

The Rise and Fall of India's Relative Investment Price

A Tale of Policy Error and Reform

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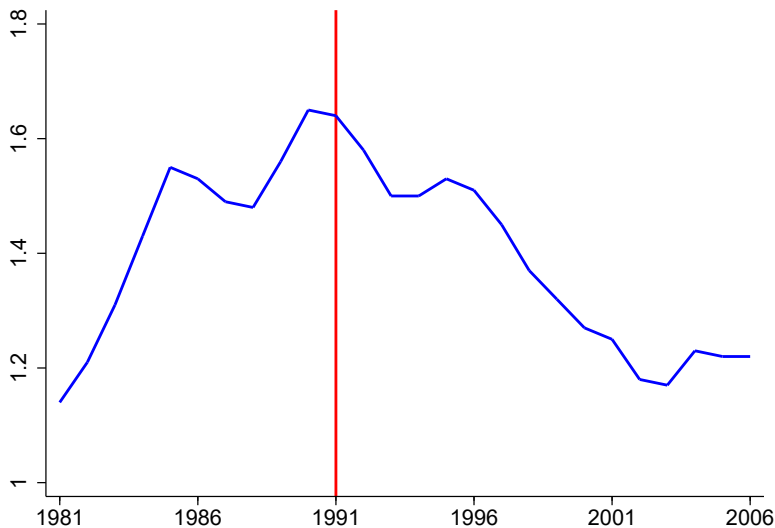
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Introduction

- 1 From 1981 to 1991 Indian relative price of investment (RPI) rose 44% compared to the world benchmark (PWT).
- 2 From 1991 to 2006 RPI fell 26% relative to the world benchmark.
- 3 Is this a big deal? Look at international variation in RPI:
 - ▶ Non G7 nation average RPI is 57% higher than G7 nation average.
 - ▶ 44% move in RPI is equivalent to transforming US economy to something like Estonia or Antigua and Barbuda in one decade.
- 4 The directional change in RPI is tantalizingly close to major economic reform in India.

The rise and fall of the relative price of investment (RPI)



Introduction

- Why did Indian RPI rise during the eighties when it fell in the developed world?
- Which policy change might be responsible for the subsequent fall in 1991 and beyond?
- We focus on one specific policy that is highly relevant to the price of investment goods - trade policy towards capital good imports.
- Could pre-reform capital import substitution policy account for the rise in RPI and can the removal of this policy explain the fall in quantitative terms?
- If yes, how much did this one policy change contribute to the subsequent increase in per capita output growth.

Capital Import Policy

- Before 1991:

- ▶ High tariff rates! UNCTAD weighted average rate on capital imports was 73%. Many individual machines faced much higher rates.
- ▶ Pervasive non-tariff barriers on capital good imports which required import licenses. Hasan et al. (2007) report coverage rates: machinery (77%); electrical (79%); transport equipment (82%).

- After 1991:

- ▶ Tariffs on imported capital goods fell from a weighted average of 72.7% in 1990 to 7.6% in 2006 in a series of steps.
- ▶ Import license requirements on many capital goods were removed during the initial reform but by 1993 this included virtually all capital goods.
- ▶ Maximum tariff fell from 400% to 45% in 6 years

Our story : pre - reform

- We interpret the need for licenses during the eighties as a binding constraint on capital imports facing firms.
- Population and productivity growth increase domestic demand for imported capital.
- Shortage of imported capital in India raises domestic price of imported capital and in turn the RPI. Tariff rates are constant in this period.
- “Success” of policy can be seen in a 28% fall in capital import share over this period.
- Model generated domestic price of imported machines reflects the implicit dynamic distortion caused by import substitution.

Our story : reform period

- Removal of license requirements lowers the domestic price of foreign capital to tariff inclusive world price (exogenous). This lowers RPI.
- In addition, tariff rates are reduced in a series of steps over 16 years.
- The fall in domestic price of foreign capital goods encourages the import of machinery into India.
- Since foreign machines are inputs into a composite domestic investment good, capital accumulation picks up as does output.

Results from calibrated model

- Calibrate our model to 1981 macroeconomic data for India. Feed in actual growth in workers and in productivity into this model.
- Model implies a 23 % rise in RPI from 1981 to 1991 driven by a rising distortion caused by the supply of imported capital falling relative to demand.
- The removal of import constraints in 1991 plus the fall in tariff rates from 73% to 7.6% causes RPI to fall 28% in the model.
- GDP per worker lower by about 3% in 1991 compared to 1981.
- Reform of capital import substitution permanently (new steady state) raises GDP per worker by 17.8%. On the transition to new steady state, this policy change explains one-fifth of observed growth pick up.

Model: household

- A representative household of size L_t maximizes lifetime utility :

$$U = \sum_{t=0}^{\infty} \beta^t \log C_t$$

- ▶ subject to budget constraint :

$$C_t + q_t l_t = w_t L_t + r_t K_t + \Pi_t^f + \Pi_t^i + \Pi_t^{\text{imp}} + T_t$$

- ▶ capital accumulation:

$$K_{t+1} = (1 - \delta)K_t + I_t$$

Model: output producing firm

- A representative firm produces final good, Y_t

$$Y_t = K_t^\alpha (z_t L_t)^{1-\alpha}$$

- maximizes profit

$$\Pi_t^f = K_t^\alpha (z_t L_t)^{1-\alpha} - r_t K_t - w_t L_t$$

- ▶ where productivity growth rate:

$$\frac{z_{t+1}}{z_t} = \gamma_z$$

- ▶ population growth rate :

$$\frac{L_{t+1}}{L_t} = \gamma_l$$

- ▶ two exogenous sources of growth : γ_l and γ_z

Model: investment good producer

- A representative investment good producer produces investment good, I_t

$$I_t = D_t^\tau M_t^{1-\tau}$$

- maximizes profit:

$$\Pi_t^i = q_t I_t - D_t - p_t^m M_t$$

where

- ▶ in pre-reform period, p_t^m is endogenous
- ▶ during reform period, p_t^m is exogenous, $p_t^m = p^w(1 + \text{tariff}_t)$
- D_t is domestic good, M_t is foreign machine and p_t^m is the domestic price of foreign machine

Model: investment good producer

- Reworked investment good producer's FOCs clarify our mechanism:

$$\frac{D_t}{M_t} = \frac{\tau}{1 - \tau} p_t^m$$

$$q_t = \frac{1}{\tau} \left(\frac{D_t}{M_t} \right)^{1-\tau}$$

- $\uparrow p_t^m$ encourages to do import substitution.
- Higher domestic price of imported capital raises RPI.

Model: importer

$$\Pi_t^{\text{imp}} = p_t^m M_t - p^w (1 + \text{tariff}_t) M_t$$

- If capital import limit \bar{M}_t is not binding, then importer chooses M_t to maximize profit, otherwise it is determined by policy.
- Market clearing determines the domestic price of capital p_t^m .

- **Before reform:** if binding, then

$$M_t = \bar{M}_t$$

$$p_t^m \geq p^w (1 + \text{tariff}_t)$$

- Profits earned are rebated back to consumers in a lump sum manner.
- If not binding, then no difference between periods.

- As population and productivity grow, the demand for M_t increases, but supply is fixed by the policy, implies $\uparrow p_t^m$
- p^w is constant (recall: in PWT, country RPI data is relative to world benchmark price).
- **During reform:** No endogenous distortion

$$p_t^m = p^w(1 + \text{tariff}_t)$$

- Government

$$\text{tariff}_t M_t = T_t$$

- All tariff collections are rebated to households in a lump sum fashion.

Model: (continued)

- Aggregate resource constraint

$$C_t + \underbrace{D_t + p^w M_t}_{\text{investment}} = Y_t$$

- If import constraint is not binding or if \overline{M}_t grows at the combined rate of population and productivity growth, then p^M and q are both constant. Otherwise both prices rise.
- If prices are constant, economy displays a balanced growth path where all other variables grow, otherwise $\frac{D_t}{M_t}$ rises over time.

Calibration of parameters

Parameter		Value	Source
Capital share in final good production	α	0.33	standard
Discount factor	β	0.9255	calibrated
Employment growth	γ_l	1.0326	PWT
Depreciation rate	δ	0.05	PWT
Productivity growth	γ_z	1.0212	PWT
Import share in investment good production	$(1 - \eta)$	0.2650	calibrated
Tariff	θ	0.72 & 0.076	UNCTAD TRAINS

- β and η jointly target 1981 $\frac{C}{Y} = .84$ and $\frac{M}{C} = .03$.

Calibration and quantitative strategy

- All results reported relative to normalized 1981 RPI (q).
- In 1981, value for \bar{M}_{1981} is chosen such that $p_{1981}^m = 1.72$
 - ▶ Implies investment producer pays no more than world price plus tariff in 1981. No distortion from license requirement.
 - ▶ Any higher \bar{M}_{1981} implies constraint is non-binding while a lower value merely effects level of RPI not the percent change.
- Since \bar{M}_t path is unobserved, we discipline it using information on $\frac{M}{C}$ in 1991 and 1981.
- Feed into the model observed worker and productivity growth from PWT. Solve for \bar{M}_t from 1981 to 1991 such that model delivers the correct $\frac{M}{C}$ in 1991.

Calibration and quantitative strategy

- Assume economy on balanced growth path before 1981.
- In 1981 \bar{M}_t starts to shrink. To match $\frac{M}{C}$ path, must fall by 3.5 % per annum.
- Import limits often quoted in nominal terms, large devaluation of Rupee.
- For the transition, we assume agents expect it to shrink for 50 years after which a balanced growth path is reestablished. Not sensitive to terminal point.
- Transition stops in 1991 with an unexpected reform that removes \bar{M}_t .
- Implicit distortion measured by p_t^m which is 115% higher in 1991 compared to 1981.

Result : pre - reform transition

- Model generates a 23% rise in RPI compared to 44% rise in the data.
- Result not sensitive to initial value of \bar{M}_t or terminal year for the policy. We tried 20, 50 and 100 years.
- Annual Output per effective unit of labour in 1991 is 2.9% below 1981 levels.

Results : reform period

- We assume \bar{M}_t was completely removed in 1992.
- We assume all tariff rate reductions were complete in 2006 so that a new balanced growth path can be calculated. Detrend all growing variables to obtain 2006 steady state (y^{06}, c^{06}, q^{06}) .
- Wish to isolate impact of tariff rate reductions from the impact of the removal of license requirements.
- This requires creation of a hypothetical reform period steady state in 1991 such that the tariff rate is chosen to match the pre-reform (1991) $p_t^m = 3.71$.

Results : reform period

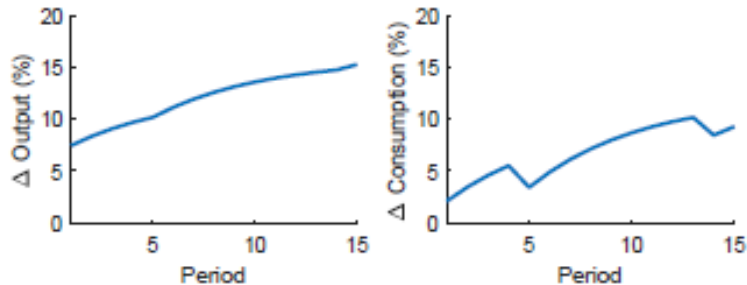
- Note hypothetical tariff rate equalizes distortion caused by licenses. Obtain output per effective unit of labor, similarly consumption (q^h, y^h, c^h) .
- Finally calculate a third steady state such that tariff rates equal their actual weighted average values in the data equal 72 % (q^{91}, y^{91}, c^{91}) .
- Total impact of reform : $\frac{q^{06}}{q^h} = -28\%$, $\frac{y^{06}}{y^h} = 17.8\%$.
- Partial impact of license removal: $\frac{q^{91}}{q^h} = -16\%$, $\frac{y^{91}}{y^h} = 11.3\%$.
- Tariff rate reduction only : -12% on q, 6.5% on y.

Reform period transition

- Obtain capital stock from the pre - reform transition in 1991 as the initial condition.
- As the government reduces tariffs from 72.7% to 7.6% , economy follows a transition path which itself changes with the change in tariff.
- Since annual data on weighted average tariff rates is unavailable, we group the changes into three episodes based on jumps in the data:
 - ▶ year 1: 52%
 - ▶ year 5: 23%
 - ▶ year 13: 7.6%.
- Each jump in tariff rate is unexpected and causes a jump to a new transition path. The transition starts anew, taking previous period capital stock as initial condition.

Result: reform induced transition

Figure: Percent change from 1991 value



- Over 15 years the economy produces an extra 180% of output and 101% of consumption.
- Output grows at 0.49% per annum on average over 15 years compared to pre-reform decade. Data : 2.2 % faster. So one reform accounts for 22% of growth pickup.

Conclusion

- Capital import substitution policies and their reform in 1991 account for a large fraction of the rise and fall in Indian RPI.
- Tariff and non-tariff barriers raise the cost of foreign capital goods causing firms to substitute domestic goods. The high price of investment lowers capital accumulation and output.
- The calibration limits the ability of the model to account for the full rise in RPI. Other sources need to be explored. Model does well in accounting for the fall.
- The removal of capital import restrictions and tariff rate reductions were significant for the economy (22 % of observed pick up in output per worker). Exogenous productivity growth constant from 1981 to 2006 by design.