# Online Technical Appendix for:
# **The Reservation Laws in India and the Misallocation of Production Factors**

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This technical appendix is a companion of the main article. In Section A give more details on the optimization problem of managers in manufacturing, as well as the equilibrium definitions. In Section B we prove the propositions of Section 4 in the paper. Then, in sections C and D we describe the macro and micro data used. Finally, in Section E we show how to obtain the TFP.

## A Model Details

In Section A.1 we give details on the key equations of the managers in manufacturing for both the restricted and unrestricted model. In Section A.2 we show how to obtain the threshold $\tilde{z}(\tau)$ that separates workers from managers in the restricted economy. In Sections A.3 and A.4 we define the equilibrium in the two economies.

### A.1 Managers optimization problem in manufacturing

Fot the unrestricted economy, the problem stated in Section 3.1 yields the FOC:

$$\begin{aligned} p_i z^{1-\gamma} \gamma \nu (k^\nu n^{1-\nu})^{\gamma-1} (k^{\nu-1} n^{1-\nu}) &= r \\ p_i z^{1-\gamma} \gamma (1-\nu) (k^\nu n^{1-\nu})^{\gamma-1} (k^\nu n^{-\nu}) &= w \end{aligned}$$

Rearranging we obtain the factor demand functions (1) and (2) in the main text, with the constant $\Theta = \left[\gamma^{\frac{1}{\gamma}} \nu^\nu (1-\nu)^{(1-\nu)}\right]^{\frac{\gamma}{1-\gamma}}$. The function $y_i(z)$ that gives the optimal output

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by an entrepreneur $z$ in sector $i$ with prices $p_i$, $w$ and $r$ is given by substituting the optimal demands of labor and capital into the production function,

$$y_i(z) = zp_i^{\frac{\gamma}{1-\gamma}} r^{\frac{-\nu\gamma}{1-\gamma}} w^{\frac{-(1-\nu)\gamma}{1-\gamma}} \nu(1-\nu)\Theta^{\gamma} \tag{A.1}$$

Above we see that $y_i(z)$ is linear in $z$. Then, given that output, labor demand and capital demand are all linear in $z$, so is the profit function

$$\pi_i(z,\tau) = (1-\tau) zp_i^{\frac{1}{1-\gamma}} r^{\frac{-\nu\gamma}{1-\gamma}} w^{\frac{-(1-\nu)\gamma}{1-\gamma}} \left[\nu(1-\nu)\Theta^{\gamma} - \Theta\right]$$

In the restricted economy, the function $y_2(z; p_2, w, r)$ that gives the optimal output by a constrained entrepreneur (those operating in sector 2 with $z > \bar{z}$) with prices $p_2$, $w$ and $r$ is given by substituting the optimal demand for labor given by equation (11) and the upper bound of capital $\bar{k}$ into the production function,

$$y_2(z) = z^{\frac{1-\gamma}{1-\gamma(1-\nu)}} \bar{k}^{\frac{\gamma\nu}{1-\gamma(1-\nu)}} \left[\gamma\frac{p_2}{w}\right]^{\frac{(1-\nu)\gamma}{1-\gamma(1-\nu)}} \tag{A.2}$$

Since $\frac{1-\gamma}{1-\gamma(1-\nu)} < 1$, $y_2(z; p_2, w, r)$ is concave in $z$. Substituting into the profit function we obtain

$$\pi_2(z,\tau) = (1-\tau)\left[p_2^{\frac{1}{1-\gamma(1-\nu)}} z^{\frac{1-\gamma}{1-\gamma(1-\nu)}} \bar{k}^{\frac{\gamma\nu}{1-\gamma(1-\nu)}} w^{-\frac{(1-\nu)\gamma}{1-\gamma(1-\nu)}} \left(\gamma^{\frac{(1-\nu)\gamma}{1-\gamma(1-\nu)}} - \gamma^{\frac{1}{1-\gamma(1-\nu)}}\right) - r\bar{k}\right]$$

which is also concave in $z$.

### A.2 Occupational choice under the SSRL

The occupational choice cutoff function $\tilde{z}(\tau)$ in the unrestricted economy is given by:

$$\begin{cases} \tilde{z}(\tau) = \frac{\tilde{z}(0;p_2,w,r)}{1-\tau} & \forall\tau\in[-1,\bar{\tau}_1] \\ \tilde{z}(\tau) = \left[\frac{w}{(1-\tau)} + r\bar{k}\right]^{\frac{1-\gamma(1-\nu)}{1-\gamma}} (p_2)^{\frac{-1}{1-\gamma}} \bar{k}^{\frac{-\gamma\nu}{1-\gamma}} w^{\frac{(1-\nu)\gamma}{1-\gamma}} \Lambda^{\frac{\gamma(1-\nu)-1}{1-\gamma}} & \forall\tau\in[\bar{\tau}_1,\bar{\tau}_2] \\ \tilde{z}(\tau) = \frac{\tilde{z}(0;p_1,w,r)}{1-\tau} & \forall\tau\in[\bar{\tau}_2,1] \end{cases} \tag{A.3}$$

where

$$\Lambda = \gamma^{\frac{(1-\nu)\gamma}{1-\gamma(1-\nu)}} - \gamma^{\frac{1}{1-\gamma(1-\nu)}}$$

and $\{\bar{\tau}_1, \bar{\tau}_2\}$ are determined by the following equations ($\hat{z}$ is constant over $\tau$ and $\frac{\tilde{z}}{1-\tau}$

increases monotonically over $\tau$ ):

$$\pi(\bar{z},\bar{\tau}_1)=w \quad \Rightarrow \quad \frac{\tilde{z}\left(0;p_2,w,r\right)}{1-\bar{\tau}_1}=\bar{z} \quad \Rightarrow \quad \bar{\tau}_1=1-\frac{\tilde{z}\left(0;p_2,w,r\right)}{\bar{z}} \tag{A.4}$$

and

$$\pi(\hat{z},\bar{\tau}_2)=w \quad \Rightarrow \quad \frac{\tilde{z}\left(0;p_1,w,r\right)}{1-\bar{\tau}_2}=\hat{z} \quad \Rightarrow \quad \bar{\tau}_2=1-\frac{\tilde{z}\left(0;p_1,w,r\right)}{\hat{z}} \tag{A.5}$$

### A.3 Equilibrium in the unrestricted economy

A steady state equilibrium is characterized by a set of prices $\{p_x,p_a,p_m,p_1,p_2,w,r\}$, capital and labor allocations in the non-manufacturing sector $\{k_a,n_a\}$, capital and labor demands in the intermediate manufactured goods sector $\{k_i\left(z;p_i,w,r\right),n_i\left(z;p_i,w,r\right)\}$, intermediate goods to produce the final consumption and investment goods, $\{a_c,m_c,a_x,m_x\}$, an aggregate capital stock $K$, an occupational choice $\{\tilde{z},\alpha\left(z,\tau\right)\}$, and household consumption and investment plans $\{c,x\}$ such that,

1. The household solves its optimization problem: equations

$$w=\max\Big\{\pi_1\left(\tilde{z},0\right),\pi_2\left(\tilde{z},0\right)\Big\} \tag{A.6}$$

and

$$\begin{cases} \alpha_1\left(z,\tau\right)=1 & \forall\tau\in\left[-1,1\right],\forall z\in\left[\tilde{z}/\left(1-\tau\right),\infty\right) \quad \text{if } \ p_1>p_2 \\ \alpha_1\left(z,\tau\right)\in\left[0,1\right] & \forall\tau\in\left[-1,1\right],\forall z\in\left[\tilde{z}/\left(1-\tau\right),\infty\right) \quad \text{if } \ p_1=p_2 \\ \alpha_1\left(z,\tau\right)=0 & \forall\tau\in\left[-1,1\right],\forall z\in\left[\tilde{z}/\left(1-\tau\right),\infty\right) \quad \text{if } \ p_1<p_2 \end{cases} \tag{A.7}$$

characterize the occupational choice, and equations (4), (5), and (6) solve the dynamic problem.

2. The agriculture goods and services firm, the aggregate manufactured good firm, and the two final good firms solve their optimization problems, that is to say,

$$p_aF^a_k(k,n)=r \quad \text{and} \quad p_aF^a_n(k,n)=w \tag{A.8}$$

$$p_mF^m_1(y_1,y_2)=p_1 \quad \text{and} \quad p_mF^m_2(y_1,y_2)=p_2 \tag{A.9}$$

$$p_cF^c_a\left(a_c,m_c\right)=p_a \quad \text{and} \quad p_cF^c_m\left(a_c,m_c\right)=p_m \tag{A.10}$$

$$p_xF^x_a\left(a_x,m_x\right)=p_a \quad \text{and} \quad p_xF^x_m\left(a_x,m_x\right)=p_m \tag{A.11}$$

3. The intermediate manufacturing goods firms solve their optimization problems, that is to say, factor demands are given by equations (1) and (2)

4. The capital and labor markets clear: equations (8) and (9) hold

5. The intermediate goods markets clear, so equations (7) hold and so do:

$$a_c + a_x = F^a(k_a, n_a) \quad \text{and} \quad m_c + m_x = F^m(y_1, y_2) \tag{A.12}$$

6. The final goods markets clear

$$c = F^c(a_c, m_c) \quad \text{and} \quad x = F^x(a_x, m_x) \tag{A.13}$$

### A.4 Equilibrium in the restricted economy

A steady state equilibrium in the restricted economy is defined as the one in the unrestricted economy, but with the threshold $\tilde{z}(\tau)$ determined by equation

$$w = \max\left\{\pi_1(\tilde{z}(\tau), \tau), \pi_2(\tilde{z}(\tau), \tau)\right\} \tag{A.14}$$

instead of (A.6); the choice of $\alpha_1(z, \tau)$ described by:

$$\begin{cases} \text{if } \; p_1 > p_2, & \alpha_1(z,\tau) = 1 \;\; \forall\tau\,[-1,1], \forall z \in [\tilde{z}(\tau), \infty) \\ \text{if } \; p_1 = p_2, & \begin{cases} \alpha_1(z,\tau) \in [0,1] & \forall\tau\,[-1,1], \forall z \in [\tilde{z}(\tau), \infty) \cap [0, \bar{z}] \\ \alpha_1(z,\tau) = 1 & \forall\tau\,[-1,1], \forall z \in [\tilde{z}(\tau), \infty) \cap [\bar{z}, \infty) \end{cases} \\ \text{if } \; p_1 < p_2 & \begin{cases} \alpha_1(z,\tau) = 0 & \forall\tau\,[-1,1], \forall z \in [\tilde{z}(\tau), \infty) \cap [0, \hat{z}] \\ \alpha_1(z,\tau) = 1 & \forall\tau\,[-1,1], \forall z \in [\tilde{z}(\tau), \infty) \cap [\hat{z}, \infty) \end{cases} \end{cases} \tag{A.15}$$

instead of (A.7); the new threshold $\hat{z}$ given by

$$\pi_1(\hat{z}, \tau) = \pi_2(\hat{z}, \tau); \tag{A.16}$$

the capital and labor demands for manufacturing firms in sector 2 with $z > \bar{z}$ given by $\bar{k}$ and equation (11); the threshold $\bar{z}$ given by equation (10); new factor market clearing conditions to replace (8) and (9); and new market clearing conditions for the intermediate goods 1 and 2 to replace (7).

In the case $p_2 > p_1$ we can rewrite the market clearing equations for capital and labor as,

$$
\begin{aligned}
K &= k_a + \int_{-1}^{1} \left[ \int_{\min\{\tilde{z}(\tau),\hat{z}\}}^{\hat{z}} k_2(z)\, g(z|\tau)\, dz + \int_{\max\{\tilde{z}(\tau),\hat{z}\}}^{\infty} k_1(z)\, g(z|\tau)\, dz \right] g(\tau)\, d\tau \\
N &= n_a + \int_{-1}^{1} \left[ \int_{\min\{\tilde{z}(\tau),\hat{z}\}}^{\hat{z}} n_2(z)\, g(z|\tau)\, dz + \int_{\max\{\tilde{z}(\tau),\hat{z}\}}^{\infty} n_1(z)\, g(z|\tau)\, dz \right] g(\tau)\, d\tau
\end{aligned}
$$

The min and max terms in the integration bounds are there to take into account that $\tilde{z}(\tau)$ may be larger than $\hat{z}$, and hence that for large $\tau$ no individual will be entrepreneur in sector 2. The market clearing conditions for the manufacturing intermediate goods are given by,

$$
\begin{aligned}
y_1 &= \int_{-1}^{1} \int_{\max\{\tilde{z}(\tau),\hat{z}\}}^{\infty} y_1(z)\, g(z|\tau)\, dz\, g(\tau)\, d\tau \\
y_2 &= \int_{-1}^{1} \int_{\min\{\tilde{z}(\tau),\hat{z}\}}^{\hat{z}} y_2(z)\, g(z|\tau)\, dz\, g(\tau)\, d\tau
\end{aligned}
$$

In the case $p_2 = p_1$ we can rewrite the market clearing equations for capital as,

$$
\begin{aligned}
K = k_a &+ \int_{-1}^{1} \int_{\max\{\tilde{z}(\tau),\bar{z}\}}^{\infty} k_1(z)\, g(z|\tau)\, dz\, g(\tau)\, d\tau \\
&+ \int_{-1}^{1} \int_{\min\{\tilde{z}(\tau),\bar{z}\}}^{\bar{z}} \sum_{i=1,2} \Big[ k_i(z)\, \alpha_i(z) \Big] g(z|\tau)\, dz\, g(\tau)\, d\tau
\end{aligned}
\tag{A.17}
$$

for labor as

$$
\begin{aligned}
N = n_a &+ \int_{-1}^{1} \int_{\max\{\tilde{z}(\tau),\bar{z}\}}^{\infty} n_1(z)\, g(z|\tau)\, dz\, g(\tau)\, d\tau \\
&+ \int_{-1}^{1} \int_{\min\{\tilde{z}(\tau),\bar{z}\}}^{\bar{z}} \sum_{i=1,2} \Big[ n_i(z)\, \alpha_i(z) \Big] g(z|\tau)\, dz\, g(\tau)\, d\tau
\end{aligned}
\tag{A.18}
$$

and for the intermediate goods as,

$$
\begin{aligned}
y_1 &= \int_{-1}^{1} \int_{\min\{\tilde{z}(\tau),\bar{z}\}}^{\bar{z}} y_1(z)\, \alpha_1(z,\tau)\, g(z|\tau)\, dz\, g(\tau)\, d\tau \\
&+ \int_{-1}^{1} \int_{\max\{\tilde{z}(\tau),\bar{z}\}}^{\infty} y_1(z)\, g(z|\tau)\, dz\, g(\tau)\, d\tau \qquad \text{(A.19)} \\
y_2 &= \int_{-1}^{1} \int_{\min\{\tilde{z}(\tau),\bar{z}\}}^{\bar{z}} y_2(z)\, \alpha_2(z,\tau)\, g(z|\tau)\, dz\, g(\tau)\, d\tau \qquad \text{(A.20)}
\end{aligned}
$$

Finally, the total amount of managerial talent allocated to each sector is given by,

$$
\begin{aligned}
Z_1 &\equiv \int_{-1}^{1}\int_{\min\{\tilde{z}(\tau),\bar{z}\}}^{\bar{z}} z\,\alpha_1(z,\tau)\,g(z|\tau)\,dz\,g(\tau)\,d\tau + \int_{-1}^{1}\int_{\max\{\tilde{z}(\tau),\bar{z}\}}^{\infty} z\,g(z|\tau)\,dz\,g(\tau)\,d\tau \\
Z_2 &\equiv \int_{-1}^{1}\int_{\min\{\tilde{z}(\tau),\bar{z}\}}^{\bar{z}} z\,\alpha_2(z,\tau)\,g(z|\tau)\,dz\,g(\tau)\,d\tau
\end{aligned}
$$

## B Theorems and proofs

**Proposition 1** *For a given $\bar{k}$, if we have an ineffectual restricted equilibrium, then*

*(a) There is no manager with a binding capital demand;*

*(b) All aggregate allocations are as in the unrestricted economy.*

**Proof.** Part (a) is obvious from the optimal allocation of managers in expression (A.15) and the definition of $\bar{z}$ in equation (10): all managers with $z > \bar{z}$ produce in sector 1 where there is no constraint and all managers with $z < \bar{z}$ are unrestricted regardless of the sector where they operate.

To prove (b), note that the *ineffectual restricted equilibrium* is characterized by the condition $p_1 = p_2$, which also holds in the unrestricted economy. Then, the FOC in (A.9) and the constant returns to scale of $F^m$ imply that the ratio of $y_1$ to $y_2$ will be the same in the two economies. In the unrestricted economy, the market clearing conditions for the intermediate manufactured goods (equations 7) and the optimal output given by equation (A.1) imply that the ratio of $y_1$ to $y_2$ equals the ratio of $Z_1$ to $Z_2$. In the *ineffectual restricted equilibrium*, the ratio of $y_1$ to $y_2$ is also equal to the ratio of $Z_1$ to $Z_2$ (this can be seen by noting that $y_2(z;p_2,w,r)$ for $z < \bar{z}$ and $y_1(z;p_1,w,r)$ are linear in $z$ and equal to each other, hence dividing equations (A.19) and (A.20) we see that $y_1/y_2$ equals $Z_1/Z_2$.) Hence, the ratio of total managerial talent allocated to each sector, $Z_1/Z_2$, is the same in both economies. Finally, the same argument applies for capital and labor, so given that $Z_1/Z_2$ is the same in both economies so will the ratio of capital and labor employed in each sector. Since all the remaining equilibrium conditions in both economies are the same, and so will be aggregate allocations and prices. ■

**Proposition 2** *For a given model parameterization, the set of $\bar{k}$ that generate ineffectual restricted equilibria is given by the interval $\bar{\mathbf{k}} \equiv \left[\bar{k}_{min}, \infty\right)$, where $\bar{k}_{min} > 0$.*

**Proof.** According to Proposition 1, all $\bar{k}$ that generate an *ineffectual restricted equilibrium* will have the same prices and aggregate allocations. Since the *ineffectual restricted* *equilibrium* implies that manufactured good 2 can only be produced by managers with $z \in [\tilde{z}(\tau), \bar{z}]$, for such an equilibrium to exist we need that the total sum of managerial talent available for manufactured good 2,

$$\int_{-1}^{1} \int_{\min\{\tilde{z}(\tau),\bar{z}\}}^{\bar{z}} z\, g(z|\tau)\, dz\, g(\tau)\, d\tau$$

is not smaller than the total amount of managerial talent $Z_2$ allocated to sector 2 in the unrestricted economy. Now, $\tilde{z}(\tau)$ is the same in all *ineffectual restricted equilibria* and equation (10) says that $\bar{z}$ is linearly increasing in $\bar{k}$. Hence, take some $\bar{k}_a > 0$. Then for any $\bar{k}_b > \bar{k}_a$ we will have $\bar{z}_b > \bar{z}_a$ and therefore

$$\int_{-1}^{1} \int_{\min\{\tilde{z}(\tau),\bar{z}_b\}}^{\bar{z}_b} z\, g(z|\tau)\, dz\, g(\tau)\, d\tau > \int_{-1}^{1} \int_{\min\{\tilde{z}(\tau),\bar{z}_a\}}^{\bar{z}_a} z\, g(z|\tau)\, dz\, g(\tau)\, d\tau$$

Hence, if the economy with $\bar{k}_a$ displays an *ineffectual restricted equilibrium* so will the economy with $\bar{k}_b$. Finally, $\bar{k}_{min} > 0$ because for $\bar{k} \leq 0$ no production of goods would take place in sector 2. ■

**Proposition 3** *The lower bound $\bar{k}_{min}$ that defines the set $\bar{\mathbf{k}}$ increases with the relative size of the restricted sector within manufacturing.*

**Proof.** Let's define $Z_2^f$ as the total amount of talent allocated to the sector 2 in the unrestricted economy. Then, following proposition 2, $\bar{k}_{min}$ is implicitly defined by

$$\int_{-1}^{1} \int_{\min\{\tilde{z}(\tau),\bar{z}_{min}\}}^{\bar{z}_{min}} z\, g(z|\tau)\, dz\, g(\tau)\, d\tau = Z_2^f$$

with $\bar{z}_{min}$ defined by plugging $\bar{k}_{min}$ in equation (10).

We want to see how $\bar{k}$ varies with the size of the restricted sector $\phi$ (the production function is given by equation 12). Note that equation (10) is not affected by $\phi$. Hence, any effect of $\phi$ on $\bar{k}_{min}$ comes through changes in $Z_2^f$. Note that equations (A.9) imply that

$$\frac{p_1}{p_2} = \frac{F_1(y_1, y_2)}{F_2(y_1, y_2)} = \frac{1-\phi}{\phi} \left( \frac{y_2}{y_1} \right)^{1-\zeta}$$

Since, the ratio of prices $p_1/p_2$ is equal to one in the unrestricted equilibrium, any increase in $\phi$ translates into increases in the $y_2/y_1$ ratio. To increase $y_2/y_1$ we need $Z_2/Z_1$ to increase. Hence, equilibria with larger $\phi$ are equilibria with larger $Z_2^f$ and hence $\bar{k}_{min}$ are larger. ■

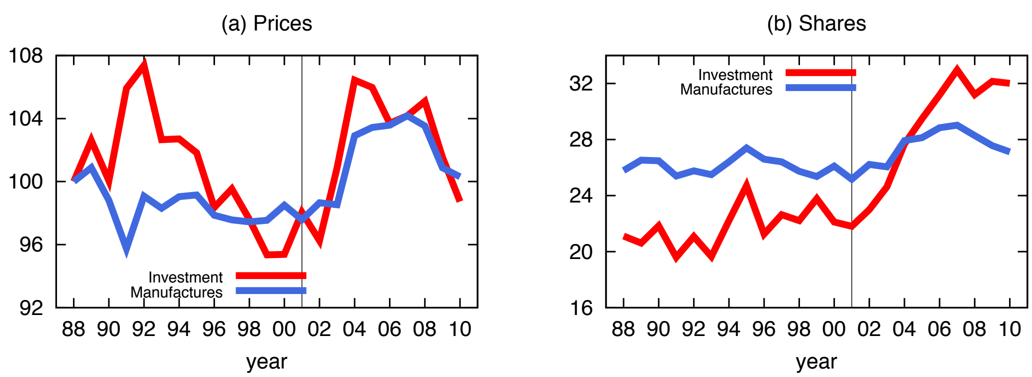
## C Macroeconomic data

We use data from the *World Development Indicators* to obtain the series of output (Gross Domestic Product), value added in manufacturing (Value Added in Industry), price of manufacturing goods (implicit deflator of Value Added in Industry divided by the implicit deflator of GDP), and prices of investment and consumption goods. We use data from the Reserve Bank of India to obtain the series for investment (Domestic Gross Capital Formation) and depreciation (Consumption of Fixed Capital).

### C.1 Time series

Panel (b) in Figure C.1 shows the times series for the investment rate and the value added share of manufactures. Panel (a) show the price of investment goods relative to consumption goods and the relative price of manufactures relative to GDP.

Figure C.1: Time Series of Investment and Manufactures




Notes: Panel (a) plots the price of investment goods relative to consumption goods (red line), and the implicit deflator of manufacturing relative to the implicit deflator of GDP (blue line). Panel (b) plots the share of investment over GDP (red line), and the share of value added in manufacturing over GDP (blue line).

### C.2 Building the capital stock

We construct the aggregate capital stock with these series by use of the perpetual inventory method and the balanced growth path assumption in the period 1988-2001. To do so, we initialize the capital stock $K_{88}$ and then use the series of investment, a depreciation rate $\hat{\delta}$, and the law of motion for capital to construct the series for capital after 1988. This process requires giving values to $K_{88}$ and $\hat{\delta}$. The former is chosen so that the capital to output ratio in 1988 equals the average capital to output ratio in the whole period

1988-2001, which is consistent with the balanced growth path assumption. The value of the depreciation parameter is chosen such that the average ratio of depreciation to GDP using the constructed capital stock series matches the average ratio of depreciation (consumption of fixed capital) to GDP in the data, which is 9.7%. We obtain the values of $K_{88} = 26.97 * 10^{12}$ 2004 Indian Rupees and $\hat{\delta} = 0.042$. The value for $\hat{\delta}$ is consistent with the calibrated value of $\delta = 0.113$ in the paper. Note that the model economy does not include growth, therefore the depreciation rate of the model includes both the actual capital depreciation and the rate of growth of GDP in the Balanced Growth Path. GDP growth between 1988 and 2001 was 5.36% per year. Hence, the actual depreciation rate net of GDP growth used in the model is 0.059. The obtained capital series yields an average capital to output ratio of 2.15 over the reference period.

## D National Sample Survey and Annual Survey of Industries

In this appendix we describe the two firm-level data sets used. In Table D.1 below we describe the variables used to measure employment, capital, and factor shares at the plant level. In Table D.2 we show statistics of plant sizes for each data set separately together with the ones of the merged data set.

**Annual Survey of Industries (ASI).** The ASI is an annual data set conducted and published by the Indian government's Central Statistical Organization since the late 60's. The ASI sampling population comprises all registered industrial units, which are factories using power employing 10 or more workers (20 if without power). The ASI consists of two parts. First, there is a census of all registered manufacturing plants in India with more than 100 workers. Second, there is a random sample of registered plants with more than 10 workers (20 if without power) but less than 100. The ASI is conducted every year by the Indian Ministry of Statistics. The data provided corresponds to the fiscal year, which in India goes from July to June. As we want to measure the size distribution of plants before the liberalization, we use the survey with reference year 2000-01, the latest year before 2003 for which the NSS is also available.

**National Sample Survey (NSS).** As mentioned above, the purpose of NSS is to cover all manufacturing production units that are not covered by ASI. This survey is conducted every five years by the Indian Ministry of Statistics: 1989-90, 1994-95, 2000-01, 2005-06, and 2010-11. It is a good data set for very small plants because the sampling universe is the set of Indian households. We use the wave with reference year 2000-01. This survey is the module 2.2 of the 56th Indian National Sample Survey.

Table D.1: Variables used

| Variable | Description | Source in ASI | Source in NSS |
|---|---|---|---|
| Employment | Total Persons Engaged | E-10 (6) | 6-4 |
| Labor Cost | Wages + Bonus + Welf.Expenses + Contributions to Provident | E-10 (7+8+9+10) | 7-3 |
| Capital(1) | Gross Value of plant and machinery (owned) | C-3 (7) | 8-2 |
| Capital Cost(2) | Rents Paid + Interest Paid + Depreciation | F-6, F-10 | 10-2, 10-3 |
| Additional Costs(3) | Materials + Fuels + Other Expenses | H-17 (6) + I-7 (6) + F-7 | 3-309 + 3-319 + 3-339 |
| Total Revenue | Sales + Other Receipts | G-7 + J-12 (7) | 5-503 |
| Value Added | Total Revenue - Additional Costs | - | - |
| Profits | Value Added - Capital Cost - Labor Cost | - | - |

Notes: (1) Value of capital at closing date in ASI ; (2) Depreciation is not reported in NSS; (3) Additional costs include Insurance Charges, Maintenance of fixed capital, communication expenses, license fees, etc.

In Table D.2 we show the distribution of employment over different plant categories for the ASI, the NSS, and the merged sample. The firm size distribution that emerges is very different if one uses the merged data set or the ASI only. As already mentioned, although NSS plants are smaller, they account for more than 3/4 of total manufacturing employment.

Table D.2: plant size distribution: ASI and NSS

(A) SELECTED STATISTICS OF THE DISTRIBUTION OF PLANTS

| | mean | percentiles | | | | | |
|---|---|---|---|---|---|---|---|
| | | 50 | 75 | 90 | 95 | 99 | 99.9 |
| NSS | 2.17 | 2 | 2 | 2 | 5 | 10 | 27 |
| ASI | 46.51 | 18 | 42 | 109 | 208 | 752 | 3198 |
| ASI+NSS | 2.63 | 2 | 2 | 4 | 5 | 13 | 86 |

(B) SHARE (%) OF EMPLOYMENT IN PLANTS OF SIZE UP TO

| | 1 | 3 | 5 | 10 | 20 | 50 | 200 |
|---|---|---|---|---|---|---|---|
| NSS | 19.4 | 66.7 | 81.3 | 92.2 | 96.8 | 99.5 | 100 |
| ASI | 0.03 | 0.14 | 0.49 | 2.84 | 9.21 | 21.1 | 45.1 |
| ASI + NSS | 16.2 | 55.5 | 67.7 | 77.2 | 82.1 | 86.1 | 91.2 |

Notes: ASI refers to the survey year 2000-1. NSS refers to survey year 2000-1. ASI+NSS refers to the merged ASI and NSS data sets.

## E Measured TFP

Total Factor Productivity is a residual that arises from measuring aggregate GDP, aggregate capital, aggregate labor and then embedding them into a simple production function. Using a standard Cobb-Douglas production function to characterize a representative firm, we can determine how much —according to our model— the conventionally measured TFP would increase if the reservation laws were lifted. Within our model it is straightforward to measure output, aggregate capital and aggregate labor for both the restricted and the non-restricted economies. However, measuring the capital share is not so direct because we have different sectors with different capital shares. We use the model data on factor payments to construct the capital share in the way it is normally done with National Accounts data.

We impose a Cobb-Douglas production function:

$$Y = AK^{\xi}L^{1-\xi}$$

Let's denote aggregate profits by $\Pi$. Note that factor payments exhaust output:

$$rK + wN + \Pi = Y$$

We impute wage income $wN$ to labor compensation, and interest income $rK$ to capital compensation. Then, we have to decide how much of entrepreneurial profits are to be considered compensation to labor and how much compensation to capital. We follow the standard practice of asking the share of profits that we impute to capital and labor to be equal to the aggregate capital and labor share, so we can obtain the aggregate capital share $\xi$ by solving

$$\xi = \frac{rK + \xi\Pi}{Y}$$

The increase in TFP from lifting the SSRL is given by,

$$\frac{A^f}{A^r} = \frac{Y^f}{Y^r}\left(\frac{K^r}{K^f}\right)^{\xi}$$

since we measure labor as total number of people in the economy, which is constant. $f$ denotes the unrestricted economy and $r$ the restricted one.

An analogous exercise can be done for the manufacturing sector with the capital share given by

$$\xi = \frac{r(K - k_a) + \xi\Pi}{p_m y_m}$$

And the increase in TFP given by,

$$\frac{A^f}{A^r} = \frac{y_m^f}{y_m^r}\left(\frac{K^r - k_a^r}{K^f - k_a^f}\right)^{\xi}\left(\frac{1 - n_a^r}{1 - n_a^f}\right)^{1-\xi}$$