fit on Indian data (2007-17): Alternative Model 1 with CRRA utility

In this specification, the model is able to capture the rise in savings rate prior to 2007, but not the fall thereafter. Thus, the decline in savings rate for India is not driven by trends in TFP, fiscal policy variables or population dynamics.

This is an ongoing work. There are other channels which may improve the fit of the model to data. For example, inflation itself may have affected savings pattern. Alternatively, the crash in the real estate market in 2007 may have changed the savings behavior. We next plan to test these alternate mechanisms in this paper.

References

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Fernández, Andrés et al. (2019). “Saving Rates in Latin America: A Neoclassical Perspective”. In: *IMF Economic Review* 67.4, pp. 791–823.