The Rise and Fall of India's Relative Investment Price

A Tale of Policy Error and Reform

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Introduction

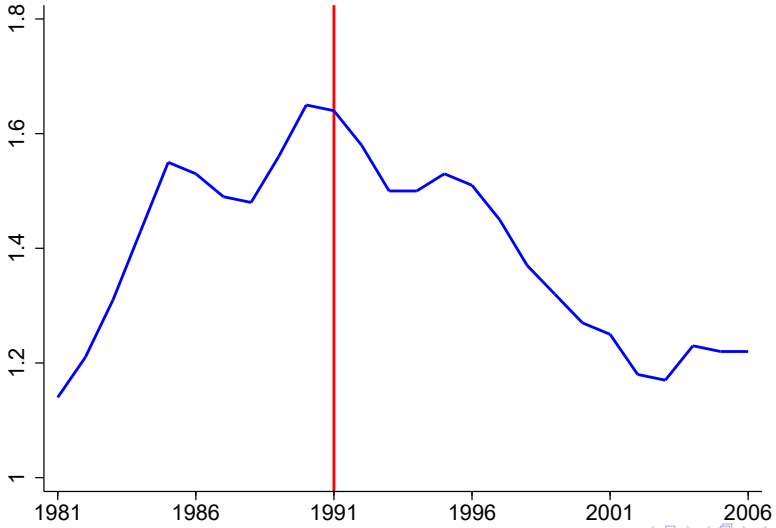
1. From 1981 to 1991 Indian relative price of investment (RPI) rose 44% compared to the world benchmark (PWT).

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 :

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

  - subject to budget constraint :

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

  - capital accumulation:

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

Model: output producing firm

- A representative firm produces final good, Y_t

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

- maximizes profit

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

  - 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, $p_t^m = p^w(1 + tariff_t)$

- 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 $\overline{M_t}$ 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

$$M_t = \overline{M_t}$$

$$p_t^m \geq p^w(1 + tariff_t)$$

- 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

$$p_t^m = p^w(1 + tariff_t)$$

- 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 $p^m_{1981} = 1.72$
  - 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

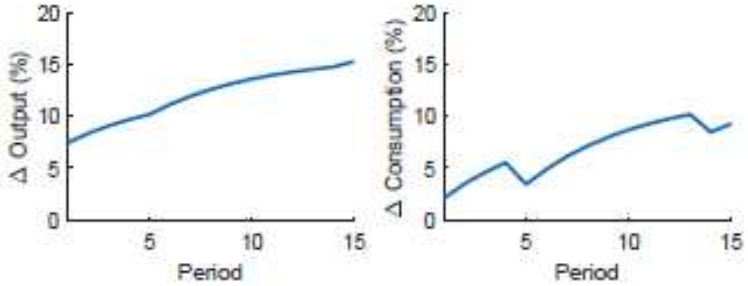
- Obtain capital stock from the pre - reform transition in 1991 as the initial condition.
- As the government reduces tariffs from 72.7% to 7.6% , economy follows a transition path which itself changes with the change in tariff.

- 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.