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Thesis title:

Effects of liberalisation on the changing balance

between state and market in India

PhD in	Economics
Cycle	XXIII
Candidate's tutor	Francesco Passarelli
Year of discussion	2013

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Federalism and the sustainability of Indian reform

Gianluca Flego

"The world's fastest growing democracy": buses at the 2006 Davos conference sporting this shiny brand easily won India the praise of communication experts[1]. There is clearly a feeling of exceptionality to what India has achieved in the two decades following the liberalisation of 1991 - further strengthened by considering that the statement is likely true not only of present times, but of the whole of modern history, with the only parallel of post-war Japan[2]. What is most stunning, though, is that this turn of events apparently caught most observers by surprise. The sheer size of public intervention in the Indian economy, and consequent strength of vested interests relying on it, made it doubtful that the measures of the Rao government after the 1991 balance-of-payments crisis would go very far. What used to be the country with the largest public sector, the most rigid labour legislation, and the highest tariffs of the non-Communist world, appeared to many a basket case of ingovernability, destined to stagnate for the foreseeable future[3]. The failure of Rajiv Gandhi's 1987 liberalisation attempt, in particular, seemed the final confirmation that this was strictly connected with the democratic nature of its polity[4]. Para-

[1] Cf. the CEO of WPP's interview for the Indian Express: http://www.indianexpress.com/news/india-has-done-a-good-job-in-branding-itself-as-the-worlds-fastest-growing-democracy/574297/, accessed on 8-9-2011.

[2] For the US economy "the highest decadal rate [of growth of real reproducible, tangible wealth per head from 1805 to 1950] for periods of about ten years was apparently reached in the 1880's with approximately 3.8 percent." (Friedman and Schwartz, 1971, p. 93). This compares with India's real GDP p.c. growth, which averaged 4% during the 1990's, and doubled during the 2000's (cf. Subramanian, 2011).

[3] The seminal study for this line of argument is Bardhan (1984), with further developments such as Dhar (1987). Short before the liberalisation, a prime example of this gloomy outlook is Kohli (1989, 1990). Most notably, even today, nothing seems obviously wrong in his analyses of the time.

[4] Cf. Kohli (1989), p. 324: "Indian materials suggest that it is quite difficult for a democratic regime to undertake a major shift in development strategy. [...] There

doxically, the fact of never degenerating into an African story of dismay seemed to add to the intractability[5].

History, one may now judge, has proved this wrong. A system seemingly enmeshed in a morass of corruption, uncompetitiveness, and populism has shown adaptability - and, quite possibly, to an unexpected degree. Bureaucracy has been eased, capital allocation liberalised, state-owned enterprises partly privatised, labour practices made less rigid. The growth slowdown of the late 90's was successfully overcome, and we now witness forecasts of India's growth rate surpassing China's in the next few years[6].

In this paper I address the issue of how the (possibly short-term) costs of liberalisation were made acceptable[7], arguing that a crucial role was played by India's federal structure and the evolution of its internal bargaining for resource sharing. I build a model of liberalisation and redistribution in a country with unequally infrastructured areas, and compare the effects of liberalisation in a unitary setup *vis-à-vis* a federal one where resources are shared according to a constitutional bargain among politicians, much in the spirit of Riker (1975). I find that shifts in bargaining power within the federation, due to loosening constraints posed by lower external military threats, may determine changes in the degree of internal redistribution that turn the odds in favour of reform. Retained resources from lesser redistribution allow richer states to compensate their internal losers while passing their costs on to the weakest members of poorer states. Federalism, hence, may act as a loss-concentration mechanism that makes liberalisation more sustainable than under a unitary setting[8].

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are [...] fairly sharp limits on how far and how fast a liberalization program can be implemented in a democracy."

[5]The literature on the African experience with structural adjustment suggests that countries where the crisis had deepened the most are the ones where liberalisation had the best chances of success: compare Ghana to, f.i., Nigeria and Zambia. Cf. Callaghy (1990), Herbst (1993), Bienen and Herbst (1996), Lewis (1996), Adedeji (2001).

[6]Cf. the note "India to Outpace China by 2013-2015" released by Morgan Stanley on 13th August 2010 (cf. http://www.bloomberg.com/news/2010-08-16/india-s-economic-growth-to-outpace-china-s-by-2013-morgan-stanley-says.html, accessed on 8-9-2011); and *The Economist*'s 2-8 Oct. 2010 issue, with the cover title: "How India's growth will outpace China's". Notably, the newspaper's view is that one of India's advantages over China in this respect is democracy.

[7]That these costs were there, and aplenty, is eloquently stated in early-90's quotes by businessmen: "Let's face it: in their heart of hearts, nobody wanted liberalisation. It sounded nice, so everyone cheered. Now that it begins pinching you, you cry foul." [Great Eastern Shipping Director Ravi Sheth, *Business World*, 20 October-2 November 1993, p. 25; quoted in Jenkins (1999), p. 117.]

[8]This is somewhat of a parallel effort to Fernandez and Rodrik (1991), who appar-

The following section reviews the literature. Section 2) outlines salient features of the evolution of Indian federalism, on which the model is built. Section 3) gives an informal account of the model, which is set out in section 4). Section 5) concludes with some historical remarks and applications of the model.

1 Literature

Several hypotheses have been put forth in the literature to explain the success of India's reforms.

Manor (1995) stresses the ability with which reforms were managed to explain their success, preventing opposition groups from uniting by "picking them off one at a time".

Varshney (1999) concentrates on how the first two budgets of 1991-'92, containing key liberalisation measures, received parliamentary approval. His argument hinges on the multidimensionality of political collocation: since the hot, "mass politics" issue of the time was not economic reform but secularism, on these two crucial occasions centre-left parties in the *Lok Sabha* were forced to vote for liberalisation along with the Congress Party, just not to be associated with the Hindu nationalists of the BJP.

McCartney (2004) reads the 1991 reforms as merely a stage in a process of opening to international financial flows, within a "logic of capital" which started affecting all world economies in the 1970's. Access to international credit markets jointly encouraged liberalisation and excessive borrowing, which marred Indian public finance increasingly in the 1990's[9].

Dossani (2007) argues that the emergence of State parties, by inducing a more unstable political system, strengthened the bureaucracy (which no longer needed to fear the politicians' tantrums) and lengthened its time horizon, allowing for more growth-promoting behaviour[10].

Jenkins (1999) draws a complex picture where reform success is crucially associated with a range of obfuscatory and divisive techniques filed under the catchphrase "reform by stealth". In this context, a salient role is played by India's federal structure, in particular the possibility for the Centre of "playing State governments against each other". What Jenkins seems to have in mind is that revendications from one State could be neutralised by allying with another *via* targeted concessions to the latter,

ently strove to explain resistance to Africa's structural adjustment programmes.

[9] Cf. also Pang, Pinto and Wes (2006).

[10] Cf. also Arroyo (2008).

so weakening overall resistance. Similar analyses are put forth by Sinha (2005) in closer parallel with China (so, across the autocracy/democracy divide). What I attempt in this paper is to make these ideas tighter and more cogent, building a rigorous theory of how a federal structure may promote liberalisation.

The argument also relates to the literature on political regimes and development, which despite considerable effort remained rather inconclusive. Barro (1996), Helliwell (1994), Londregan and Poole (1990), Przeworski and Limongi (1993), and Mulligan and Sala-i-Martín (2004) find no robust effect of democratic regimes on growth, while Tavares and Wacziarg (2000) find a moderate negative net effect. On the other hand, focussing on democratisation, Minier (1998), Roll and Talbott (2003), Jones and Olken (2005), Papaioannou and Siourounis (2004), Giavazzi and Tabellini (2005) and Rodrik and Wacziarg (2005) find positive average effects[11]. However, Glaeser *et al.* (2004) criticise the relevance of common institutional indicators and their systematic correlation with growth-promoting policies[12].

Puzzles so hard raise suspects of some basic misformulation. Democracy and dictatorship are concepts too loose - the point is which democracy and which dictatorship one looks at. Hence, a recent stream of literature tries to look at "the devil in the details" (cf. Persson and Tabellini, 2006), i.e., the various forms democracy can take and their policy outcomes. Persson (2005) finds that parliamentary, proportional, and permanent democracies tend to pursue liberalisations more than, respectively, presidential, majoritarian, and temporary ones. The finding is confirmed in Persson and Tabellini (2006), where it is qualified by the fact that, nevertheless, it is majoritarian and esp. presidential democracies that actually grow faster (due to lower public expenditure)[13].

I propose here that another important determinant of a democracy's policies can be the bargaining taking place between its constituent units - especially whenever it serves to defuse its "oversensitivity" to distributive

[11] Persson and Tabellini (2007) find a strong negative effect of leaving democracy, and point at strong country heterogeneity.

[12] The 10th Oct. 2010 post on Gary Becker and Richard Posner's blog aptly summarises: "Whether on average democracies are more conducive than autocracies to economic growth is far from well established." (http://www.becker-posner-blog.com/2010/10/democracy-or-autocracy-which-is-better-for-economic-growth-becker.html, accessed on 14-9-2011).

[13] This is motivated arguing (based on Giavazzi and Tabellini, 2005) that economic liberalisations are indeed more likely in parliamentary democracies; but when following political liberalisations, they end up producing mediocre growth outcomes.

issues (suggested by median voter models such as Alesina and Rodrik, 1994 and Tabellini and Persson, 1994). I set out a mechanism whereby it is the federal structure of a democracy, combined with inter-State productivity divergence and shifts in the regional military environment, that leads it to growth-promoting policies - that makes democracy work.

2 Indian federalism and liberalisation

India has been a federation since indipendence and is currently made up of 28 States and 7 Union Territories[14]. The fiscal relationship between the Centre and the States is characterised by strong "vertical fiscal imbalances": most revenues are raised by the Centre, while the bulk of the expenditure is done at the State level[15]. The States' fiscal gap is filled by central transfers, taking place through three main channels: 1) the Finance Commission, a (supposedly independent) committee of experts appointed by the president of India every five years, which establishes the formula for revenue sharing between the States, along with special-purpose grants; 2) the Planning Commission, a permanent committee chaired by the prime minister and composed of members of the federal and States' governments; 3) transfers directly assigned by central ministries for Central Sponsored Schemes (CSS)[16]. Beside these, *implicit transfers* operate through tax exportation and subsidised lending from the Centre to the States.

This architecture stands against a background of fairly high income inequality[17] and infrastructure disparity, itself an inheritance of past policies, which has increased under liberalisation (Rao, Kalirajan and Shand, 1999; Ahluwalia, 2000; Aghion *et al.*, 2005[18]). Moreover, labour mobility has historically been low in India[19] for linguistic, skill-related and social (caste) reasons, and cannot be relied upon to promote convergence.

[14] The number and borders of the States have been modified several times, and these are hence not intangible constituent units.

[15] Rao (1993), Kletzer and Singh (1996), Rodden and Wibbels (2002) .

[16] The literature abounds with detailed descriptions of this structure; cf. e.g. Rao and Singh (2001, 2004), Anand *et al.* (2001), McCarten (2002), Heredia-Ortíz *et al.* (2005).

[17] *Per capita* income in the richest State (excluding the small State of Goa) was eight times that of the poorest State in 2007, and the trend is steadily increasing: cf. Rao and Jena (2008), p. 19.

[18] However, Rao (2009a) points out that this trend has shown no acceleration after 1991.

[19] Cf. Avinder Singh (2006), Deshingkar (2008), Rao (2009a), Kundu (2011).

If it is the fiscal transfer system that stands to dampen the inequalities, richer States have to contribute more than they receive, giving rise to "horizontal imbalances". Such equity considerations are built into the Finance Commission sharing formula, by including "backwardness" as a variable. The large literature on Indian fiscal federalism has pointed out some stylised facts:

- Formulaic transfers by the Finance Commission have been "equalising" (i.e. poor States' GDP *p.c.* post-transfer is higher than pre-transfer); cf. Rao (2000, 2004);
- Planning Commission transfers (both formulaic and discretionary), CSS, as well as implicit transfers have been neutral or disequalising, undoing most (though not all) of the equalisation (Rao, 1997, 2004; Rao and Singh, 1998a, 1998c, 2001, 2005; Shankar and Shah, 2009; Kavita Rao, 2009; Chakraborty *et al.*, 2010; Rao and Sen, 2011);
- Political considerations (electoral importance of the State, alignment with the Centre) are clearly most important for discretionary transfers (Rao and Singh, 2001, 2006; Khemani, 2002, 2007; Purfield, 2004; Arumpalam *et al.*, 2008; Biswas *et al.*, 2010); but even Finance Commission transfers fail to exhibit equalising impact once state fixed effects are included (Rao and Singh, 2006)[20].

The diachronic evolution of the transfer system displays interesting features, too. Recognition that it has become more discretionary is commonplace (Rao and Singh, 2004; Heredia-Ortíz and Rider, 2005; Rao, Sen and Jena, 2008; Rao, 2009a; Rao and Shah, 2009; Shankar and Shah, 2009[21]). Rajaraman (2007) builds a measure of discretion for each year since independence by taking the ratio between the non-formulaic and formulaic shares of overall transfers, named "bargaining margin". This is associated with an index of political fractionalisation (built as the share of the 15 major States whose government is not aligned with the party in charge at the Centre). Two facts emerge:

1. the bargaining margin is initially very high (60-70% in the 50's-60's) until it suddenly drops to below 10% in 1969 with the extension of

[20] International comparisons show this as no surprise: cf. e.g. Banful (2010) for Ghana.

[21] The awareness has leaked to the economic press: cf. Mythili Bhusnurmath on the *Economic Times* issue of 31st Dec. 2009 (http://articles.economictimes.indiatimes.com/2009-12-31/news/28446133_1_state-governments-autonomy-state-domestic-product/2, accessed on 8-9-2011).

formulaic sharing to Planning Commission transfers (introduction of the so-called "Gadgil formula"). This is easily interpreted as a lagged reaction to the spike in political fractionalisation of 1967, when the Congress Party first lost a number of State elections;

2. after 1970, the political fractionalisation index kept increasing (with declining volatility), stabilising at around 40-50%, while "the formulaic share began to decline"[22], i. e., the bargaining margin started to increase.

A clear pattern of India's post-independence history is the gradual shifting of power to regional governments and regional parties[23]. The outlined dynamics of the bargaining margin is consistent with a story where, initially, the hierarchic structure of Nehru's Congress Party largely sterilised political bargaining within the federation[24]. When the Congress started losing its grip on power, though, this suddenly emerged at centre stage; further regionalisation widened its room[25].

This development - which may be called the *activation* of Indian federalism - had far-reaching consequences. The presumption is that it affected the redistributive function of the Indian transfer system negatively. This seems an almost automatic consequence of the increase in the bargaining margin, since as seen above equalisation "is entirely due to the redistribution achieved in Finance Commission transfers" (Rao, 2004), and implicit transfers are (positively) "productivity related" (Rao and Shah, 2009)[26]. Indeed, worries about the Finance Commission's increasingly constrained capacity for equalisation are recurrent (Rao, Sen and Jena, 2008). The result is that the income elasticity of transfers has decreased "from –0.35

[22] Rajaraman (2007), p. 13.

[23] This is an obvious remark, made already by Riker (1975), p. 139; cf. more recently Bagchi (2003a). Yadav and Palshikar (2009) argue that the 1953 reorganisation of States along linguistic lines set off a long-term process that "has crystallised the citizens' identity around States" (albeit not everywhere with the same intensity), which was not the case before. See Kailash (2011) for a recent survey of research on Indian State politics.

[24] In Riker's (1975) own terms, Nehru's Congress Party had both 1) full control of regional governments and 2) a strong party discipline. This entails "complete absence of decentralization", whereby "the vast majority of significant political decisions are made at the center and in which the notion of state or provincial rights is quite meaningless" (Riker, 1975, p. 133).

[25] An analogous relationship between Congress decline and progressive fiscal decentralisation is tracked down in Rodden and Wibbels (2002, p. 528).

[26] Also, the "population" variable in transfer formulae routinely assumes 1970 figures, thereby disregarding higher fertility rates in poorer States.

in 1990-91 to –0.20 in 1998-99" (cf. Rao, 2002, 2003, 2004a, 2004b): as recently stated in a report to the Commission on Centre-State Relations, "the equalizing impact is declining over time" (Rao, 2009b)[27].

To sum up, the following characters of India's federalism stand out:

- high vertical imbalances - i. e. mismatch between revenue and expenditure at the States' level - leaving room for significant Centre-State transfers;
- high and rising income inequality and productivity disparity between States (rich States are more productive due to better infrastructure). After the '91 liberalisation of capital allocation ("demise of the *license raj*"), this implied investment mostly flowing to rich States;
- low inter-State labour mobility;
- post-independence, progressive demise of hierarchic decision mechanisms and, connectedly, rise of inter-State bargaining, with creeping negative effects on equalisation.

Such features are the basis for the model of section 4. We know proceed to sketch it.

3 The argument

Assume a static, one-period setting, which implies restricting attention to the short-term effects of reform. One may argue that Pareto-improving, growth-enhancing reforms should be met with rather mild and transient resistance: taking this to the extreme, it is unclear why resistance to liberalisation should be there at all. Be it what may, let us take the case most unfavourable to reform, where people care only about short-term

[27] Cf. also Shankar and Shah (2009), p. 281: "we find some evidence supporting the [...] hypothesis that discretionary explicit transfers have contributed to increasing regional disparities in India." An even stronger view is in Chakraborty *et al.* (2010) and Chakraborty (2003), pp. 18-19: "The analysis of the State-wise distribution of federal resources revealed an increase in the transfer of resources more towards middle income States at the cost of a decline in the transfers to low income States. [...] The principal reason for increasing inequality is the mechanism of federal transfers." Bagchi (2003b), p. 31, sums up: "It is disturbing to find that the changing character of India's fiscal federalism may be affecting its redistribution function in a negative way."

pains and gains: obviously, relaxing this assumption would only make things easier for reformers.

Country I is made up of regions with different inherited infrastructural endowments, which are fixed for the short run, and determine different productivities of capital *ceteris paribus*. To focus on the impact of infrastructure, assume that this is the *only* difference between the regions: they are equally sized and populated[28], have a share of workers which is the same in each state, and the same endowments of private capital (further endowment inequalities would only reinforce the logic). There is no inter-State labour mobility, in keeping with the above stylised facts.

In a unitary constitutional setup, tax rates and unemployment subsidies are centrally determined. The pre-reform *license raj* may be likened to the state pooling private capital, allocating it economy-wide, riping the overall profits and redistributing them (minus taxation) to the capitalists. In a sense, this is as if every capitalist had an equal share in each region's economy. The overall portfolio return is an average of the regions' diverging capital productivities.

A financial crisis forces the government to fiscal retrenchment i.e. public sector downsizing. We assume that the government only spends in unemployment subsidies[29]. This decreases supply of productive labour. In a general shift to market-based economics, cuts in subsidies go along with liberalisation of capital allocation. Capitalists are now allowed to allocate their funds optimally. Obviously, the previous allocation remains feasible, which implies that the free-market returns will be at least as good as the *license-raj* one. Capitalists cannot lose from such a reform. Since productivity varies across regions, so do capital allocations and wages. Thus, workers in more (less) infrastructured areas are better (worse) off. Hence, for a given unemployment subsidy, reform raises unemployment in less-infrastructured areas. Decreasing the unemployment subsidy for fiscal retrenchment only creates new losers. As will be seen in detail below, maintaining a majority imposes heavy constraints on the feasible amount of fiscal retrenchment.

The federal setup is characterized as such that taxation is central but States have decisional power on the amount of unemployment subsidy. This is meant as a stylized expression of India's vertical imbalances, seen

[28] This is a roughly accurate description of India's demography: low *p.c.* income States account for approx. 45% of the population, while the above-average-income States' population share is ca. 49% (cf. Rao and Shah, 2009, p. 8).

[29] Stressing, though, that patronage overstaffing of state-owned enterprises can be seen as providing alternatives to productive employment.

above. Hence, States choose subsidies to maximise their median voter's welfare. In such a setting, capital liberalisation sparks off subsidy competition to attract capital through higher labour supply. Therefore, States have an incentive to decrease their subsidies, which translates into higher central public savings.

We further explore the case in which States bargain for transfers to finance these subsidies. The different infrastructure endowment implies higher welfare for better infrastructured States in case these were to exit the federation and get decisional power over their tax rates as well. This better threat point is reflected in larger shares of federal grants, which allow them to compensate internal losers. Hence, weak States are unable to get help from the Centre exactly when they most need it. Federalism under liberalisation becomes a divide-and-rule mechanism for concentrating losses, by pitting the rich States' labour force against weak States' one. This increases the feasible amount of fiscal retrenchment, along with liberalisation's odds of success.

4 The model

4.1 General assumptions

Federal country I has two component States, infrastructure-rich Rich and infrastructure-poor Poor (indexed resp. with R and P). This is captured by different technological parameters in an otherwise identical IRS production function:

$$Y_j = a_j K_j L_j$$

with $j = R, P$, $a_R > a_P$. Both have the same amount of labour $N_R = N_P$ (normalized to 1) which is immobile between States. Each State possesses an equal endowment of immobile capital, resp. $\underline{K}_R = \underline{K}_P$. Further, there exists an amount of mobile capital $\hat{K}$ which can be allocated anywhere within the federation. All capital is owned by capitalists, who can only invest and whose number is electorally negligible: for the sake of simplicity, let us assume that their population mass is zero. So, reforms are passed by winning a simple majority among workers in the federation *and*, if a State-level voting stage takes place, in each State (let us call the ability of a bill to win a majority *sustainability*). Indifferent voters are in favour. In case labour force is split exactly in half, the capitalists' vote is decisive.

From the above production function, we have:

$$w_j = a_j K_j \qquad\qquad r_j = a_j L_j$$

by which, for simplicity, congestion effects are prevented in both capital and labour markets. Again for simplicity we assume that if all capital flows to Rich, its wages are equal to one: $a_R\left(\underline{K}_R + \hat{K}\right) = a_R \overline{K}_R = 1$[30]. Worker i gets linear utility from j's wage ($U^e_{i,j} = w_j$) and is identified by an individual leisure preference parameter l_i, uniformly distributed between $\underline{l} = 0$ and $\bar{l} = 1$ in each State. This adds up with j's prevailing unemployment subsidy b_j to give utility from unemployment, $U^u_{i,j} = b_j + l_i$. Thus, each worker works according to the following optimal decision rule:

$$work\ iff\ U^e_{i,j} \geqslant U^u_{i,j} \Leftrightarrow w_j \geqslant b_j + l_i$$

In equilibrium the marginal worker i^* values working just as much as staying jobless: $a_j K_j = b_j + l_{i^*}$. We can thus denote with L_j the set of State j's workers whose leisure preference is no higher than its marginal worker's; i. e., L_j is State j's employment. This is then given by the equilibrium condition:

$$L_j = a_j K_j - b_j$$

while unemployment is $u_j = 1 - L_j = 1 - a_j K_j + b_j$[31].

Unemployment benefits are financed by taxes centrally levied on profits alone. Hence, a balanced central government budget constraint reads:

$$\tau\left(r_R K_R + r_P K_P\right) = b\left(u_R + u_P\right) \tag{1}$$

Based on the assumptions, employed and unemployed workers have different utility functions and hence different policy preferences on taxation and unemployment subsidies. On the other hand, employment levels are endogenous to the policy variables. This is circumvented by assuming (realistically) that the median voter is employed in each State given any viable allocation of capital. This amounts to assuming $a_P \underline{K}_P \geqslant 1/2$ (i.e., it is always possible to have at least half of each State's population working by setting subsidies to zero) and the existence of an upper bound $\overline{\tau}$ for the tax rate. This turns out to be:

[30] implying Poor's wages lower than one for any capital allocation.

[31] This implies $u_j = 1 \Leftrightarrow b_j \geqslant a_j K_j$ and $u_j = 0 \Leftrightarrow b_j \leqslant a_j K_j - 1$; in words, unemployment benefits must be higher than the wage prevailing in j for nobody to work, and no greater than zero for everyone to work. Note that the latter implies that a zero b_j, in general, is not enough for unemployment to be nought.

$$\tau < \overline{\tau} = \frac{2a_P\underline{K}_P\left(a_P\underline{K}_P - 1/2\right)}{3 - a_P\underline{K}_P} \tag{2}$$

Proof: see Appendix.

It seems reasonable to assume that the tax rate cannot exceed some level which is compatible with preventing capital from fleeing abroad. The upper bound on the tax rate can also be interpreted as capturing this external constraint on national taxation.

To establish a benchmark for liberalisation outcomes, we first outline the *status quo* pre-reform situation.

4.2 *License Raj* (LR)

Originally the economy is subject to a strict *dirigiste* system of government investment licensing, known as *license raj* (LR). This means that investment needs governmental permission, which is awarded according to egalitarian political goals. Furthermore, tax rate and unemployment subsidy are the same across the whole federation. Let us assume the initial allocation is exactly equal across states[32]. This implies the following expressions for wages, employment and interest rates:

$$w_j^{LR} = a_j\frac{\overline{K}}{2} \qquad L_j^{LR} = a_j\frac{\overline{K}}{2} - b \qquad r_j^{LR} = a_jL_j^{LR} = a_j\left(a_j\frac{\overline{K}}{2} - b\right)$$

and, from 1 and the assumptions, the unemployment subsidy that ensures a balanced budget, b_{BB}^{LR}, reads:

$$b_{BB}^{LR}\left(u_R + u_P\right) = \tau^{LR}\left(r_R^{LR}K_R^{LR} + r_P^{LR}K_P^{LR}\right)$$

Solving for the subsidy yields:

$$b_{BB}^{LR} = f\left(a_R,\, a_P,\, \tau^{LR}\right) \tag{3}$$

(see Appendix for the explicit expression.)

Since unemployment is higher in Poor, and taxable profits are mostly generated in Rich, centralisation of public finances provides an *automatic redistributive mechanism*.

[32] i.e., $K_R^{LR} = \underline{K}_R + \frac{\hat{K}}{2} = K_P^{LR} = \underline{K}_P + \frac{\hat{K}}{2} = \frac{\overline{K}}{2}$, where $\overline{K}$ is the overall amount of capital available in the economy.

In order to replicate the actual reform dynamics, let us assume that an unexpected economic slump sends the federal budget into deficit[33]. A balance-of-payments crisis ensues which forces the country to adopt a stabilisation programme of spending cuts *cum* liberalisation, effectively dismissing the *license raj*. Hence, mobile capital is allowed to chase the highest return. In the most general case (i.e., without excluding that the States be allowed to set their own tax rates and subsidies), if mobile capital flows in equal amounts to both Rich and Poor, then the following No-Arbitrage Condition (NAC) would apply:

$$(1-\tau_R)\, a_R L_R = (1-\tau_P)\, a_P L_P$$

which only happens if Poor makes up for the technological handicap through lower taxes and/or higher labour supply (hence, lower unemployment subsidies).

The central government, on the other hand, seeks to realize public savings by cutting expenditure (through lower unemployment and/or subsidies) without decreasing the tax rate, which is hence assumed to equal its *license raj* level throughout. We next study the sustainability of this bill under various institutional setups.

4.3 Unitary Reform (UR)

Let us first analyse the unitary case. In this arrangement, both the tax rate and the unemployment subidy are set at the central level and are hence common to Rich and Poor. There is no way for Poor to fill the technological gap in such an environment, and the No-Arbitrage Condition cannot hold. Hence, mobile capital shifts entirely to Rich. Wages and employment levels become:

$$w_R^{UR} = a_R \overline{K}_R = 1 \qquad w_P^{UR} = a_P \underline{K}_P$$

$$L_R^{UR} = a_R \overline{K}_R - b = 1 - b \qquad L_P^{UR} = a_P \underline{K}_P - b$$

Since an equal increase in capital yields greater wage and employment gains in Rich than in Poor (due to the former's better infrastructure), overall profits increase and unemployment falls, univocally improving the country's budget balance w.r.t. the Pareto-inefficient *license raj*.

[33] The actual proximate causes of the crisis of '91 were the Gulf War (with the oil spike and the stop of remittances from the Middle East) and the collapse of USSR (traditional outlet for Indian exports).

Higher unemployment in Poor and income in Rich, on the other hand, imply that the redistributive character of centralised public finance is enhanced.

Is it possible to make further public savings by slashing subsidies? No. In fact:

Proposition 1: *Whenever both taxes and subsidies are centrally set, any cut in the latter makes the majority lose from liberalisation, and is hence unsustainable.*

Proof: Greater public saving is only feasible if subsidies are cut. As wages in Poor decrease w.r.t. their *license-raj* level, though, workers in Poor are opposed to reform for all subsidy levels. Since any decrease in subsidies occurs at a loss on the unemployed's side in each state, this would make the whole of Poor's labour force along with part of Rich's oppose reform.

A (so-defined) unitary country, hence, is no avail to stronger fiscal retrenchment. In search for arrangements to help us out, let us then turn to federations.

4.4 Federal Reform (FR)

We have seen in section 2 that the Indian fiscal federation is characterised by high "vertical imbalances", i.e., mismatches between tax revenues and expenditures of the States. In order to portray this, let us now assume that the tax rate is still determined at the Centre, which keeps it unvaried at its *license-raj* level ($\tau^{FR} = \tau^{LR}$). States, instead, have now the power to set unemployment subsidy levels, provided that they do not exceed the *license-raj* value. Tax rates being equal, the No-Arbitrage Condition (NAC) simplifies to $a_R L_R = a_P L_P$. Since each State's median voter is employed by assumption, and workers' utilities are strictly increasing in States' capital, cutting unemployment subsidies to attract capital is an optimal strategy for each State. If the No-Arbitrage Condition holds, then each State receives the same amount of capital. Based on this fact we can derive the following reaction functions:

$$b_j^* (b_k) < \frac{a_k}{a_j} b_k + \frac{a_j^2 - a_k^2}{a_j} \frac{\overline{K}}{2} \tag{4}$$

Proof: see Appendix.

Therefore, Poor can grab all mobile capital by cutting its subsidies so to more than compensate for the technological differential. Rich's optimal response is to retaliate and lower its subsidies in turn. Clearly, then, Bertrand competition sparks off a race to the bottom which would drive down subsidies and unemployment in both States. Even if Poor's subsidy is set to zero, though, mobile capital would flow entirely to Rich, so that for Poor no wage gains would follow anyway. In other words, there exists a threshold level for Rich's Federal-Reform subsidies ($b_R^{FR} < \frac{a_R^2 - a_P^2}{a_R} \frac{\overline{K}}{2}$) which ensures that this happens *no matter what P does*. In equilibrium, hence, Rich's subsidies may well be positive, whereas Poor's surely fall all the way to zero.

If Rich's subsidies in this setting are lower than the *license-raj* ones, we know that its employment increases, while obviously expenditures in Poor are nil since so are its subsidies. Also, labour participation and hence profits go up in both States. Hence, overall subsidy expenditures decrease, taxable profits increase, and further public saving is feasible w.r.t. Unitary Reform.

What about sustainability in this case?

Proposition 2: *Liberalisation in a Federal Reform setting is only sustainable if the technological gap is so wide that Rich can afford keeping its subsidies unvaried w.r.t. the* license raj.

Proof: see Appendix.

Unless the poor State's technological handicap is extreme, a federal setup in itself is by no means enough to make it more likely that reforms will be passed. We should add further considerations to the picture, regarding in particular the outcomes of a possible disbandment of the federation.

4.5 Secession Threats and Federal Reform *cum* Secession (FRS)

Hence, let us further consider the case in which states may secede, that will also be relevant in the following. In this case, then, thouroughly Sovereign States (SS) compete on the tax rate as well as on the implied subsidies (let us assume again that tax rates are no higher than the *license-raj* ones). It can be proven that:

Proposition 3: *There exists a threshold for Rich's tax rate* ($\overline{\tau}_R^{SS}$) *such that any tax rate of Rich's falling strictly below this value drives mobile capital entirely to R* no matter what P does. *This threshold is increasing in Poor's technological handicap.*

Proof: see Appendix.

On the other hand, recall that $\overline{\tau} = \frac{2a_P\underline{K}_P\left(a_P\underline{K}_P - 1/2\right)}{3-a_P\underline{K}_P}$ (the upper bound on *license-raj* tax rate, derived in section 4.1) is an increasing function of Poor's handicap (as expressed by a_P and $\underline{K}_P$).

Therefore, a smaller technology and capital handicap of Poor increases the maximum *license-raj* rate ($\overline{\tau}$) w.r.t. the maximum rate Rich can impose as a Sovereign State ($\overline{\tau}_R^{SS}$). In this case, competition between States stiffens, which causes both of their tax rates and unemployment subsidies to fall sharply following a secession. Conversely, a greater technology and capital handicap decreases $\overline{\tau}$ w.r.t. $\overline{\tau}_R^{SS}$. Rich is then so strong that it can afford laying back on high tax rates, possibly as high as the *status quo* level. Summing up:

Proposition 4: *Secession leads to falls in each State's tax rate and unemployment subsidy, which are greater the smaller is the technology and capital gap.*

This is clearly due to the fact that tax competition is made more intense by the absence of a strong technological edge on which Rich can count to attract mobile capital.

Obviously, if the technological gap is so large that keeping the old *license-raj* tax rate is enough to get all the capital, nothing needs to be done on Rich's side to ensure this attraction. This case is not very interesting, though, and we assume henceforth that the threshold tax rate to keep hold of mobile capital under Sovereign States, $\overline{\tau}_R^{SS}$, is no higher than the *license-raj* rate, so that tax rates and subsidies effectively fall in *both* States w.r.t. their LR levels.

Analogously to the case of unemployment-subsidy competition above, then, Bertrand's logic drives Poor's tax rate and subsidies to zero in this setting. The Nash equilibrium, then, involves capital entirely flowing to Rich and zero tax rates and subsidies in Poor, while tax rates (and consequently subsidies) in Rich are constrained by a threshold but may well be positive.

Since we have seen that both capital (hence wages) and subsidies fall in Poor, the Sovereign States equilibrium necessarily implies a loss for Poor's median voter. Further, since Rich's subsidies fall as well, this holds for R's unemployed too. Adding an adverse military shock from coalition breakup, as will be done in the following, would obviously only reinforce this.

We may now turn back to the Federal Reform case and ask ourselves how things would change if secession threats are taken into account (Federal Reform *cum* Secession, FRS).

Proposition 5: *If States can leave the federation,* status quo *(*license-raj*) subsidies are the unique SPNE. This reform is sustainable, but entails no public saving beyond the Unitary Reform case.*

Proof: In the FR case, Rich ended up with lower subsidies to preempt Poor's undercutting and keep hold of mobile capital. Now, Rich can menace to leave the federation if Poor does not comply with keeping its subsidies high. Given Poor's payoff in the Sovereign States case, the threat is credible. Both States keeping the *status quo* (*license-raj*) subsidies is therefore a Nash equilibrium. Needless to say, this entails higher unemployment rates - and subsidy expenditures - than under Federal Reform. Analogously to the Unitary Reform case, then, all Rich's employed are gaining in this case, while Poor's and Rich's unemployed break even. □

From the point of view of the Centre's goals of fiscal retrenchment, then, this scenario is a clear failure. Here, instead, the federal framework ends up providing a coordination mechanism that allows States to eschew harmful competition.

More is unchanged in this setting, though. To defuse Poor's competitive threat, Rich is still forced to hand over its riches to it in significant amounts: as was already true under Unitary Reform, this is actually magnified w.r.t. the *License Raj*. We might well expect that this is not something with which Rich wishes to put up forever, and that it may try to leverage its economic strengths in order to keep a larger share of resources. This is what we explore in the following section.

4.6 Nash Bargaining solution (NB)

Suppose now that a further (and maybe implicit) piece of reform involves divvying up tax revenues between the States by Nash Bargaining (NB). In other words, the system moves from central allocation of funds between

regions, to tax sharing through a negotiation in which the States' payoff from leaving the federation ("outside options") come into play. This aims at modeling the passage from hierarchy to bargaining, which was seen in section 2 as the fiscal side of rising decentralisation after Nehru's death.

It was seen in section 4.1 that each State's median voter is employed, and hence interested in maximising wages by luring more capital to her State. This implies that nothing short of getting all mobile capital can ever satisfy Rich's electorate. As before, the threat posed to Poor's workers by the secession outcomes rules out undercutting. Hence, Poor has no way to take hold of capital, and ends up with low wages anyway. We may assume that, among subsidies which leave them indifferent, voters choose the highest. Its best remaining choice, then, would be to keep subsidies as high as it is feasible, given the funds accruing to it (let us denote these highest possible subsidies with $\bar{b}_R^{NB}$ and $\bar{b}_P^{NB}$). This allows Rich, on its side, to do the same.

Let us denote the revenue shares accruing to Rich and Poor resp. with ρ and π, summing up to 1. Assuming balanced budgets in each State, we can get expressions for the maximum unemployment subsidies $\bar{b}_R^{NB} = f\left(\underset{+}{\rho}, \underset{+}{\tau^{LR}}, \underset{+}{a_R}; \underset{-}{\bar{b}_P^{NB}}\right)$ and $\bar{b}_P^{NB} = f\left(\underset{+}{\pi}, \underset{+}{\tau^{LR}}, \underset{+}{a_P}; \underset{-}{\bar{b}_R^{NB}}\right)$ (explicit derivation in the Appendix).

This non-linear system can be solved numerically. The crucial fact is that, under the assumed parameter values, each State's unemployment subsidy is strictly increasing in its revenue share.

The Nash Bargaining problem reads:

$$\max_{\{\rho,\,\pi\}} \left(\bar{b}_R^{NB} - d_R\right)\left(\bar{b}_P^{NB} - d_P\right) \tag{5}$$

where d_R and d_P are R's and P's disagreement points ("outside options"). Fully in the spirit of Riker's theory of federalism, it is natural to assume that the latter are the combination of economic outcomes that would prevail for subsidies if Rich and Poor were Sovereign States (i.e., b_R^{SS} and b_P^{SS}), and a military factor due to changes in defense capabilities. Hence (recalling that $\pi = 1 - \varrho$) 5 becomes

$$\max_{\{\varrho\}} \left(\underset{+}{\bar{b}_R^{NB}}(\varrho) - \left(b_R^{SS} - \xi\right)\right)\left(\underset{-}{\bar{b}_P^{NB}}(\varrho) - \left(b_P^{SS} - \xi\right)\right)$$

where ξ denotes the adverse military shock due to secession, assumed to be symmetric for the two states. The problem can be solved by numerical simulation.

Figure 1 plots Rich's share ϱ as a function of the secession military shock ξ for various values of Poor's technology a_P. The arrow indicates decreases in the latter and therefore - since under Nash Bargaining all mobile capital flows to Rich anyway - increases in Poor's handicap in technology and capital allocation [34].

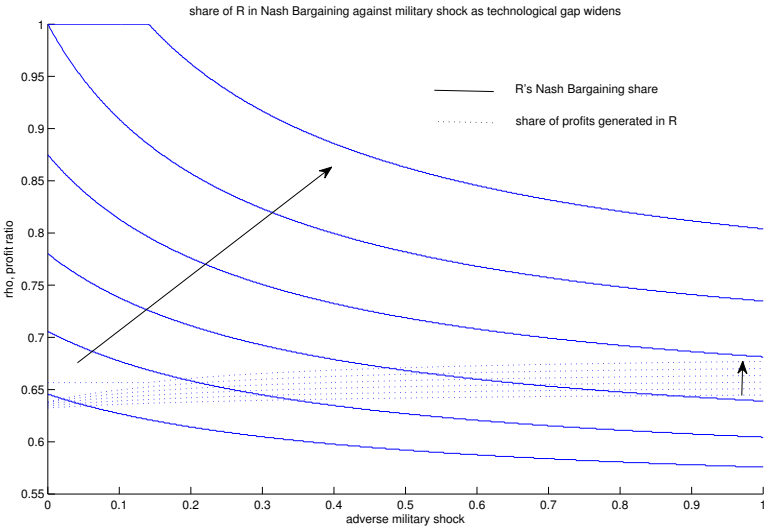

Figure 1:

Intuitively, a larger adverse military shock induces Rich to let go more of its wealth to Poor. On the other hand, a wider technological gap worsens Poor's bargaining position for any given military shock, enlarging Rich's share (which is anyway always comfortably above one half). We can see from figure 2 how maximum unemployment subsidies in Rich and Poor under Nash Bargaining accordingly evolve (only the range $0 \leqslant \xi \leqslant 0.5$ is reported).

[34] The simulation assumes the following parameter values: $a_R \overline{K}_R = 1$, $0.775 \leqslant a_P \leqslant 0.875$, $\underline{K}_P = 0.8$, $0 \leqslant \xi \leqslant 1$, and $b_P^{SS} = 0$ derived above.

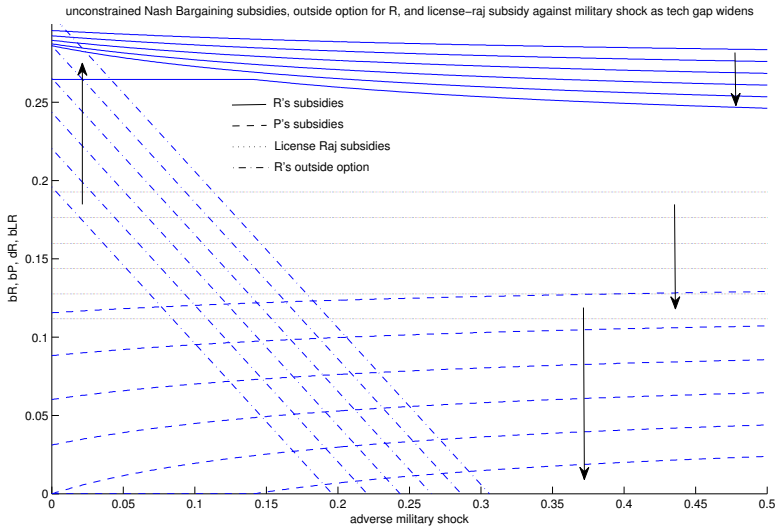

Figure 2:

Some remarks are in order. Rich's Nash Bargaining maximum subsidy is always largely below Poor's, so that revenue allocation by Nash Bargaining entails clear losses for Poor's unemployed, as expected. Nevertheless, Poor's NB maximum subsidy is always above its outside option $d_P = b_P^{SS} - \xi$ (not plotted), obviously because this is negative given unemployment subsidies for Poor under Sovereign States are zero (cf. section 4.5) and non-negative military shock. Hence, Poor never has an incentive to leave the coalition. Conversely, Rich's maximum subsidies under NB are always largely *above status quo* (*license-raj*) subsidies.

Greater military shocks persuade Rich to redistribute more to prevent coalition breakup. On the other hand, for each given shock, worse technological productivity in Poor determines large falls in the maximum subsidy Poor can attain through Nash Bargaining. Note, furthermore, that it also has a (milder) depressive effect on Rich's maximum subsidies under NB as well as *license-raj* subsidies (see the arrows on the right). This is due to the fact that lower productivity in Poor makes for lower taxable income and hence less overall tax revenues.

Instead, Rich's outside option is improved by a wider technological gap,

since it would need a lower fall in its tax rate to keep hold of mobile capital outside the coalition. This means that, under Sovereign States, Rich could afford paying higher subsidies, so that its outside option improves. Nonetheless, Rich's Nash Bargaining maximum subsidies stay above its disagreement point unless technological handicaps are huge: cf. e.g. the lowest solid and highest dash-dotted line, corresponding resp. to NB subsidies and outside options for Rich under Poor's technology $a_P = 0.775$. By such values, Poor's competitiveness is so low - hence Rich's tax rates and subsidies when Sovereign so high - that Rich has an incentive to quit the federation if the military threat is weak enough.

The adverse effect of subsiding military threats on redistribution comes out most clearly from figure 3 (the arrow has the usual meaning). Here we see that the ratio between Poor's and Rich's Nash Bargaining subsidies, which is always below one, gets smaller as the military shock and Poor's technological productivity decrease.

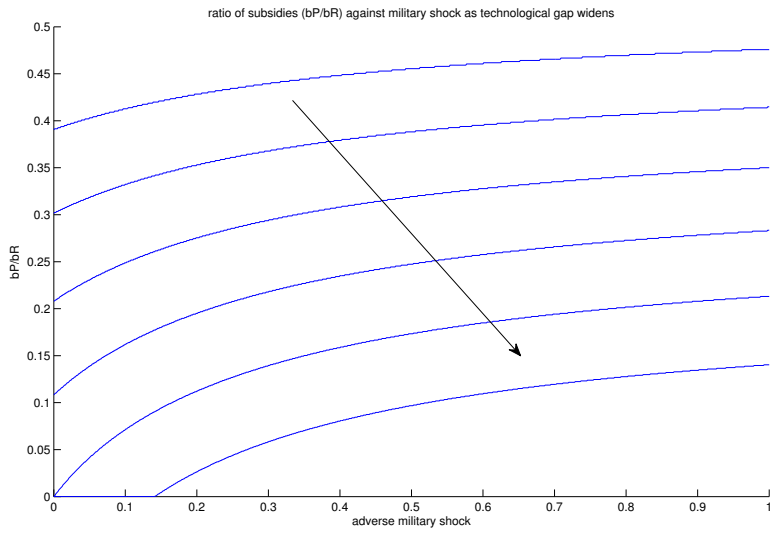

Figure 3:

We may now impose, in keeping with the preceding discussion, that subsidies cannot exceed their *status quo license-raj* value, unless this is

incompatible with a State's participation in the coalition, in which case it gets just enough to keep it in (i.e., its outside option). In this case, we get starker results. Let us start with figure 4, the constrained counterpart of figure 2. Clearly, as soon as the participation constraint becomes binding, i.e., as soon as Rich's outside option exceeds the *status quo license-raj* subsidies ($d_R > b^{LR}$), Rich's subsidies start increasing, while Poor's subsidies keep decreasing.

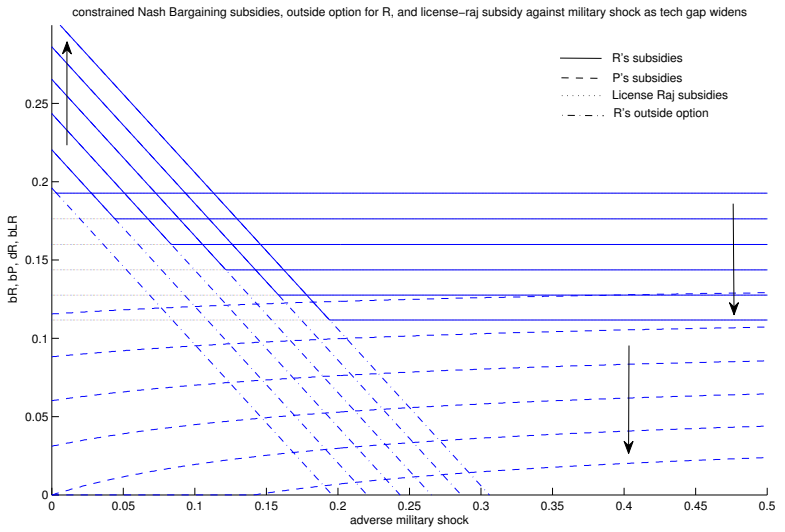

Figure 4:

The crucial question, of course, is how much saving the federal government is able to generate under the latter sustainable reform scheme, compared to the other sustainable ones (figure 5).

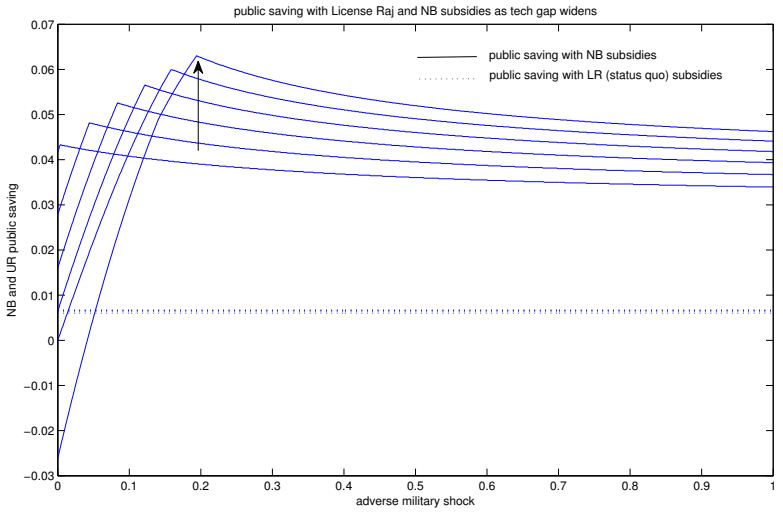

Figure 5:

Recall from proposition 2 of section 4.4 that the only sustainable setup which consented savings above the baseline case of scenarios with subsidies equalling the *license-raj* ones everywhere was that of Federal Reform - in the rather remote case that the technological gap was so large to allow Rich to retain *license-raj* subsidies all the while Poor's subsidy expenditure fell to zero -. This can be usefully contrasted with figure 5, based on which we can state that:

Proposition 6: *Barring extreme parameterisations, tax revenue sharing by Nash Bargaining makes larger public saving attainable than all other sustainable liberalisation scenarios.*

In fact, reform under Nash Bargaining permits public saving vastly above that baseline in a *substantially* wider range of parameter values. This happens in all but extreme cases where the military shock becomes almost negligible and the technological gap is really large. In the latter case, resources appropriated by Rich may more than offset savings obtained on expenditures in Poor, leading to the budget imbalances reform was aimed to remove. Capping Rich's subsidies at levels compatible with

a balanced federal budget would then prompt Rich to quit. This dire expropriation of the poor seems, at any rate, far off India's current case.

5 Conclusions

Regional inequalities are a major concern in most of the world's countries. Policies get shaped - and warped - by the demand for redistribution they raise, and by resistance to it. Also, they have a tendency for getting countries into trouble. Transfers distort incentives to factor mobility; they may slow down convergence, and induce "dependency syndromes" which hold back rich and poor areas alike[35]. There seem to be clear limits to how much more productive regions are willing to let go, and especially, for how long. On the recipients' side, aid dependence may be perceived as humiliating; aid refusal as a sign of poor national solidarity. Lack of convergence after decades of transfers wears out communal trust, as well as trust in public sector operations, putting national unity under strain. A general consideration is that, seemingly, accounts of the reasons of poverty seem to differ widely on an intra-communal basis from an inter-communal one: even those who believe that poverty in their community is *not* due to lack of effort may be willing to believe so as regards poorer parts of their country. Feelings of caring or moral duty may quickly fade with distance, and acceptance of redistribution with them.

In section 2 we have seen that a salient feature of post-independence India is growing decentralisation with, quite possibly, a creeping impairing of fiscal equalisation. The theory laid out above leads one to trace this back to changes in the balance of power between regions, and these in turn to shifts in the country's environment, most notably in the strength of external military threats. As we have seen in section 4.6, subsiding threats disproportionately favour richer regions, by improving their outside options and hence the share of revenues they can keep for themselves. Under liberalisation, these regions can put such additional funds to good use to compensate internal losers, increasing support for reform. We are led, therefore, to inspect South-Asia's post-war records, in search for the underlying factors of this process.

The early history of the Indian republic is full of action: beside the struggle with Britain at the start, conflict erupted with the Muslim ele-

[35] The issue's commonness and salience has recently attracted a fair amount of attention from development agencies such as the World Bank: cf. Shankar and Shah (2003), Shah (2007).

ment of the Indian Home Rule coalition, leading to the the bloody 1947 Partition from Pakistan. This was soon joined by border clashes with China, peaking in the war of 1962. However, after Mao's death, Sino-Indian relationships clearly steered towards normalisation. This was not paralleled by subsidence of tension with Pakistan, which could be set off anytime by internal frictions with widespread Muslim minorities and by the dispute for Kashmir, and are serious enough not to recommend a lonesome confrontation.

Yet, there has clearly been a fall in military threats to India in recent decades, although probably insufficient to cause the federation to disband. It seems, then, that a deep determinant of the policy reorientation of the 1990's is to be traced back to this shift in India's environment. This is best seen by contrasting it with other partly comparable country stories, which I do in the next section.

5.1 Extensions and historical parallels

Many countries interested by the wave of liberalisations of the 90's were federations, and some of them were undoubtedly "active" federation in the sense given in section 2. Among these, Former Yugoslavia and India are clear standouts. What explains, then, their diverging outcomes?

For all their difference in size and income *per capita*, the parallels between India and Yugoslavia were strong; so much so, that one may look like a mirror image of the other. The endorsement of cooperative socialism made the latter the "most capitalist" country of the communist block, as much as the gigantism of the Nehruvian state made the former what most akin there was to a socialist country outside of it. This link was sanctioned in Nehru's and Tito's collaboration within the Non-Aligned Movement.

Further similarities were the great internal cultural diversity (with special regard to the crucial role played in both by Muslim minorities) and the fairly high degree of interstate income inequality: these features were at the backstage of the very federal structure of the countries. In both cases, the former was tackled through a strong governmental commitment to secularist ideology, which could not prevent ethnicity and religion from gradually gaining the centre stage. The latter, on the other hand, was arguably reinforced by state action in the runup to 1991. Following Riker (1975), again we may point out that Yugoslavia was set up in response to German and Italian expansionism (quite possibly, a Soviet intervention subsequently stepped in as a further menace). India, on the other hand, had to confront Britain, Pakistan and China. Notably, the retreat of mil-

itary threats was more marked in the Yugoslavian case. Croatia's and Slovenia's outside options looked undoubtedly better than Macedonia's or Kosovo's, as much as Maharashtra's or Gujarat's compared to Bihar's or Uttar Pradesh'.

What is probably most telling, though, is to look at the internal bargaining strength of the rich states. Croatians and Slovenians, together, were a clear minority within Yugoslavia (Serbs alone are more numerous than the sum of the two). On the other side, the 1974 Constitution - with its cabinet government system (one republic, one vote) and its republic-like prerogatives given to Vojvodina and Kosovo - made Serbia only one among eight voters in the cabinet: it could easily find itself in the minority. During the 80's, Serbia struggled to compress Kosovo's and Vojvodina's autonomy, causing Kosovo Albanians' reaction which was promptly supported by Croatia and Slovenia. The 1988-89 "anti-bureaucratic revolution" led to the substitution of leaderships of Kosovo, Vojvodina and Montenegro with pro-Serb figures; this was quickly followed by the passing of constitutional amendments reestablishing Serbia's control over its two autonomous provinces. The balance of cabinet votes was then tilted again in Serbia's favour. Finally, it is sometimes argued that Serbs held a dominant position within the Yugoslav People's Army, especially in the higher echelons of hierarchy, due to their long-time military traditions[36].

Summing up, Croatia and Slovenia had every good reason to believe that the bargaining for transfers, *from then on*, would end up to their disfavour (forcing them to "feed the southern bums", as nationalistic rhetoric would put it). The conjunction of economically good outside options, inherited from prior federal policies which reflected their former strong bargaining position; the demise of external threats; and a seemingly unfavourable shift in the internal balance of power, prompted the two rich northern republics to reconsider their adhesion to the federation.

So, the relative strength of the bargaining position of its rich states may lie at the basis of the relative success of India's liberalisation process. On the other hand, its interaction with the persistence of external threats kept the federal setup incentive-compatible, and spared India a (possibly rough) dismantling, Yugoslav-style, which would have likely destabilised the whole region and wrecked its growth prospects for a long time to come.

[36] Naturally, this dominance is unquestioned after the beginning of the 1991 Croatian war, when most Croats left the JNA. Also as regards previous decades, it is probably more true w.r.t. Muslims than Croats, as Croatian Generals even participated in the siege of Vukovar.

Appendix

Proof of 2

Suppose b is the same for both R and P. Note first that, in such case, $u_P(\underline{K}_P) > u_R(\underline{K}_R) > u_R(\frac{\overline{K}}{2}) > u_R(\overline{K}_R)$ since $a_P\underline{K}_P < a_R\underline{K}_R < a_R\frac{\overline{K}}{2} < a_R\overline{K}_R$. Further, b and hence u_P can be raised most easily when taxable income is highest and P's wage is lowest, i.e., when all mobile capital is in R so that $K_R = \overline{K}_R$ and $K_P = \underline{K}_P$. Then, evidently, $w_R > w_P$. Hence if b is s. t. $u_P(b) < 1/2$, then *a fortiori* $u_R(b) < 1/2$. $u_P(b) < 1/2$ implies $b < a_P\underline{K}_P - 1/2$. In 1, substituting u_R and r_j's with their expressions, applying $a_R\overline{K}_R = 1$, $\overline{b}$ s. t. $u_P(b) = 1/2$, and solving for $\overline{\tau}$, one gets 2. In what follows we will assume that b_j's cannot exceed the *status quo* (centralised) level. Thus, whenever $K_R = \overline{K}_R$ and $K_P = \underline{K}_P$, 2 ensures that the median voter is employed.

Suppose instead that $K_R = K_P = \frac{\overline{K}}{2}$ (i.e., move $\frac{\hat{K}}{2}$ from R to P). For any b, taxable profits get lower, and (since $\left|\frac{\partial u_R}{\partial K_R}\right| = a_R > \left|\frac{\partial u_P}{\partial K_P}\right| = a_P$) overall unemployment rises. Since $u_R(\frac{\overline{K}}{2}) < u_P(\frac{\overline{K}}{2}) < u_P(\underline{K}_P) < 1/2$, even $\overline{b}$ would still make the median worker employed everywhere. Further, $\overline{b}$ granted to more people out of less profits can only be financed by $\tau > \overline{\tau}$. Hence, when $K_R = K_P = \frac{\overline{K}}{2}$, 2 implies $b < \overline{b}$. □

Remarks: 2, since $a_P\underline{K}_P < 1$, clearly satisfies $\overline{\tau} < 1$ (actually, $\overline{\tau} < 1/2$). It can be seen that non-negative tax rates are ensured by the above assumption $a_P\underline{K}_P \geqslant 1/2$. 2 also implies that this upper bound tax rate is an increasing function of a_P and hence, for given a_R, an inverse function of the technological gap $\frac{a_R}{a_P}$: the lower a_P, the lower P's wages, the lower unemployment benefits are needed to put most of P's labour force to work.

Explicit expression for 3

$$b_{BB}^{LR} = \frac{\left[\left(2 - \left(1-\tau^{LR}\right)\left(\sum_j a_j\right)\frac{\overline{K}}{2}\right)^2 + 8\tau^{LR}\sum_j\left(a_j^2\right)\left(\frac{\overline{K}}{2}\right)^2\right]^{\frac{1}{2}}}{4} + \frac{\left(1-\tau^{LR}\right)\left(\sum_j a_j\right)\frac{\overline{K}}{2}}{4} - \frac{1}{2}$$

assuming $b \geqslant 0$.

Proof of 4

If subsidies were such that the NAC holds, it would become:

$$a_j b_j - a_k b_k = \left(a_j^2 - a_k^2\right) \frac{\overline{K}}{2} \Rightarrow b_j = \frac{a_k}{a_j} b_k + \frac{a_j^2 - a_k^2}{a_j} \frac{\overline{K}}{2}$$

The b_j that satisfies the NAC is an increasing function of b_k. Rearranging we get the following reaction functions:

$$b_j^* \left(b_k\right) < \frac{a_k}{a_j} b_k + \frac{a_j^2 - a_k^2}{a_j} \frac{\overline{K}}{2}$$

Proof of Proposition 2

If subsidies do not change, those in Rich who stay unemployed under Federal Reform break even, while everyone else in Rich wins from reform. On the other hand, everyone in Poor loses from reform, either from lower wages or from zero subsidies. In other words, workers are split in half along state lines: according to our assumption, the capitalists' vote is then decisive and it is obviously in favour.

If Rich's subsidies fall, which happens if the technological gap is not wide enough, the reform cannot be passed. In fact, we have seen that Rich's wages rise w.r.t. the *license raj*. This implies that in Rich, unequivocally, the LR-employed are winners. Moreover, Rich's winners include a share of newly employed workers that would not have been unemployed at the new wage even if subsidies had stayed unchanged. Still, the wage increase is not enough to compensate the remaining workers, who are either forced to work due to lower subsidies, or stay unemployed with a lower utility. In Poor, both employed and unemployed under LR lose from reform, as before. Hence, if Rich's subsidies fall the majority is against. □

Proof of Proposition 3

From the expression for balanced budgets, $b_j u_j = \tau_j r_j K_j$, substituting r_j's and u_j's with their formulae, each b_j can be expressed as a function of τ_j. Assuming all mobile capital flows to R (and hence $K_R = \overline{K}_R$), which

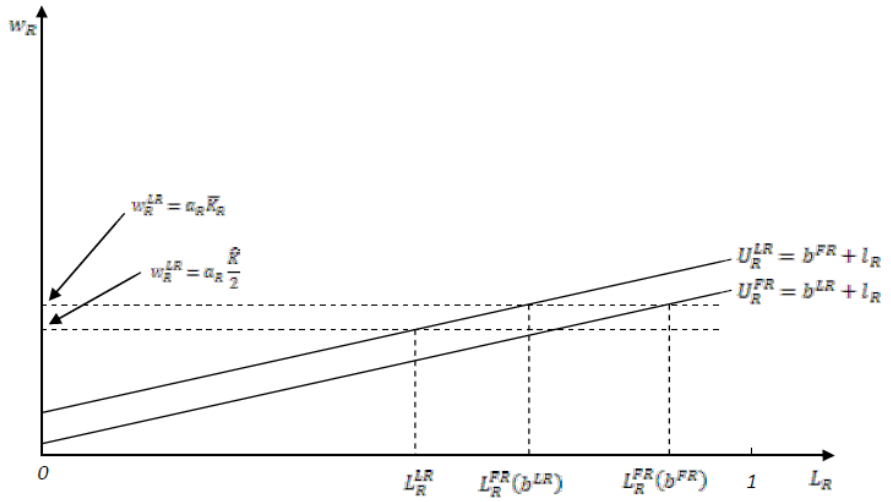

Figure 6: R's labour supply under liberalisation and subsidy cuts

makes r_R^{SS} highest *via* increased wages and labour supply, we can solve for (nonnegative) b_R:

$$b_R^{SS} = \frac{\left(\tau_R^2 + 4\tau_R\right)^{\frac{1}{2}} - \tau_R}{2} \tag{6}$$

which is increasing in τ_R. In fact, the derivative is $\frac{\partial b_R}{\partial \tau_R} = \frac{2+\tau_R}{2\sqrt{\tau_R^2+4\tau_R}} - \frac{1}{2}$, which is strictly greater than zero $\forall\, \tau_R$ since $4 + 4\tau_R + \tau_R^2 > 4\tau_R + \tau_R^2$.

$\overline{\tau}_R^{SS}$ is derived by plugging the most aggressive tax rate and subsidies P can choose, $\tau_P^{SS} = b_P^{SS} = 0$, into the No-Arbitrage Condition, along with 6 and the expression for r_R. By so doing, one gets an equivalence that $\overline{\tau}_R^{SS}$ must satisfy:

$$\left(1 - \overline{\tau}_R^{SS}\right)\left(1 - \frac{\left[\left(\overline{\tau}_R^{SS}\right)^2 + 4\overline{\tau}_R^{SS}\right]^{\frac{1}{2}} - \overline{\tau}_R^{SS}}{2}\right) = \frac{a_P}{a_R}\left(a_P \overline{K}_P\right) \tag{7}$$

Remarks: Note that, for $\overline{\tau}_R^{SS} \to 0$, the LHS of 7 tends to one from the left. Instead, the RHS is strictly smaller than one, since $\frac{a_P}{a_R} < 1$ and $a_P\overline{K}_P = a_P\overline{K}_R < a_R\overline{K}_R = 1$. This ensures that there exists such a $\overline{\tau}_R^{SS} > 0$. Naturally, if a_P is very low, $\overline{\tau}_R^{SS}$ might be so high to allow for b_R^{SS}'s that induce R's median voter to stay unemployed. Figure 7 shows that values of a_P above 0.6 - such as those considered in the simulation in section 4.6 - comfortably prevent this.

$\tau_R^{SS} = \overline{\tau}_R^{SS}$ makes investors indifferent between the corner solutions $K_R^{SS} = \overline{K}_R$ and $K_P^{SS} = \overline{K}_P$, since in this case any decrease in K_R^{SS} makes $r_P^{SS} > r_R^{SS}$ due to P's increased labour supply, and viceversa. Hence, the equilibrium for such tax rate in R is indeterminate. Also, $K_R^{SS} = K_P^{SS} = \frac{\overline{K}}{2}$ cannot be an equilibrium, since it would require τ_R, $\tau_P > 0$ (but then each could attract more capital by undercutting its tax rate).

7 implies that $\overline{\tau}_R^{SS}$ is a decreasing function of a_P and $\underline{K}_P$. The LHS of 7 is an inverse function of $\overline{\tau}_R^{SS}$, a consequence of $\left[\left(\overline{\tau}_R^{SS}\right)^2 + 4\overline{\tau}_R^{SS}\right]^{\frac{1}{2}} - \overline{\tau}_R^{SS}$ being increasing in $\overline{\tau}_R^{SS}$, as shown above. The RHS of 7 can be rewritten as $\frac{a_P}{a_R}\left(a_P\underline{K}_P\right) + \frac{a_P}{a_R}\left(a_P\hat{K}\right)$, a direct function of a_P and $\underline{K}_P$. Therefore, $\overline{\tau}_R^{SS}$ is an inverse function of a_P and $\underline{K}_P$. Intuitively, larger technological handicaps on P's side allow R to set higher tax rates without losing its competitive edge in attracting capital. □

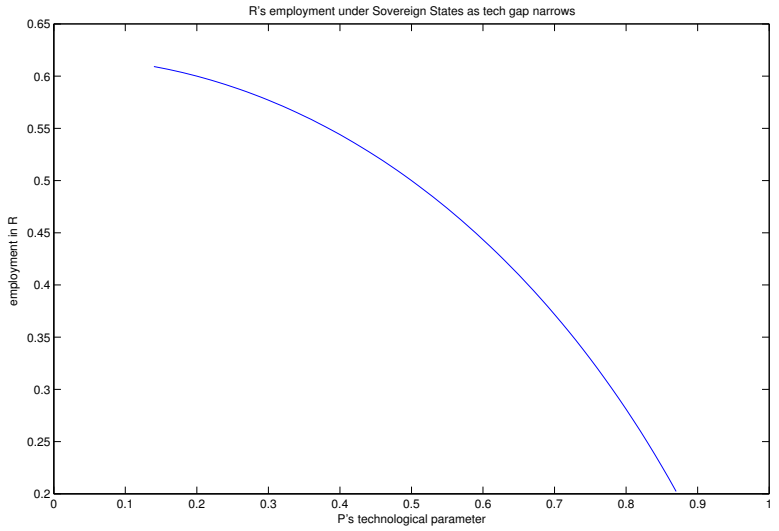

Figure 7:

Explicit derivation for $\overline{b}_R^{NB}$ *and* $\overline{b}_P^{NB}$

Balanced budgets in each State imply:

$$R: \quad \rho\tau^{LR}\left(r_R^{NB}\overline{K}_R + r_P^{NB}\underline{K}_P\right) = \overline{b}_R^{NB}u_R^{NB}$$

$$P: \quad \pi\tau^{LR}\left(r_R^{NB}\overline{K}_R + r_P^{NB}\underline{K}_P\right) = \overline{b}_P^{NB}u_P^{NB}$$

Employing $a_M\overline{K}_M = 1$ and solving for $\overline{b}_R^{NB}$ and $\overline{b}_P^{NB}$ yields the two convoluted formulae:

$$\overline{b}_R^{NB} = \frac{\left[\left(\rho\tau^{LR}\right)^2 + 4\rho\tau^{LR}\left(1 - a_P\underline{K}_P\overline{b}_P^{NB} + \left(a_P\underline{K}_P\right)^2\right)\right]^{\frac{1}{2}} - \rho\tau^{LR}}{2}$$

$$\bar{b}_P^{NB} = \frac{\left[\left[1-\left(1-\pi\tau^{LR}\right)a_P\underline{K}_P\right]^2 + 4\pi\rho\tau^{LR}\left(1-\bar{b}_R^{NB}+(a_P\underline{K}_P)^2\right)\right]^{\frac{1}{2}}}{2} - \\ - \frac{\left(1-\left(1-\pi\tau^{LR}\right)a_P\underline{K}_P\right)}{2}$$

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Gilded Ages: Corruption, liberalisation and growth under democracy and dictatorship

Gianluca Flego

Not a "golden" but a "gilded" age is what India seems to be experiencing. Apparently, the entrepreneurial forces summoned by the '91 pro-market shift had not only innovation on the agenda. "Regime corruption" or "state capture" - *i.e.* the capitalists' ability to have market rules shaped in their favour - worries many observers, lest it jettisons market competition and healthy incentives for investment and innovation. The dynamics seems to replicate closely that of several (actually, most) developers. Rapid growth seems to spark off greed, which is not always and not only good (insofar as it follows "the rules"), but can instead easily turn bad (as it tries to make them up).

This paper attempts to provide a framework to analyse the nexus of liberalisation, corruption and growth, aiming to capture some critical features of "regime corruption": its informational (*i.e.*, secrecy) and coalitional characters. Corruption of a whole political regime requires unity of intent, a conspirational trait which is not easily constructed and maintained across extended organisations like states. Although some political regimes may start off as conspiracies - "kleptocracies", "executive committees of the bourgeoisie", or the like -, this is arguably not the case of India, as well as China and other late developers. It is interesting, hence, to figure out exactly how regimes may "conjure" to change their nature. A crucial aspect of the emergence, persistence, and change, of corruption levels seems to lie in a network of reciprocal expectations which are largely tacit by necessity and, hence, typically display stickiness and hysteresis. These expectations play a central role, in particular, to define what is perceived as "exception" and "rule" or "episodic" and "systemic", and hence, very often, *de facto* "acceptable" and "unacceptable", which affects individual behaviour.

We set up a framework to analyse norm formation and collusion building as the result of mutually dependent action of bureacrats/politicians,

who make choices on corruption opportunities based on an intrinsic morality parameter, and on their odds of normative shifts given their beliefs on the others' morality. Dynamic adjustment of beliefs interacts with regimes and payoffs, to induce an evolution of equilibrium corruption levels and of probabilities of normative shifts.

The paper proceeds as follows. Section 1 sets out the Indian background and motivation. Section 2 discusses the issue of state capture. Section 3 draws some more accurate historical parallels. Section 4 reviews the theoretical literature on growth and corruption, and sketches the model laid out in section 5. Section 6 concludes.

1 Liberalisation and corruption in India

It is easy to say that India's post-'91 experience with liberalisation has been tremendously gratifying for liberalisers, vindicating their expectations on virtually all respects but one: corruption. Some hoped liberalisation would do away with the *license raj*'s notorious red tape, and therefore with the entrepreneurs' continuous need to "grease its wheels"[1].

If anything, nevertheless, corruption seems to have gone up in the last decades[2]. The dubbing of "India's Gilded Age"[3] aptly captures a perception that is acute in the general public[4]. Corruption-motivated movements have sprung up vehemently in recent years (the salient example being Anna Hazare) and related topics routinely make the headlines. Further, there is no shortage of official recognition of the issue, witness the many statements[5] and measures[6] tackling with it.

[1] The idea that a strong turn to the market is a key passage towards a less corrupt economy and polity is a recurrent motive of (esp. less recent) country reports by the Bretton Woods institutions. During the Asian financial crisis, Gray and Kaufmann (1998) state it in an exoteric WB publication. For India, a pre-reform instance from the staunchly pro-market Cato Institute can be found in Rajan (1988). Surely this reasoning has merits, and it is repeated in recent official statements on corruption s.a. the "White Paper" on black money (Indian Republic, Ministry of Finance, 2012, p. 52) and in the 2011 India OECD report (OECD, 2011).

[2] As mere examples of concerned accounts see Singh (2003), Heston and Kumar (2008).

[3] cf. Varshney and Sinha (2011).

[4] Cf. the Pew Research poll released in October 2010, 98 per cent of Indians indicate corrupt political leaders as a "very big" or a "moderately big" problem. Cited in http://www.indianexpress.com/news/more-corrupt-more-accountable/894605/

[5] Cf. the aforementioned "White Paper" of the Ministry of Finance; or Central Vigilance Commission (2010).

[6] Cf. the huge debate over the "Lokpal" (Sanskrit for "protector of the people") bill,

A large literature starting with Mauro (1995)[7] bolsters the intuitive idea that corruption and growth are inversely related. If this were the whole picture, India's story of high growth *cum* corruption seems either paradoxical, or casting a shadow on the country's prospects. Indeed, fittingly, investment banks are currently revising downwards growth expectations for India[8] - the trigger being economic slowdown joint with parliamentary deadlock, amidst ministerial corruption scandals. A recurrent worry among economists is the possibility that, if the trend is not corrected, corruption may eat up growth leading to a middle income trap[9].

The rising frequency of episodes of "grand corruption" - *i.e.* "the subversion of the system by senior government officials and formations of the political executive, usually in collusion with private sector players"[10] - involving the highest layers of government draws much attention. Despite all observational issues[11], the impression looms of a mounting danger of state capture, by hands of the same entrepreneurial class that was a crucial factor of the boom. Debroy and Bhandari (2011) amply document the increase in monetary values (in real terms) associated with such scams in recent years. Phrases such as "India's robber barons" or "Great Gatsby has come to India"[12] replenish the press.

The evidence on the dynamics of petty corruption[13] is more mixed. Despite a worsening since 2007 that has raised much worry[14], Transparency

a draft on anticorruption and protection of whistleblowers proposed to the parliament in 2011.

[7] See also Bardhan (1997), Ades and Di Tella (1997), Leite and Weidmann (1998), Tanzi and Davoodi (2000), Kaufmann and Kraay (2002), Méon and Sekkat (2005), , Swaleheen (2011), and a refined reformulation (based on Dasgupta's notion of "genuine" wealth and investment) in Aidt (2009). Estimates of the growth impact of a one point increase in corruption range from -0.3% to -1.8% (Davoodi, 2001).

[8] Cf. http://www.ft.com/intl/cms/s/0/e88c7f1c-a63d-11e1-9453-00144feabdc0.html#axzz1vyd5ieIy

[9] Cf. http://www.theatlantic.com/international/archive/2011/06/uncertain-future-for-rapidly-growing-india/239781/

[10] Central Vigilance Commission (2010), p. 5.

[11] It is often remarked that freer media and higher literacy rates allow for better monitoring by the electorate, making it less likely to get away with a scam. Claims of rampant corruption may hence be "exaggerated". Cf. f.i. Panagariya (2008).

[12] Cf. http://india.blogs.nytimes.com/2012/03/12/the-great-gatsby-comes-to-india/, again by economist Vivek Dehejia.

[13] Which the Central Vigilance Commission defines, in turn, as "the collusive or coercive action of a public official *vis-à-vis* a member of the public to subvert the system over relatively small transactions".

[14] Cf. http://www.csmonitor.com/World/Asia-South-Central/2011/1201/How-corrupt-is-India-It-s-getting-worse-index-says

International indices (which are based on subjective users' perceptions, and tend to be focused on petty corruption) have seen steady improvement since 1991. Petty corruption in India is traditionally linked to "acute scarcities"[15], which growth itself may help to soothe via higher bureaucratic wages. Indeed, this expectation seems buttressed by empirical analyses of petty corruption across Indian states such as Charron (2010), who finds evidence of negative association between "development" (a combined index of GDP p.c. and literacy rates) and corruption. On the other hand, World Bank 1996-2010 data on "control of corruption" in the World Governance Indicators[16] (which pool together petty and grand corruption) give a more ambiguous picture, with estimates hovering around the 40th percentile of the surveyed countries without recognisable trends.

This dynamics of growth and corruption appears far from unique. Indeed, the very term "Gilded Age" is taken from the history of late XIX century US: originally Mark Twain's sobriquet, portraying a time of rapid growth and rampant corruption. Based on newspapers' reports since the early XIX century, Glaeser and Goldin (2004) document a secular decline of corruption joint, nonetheless, with "boom-bust" cycles in the late 1830's, 1850's, 1870's, 1900's, 1930's and 1950's. With the caution due to data limitations, they conjecture an inverted-U evolution, with corruption reaching a global maximum around 1873. Curiously enough, the "Gilded Age" would then be a period of relative improvement - its ill fame due, in the main, to heightened awareness.

Another clear parallel is China. Wedeman (2004a, 2004b, 2012) documents a trend of "intensification" of corruption, *i.e.* increases in monetary values and hierarchical positions of bureaucrats involved. This seems to mirror India's story fairly closely. Nevertheless, Sun (2004, 2006, 2009) stresses that "the Chinese state is not itself organized for rent capture": no central minister has been brought down for corruption and, after a strong increase up to 2000, the number of corruption files seems to have plateaued. In other words, for all its salience, corruption would be a fundamentally peripheral affair to the Chinese state. A much more sullen picture emerges for India. Clearly enough, the difference in political regime is a conspicuous factor to weigh up.

[15] Wade (1985); cf. analogous considerations in Myrdal (1989), Singh (1997, p. 219) and in the documents by the Third Pay Commission (1970-1973). An amazing fresco is in Parry (2000).

[16] Kaufmann, Kraay and Mastruzzi (2010).

2 Liberalisation and state capture

Especially spurred by the experience of transition countries, the post-90's literature on corruption has increasingly taken issue with the assumption, implicit in previous studies such as Mauro (1995) and Ades and Di Tella (1997), that the various types of corruption are highly correlated and their consequences roughly similar. Structural shocks such as political and economic reforms may well have differential effects on corruption involving different subjects for different motives. A crucial distinction, in particular, is that between corruption affecting the *implementation vs.* the *formation* of market regulations. As liberalisation consists in a shift in public/private balance of power, the possibility of players designing their own rules *i.e.* of state capture (or, as other scholars name it, "regime corruption"[17]) is as serious a matter as any, like we just saw for India and China.

Based on data from post-Soviet economies, Hellman, Jones and Kaufmann (2000) draw a fascinating and nuanced picture of capture activities by firms (reprised by World Bank, 2000). Somewhat surprisingly, captor firms tend to be new entrants which do not enjoy previous relationship with state officials (as most often do privatised firms). Furthermore, as expected, in high capture states (*i.e.*, where the share of firms purchasing favours is high), captor firms grow much more rapidly, all at the expense of *average* growth rates[18]. Analysing the factors underlying the capture economy, they suggest the presence of an inverted-U relationship whereby the first introduction of civil liberties is associated with the emergence of state capture, whereas it is only when a threshold is trespassed that further reforms lower state capture. Expanding the analysis, Kaufmann and Kraay (2002) find a strong positive effect from governance indicators to *p.c.* GDP, but a weak and possibly *negative* reverse effect - a "corrupting effect of growth", so to speak. This fits well with the evidence in Treisman (2000), who finds a negative effect of democratisation on corruption only fourty years after regime change, and Montinola and Jackman (2000), who suggest the presence of threshold effects in the anticorruption impact of democratic reforms.

Hellman, Jones and Kaufmann (2000) call for the development of a "conceptual framework" of the interaction of captor firms and politicians after liberalisation, under democratic and authoritarian rule. This is the goal to which this paper aims to contribute. But first let us discuss some

[17] Cf. Tummala (2006, 2009).

[18] In low capture economies, captor firms tend to underperform, so that capture appears then to be a *substitute* for innovation.

more examples.

3 Late developers and corruption, *encore*

Russia, Korea, Taiwan, the Philippines and Indonesia are further interesting comparisons.

Russia's story is fairly well known[19]. After democratisation in '91, a first round of "voucher privatisations" was intended to distribute Russia's wealth among the general public. Unfortunately, it was easily captured mostly by insiders, as *per capita* vouchers had been sold by cash-strapped and uninformed Russian citizens long before any privatisation took place. In the runup to the 1996 elections, which menaced to topple reformers in favour of post-communists, the government accepted the banker V. Potanin's "loan-for-shares" plan in exchange for unrestrained campaign support from banks and the media. This turned out to be a fire sale of state assets, and created the notorious lot of Russian oligarchs. As well known, electionwise, the strategy proved successful.

Russia seems a clear example of perverse interaction between economic and political liberalisation: faced with mounting pressures of the kind essential to a democratic polity, the political establishment "sold out" to collusion with oligopolists.

On the other side, Taiwan and Korea famously share "liberal autocracy"[20] regimes, a story of "miraculous" growth, and moderate rates of corruption despite strong state intervention. But it is worth going through the details emerging from Wang (2002), You (2005), You and Khagram (2005) and Ha and Lee (2007).

The two had in common the crucial postwar circumstances of colonial Japanese landed *élites* to uproot, and of direct and bellicose Communist threats to counter. They were hence spurred by the Truman administration into enacting biting land reforms that drastically diminished inequality (and hence redistributive pressures[21]). During the boom, however, their paths forked.

Taiwan was dominated by a continental Chinese KMT ruling class largely estranged from local society. It hence followed a dual track of

[19] Cf., a.o., Gaidar (2000), Freeland (2000), Goldman (2003), Desai (1995, 2005, 2006).

[20] Cf. Zakaria (2004).

[21] Cf. Acemoglu, Ticchi and Vindigni (2007), who - based on Alesina and Rodrik (1994) - see strong inequalities as conducive to patronage and state capture (as the *élite*'s strategy to prevent redistribution) and hence stagnation.

development based on locals-owned SME's downstream, and large SOE's upstream. The government thus sought to appease the Taiwanese populace, all the while guarding the commanding heights of the economy, for strategic *i.e.* military reasons. Disciplined by Mao externally, and by enduring attrition with the locals internally, the KMT bureaucracy needed industrial might and reinvested most of the SOE's high profits. In this way, the very constitution of a big business class was by and large prevented. Also, high margin industries were mostly under public control, so that inequality was kept at low levels. The upshot of this very balanced situation was that corruption stayed minimal throughout.

Korea's development, instead, was famously based on the large *private* industrial conglomerates known as *chaebol*. These were hugely favoured through subsidies and other state policies, with the goal of capital accumulation which was indeed strong. The arrangement, however, left profits in private hands, which over time led to the buildup of income inequality. The state/*chaebol* balance of power, furthermore, tilted progressively towards the latter as they came to dominate a larger share of the country's strategic assets (and were hence "too big to fail"): the system evolved, so to speak, from "state autonomy" to "state capture". Democratisation in the early 90's reinforced this *via* shifting demand for campaign donations from the *chaebol*[22], a state of affairs unperturbed until the IMF's '97 intervention.

With this, Wedeman (1997) and You (2005) contrast the story of the Philippines. Lacking a Communist regime at the door, and a colonial *élite* which had lost the war, this country did not experience significant land redistribution. All successive regimes, democratic and autocratic alike!, were in the hands of the landed *élite*: utter corruption ensued. In other words, here seems at play a classic scenario of underdevelopment *à la* Barrington Moore, with the imaginable results in GDP *p.c.* terms.

Finally, the case of Indonesia is recurrently depicted (cf. f.i. Robison and Hadiz 2004) as that of the reconstruction of oligarchy domination and cronyism through the transition from a strongly centralised and authoritarian regime to a more decentralised and democratic one. Suharto's era is universally known as one of pervasive corruption: Vishny and Shleifer (1993) already pick it as the textbook example of what they name cen-

[22] "By the late 1980s Roh and later YS [Kim Young-sam] had established so much 'democracy' that I needed over 100 envelopes [bribes] in order to build a factory last year. That never occurred under Park or Chun - they eliminated the middleman, and while you had to pay for access, you could do it at the top levels, and not worry so much about the bureaucracy." Businessman cited by Kang (2002), p. 197.

tralised non-collusive corruption. The post-'97 debate regarded it as the basket case of East-Asian "crony capitalism" which the IMF intervention explicitly set out to abate. And yet, corruption does not seem to have been curbed after the fall of Suharto. The collusive/non-collusive (or with/without theft) cleavage is instead often employed (McIntyre 2001, Smith *et al.* 2003) to interpret post-democratisation developments: corruption has gone more "anarchic", disperse, inclusive and competitive; hence, in a sense, "democratic" (cf. Hicks 2004[23]). However, assessments of its overall quantitative incidence w.r.t. pre-'98 do not show decrease (cf. Robertson-Snape 1999, Robison 2006).

To sum up, that growth accelerations ensuing liberalisation may engender spurts of corruption is by no means an uncommon dynamic, especially in LDC's[24]. The extent to which a polity is vulnerable to these perverse effects depends on the afore-prevailing equilibrium, and the manner in which institutional shocks hit it. The examples considered seem to display three stylised cases: in several instances, most notably Russia, the perturbation of a previous low-corruption equilibrium by democratisation *via* its competitive effect (scramble for campaign funds) brings it to higher levels with a serious risk of state capture. However, if the foregoing regime is instead utterly corrupt, the competitive and inclusive character of democracy may well make it less organised and collusive: if checks and balances like a free press are developed, it may well drive it down, esp. in the long run. Nonetheless, this may be made harder if semi-collusive power sharing arrangements are prevalent, whereby parties take turns in country and local governments. If entry in the political system is somehow hindered - *e.g.* by strong campaign fundings requirements - no real alternative may be available ("politicians are all the same"), making collusion sustainable even in a democratic setting. This seems the case of India[25]. On the contrary, a credible alternative competitor induces disciplining towards old players too. This, obviously, should be the hallmark of a functioning democracy, and seems to be the case of Poland, Hungary and the Baltic states (World Bank 2000).

[23] A similar trend is documented for India's esp. petty corruption after decentralisation reforms by Véron *et al.* (2006).

[24] To this may concur institutional immaturity, low literacy rates, but also technological factors such as economic development ushering into a region of wide-spread IRS structures (as often found in industrialisation). For the US' "Gilded Age", this is noted by Glaeser and Goldin (2004, p. 20).

[25] Cf. Blechinger (2002), p. 12: "a change in government might indicate who is 'in' and who is 'out', but might no longer provide voters with an alternative." Examples cited include Italy and India.

Based on these observations, with the aim of reproducing some of the salient dynamics exposed, we now proceed to sketch the model.

4 The story

The very name of corruption evokes the idea of a gradual phenomenon of progression (or regression) of rot in an organisation. This is reinforced by a whole imagery of "rotten apples" which may, or may not, spoil the whole basket. The "atmosphere" of the organisation, which may be defined as the dominant conjecture on the relative prevalence of such "rotten apples" within it, is a piece of information which its members likely come to sense: it forms part of a kit of patterns of behaviour seemingly alike to what Nelson and Winter (1982) name *routines* of a firm, and consider akin to a genetic code specific to it.

Arguably, it is a broadly shared experience that the sheer (perceived) frequency of a behaviour within an organisation breeds a "cosí fan tutte" effect of *de facto* acceptance and impunity. This is based on what Subramanian (2012) imputes to the time-honoured problem of "quis custodiet ipsos custodes" (if corruption spreads to the inspectors, the inspected will not get caught); and possibly even on something deeper, *i.e.* the fact that even where detection were to be no less likely, I will feel (and be seen, and hence be) in less grave a position if I am not the only one. Without need to subscribe to the interpretation that "western" bureaucratic moral norms, themselves, were not internalised by Indian civil servants[26], we may argue that aversion to immoral deeds always features the coexistence of the motive of "guilt" with the motive of "shame": while the number of associates might be irrelevant for the first, it may well, instead, affect the second.

By including such considerations, we aim to reconcile the approach based on individual rationality to the clear evidence of a characteristically imitative feature of corruption, emphasised f.i. by Rose-Ackerman (2001)[27] and Warburton (2001)[28] and empirically retrieved by Tavits (2005)[29].

[26] As recurrently argued by social anthropologists such as Gill (1998), and forcefully contested by Parry (2000).

[27] "In surveys [of post-socialist societies], people justify their corrupt behavior by citing its prevalence."

[28] The author (a former anti-corruption investigator of the Australian federal Police) stresses the "powerful atmosphere of organisational integrity" that "can contribute significantly to an actor's inhibitory motivational forces" (p. 256).

[29] It is also most fitting to quote Nehru's words, already cited by Myrdal (1968) and

To the best of my knowledge, theoretical work on growth *cum* corruption[30] fails to incorporate explicitly these aspects. Blackburn *et al.* (2010), in particular, manage to derive dependence of a bureaucrat's likelihood to be corrupt on that of other bureaucrats. The mechanism of transmission, however, does not run through inherent features of the organisation, but instead through the macroeconomy: corruption of tax office bureaucrats drives down tax income, which forces the government to set higher tax rates, and hence incentivises households to escape them through higher bribes (which lure more bureaucrats). It may well be that this effect is less important than the imitational channels considered here.

Through privatisation, freer price setting, and other policies, existing firms under liberalisation probably experience a profitability spike: this indeed should be the trigger of the investment and growth rise. Since entry of competitors is likely to be slow (for technological, financial, and other reasons) firms can employ these larger cash flows to buy protection. We may assume that isolated bureaucrats can only provide limited favours (which we interpret here as "petty corruption") - such as slowing down competitor entry by one period, or providing competitive advantages through f.i. fast-track licensing, preferential infrastructuring, contracting and taxation (*e.g.* looser monitoring on tax evasion), or the like. For this, obviously, firms are only willing to pay little. Corruption *is* deprecated, however, so that caught bureaucrats are ousted and communicating one's intention to take bribes is not an option.

Still, the real gains can only be made if bureaucrats manage to forge coalitions to extract rents that are large enough to set a standard and a pattern of behaviour. Then, they can block entry for extended periods of times ("grand corruption"), thus protecting large rents which they share with the oligopolists. By mere simplicity, we posit that this normative shift, whereby corruption goes *de facto* unpunished, occurs if a simple majority of bureaucrats is discovered corrupt in a period. Increased probability of such an event, due to higher odds attributed to fellow bureaucrats taking bribes, tilts each agent's incentives *via* imitation effects varying the share of corrupt *vs.* honest agents.

Democratisation affects this system in two main ways: on the one side,

Gould (2011): "Merely shouting from the house-tops that everybody is corrupt creates an atmosphere of corruption. People feel they live in a climate of corruption and they get corrupted themselves. The man in the street says to himself, if everybody seems to be corrupt why shouldn't I be corrupt?"

[30] Cf. *e.g.* Basu and Li (1998), Barreto (2000), Plekhanov (2007), Aidt *et al.* (2008), Blackburn *et al.* (2010), Harstad and Svensson (2011).

it increases the demand for rents due to campaign funding needs. On the other, electoral competition creates incentives to expose scams. The tightness of competition is obviously affected by the ratio of power shares available to the incumbent w.r.t. the opponent. We also explore how this is reflected into equilibrium levels of corruption.

5 The model

5.1 Oligarchy

We start from an oligarchic regime composed of an even number of $n \geq 4$ bureaucrats. Each bureaucrat i has linear utility, and values any corrupt income at its monetary value times an idiosyncratic parameter ψ_i. He chooses whether to be corrupt or not. Corruption may assume two forms: *petty corruption* takes place if the bureaucrat takes a bribe alone. In such case he can only arrange for limited benefits to the briber: for instance, he can bar access to a market, so to keep up profits, but only for a short period. The compensation for such effort is b. Otherwise, the bureaucrats may collude to protect markets permanently, forcing stagnation on the economy, and share the large proceeds with the oligopolists getting $\frac{\pi}{n}$ in each period from now on (*grand corruption*). This happens if there is a shift in social norms after which corruption is *de facto* considered acceptable by the regime. This is more likely to occur if corruption becomes widespread: schematically, we assume this means that a simple majority of bureaucrats, $n/2 + 1$, is discovered corrupt. In an oligarchic regime, if not discovered corrupt the bureaucrat stays in power for sure and gets compensation R, plus his share of grand corruption income in case of normative shift, plus the expected utility from the continuation of the game. Corruption is discovered with exogenous utility p, which certainly leads to the bureaucrat's ousting, and replacement from the same population, unless a normative shift occurs. If not discovered, he gets R, bribe b - multiplied by a morality parameter ψ of appreciation of corrupt income -, *or* his share of grand corruption income $\frac{\pi}{n}$ - again multiplied by ψ -, plus the continuation value of the game.

Discovery of each bureaucrat's corruption is a random i.i.d. event. In each period there is a common prior on the distribution of ψ's in the population from which the n bureaucrats are drawn, based on which each bureacrat i assigns *the same* odds q to the event of each *other* bureaucrat being corrupt. Obviously, the probability of i being corrupt is known

to i, and can be $q_i = 1$ or $q_i = 0$ if i chooses to be corrupt or not. Based on the number of bureaucrats discovered corrupt in each period, this probability - hence the probability of all composite events, among which that of a normative shift - is updated at the end of every period by each surviving bureaucrat in the same way via Bayesian updating. ψ's are private information, communicating them (and *a fortiori* the intention of accepting bribes) prompts immediate ousting.

Given the assumptions, in a one-period setup, the expected utilities to bureaucrat i from being and not being corrupt are respectively:

$$U^{OL}_{i,\,nocorr} = R + P\left(c \geq {}^{n}/_{2} + 1 \middle|\, q,\ q_i = 0\right)\psi_i \frac{\pi}{n} \qquad if\ not\ corrupt$$

$$U^{OL}_{i,\,corr} = (1-p)\left(R + \psi_i b\right) + P\left(c \geq {}^{n}/_{2} + 1 \middle|\, q,\ q_i = 1\right)\psi_i \frac{\pi}{n} \qquad if\ corrupt$$

where c is the number of bureaucrats discovered corrupt in a period.

(Let us rename $P\left(c \geq {}^{n}/_{2} + 1 \middle|\, q,\ q_i = 0\right)$ and $P\left(c \geq {}^{n}/_{2} + 1 \middle|\, q,\ q_i = 1\right)$ as P_0^{OL} and P_1^{OL} respectively. Clearly, $P_1^{OL} > P_0^{OL}$.)

This implies that $U^{OL}_{i,\,corr} = U^{OL}_{i,\,nocorr}$ iff $\psi_i = \widetilde{\psi}_1^{OL} = \frac{pR}{(1-p)b + \left(P_1^{OL} - P_0^{OL}\right)\frac{\pi}{n}} \geq 0$. Assuming that $q\left(\psi\right)$indifferent bureaucrats are corrupt, i's optimal decision rule is hence to accept bribes iff $\psi_i \geq \widetilde{\psi}_1^{OL}$.

By backward induction we can work out the analogue for a two-period setting (where the future is discounted by β). The implied $\widetilde{\psi}_2^{OL}$ for ψ_i's above $\widetilde{\psi}_1^{OL}$ reads:

$$\widetilde{\psi}_2^{OL} = \frac{\left\{p + p\beta\left(1-p\right)\right\}R}{\left(1-p\beta\right)\left(1-p\right)b + \left[\left(P_1^{OL} - P_0^{OL}\right)\left(1+\beta\right) - p\beta P_1^{OL}\right]\frac{\pi}{n}} \qquad (1)$$

analogously, for ψ_i's below $\widetilde{\psi}_1^{OL}$:

$$\widetilde{\psi}_2^{OL} = \frac{\left\{p + p\beta\right\}R}{\left(1-p\right)b + \left[\left(P_1^{OL} - P_0^{OL}\right)\left(1+\beta\right) - p\beta P_0^{OL}\right]\frac{\pi}{n}} \qquad (2)$$

By inspection of 1 and 2, one notes that necessarily $\widetilde{\psi}_2^{OL} > \widetilde{\psi}_1^{OL}$ in both cases whenever the denominators are positive. Clearly enough, the $P_1^{OL} - P_0^{OL}$ difference tends to zero as n increases (for individual contributions to the likelihood of normative shifts wane). Hence, we assume that n is small enough for given b, p, β to ensure that $\widetilde{\psi}_2^{OL}$ is nonnegative. Therefore, the $\left[\widetilde{\psi}_1^{OL},\ \widetilde{\psi}_2^{OL}\right]$ intervals necessarily occupy the field of ψ_i's s.t. $\psi_i \geq \widetilde{\psi}_1^{OL}$,

which refer to the case in which corruption *does* take place in the last period. Hence, the proper threshold value $\widetilde{\psi}_2^{OL}$ to consider for the two-period case is the one expressed by 1. Note further that there exists an n small enough to make $\widetilde{\psi}_2^{OL}$ decreasing in q.

We assume that the set of possible models M_m of the distribution of ψ's in the population takes the form of a range of normal distributions with equal variances, so that a model is pinned down by its distribution mean (and M_m is hence equipotent to the real line). Further, we assume that the attribution of odds to each possible model, or *belief*, itself takes the form of a normal distribution (such beliefs are then nonnull in the sense of attributing strictly positive odds to all models). Since a product of normal distributions is normal, a belief is itself fully characterised by its distribution mean. Any given belief implies that q, the odd attached to the event of any other bureaucrat being corrupt, is defined as the probability mass of ψ's lying above a certain threshold $\widetilde{\psi}$ (*i.e.*, $q = \int_{\widetilde{\psi}}^{\infty} p(\psi)\, d\psi$). Clearly, then, q is equal to one minus the c.d.f. of $p(\psi)$.

Bayesian updating takes the usual form:

$$P(M|c) = \frac{P(c|M)\, P(M)}{\sum_m P(c|M_m)\, P(M_m)}$$

A number of bureaucrats discovered corrupt f.i. higher than expected prompts each surviving bureaucrat to shift their attribution of odds - and hence the implied belief on the distribution of ψ_i's in the population - to the right.

For any given belief (*i.e.*, attribution of odds to models), a *coherent conjecture* is defined as a threshold $\widetilde{\psi}$ s.t. the implied q induces the same threshold $\widetilde{\psi}$ (point A in figure 1). In words, a coherent conjecture on $\widetilde{\psi}(q)$ is such that any bureaucrat, holding a belief, and knowing that it is shared by all other bureaucrats, can infer that based on it and on the relevant threshold function (such as 1), the latter will be corrupt iff their private ψ's are above $\widetilde{\psi}(q)$, an event to which all bureaucrats attribute exactly odds q. We can now state and prove the following proposition.

Proposition 1. a) For any continuous nonnull belief, and any continuous strictly positive $\widetilde{\psi}(q)$, there exists a coherent conjecture.

b) Under normality of beliefs and monotonic $\widetilde{\psi}'_q$, there exist at most three coherent conjectures.

Proof. a): since beliefs are continuous nonnull distributions, $q(\psi)$ is invertible and strictly decreasing over the closed interval [0, 1]. Either $\widetilde{\psi}(q)$

is increasing or it is decreasing, in which case its image is bounded above and below. Since $q^{-1}(\psi)$ and $\widetilde{\psi}(q)$ are both continuous over the same domain, in the former case, one is increasing and the other decreasing, and $q^{-1}(\psi)$ image spans the whole parameter space of ψ's, hence they cross; in the latter, if they did not cross, $\widetilde{\psi}(q)$ would lie below or above $q^{-1}(\psi)$ for all q, contradicting $\widetilde{\psi}(q)$'s boundedness.

b) follows from c.d.f. of a normal belief having two flexes and monotonicity of $\widetilde{\psi}'_q$.$\diamond$

The number of bureaucrats discovered corrupt, and hence the evolution of beliefs, depends on the fraction of bureaucrats actually above the threshold, which is jointly determined by ψ's actual distribution and the belief on it.

We define as *equilibrium* a coherent conjecture on $\widetilde{\psi}(q)$ which is *locally truthful* in the sense of inducing the q of ψ's *actual* distribution *for that draw* of n bureaucrats (note that, since n is finite, this *actual* q, name it $\widehat{q}(\psi)$, is discontinuous and weakly decreasing).

An equilibrium $\widetilde{\psi}(q)$ is *locally stable* iff there exists a neighbourhood $\left[\widetilde{\psi}(q)-\varepsilon,\, \widetilde{\psi}(q)+\varepsilon\right)$[31] s.t., after any shock to beliefs falling in it, keeping the same actual distribution of ψ's among the n bureaucrats, expectations on subsequent states of the system revert to $\widetilde{\psi}(q)$ (points B and B' in figure 1). Informally, this means that, after the induced shock to q, if it were possible to average out the randomness of corruption discovery by an unlimited number of trials for each period, and substitute each ousted bureaucrat with another characterised by the same ψ_i, the system would revert to $\widetilde{\psi}(q)$. If shocks to beliefs are within the neighbourhood, the probability of not reverting to a locally stable equilibrium goes to zero in the lon run due to the Law of Large Numbers.

Further, we define as *quasi-equilibrium* a coherent conjecture on $\widetilde{\psi}(q)$ which is not an equilibrium (*i.e.*, the belief does not locally induce the actual $\widehat{q}()$) and there exists a neighbourhood $\left(\widetilde{\psi}(q)-\varepsilon,\, \widetilde{\psi}(q)+\varepsilon\right)$ s.t. after any shock to beliefs falling into it, expectations on subsequent states of the system revert to $\widetilde{\psi}(q)$ (point C in figure 1).

The following proposition characterises these points.

Proposition 2. a) There always exists a locally stable equilibrium.

[31] The interval is closed below and open above due to the assumption that indifferent bureaucrats accept bribes.

b) A coherent conjecture on $\widetilde{\psi}(q)$ is a locally unstable equilibrium iff i) $q^{'}(\psi) < \widetilde{\psi}_{q}^{-1'} < 0$ (*i.e.*, the threshold function is decreasing and beliefs cross it from above) and $\widetilde{\psi}$ is a continuity point of $\widehat{q}(\psi)$.

c) A coherent conjecture on $\widetilde{\psi}(q)$ is a quasi-equilibrium iff i) holds and $\widetilde{\psi}$ is a discontinuity point of $\widehat{q}(\psi)$.

Proof. a) Recall that i) $\widehat{q}(\psi)$ is discontinuous and weakly decreasing, and ii) $\widetilde{\psi}(q)$ is either increasing or decreasing and bounded above and below. $\widehat{q}(\psi)$ and $q(\psi)$ span the whole parameter space of ψ, hence there exists a $\widetilde{\psi}(q)$ s.t. $q = \widehat{q}$ and a belief comprehending point $\left(\widetilde{\psi},\, q\left(\widetilde{\psi}\right) = \widehat{q}\right)$. Given ii) and normal beliefs, necessarily there exists either a q^{*} s.t. $\forall\, q > q^{*}$, $\widetilde{\psi}(q) < q^{-1}(\psi)$ or a q^{**} s.t. $\forall\, q < q^{**}$, $\widetilde{\psi}(q) > q^{-1}(\psi)$, or both. A f.i. leftward shock to the belief would lead to a $q < \widehat{q}$ and hence, on average, to corruption discoveries more numerous than what was believed, leading to rightward revisions of the belief. Expectations on subsequent states of the system revert to $\widetilde{\psi}(\widehat{q})$, *i.e.*, the equilibrium is locally stable.

b) In such a case, a f.i. leftward shock to the belief would lead to a $q > \widehat{q}$ and hence, on average, to corruption discoveries less numerous than what was believed, leading to revisions driving beliefs further to the left. The equilibrium is locally unstable.

c) In such a case, a f.i. leftward shock to the belief would lead to a $q < \widehat{q}$ and hence to corruption discoveries *on average* more numerous than what was believed, leading to rightward revisions. Nonetheless, in such a $\widetilde{\psi}(q)$, evidently $q > \widehat{q}$, which leads to leftward revisions. Hence, there is a neighbourhood wherein the system is attracted to a point which is itself unstable. $\diamond$

Figure 1 provides a graphic illustration of coherent conjectures (points A, B, B', and C), locally stable equilibria - as horizontal crossings between the threshold function and ψ's actual distribution: points B and B' -, and of a quasi-equilibrium, point C.

If the system starts off from point A, beliefs on corruption exceed the induced corruption in that case, given the threshold function and the actual underlying distribution. Beliefs would hence be driven downwards (vertical arrow). In that range of values, the actual number of bureaucrats willing to be corrupt is zero. Since the intersection with the threshold function is positive anyway, though, the induced beliefs would be too high anyway and the shifting process would continue indefinitely, approximating the conjecture of zero corruption.

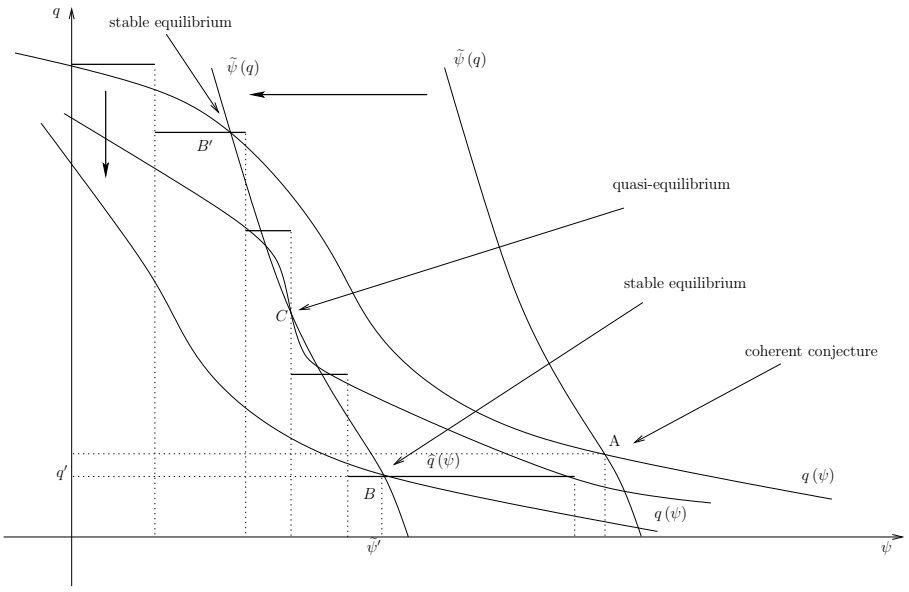

Figure 1: Thresholds, beliefs and equilibria

If the threshold function were to be shifted leftwards (horizontal arrow), instead, points B and B' would arise as equilibria with respectively low and high corruption. Despite the fact that the underlying actual distribution of morality is unvaried, such equilibria are sustained simply because agents believe that they live in a world of low and high corruption respectively.

If the system ever lands on point C, instead, corruption is on average higher than expected. This implies an upward revision of beliefs. Within a neighbourhood of point C, nevertheless, this drives the number of corrupt bureaucrats *down*, so that subsequent average corruption is lower. This drives beliefs to the left, back to point C, so that the cycle recommences.

A *long-run equilibrium* is a locally stable equilibrium to which expectations on the system converge by successive substitution of ousted bureaucrats. We can prove the following.

Proposition 3. a) The likelihood of exiting the neighbourhood of a locally stable equilibrium is increasing in q.

b) Iff $\widetilde{\psi}(q)$ is increasing, there exists only one long-run equilibrium. This is characterised by $q = 0$ iff the highest ψ_i of either the *actual* population or the *initial* sample distribution of ψ's is lower than $\widetilde{\psi}(0)$.

c) Iff $\widetilde{\psi}(q)$ is decreasing, and the highest ψ_i of the *actual* distribution $(\overline{\psi})$ is lower than $\widetilde{\psi}(0)$, the system may converge *in expectations* only to two *long-run* equilibria: a positive-corruption equilibrium and a zero-corruption one. Probability of realised convergence to each is a direct function of their proximity to the equilibrium induced by initial beliefs (*path embeddedness*). Furthermore, in the left neighbourhood $\left(\overline{\psi},\, \widetilde{\psi}(0)\right]$, convergence to the zero-corruption equilibrium is deterministic.

Proof. a) In the neighbourhood wherein an equilibrium is locally stable, the probability of m bureaucrats being discovered corrupt is given by $\binom{nq}{m} p^m (1-p)^{nq-m}$ for $m \leq nq$, and 0 otherwise. Evidently, then, higher q's strictly increase the likelihood of large belief revisions and, *ceteris paribus*, that of equilibrium shifts.

b) If $\widetilde{\psi}(q)$ is increasing, it crosses beliefs and the actual distribution only once. By the law of large numbers and the fact that bureaucrats discovered corrupt are replaced from the same population, the expected number of corrupt bureaucrats coincides with the unique equilibrium.

c) Due to replacement of bureaucrats discovered corrupt from the same population, the number of corrupt bureaucrats converges to its expectation in the long run due to the law of large numbers. If the system starts

off with a conjecture on $\widetilde{\psi}$ above the highest *actual* ψ_i, corruption discoveries are always zero. This drives beliefs leftwards indefinitely, converging deterministically to the zero corruption equilibrium. $\diamond$

Corollary. If a $q = 0$ equilibrium exists, the likelihood of exiting it is also 0: hence, it is stable not only in expectations but in realisations. We can name this equilibrium *completely stable*.

We have seen above that, for a small enough *élite*, the threshold function $\widetilde{\psi}(q)$ is decreasing and bounded above and below. Intuition for this is that, if few agents are involved, my contribution to the likelihood of a normative shift is significant. Hence, only if I believe the others to be very corrupt on their own the risk taken by playing along will pay off. On the other hand, if my contribution is marginal (increasing $\widetilde{\psi}(q)$), there is no point in running risks, and this is all the more true if I believe the environment to be very corrupt *i.e.* normative shifts very likely anyway. In such a case, then, only the truly immoral will be corrupt.

If we concentrate on the first case, what the proposition above says is that provided no bureaucrat is immoral enough to be corrupt no matter what, under a so-modeled oligarchic regime there must exist a completely stable situation wherein no bureaucrat is ever corrupt. Globally, in such a situation, beliefs may well be grossly wrong and in particular vastly overestimate *élite* morality. Despite being immoral enough to easily accept bribes, if only he could know the truth, each bureaucrat stays clean for the sole reason that he believes others to be so. Collapse into such a state is increasingly likely the lower corruption is at a given moment, and it becomes certain if shocks ever drive beliefs below $q\left(\overline{\psi}\right)$.

5.2 Democracy

We model a democratic regime in the following - admittedly selective - way. A *democratisation* consists in an unexpected splitting of the n bureaucrats in two equally-sized parties, randomly selected to be either incumbent I or opponent O. We assume that the splitting occurs after bureaucrats have been discovered corrupt in the previous period but before they get ousted: this is so that the public is allowed to elaborate beliefs on the distribution of ψ's of each party based on the information emerged on the respective degree of corruption. The relatively high amount of randomness in this definition of democratisation is meant to capture the intrinsically chaotic nature of such processes: everyone has a past and is possibly compromised

with the authoritarian regime, and which political exponents become the new incumbents is very often the result of very idiosyncratic and unpredictable circumstances.

Opponent party members are not entirely excluded from power but face $\alpha \in [0, 1]$ times the incumbent party's rewards, which are the same (R, b) as before. This is meant to capture the fact that in actual democracies information on the relative morality of the opponent party is often not at all unavailable, since this does enjoy shares of power, possibly in a hierarchically or geographically limited manner.

Electoral caimpagns provide evident incentives for corruption[32]. Each party strives for election, which is a random event bureaucrat i believes to occur with probability $\underline{r}\,(q - q^*)$ if he is incorrupt, $\overline{r}\,(q - q^*)$ if he is corrupt where q is i's conjecture on his own party's corruption, and q^* is i's conjecture on the other party's corruption. Assume $\forall\, q - q^*$, $\overline{r} > \underline{r}$ and $\frac{\partial r}{\partial q - q^*} > 0$, $\frac{\partial^2 r}{\partial (q-q^*)^2} < 0$. In words, the probability of reelection is increasing and concave in the difference between my party's and the other's corruption level. The more corrupt my party is w.r.t. to its competitor, the larger campaigns it can fund, the more likely it is that it gets reelected other things being equal.

The number of corruption discoveries c is not immediately released. Instead, O has the choice whether to denounce I's c to the general public. If it does, I can respond tit-for-tat by denouncing O's. Iff $c_I > c_O$, O automatically gets in charge. Otherwise, clearly, O will not denounce and elections will take place. Unless a normative shift occurs, politicians discovered corrupt lose their period income but are only ousted if their party is not the incumbent in the following period. After the elections (if any), c_j's are anyway made public so to update beliefs.

Importantly, in this setting, the normative shift takes place iff a simple majority of *each* party is discovered corrupt at a given time. In this case, I's and O's members receive respectively $\frac{1}{1+\alpha}\frac{\pi}{n/2}$ and $\frac{\alpha}{1+\alpha}\frac{\pi}{n/2}$.

We can derive the one-period problem for I and O as above. Politician i of I's utilities are:

[32] Blechinger (2002), p. 5-6: "campaign limits are always exceeded." Heston and Kumar (2008), p. 12-13: "Elections in India are a costly affair" "Under the Indian election laws, the political parties are required to submit their audited accounts to the election commission and the income tax authorities. In reality, they do not and are not penalised for the violation. [...] Public funding of election costs is not available."

$$U^{DEM}_{I,\,i,\,nocorr} = R$$
$$+P\left(c_I \geq {}^{n}/_{4}+1 \ \wedge \ c_O \geq {}^{n}/_{4}+1 \middle|\, q,\, q^*,\, q_i = 0\right)\psi_i \frac{1}{1+\alpha}\frac{\pi}{{}^{n}/_{2}} \qquad if notcorrupt$$

$$U^{DEM}_{I,\,i,\,corr} = (1-p)\,(R+\psi_i b)$$
$$+P\left(c_I \geq {}^{n}/_{4}+1 \ \wedge \ c_O \geq {}^{n}/_{4}+1 \middle|\, q,\, q^*,\, q_i = 1\right)\psi_i \frac{1}{1+\alpha}\frac{\pi}{{}^{n}/_{2}} \qquad if corrupt$$

(As above, let us rename probabilities: $P^{DEM}_1 > P^{DEM}_0$.)

The analogues for O can be simply derived by multiplying each RHS by α.

One-period threshold functions $\widetilde{\psi}^{DEM}_1(q,\, q^*)$ are the same for I and O and equal to

$$\widetilde{\psi}^{DEM}_1 = \frac{pR}{(1-p)\,b + \left(P^{DEM}_1 - P^{DEM}_0\right)\frac{1}{1+\alpha}\frac{\pi}{{}^{n}/_{2}}}$$

$\widetilde{\psi}^{OL}_1 = \widetilde{\psi}^{DEM}_1$ iff $q = q^*$ and $\alpha = 1$ or $q = q^* = 0$.

Two-period equations are expectedly more complicated. Name L^j_1 and L^j_0, with $j \in \{I,\, O\}$, the probabilities of holding elections (*i.e.*, of no more corruption discoveries in the incumbent than in the opponent, provided that no normative shift occurs), if the bureaucrat is and is not corrupt respectively[33]. Clearly, $L^I_1 < L^I_0$, $L^O_1 \geq L^O_0$, and their differences decrease with n. For members of I and ψ_i's above $\widetilde{\psi}^{DEM}_1$:

$$\widetilde{\psi}^{DEM}_{2,I} = \frac{\left\{p + \Lambda^I \beta\,(1-p)\right\} R}{(1-\Lambda^I\beta)\,(1-p)\,b + \left\{\left(P^{DEM}_1 - P^{DEM}_0\right)(1+\beta) - \Lambda^I \beta P^{DEM}_1\right\}\frac{1}{1+\alpha}\frac{\pi}{{}^{n}/_{2}}} \tag{3}$$

analogously, for ψ_i's below $\widetilde{\psi}^{DEM}_1$:

$$\widetilde{\psi}^{DEM}_{2,I} = \frac{\left\{p + \Lambda^I \beta\right\} R}{(1-p)\,b + \left\{\left(P^{DEM}_1 - P^{DEM}_0\right)(1+\beta) - \Lambda^I \beta P^{DEM}_0\right\}\frac{1}{1+\alpha}\frac{\pi}{{}^{n}/_{2}}} \tag{4}$$

where $\Lambda^I = \left[\alpha p + \alpha\,(1-p)\,\overline{r} + (1-\alpha)\,\underline{r}\right] L^I_0 - \overline{r} L^I_1$.

[33] *I.e.*, $P^j_1\left(c_I \leq c_O | c_I \vee c_O \leq {}^{n}/_{4}\right)$ and $P^j_0\left(c_I \leq c_O | c_I \vee c_O \leq {}^{n}/_{4}\right)$.

Again, for members of O and ψ_i's above $\widetilde{\psi}_1^{DEM}$:

$$\widetilde{\psi}_{2,O}^{DEM} = \frac{\left\{\alpha p + \Lambda^O \beta\,(1-p)\right\} R}{(\alpha - \Lambda^O\beta)\,(1-p)\,b + \left\{\alpha\,(P_1^{DEM} - P_0^{DEM})\,(1+\beta) - \Lambda^O \beta P_1^{DEM}\right\} \frac{1}{1+\alpha}\frac{\pi}{n/2}} \tag{5}$$

analogously, for ψ_i's below $\widetilde{\psi}_1^{DEM}$:

$$\widetilde{\psi}_{2,O}^{DEM} = \frac{\left\{\alpha p + \Lambda^O \beta\right\} R}{\alpha\,(1-p)\,b + \left\{\alpha\,(P_1^{DEM} - P_0^{DEM})\,(1+\beta) - \Lambda^O \beta P_0^{DEM}\right\} \frac{1}{1+\alpha}\frac{\pi}{n/2}} \tag{6}$$

where $\Lambda^O = \left(L_1^O - L_0^O\right) + \left[\alpha p + (\alpha\,(1-p)\,\overline{r} + (1-\alpha)\,\underline{r})\right] L_0^O - \overline{r} L_1^O$.

Clearly, in this setting whether $\widetilde{\psi}_{2,j}^{DEM} \gtreqless \widetilde{\psi}_{1,j}^{DEM}$ depends on the value of $\Lambda^j \gtreqless 0$.

Based on the distribution of c, the following lemmas are easily shown:

Lemma 1. $\Lambda^I \leq p$, with equality iff $\alpha = 1$ and $q = q^* = 0$; also, if $q = q^* = 0$ and $p, \overline{r} > 0$, then $\Lambda^O < \Lambda^I \ \forall\, \alpha$. Hence, for $q = q^* = 0$, $\widetilde{\psi}^{OL} \geq \widetilde{\psi}_{2,I}^{DEM} > \widetilde{\psi}_{2,O}^{DEM}$, and that the previous assumption that n be small enough for $\widetilde{\psi}_2^{OL} \geq 0$ ensures $\widetilde{\psi}_{2,I}^{DEM} \geq 0$ too.

Proof. The difference $L_0^I - L_1^I$ is highest if $q = 0$. Even in this case, Λ^I collapses to $\alpha p - (1-\alpha)\,(\overline{r} - \underline{r}) + (1-\alpha)\,p\overline{r} \leq p$, with equality for $\alpha = 1$. $\diamond$

This signifies that, if prevailing conjectures are of zero (or very low) likelihood of corruption, democratisation leads to increased risks of corruption w.r.t. an authoritarian regime.

Lemma 2. Lower α's and higher q^*'s shift the value of $\widetilde{\psi}_{2,I}^{DEM}$ to the left for $q = 0$.

Proof. From the formula in the above proof it can be seen that Λ^I is decreasing in α for $q = 0$. Higher q^*'s decrease $L_0^I - L_1^I$, hence Λ^I, and increase $P_1^{DEM} - P_0^{DEM}$. Both shift $\widetilde{\psi}_{2,I}^{DEM}$ to the left. $\diamond$

Lemma 3. With $\alpha = 0$ and $q^* = 0$, $\Lambda^O = -(\overline{r} - \underline{r})$: it is hence negative and increasing in q, and so is $\widetilde{\psi}_{2,O}^{DEM}$. With $\alpha = 0$ and $q^* = 1$, it is generally ambiguous whether $\Lambda^O = \left(L_1^O - L_0^O\right) - \left(\overline{r} L_1^O - \underline{r} L_0^O\right)$ is increasing or decreasing in q. However, $\widetilde{\psi}_{2,O}^{DEM}$ is negative anyway (by simplification) and increasing in q.

Lemma 4. If α is s.t. $\widetilde{\psi}_{2,O}^{DEM}$'s denominator is positive, $\widetilde{\psi}_{2,O}^{DEM}$ is decreasing in α.

Lemma 5. If $\alpha = 1$ and $q^* = 0$, $\Lambda^O = p(1-\overline{r})$ (and hence $\widetilde{\psi}_{2,O}^{DEM}$) is positive and decreasing in q. If $\alpha = 1$ and $q^* = 1$, Λ^O (hence $\widetilde{\psi}_{2,O}^{DEM}$) moves ambiguously w.r.t. $q^* = 0$ (since the probability of holding elections decreases, but $1-\overline{r}$ rises). However, it is positive and decreasing in q, much more than with $q^* = 0$, both for the presence of the π term and for the decrease in Λ^O.

Proof. By inspection of $\widetilde{\psi}_{2,O}^{DEM}$. $\diamond$

Lemma 6. $\forall\, q$, $q^* > 0$, the difference between $P_1^{OL} - P_0^{OL}$ and $P_1^{DEM} - P_0^{DEM}$ wanes with larger n's. Consequently, $\forall\, \alpha\ \exists\, n$ below which $q = q^* = 1$ implies $\widetilde{\psi}_{2,I}^{DEM} \geq \widetilde{\psi}_2^{OL}$.

Proof. By lemma 2, $\widetilde{\psi}_{2,I}^{DEM}$ is decreasing in α, which then needs to be above a threshold for $\widetilde{\psi}_{2,I}^{DEM} \geq \widetilde{\psi}_2^{OL}$ with $q = q^* = 1$. Relative weight of a politician's corruptness on the probability of normative shifts is greater in democracy, since he can block majority from his party even if the other already features it. However, this weight decreases as the number of bureaucrats rises. Consequently, α needs to be higher for $\widetilde{\psi}_{2,I}^{DEM} \geq \widetilde{\psi}_2^{OL}$ as n increases. $\diamond$

Figure 2 and 3 plot the ensuing situation.

Clearly, a variety of possibilities emerge. We limit ourselves to proving the following.

Proposition 4. If the system starts from a completely stable equilibrium and $\overline{\psi} \not\leq \widetilde{\psi}_{2,I}^{DEM}$, $\widetilde{\psi}_{2,O}^{DEM}$, then democratisation increases equilibrium corruption.

Proof. In a completely stable equilibrium (which presupposes $\overline{\psi} \leq \widetilde{\psi}_2^{OL}$), obviously $c = 0$: after democratisation, hence, beliefs on ψ's for I and O are unchanged. O's threshold may move upward or downward based on parameter values: however, I's threshold necessarily moves downward (point 3 above). This implies higher beliefs on I's members' q. (Clearly, since $\widetilde{\psi}_{2,I}^{DEM}$ is bounded below due to α, $q^* \geq 0$, normal beliefs on I imply that such q is also < 1.)

If $\widetilde{\psi}_{2,O}^{DEM} \leq \overline{\psi} \vee \widetilde{\psi}_{2,I}^{DEM} \leq \overline{\psi}$, then c_I, c_O will confirm such conjectures in the long run, *i.e.* $q > 0 \wedge q^* \geq 0$ in equilibrium. $\diamond$

Proposition 5. If the system starts from beliefs s.t. $q = 1$ and $q = q^* = 1$ implies $\widetilde{\psi}_{2,I}^{DEM} > \widetilde{\psi}_2^{OL}$, then democratisation decreases equilibrium corruption.

Proof. Evidently after the I-O splitting c_I, $c_O \leq 1$, implying $q \leq 1$ for both parties under $\widetilde{\psi}_2^{OL}$. The hypothesis on $\widetilde{\psi}_{2,I}^{DEM}$ implies then that

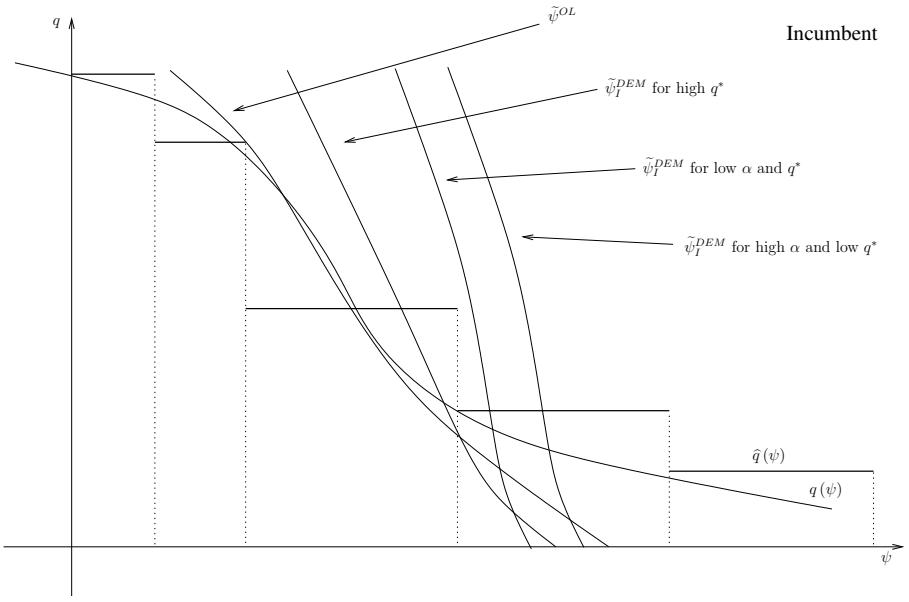

Figure 2: Threshold functions for the Incumbent.

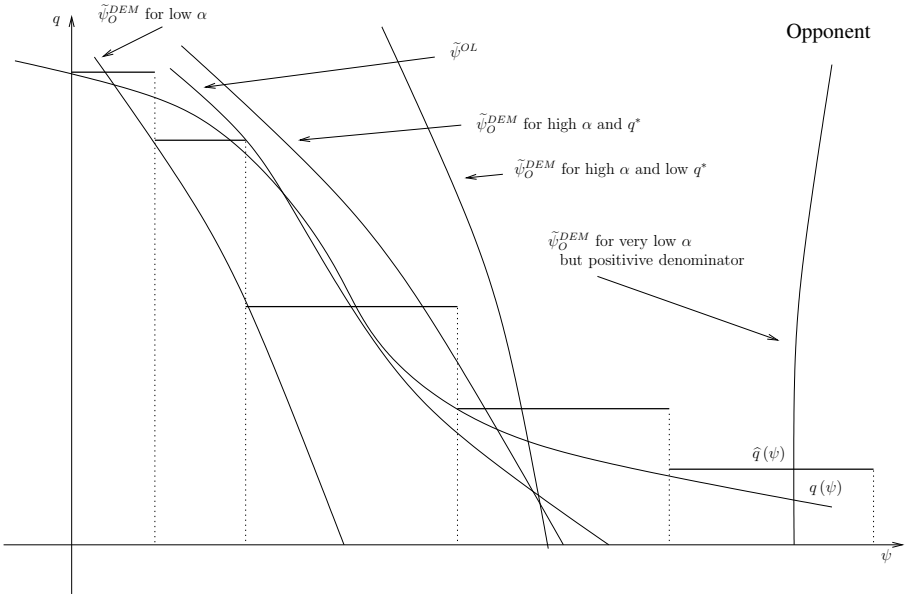

Figure 3: Threshold functions for the Opponent.

democratisation reduces corruption at least for I. In case $\widetilde{\psi}_{2,O}^{DEM}$ is s.t. corruption for O is also reduced, this entails further upward shifts of $\widetilde{\psi}_{2,I}^{DEM}$ (point 3 above), hence further decreases in corruption. $\diamond$

In words, we do not consider here that democratisation possibly reaches the "core" level, *i.e.* modifying structural parameters (the actual morality distribution, which can be seen as a "deep", f.i. cultural, determinant). Nonetheless, it may well constitute a perturbation of the system of reciprocal beliefs, whose eventual mutual reinforcement may lead to quite spectacular increases.

Still, democracies can indeed provide a disciplining device reining in high levels of corruption. Here follows another such interesting mechanism:

Proposition 6. For sufficiently concave $r(\cdot)$, there exists an $\underline{\alpha}$ s.t. $\alpha \to \underline{\alpha}$ from the right leads to *upward* shifts of $\widetilde{\psi}_{2,O}^{DEM}$.

Proof. Inspection of 5 and 6 shows that $\forall \alpha \geq 0$, $\exists q^* > 0$ above which $\Lambda^O > 0$. (Intuitively, this is saying that the increase in the probability of holding elections if a member of O is corrupt dominates the increase in the probability of winning them if they are held. Recall that more corruption discoveries in I than in O lead to no elections and immediate incumbent ousting.) In such cases, there exists $\underline{\alpha}$ s.t. if $\alpha \to \underline{\alpha}$ from the right, then the denominator approaches zero from the right, which drives $\widetilde{\psi}_{2,O}^{DEM}$ to $+\infty$. $\diamond$

Informally, this amounts to saying that, for suitable parameters, higher election stakes (greater share of political income appropriated by the incumbent) may lead to a strong incentive to cleanliness for the political challenger. Since low corruption beliefs on O shift I's threshold upward, this provides a disciplining device for the incumbent as well, despite in general big losses from electoral defeat make strategies of "risking one's all" in corrupt campaign financing all the more likely.

5.3 Liberalisation and privatisation

We may now model the effects of market oriented reforms, most schematically, as a sudden rise in big business profits. This is a likely short-run outcome of the privatisation of SOE's, which concentrate in upstream sectors under oligopolistic market structures. Liberalisation by itself likely entails some degree of red tape pruning (which may rein petty corruption

in), and of freer price setting. Obviously, wishful reformers expect competitors to eventually bring down prices, as well as the profit motive to spur TFP growth. However, even under the most benign conditions, entry is likely to be gradual for structural reasons - seed money retrieval, technology acquisition - so that profits only come down with time. This opens a temporal window in which especially grand corruption opportunities are ripe, potentially hijacking reform liberalisation itself *via* anti-competitive policy favours. Such perverse effects put to risk the very goals of liberalisation. The extent to which shifts in bribe supply translate into changes in equilibrium corruption, though, obviously depends on the relative receptivity of the political system.

In terms of our foregoing framework, this can simply be seen as a slowly decaying spike in π. Obviously, this has no effects on threshold functions whenever any group's q is zero (so that splitting of π by collusive grand corruption is - believed to be - impossible). Its importance increases, though, as odds given to *all* groups being corrupt get higher than that. This translates into a downward rotation of relevant thresholds, which obviously further increases corruption.

Given the perturbing effect seen above, liberalisation *cum* democratisation may well create room for these perverse effects to take place.

In this junction, we may hence interpret and explore some cases in the light of the model. By Proposition 4, low levels of corruption under autocracy are increased by democratisation. As seen above, we may regard the Russian case as the concurrence of this effect with that of a sharp shift in π due to liberalisation. Thresholds are moved downward for $q = 0$ by the first, rotated leftward by the second. The result is a very sharp increase in corruption, even if its initial level was low as it is likely in Russia's case.

Korea and (even more starkly) Taiwan display the increase in π and democratisation in a very gradual sequence. The leftward rotation of thresholds had minimal effects on q due to its low initial effect. Causing a leftward shift, instead, democratisation did increase it, but without the disrupting effects tied to its concurrence with liberalisation as in Russia.

The Philippines and Indonesia seem to be interpretable as cases of average levels of corruption. Either there was no limpid episode of discrete liberalisation (Philippines), or this did not change profitability prospects all that radically (Indonesia). Hence, democratisation did not lead to clear variation in the amount of corruption, but instead, as seen, to deep changes in its structure, in terms of competitiveness, short-sightedness and inclusiveness. For Indonesia, the result is the strong post-Suharto increase in unpredictability and anarchy that was noted above.

India seems to display strong electoral incentives towards corruption (strongly rising $r(\cdot)$)[34], and a very high α *i.e.* large shares of power apportioned to the opponent. This makes for ready availability of both corruption opportunities to all competitors, and of information about it. The upshot is a diffuse "they're all the same" perception that severely hinders fight on corruption. If the system becomes more accessible, as perhaps testified by Hazare's movement's success, we may be moving towards a gradual lowering of α *i.e.* a more functioning democracy, as depicted in the last scenario.

China's contrast to India seems naturally explained within the framework. Post-liberalisation increases in profitability *without* regime changes only cause a leftward rotation in the threshold: they hence have moderate corruption effects when the system starts from very low levels.

Finally, cases of democratisation in East-European countries may fit with the theory enclosed in proposition 6. Accessibility of democratic competition from outsiders with low shares of power (low α), there, seems to provide disciplining devices of sufficient intensity to keep corruption at low levels, despite the effects of liberalisation.

6 Conclusion

Enduring big business-bureaucracy collusion or "cronyism" is often explained as a legacy of previous *élite*-backed *coups d'État* which would cement collaboration, and thereby undermine state autonomy. Now, since overwhelming military power must ultimately lie with the state, one may ask why, in such a context, the regime should accept to share rents with the oligopolists at all, instead of simply seizing their assets. Division of labour may be an answer: bureaucrats should appoint firm managers anyway, hence they might as well keep the present ones. International constraints, such as US-protected multinational corporations, may be another. But, under certain circumstances, the power of unspoken intentions may be a crucial part of the explanation.

Even where collusive subversive behaviour is privately rational for each actor involved, as in the preceding example, if communication is hard, risky, and only marginally useful when performed one-to-one, coalition building may be no different from an exercise in groping in the dark. This

[34] largely owing to its more fragmented party system after the 80's, due to the secular decline of Congress.

fact may prove powerful enough to sustain a "virtuous" network of reciprocal expectations even without any supporting fundamental *i.e.* intrinsic public ethics (obviously without excluding it). However, the reasons of fragility of this setting are equally clear: institutional shocks can realign reciprocal expectations possibly radically apart from the starting equilibrium, with the emergence of large amounts of latent information.

An interesting consideration is that, to the extent that a memory of the past is kept, the shock may be irreversible. In such cases, then, it is largely on the fragile bedrock of the unsaid that good equilibria are erected and maintained. Once ears have been lent, things said, acts uncovered[35], there is no more undoing it. The system takes a twist of its own. This holds if corruption gets *de facto* unsanctionable, but, as Warburton notes, *a fortiori* if it stays sanctionable. Once networks of expectations have been established, cheap talk can hardly unhinge them, simply because it can only persuade individuals: but expectations on others, not individual persuasion, are what agents act out of. This clearly induces sluggishness ("path dependence") in organisational culture, even disregarding all sorts of habit formation.

It is not hard to think of other phenomena that may be analysed along these lines. In fact, it is hard to think of organisational issues which are *not* enormously affected by "atmosphere" factors, as they were outlined above. Experiences of culture crossing show that the very same person may well act differently in different surroundings, which seems hard to explain if culture is given overly strong substantive meanings. Instead, it seems quite natural if it is seen as a matter of tacit coalitions, whose eminently contextual character is evident.

The tractability of the model allows it to be embedded in explicit endogenous growth environments. An upstream/downstream, oligopolistic/competitive distinction, possibly linked with the plausible TFP effects of liberalisation shocks, would make for joint analysis of privatisation and price liberalisation on profitability dynamics and hence potential corruption. Hellman *et al.* (2000)'s already-mentioned finding that it is captor firms that are most likely to innovate may be thus naturally embedded.

[35]Cf. Warburton (2001, p. 225): "This is why interest groups are willing to pay huge amounts to have 'the ear' of political decisionmakers. [...] Once a channel of communication has been established and one corrupt transaction executed, the nature of the communication changes between the two actors. There is no longer an instigator and a target, only two willing participants. The corrupt transaction is sanctionable and secret ensuring the channel of communication cannot be closed even if one actor decides they no longer want to participate."

A final note can be devoted to the importance and nature of culture in organisation, and especially in authoritarian bureaucratic pyramids. The strong divergence in corruption levels among autocracies, which largely mirrors that in their growth performances, is very often traced back to cultural factors in their society and also political hierarchies. It is obvious that individual (meaning intrinsic, transferable, non-contextual) cultural factors would play a role; but this in itself would lead to limited temporal persistence, in the absence of within-organisation transmission mechanisms such as imitation. Norms may hence provide focal points for networks of expectations. Successive entrants would perceive the prevailing norm and adapt (*i.e.*, *conform*, conditional on their personal attitudes). This would reinforce the norm and carry it over time.

We may hence analyse and contrast China's history according to this picture. The historical precedent of Maoism (and especially of the Cultural Revolution) gave as powerful a signal of populist anti-capitalist ideological bias as one can possibly ask for, enshrined under the title of "Lei Feng" values: selflessness, dedication, abhorrence for private sector (bourgeois) dominance over public affairs. This established public norms including a strong loathing of corruption. Even beyond the political (and, largely, idelogical) demise of Maoism, this may have entrenched prevailing expectations of strong personal dislike for corruption on the side of fellow bureaucrats - *regardless* of whether this corresponded to actual preferences.

Paradoxically enough, hence, it is a legacy of strongly anti-capitalistic norms that may play a big role in the functioning of a vibrant quasi-capitalist economy.

Economic sociology accounts of divergent development experiences typically stress "path embeddedness" as a crucial factor of explanation. On the other hand, persistence is a feature of institutions commonly emphasised by the political economy literature. Their precise meaning and underpinnings in social interaction are nevertheless often left unexplained, which leaves without a theory of why they are sustained, and especially, when they may give out. I believe that this analysis of "atmospheres" and of the dim power of the unsaid within complex organisations may have a fundamental role to play in explaining such phenomena, providing a deeper account of what often goes under the catch-all term of "cultural factors".

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Liberalisation, productivity and scale in India's Iron & Steel industry

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"All the money we have put in heavy industries is for tomorrow's benefit, though it brings in some benefit today also. It will take some years before this investment yields fruits."[1]

It probably took some years *more* than expected, but Nehru's wish seems finally vindicated. The average rate of growth of real Iron and Steel production, for example, after slowing down to 4.7% in the Nineties (from 5.9% in the Eighties), has boomed to 13.2% between 2000 and 2007. This study analyses the sources of this growth. In particular, it is asked if the liberalisation of the Nineties has somehow effected greater exploitation of returns to scale; further, whether this has spurred production to concentrate in states characterised by brighter productivity dynamics.

The issue is interesting in light of the well-documented pre-reform anomalies of the Indian manufacturing sector, as brought out in particular in Rajan *et al.* (2006). These were relative oversizing of skill- and capital-intensive industries within the economy, and dwarfism of the average firm within them (w.r.t. to international standards on either matter): legacies both, they argue, of pre-reform India's policies such as Import Substituting Industrialisation. In such a context of strong departure from world best practices, it could be thought that liberalisation would cause reversion to the pattern typical of comparable countries: the implication for the field would have been radical downsizing. Since this clearly has not happened, the alternative response could be expected to be increases in firm size. Barring demand booms of such an extent to call for a host of new entries - all along that existing firms swell -, this would presumably induce some degree of plant concentration. What pattern would this follow, and

[1] J. Nehru, "Our Policies Justified", speech on the no-confidence motion against the government, Lok Sabha, 22nd August, 1963, reprinted in *Jawaharlal Nehru's Speeches*, Publications Division, Ministry of Information and Broadcasting, GoI.

especially its interaction with the well-known productivity heterogeneity across Indian states, is hence an interesting question to ask.

The paper estimates the post-reform exploitation of increasing returns to scale in Indian capital-intensive manufacturing and its interaction with productivity, specifically regarding the industry which was a prime target of ISI since (at the very least) Stalin times, *i.e.* Iron and Steel. It will be also asked if brisker productivity growth predicts geographical attraction of production shares and, possibly, consequent divergence of growth in average firm sizes across states.

We aim thus to refine and extend the analysis of Thangavelu and Pattnayak (2005, henceforth T-P) , who found evidence of increasing returns to scale in the Indian Iron and Steel sector both pre- and post-reform, although without clear signs of their greater exploitation in its aftermath. Analysis of the regional dimension of the industry's post-'91 evolution allows us to get a more detailed picture. We confirm at the regional level the clear presence of IRS in the Indian Iron and Steel industry. We also find that comparatively higher exploitation of returns to scale (relative to other states in the federation) takes on a strong association with higher production shares in the post-liberalisation period w.r.t. the preceding one; furthermore, that a dynamics towards such greater exploitation, as expressed in current and lagged variations in scale economies, has strong explanatory power on relative increases in a state's production shares in the post-reform period, *unlike* in the pre-reform one, even accounting for the effect of increases in average plant size. We interpret this as evidence of reform spurring industrial rationalisation - implying the overcoming of the lamented "dwarfism" -, and of this leading in turn to a widening of divergence between states in terms of concentration of production.

This work contributes to an ongoing debate on the role of TFP in India's economic growth acceleration. The topic is obviously important against the backdrop of discussions on the overall role of productivity growth w.r.t. capital accumulation in high-growth LDC's, esp. in Asia, going back at least to Young (1992, 1995). Clear indications of low TFPG (f.i. in manufacturing) may well cast doubts on long-run sustainability of India's growth, as per Krugman's (1994) "perspiration *vs.* inspiration" story[2] - although a fifteen-year time lapse past the Asian crisis does not suggest that Singapore's boom was so unsustainable after all. Another related issue is an even more classic debate on whether state intervention

[2]Naturally, economists as diverse as D. Rodrik, J. Bhagwati and H.-J. Chang early noticed that as relevant a rise in saving/investment rates as East Asia's is hardly too little, in itself, to speak of a "miracle".

should (and is able to) jump-start industrialisation, overcoming barriers to entry due to IRS technologies and supposed (esp. financial) market failures.

The paper proceeds as follows: section 1 reviews the literature. Section 2 sets out our strategy. Section 3 describes the data. Section 4 presents the results and section 5 concludes.

1 Literature review

The estimation of the impact of liberalisation on India's TFPG has so far yielded fairly inconclusive results. Ahluwalia's (1991) early effort, showing an increase in TFPG following the first timid reforms of the Eighties, was quite radically challenged by Balakrishnan and Pushpangadan (1994)(hereafter B-P), who questioned the former's Single Deflation (SD) methodology to compute real Value Added (VA) as biased, and argued for replacing it with a Double Deflation (DD) method. Essentially, instead of deflating nominal VA by the relevant industry product Wholesale Price Index (WPI), one takes the difference between appropriately deflated output and inputs. Strikingly, TFPG estimations are turned around by such a method: namely, TFP would have *decreased* in India in the Eighties. Using the same technique, Balakrishnan, Pushpangadan and Suresh Babu (2000) (B-P-S) confirm this result for the Nineties.

This strategy, nevertheless, was itself disputed by Mohan Rao (1996) who showed DD to be biased too, proposing a different unbiased method based on the gross output framework and Divisia deflation (which is now the standard approach in most later studies). Thereby, he arrived at results analogous to B-P as regards TFPG in the Eighties. A more recent wave of studies include Unel (2003) who found increases in TFPG following 1991 reforms, and Goldar (2004) who criticised and revised the former's capital input construction, finding reverse trends. Goldar and Banga (2007) reached similar conclusions, while pointing out the importance of accounting for the post-'91 boom of services' share in manufacturing inputs to prevent TFPG overestimation. Hulten, Bennathan and Srinivasan (2005) (H-B-S) criticised B-P's and Rao's construction of deflators on account of assuming a fixed input structure (specifically, the 1993 I-O table), which entails obvious risks of overlooking important changes in adopted technologies. Their methodology improves this aspect constructing a Divisia materials deflator varying by year and state, thereby finding no significant change in TFPG pre- and post-reform. The approach is

adopted and expanded by Mohommad (2010), who finds TFP accelerated after 1991, and by the present study.

2 Methodology

2.1 Variables construction

In an effort to approximate econometric best practices in a field so sensitive to technical - esp. measurement - issues[3], in this paper we take profit of existing research in several ways. In agreement with theoretical literature on TFP analysis such as Aldaz and Millán (2000) and Hulten (2009), instead of a value-added approach, we adopt a translog-cost-function approach to the estimation of TFP and scale economies, based on a "KLEMS" (capital-labour-energy-materials-services) production function. This prevents possible biases due to the adoption of the value-added framework (whose main motive is often data availability). The well-known advantage of such a strategy lies in its noticeable subtlety and flexibility - as non-neutral (i.e., factor-saving/consuming) technical progress is allowed -, whereas its disadvantage is in the large data requirements needed to provide estimates of the many parameters.

Following H-B-S and Mohommad (2010), we then construct a Divisia-Törnqvist-type deflator for capital inputs, materials, energy and services. This is done through a flexible weighting scheme based on five rounds of (constant '93 prices) I-O tables by the Central Statistical Organisation between 1973 and 2006 (employing linear interpolation to retrieve missing-years coefficients), and state-varying price indices (WPI for manufactured products and, for want of better, CPI for services[4]). Lacking detailed year-state indices for most production factors reported in I-O tables, and being particularly interested in the regional dynamics of input expenditure decisions, we adopted the strategy of deriving state deviations from federal CPI on the closest available category. As expected, given India's generally remarkable economic diversity, such deviations are far from irrelevant and can instead reach 20% +/- the federal price level. We employed such calculated differences to determine imputed values of state-level price indices for remaining I-O inputs. This allows to construct a flexible - and as far as

[3] Cf. the related warnings in Griliches (1994).

[4] Apparently this is the strategy also followed by Banga and Goldar (2007). With growing awareness of the importance of services in the economy, construction of a Services Wholesale Price Index is currently underway in India.

possible accurate - deflation scheme varying by year and state, based on which we proceed to deflate nominal figures on capital, output, material and other inputs.

Data on Iron and Steel industry is taken from the issues 1973-2006 of the Annual Survey of Industries, published by Central Statistical Organization, Ministry of Industry, Government of India, for the federation as a whole and 14 states, namely Andhra Pradesh (AP), Bihar (from 2000 partitioned in Bihar and Jharkhand), Karnataka, Kerala, Madhya Pradesh (MP, from 2000 partitioned in Madhya Pradesh and Chhattisgarh), Punjab, Uttar Pradesh (UP), Odisha, Maharashtra, Rajasthan, West Bengal (WB) and Tamil Nadu (TN). Reason for the choice is mainly representativeness: such states account for the vast majority of Indian population, are fairly diverse in terms of geography, culture, language, political orientation and level of development (human and economic), and are not subject to the possibly peculiar dynamics of city states like Delhi, Goa and Pondicherry, or of the variously geopolitically sensitive states of Jammu and Kashmir and of the North-Eastern region of India.

2.2 Estimation

Since the main objective of the study is the assessment of exploitation of returns to scale, it is clear that the growth accounting method - with the assumptions of perfect competition and constant returns it involves - cannot be the methodology of choice in the present context. We hence resort to econometric translog cost function estimation which, as known, dispenses with such requirements.

Employing the iterative Zellner efficient (IZEF) method, we estimate a system of simultaneous equations representing translog cost and input share functions: the latter are derived by Shephard's lemma through logarithmic differentiation of the first w.r.t. input price, based on duality theory. As shares sum up to one, consistent estimates can be obtained by any set of N-1 input equations, so that the materials share cost equation was excluded. However, estimates are insensitive to which input share equation is dropped from the model.

As in T-P (2005), we split the sample in pre- and post- reform period and test for the presence of different technical and scale features. Being specifically interested in the dynamic effect of reform and in regional variation, we add a series of time and state dummy variables and interactions, as in Mohn (1994). The translog cost function reads:

$$\ln c\,(p,\,y,\,d,\,t) = \alpha_r^* + \alpha_{yr}^* \ln y + \frac{1}{2}\alpha_{yy} \ln y^2 + \sum_{i=1}^{n} \alpha_i \ln p_i$$
$$+ \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \alpha_{ij} \ln p_i \ln p_j + \sum_{i=1}^{n} \alpha_{iy} \ln p_i \ln y$$
$$+ \gamma_{tr}^* \ln t + \sum_{i=1}^{n} \gamma_{itr}^* \ln p_i \ln t + \gamma_{ytr}^* \ln y \ln t + \frac{1}{2}\gamma_{ttr}^* (\ln t)^2$$

where $\alpha_r^* = \alpha_0 + \alpha_r d_r$, $\alpha_{yr}^* = \alpha_y + \alpha_{yr} d_r$ and $\gamma_{..r}^* = \gamma_0 + \gamma_{..r} d_r$, and d_r are state dummies capturing state deviations from federal values. Share equations, being the derivatives of the cost function w.r.t. the input price, read:

$$s_{ir} = \alpha_i + \sum_{j=1}^{n} \alpha_{ij} \ln p_j + \alpha_{iy} \ln y + (\gamma_{it0} + \gamma_{itr} d_r)\, t$$

As well stated by Mohn (1994), the inclusion of dummy variables and their interactions comes at the cost of a big increase in the number of coefficients to estimate. However, the relatively large dataset (given the level of aggregation) and long time span allow the IZEF procedure to yield fairly precise estimates, so that most key parameters for the analysis are significant even when all dummies are kept. To prevent efficiency losses from the inclusion of irrelevant variables, as well as to streamline estimation, we nonetheless take the approach of routinely dropping the least significant dummies.

The constraints $\sum_{i=1}^{n} \alpha_i = 1$, $\sum_{i=1}^{n} \alpha_{ij} = \sum_{j=1}^{n} \alpha_{ji} = \sum_{i=1}^{n} \alpha_{iy} = \sum_{i=1}^{n} \gamma_{itr}^* = 0$ are imposed, ensuring homogeneity of the cost function w.r.t. prices and of symmetry of the matrix of second derivatives. The IZEF model assumes errors to be jointly normally distributed, but allows contemporaneous cross-correlation across equations. Positivity of predicted input shares and concavity of the cost function (i.e. negative-definiteness of the Hessian of its second derivatives) is checked post-estimation.

For each state, the presence of constant returns to scale and of neutral technical change is tested *via* the Wald test, which is asymptotically distributed as a chi-squared with degrees of freedom equal to the number of tested independent restrictions.

Based on coefficient estimates, a series of measures of (neutral and non-neutral) technical change and of scale economies is then derived. This

allows to decompose the elements of technical progress in a subtle manner. Neutral and non-neutral technical change is measured by the time-derivative of the cost function:

$$TE = \frac{\partial \ln C}{\partial \ln T} = \gamma^*_{tr} + \sum_{i=1}^{n} \gamma^*_{itr} \ln p_i + \gamma^*_{ytr} \ln y + \gamma^*_{ttr} t \qquad (1)$$

which can be decomposed in a neutral (pure time) component $T1 = \gamma^*_{tr} + \gamma^*_{ttr} t$, a scale-augmenting component $T2 = \gamma^*_{ytr} \ln y$, and a factor-saving (or -consuming) technical change component $T3 = \sum_{i=1}^{n} \gamma^*_{itr} \ln p_i$: a significantly positive (negative) γ^*_{itr} signals i-factor-consuming (-saving) technical change in state r in the period of estimation. Clearly enough, technical progress corresponds to a negative TE, since this would show a percentage decrease in costs. Scale economies are instead measured by the output derivative of the cost function:

$$SE = \frac{\partial \ln C}{\partial \ln Y} = \alpha^*_{yr} + \alpha_{yy} \ln y + \sum_{i=1}^{n} \alpha_{iy} \ln p_i + \gamma^*_{ytr} t$$

It is clear from the formula that higher returns to scale correspond to a lower value of SE, and an increase in their exploitation to a positive variation in such value. Intuition for this is that, if e.g. $SE < 1$, cost increases are less than proportional to output increases. Based on coefficient estimates, the dynamics of these measures is explored in the pre- and post-'91 periods. TFP is calculated via the translog cost function as:

$$TFP = -TE + (1 - SE)\, \dot{y}$$

from which it is clear that, as intuitive, greater scale economies add to technical change in enhancing productivity.

3 Empirical results

3.1 Technical change and scale economies after liberalisation

The strategy of dropping the least significant dummies improves estimation significance without substantial variations in the measures of technical change and scale economies. The predicted input shares are positive, as

expected, and the Hessian matrix is negative semidefinite for all observations. This suggests that the translog cost equation is a well-behaved concave function.

We show the results for the two periods, reported in Table 1 to 4, after severely insignificant dummies are dropped (signalled by missing parallels in the colums of 1973-1990 and 1991-2006 respectively; dummies completely absent were insignificantly different from zero in both regressions). Estimates of included variables are remarkably robust to exclusion of irrelevant ones. As can be seen, the vast majority of extant variables is significant, often at the 1% level: this concerns, in particular, all remaining time dummies (coefficients on T, its square, and interactions with factor prices and with output).

The estimated coefficients display several interesting patterns. First of all, they qualify T-P's finding that the '91 liberalisation bill has been rather successful in spurring technical progress. In fact, this seems less true overall than for individual states. The time parameters for the federation (coefficients on $\ln T$ and its square) are positive and significant for both periods, but take values much lower in the post-reform one. On the other hand, most state time dummies are negative in both periods, although the absolute value of the estimates is higher before '91. Technological progress (in terms of lower average TE's post-reform) is registered in states such as Andhra Pradesh, Bihar, Madhya Pradesh, Odisha, Punjab, and more mildly Karnataka. Tamil Nadu and West Bengal witnessed no fundamental change, whereas productivity seems to have slowed in the remaining states (markedly in UP and Rajasthan). It can be noted that this fits well with the well-known advancement of the industry in AP, MP (-Chhattisgarh), Karnataka and Bihar (-Jharkhand). This is well shown by the dual measurement of TE and TFP in the two periods (figure 1 and 2), which brings out the overall improvement in technical progress as well as some trend of divergence.

As for non-neutral technical change, the interactions with input prices signal clear adoption of labour-saving technology in both periods, mirrored in declining *absolute* employment levels in the federation despite the industry's growth. Most states witness materials- and services-consuming technical change (a notable exception is Odisha), which squares with the large increase in the share of services documented for most Indian industries. Capital-saving technical change seems to prevail in both periods, although much less markedly after '91, with AP, Bihar, Odisha, WB and Gujarat in fact turning to capital-using technical change. As per equation 1, this is probably the root of the progressive worsening of technical

VARIABLES	1973-1990 (log)cost	1991-2006 (log)cost	VARIABLES	1973-1990 (log)cost	1991-2006 (log)cost
AP		0.960	Punjab*T*pE	0.00742*	0.0382***
		(1.346)		(0.00408)	(0.00563)
AP*T	-6.326***		Rajasthan*T*pE		0.0310***
	(0.865)				(0.00588)
Gujarat*T	-5.975***		TN*T*pE		0.0245***
	(1.086)				(0.00549)
Haryana*T	-5.622***		UP*T*pE		0.0269***
	(1.006)				(0.00521)
Karnataka*T	-4.419***		WB*T*pE	0.0128***	0.0165***
	(1.056)			(0.00451)	(0.00551)
Kerala*T	-6.719***	-2.137***	Bihar*T*pS		-0.00380
	(1.101)	(0.477)			(0.00242)
MP*T	-5.232***		Gujarat*T*pS	0.0357***	0.0138*
	(1.080)			(0.00498)	(0.00741)
Maharashtra*T	-4.212***		Haryana*T*pS	0.0404***	0.0581***
	(1.428)			(0.00514)	(0.00692)
Odisha*T	-4.971***		Kerala*T*pS		0.0576***
	(0.889)				(0.00724)
Punjab*T	-4.862***		Karnataka*T*pS	0.00947**	
	(1.072)			(0.00424)	
Rajasthan*T	-6.740***		MP*T*pS	0.00246	0.0250***
	(1.061)			(0.00506)	(0.00686)
TN*T	-5.342***		Odisha*T*pS	-0.00118	-0.0123***
	(1.098)			(0.00365)	(0.00214)
UP*T	-5.661***		Punjab*T*pS	0.0532***	0.0721***
	(1.058)			(0.00480)	(0.00740)
WB*T	-5.803***		Rajasthan*T*pS	0.0180***	0.0703***
	(1.006)			(0.00600)	(0.00699)
AP*T*pE	0.0202***	0.0128***	TN*T*pS	0.0231***	0.0331***
	(0.00361)	(0.00237)		(0.00505)	(0.00684)
Bihar*T*pE	0.0109**	0.0253***	UP*T*pS	0.0370***	0.0542***
	(0.00468)	(0.00897)		(0.00497)	(0.00656)
Gujarat*T*pE	0.00752*	0.0278***	WB*T*pS	0.0159***	0.0111*
	(0.00419)	(0.00561)		(0.00416)	(0.00670)
Haryana*T*pE		0.00905*	AP*T*w	-0.0202***	-0.0128***
		(0.00546)	Bihar*T*w	-0.0254***	0.00716
Karnataka*T*pE	0.0290***	0.0183***	Gujarat*T*w	-0.0180***	-0.0199***
	(0.00455)	(0.00245)		(0.00375)	(0.00280)
Kerala*T*pE		0.0489***	Haryana*T*w	-0.0226***	-0.0215***
		(0.00720)		(0.00384)	(0.00272)
MP*T*w		0.0263***	Karnataka*T*w		-0.0183***
		(0.00538)			(0.00245)
Maharashtra*T*w	0128***	0.0154***	Kerala*T*w		-0.0173***
	(0.00450)	(0.00354)			(0.00361)

y: *output* w: *wage* pE: *price of energy* pK: *price of capital*

pS: *price of services* pM: *price of materials* T: *time*

Table 1: IZEF regression results, 1973-2006

VARIABLES	1973-1990 (log)cost	1991-2006 (log)cost	VARIABLES	1973-1990 (log)cost	1991-2006 (log)cost
Maharashtra*T*w	-0.0212***	-0.0154***	Punjab*T*pM	0.0922***	0.121***
	(0.00412)	(0.00354)		(0.00730)	(0.0142)
Odisha*T*w	-0.0148***	0.00697**	Rajasthan*T*pM	0.0473***	0.114***
	(0.00422)	(0.00282)		(0.0111)	(0.0135)
Punjab*T*w	-0.0231***	-0.0181***	TN*T*pM	0.0346***	0.0565***
	(0.00366)	(0.00278)		(0.00965)	(0.0131)
Rajasthan*T*w	-0.0189***	-0.0229***	UP*T*pM	0.0701***	0.0891***
	(0.00416)	(0.00291)		(0.00948)	(0.0126)
TN*T*w	-0.0173***	-0.0187***	WB*T*pM		0.0186
	(0.00393)	(0.00273)			(0.0128)
UP*T*w	-0.0191***	-0.0220***	AP*T^2	-0.347***	0.284***
	(0.00380)	(0.00258)		(0.134)	(0.0944)
Bihar*T*pK	0.0667***	-0.0286**	Bihar*T^2		-0.446**
	(0.0120)	(0.0113)			(0.192)
Gujarat*T*pK	-0.0866***	-0.0448*	Gujarat*T^2	-0.557***	
	(0.0115)	(0.0232)		(0.162)	
Haryana*T*pK	-0.0899***	-0.142***	Haryana*T^2	-0.466***	
	(0.0118)	(0.0218)		(0.149)	
Kerala*T*pK		-0.179***	Karnataka*T^2	-0.245*	-0.172
		(0.0235)		(0.138)	(0.118)
Karnataka*T*pK	-0.0385***		Kerala*T^2	-0.426***	
	(0.00613)			(0.134)	
Maharashtra*T*pK	-0.0842***		MP*T^2	-0.273*	-0.309***
	(0.0117)			(0.149)	(0.0574)
MP*T*pK		-0.0884***	Maharashtra*T^2	-0.334**	
	(0.0215)			(0.154)	
Punjab*T*pK	-0.130***	-0.213***	Odisha*T^2	-0.245*	-0.200**
	(0.0111)	(0.0233)		(0.129)	(0.0998)
Rajasthan*T*pK	-0.0464***	-0.193***	Punjab*T^2	-0.349**	-0.257***
	(0.0141)	(0.0222)		(0.162)	(0.0929)
TN*T*pK	-0.0403***	-0.0954***	Rajasthan*T^2	-0.538***	
	(0.0115)	(0.0216)		(0.176)	
UP*T*pK	-0.0881***	-0.148***	TN*T^2	-0.374**	-0.164*
	(0.0115)	(0.0207)		(0.176)	(0.0920)
WB*T*pK	-0.0287***	-0.0463**	UP*T^2	-0.533***	
	(0.00594)	(0.0211)		(0.163)	
Bihar*T*pM	-0.0521***		WB*T^2	-0.449***	-0.198*
	(0.0122)			(0.109)	(0.105)
Gujarat*T*pM	0.0613***	0.0231	AP*y*T	0.457***	-0.0901***
	(0.00754)	(0.0142)		(0.0718)	(0.0133)
Haryana*T*pM	0.0720***	0.0958***	AP*Y		0.0479
	(0.00972)	(0.0133)			(0.110
Kerala*T*pM		0.0897***	Bihar*y*T	-0.0617***	0.00902
		(0.0141)		(0.00746)	(0.0152)
Maharashtra*T*pM	0.0522***	Bihar*y		0.0264**	
	(0.00789)				(0.0129)
MP*T*pM	0.0219***	0.0433***	Gujarat*y*T	0.442***	-0.0331***
	(0.00576)	(0.0131)		(0.0981)	(0.00721)
Odisha*T*pM		-0.0167***	Gujarat*y		0.0428**
		(0.00406)			(0.0183)

y: *output* w: *wage* pE: *price of energy* pK: *price of capital*
pS: *price of services* pM: *price of materials* T: *time*

Table 2: IZEF regression results, 1973-2006, cont'd

VARIABLES	1973-1990 (log)cost	1991-2006 (log)cost	VARIABLES	1973-1990 (log)cost	1991-2006 (log)cost
Odisha*T*pM		-0.0167***	Gujarat*y		0.0428**
		(0.00406)			(0.0183)
Haryana*T*y	0.397***	-0.0569***	MP*T*w	-0.0244***	-0.00620**
	(0.0889)	(0.00834)		(0.00430)	(0.00270)
Haryana*y		0.0560***	pK	0.0515	0.620***
		(0.0210)		(0.0772)	(0.0388)
Karnataka*y*T	0.280***	-0.0282*	pS	0.253***	
	(0.0927)	(0.0157)		(0.0315)	
Karnataka*y		0.0747***	pM	0.185***	0.0534***
		(0.0225)		(0.0480)	(0.0206)
Kerala*y*T	0.518***	0.109**	pE	0.179***	0.0776**
	(0.0997)	(0.0442)		(0.0234)	(0.0306)
Kerala*y		0.0717**	y	0.178	0.0796
		(0.0336)		(0.271)	(0.239)
Maharashtra*y*T	0.273**	-0.0199***	T	6.002***	1.928***
	(0.121)	(0.00624)		(0.915)	(0.414)
Maharashtra*y		0.0314**	w*y	0.00205	-0.0103***
		(0.0153)		(0.00176)	(0.00151)
MP*y		0.0147	pM*y	-0.0134**	0.0156***
		(0.0137)		(0.00551)	(0.00280)
Odisha*y*T	0.328***	-0.00493	pE*y	-0.00485*	0.00331
	(0.0735)	(0.0122)		(0.00249)	(0.00295)
Odisha*y		0.0431**	pS*y	-0.0178***	0.0104***
		(0.0179)		(0.00337)	(0.00129)
Punjab*y*T	0.320***	-0.0327***	pK*y	0.0341***	-0.0190***
	(0.0955)	(0.0116)		(0.00892)	(0.00536)
Punjab*y		0.0497***	y^2	0.0790***	0.0788***
		(0.0183)		(0.0254)	(0.0219)
Rajasthan*y*T	0.517***	-0.0719***	T^2	0.426***	0.224***
	(0.0996)	(0.0110)		(0.119)	(0.0538)
Rajasthan*y		0.0614**	y*T	-0.445***	-0.143***
		(0.0261)		(0.0744)	(0.0309)
TN*y*T	0.370***	-0.0323***	pM*pM	0.217***	0.0892***
	(0.0980)	(0.0123)		(0.0151)	(0.00588)
TN*y		0.0483**	pK*pK	-0.131***	0.0171
		(0.0204)		(0.0211)	(0.0184)
UP*y*T	411***	-0.0552***	w*w	0.0250***	0.00647***
	(0.0944)	(0.00881)		(0.00201)	(0.00131)
UP*y		0.0543***	pS*pS	0.0587***	0.0754***
		(0.0209)		(0.0105)	(0.00451)
WB*y*T	0.427***	-0.0152	pE*pE	-0.0112***	0.00142
	(0.0795)	(0.0126)		(0.00225)	(0.0161)
WB*y		0.0623***	pK*pS	0.132***	
		(0.0174)		(0.0205)	

y: *output* w: *wage* pE: *price of energy* pK: *price of capital*
pS: *price of services* pM: *price of materials* T: *time*

Table 3: IZEF regression results, 1973-2006, cont'd

VARIABLES	1973-1990 (log)cost	1991-2006 (log)cost	VARIABLES	1973-1990 (log)cost	1991-2006 (log)cost
Odisha*T*w	0.0159***	0.0360***	MP*T*w	-0.0244***	-0.00620**
	(0.00427)	(0.00507)		(0.00430)	(0.00270)
w	0.331***	0.249***	pK*pE		-0.00994
	(0.0189)	(0.0183)			(0.0160)
pK*w	-0.00133	-0.00715	w*T	0.00583	0.0126***
	(0.00611)	(0.00710)			(0.00284)
pS*pM	-0.171***	-0.0729***	pM*T	0.0234***	-0.0523***
	(0.0152)	(0.00493)		(0.00826)	(0.00973)
pS*w	-0.0195***	-0.00253	pE*T	0.00161	-0.0214***
	(0.00239)	(0.00217)		(0.00460)	(0.00671)
pE*w	0.0112***	0.00852***	pS*T	-0.0120**	-0.00918*
	(0.00225)	(0.00246)		(0.00587)	(0.00506)
pM*w	-0.0460***	-0.0164***	Constant	1.100	0.233
	(0.00625)	(0.00614)		(1.438)	(1.291)
pK*T	-0.0189	0.0703***			
	(0.0132)	(0.0174)			
Observations	208	171			
R-squared	0.991	0.974			

y: *output* w: *wage* pE: *price of energy* pK: *price of capital*

pS: *price of services* pM: *price of materials* T: *time*

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4: IZEF regression results, 1973-2006 ended

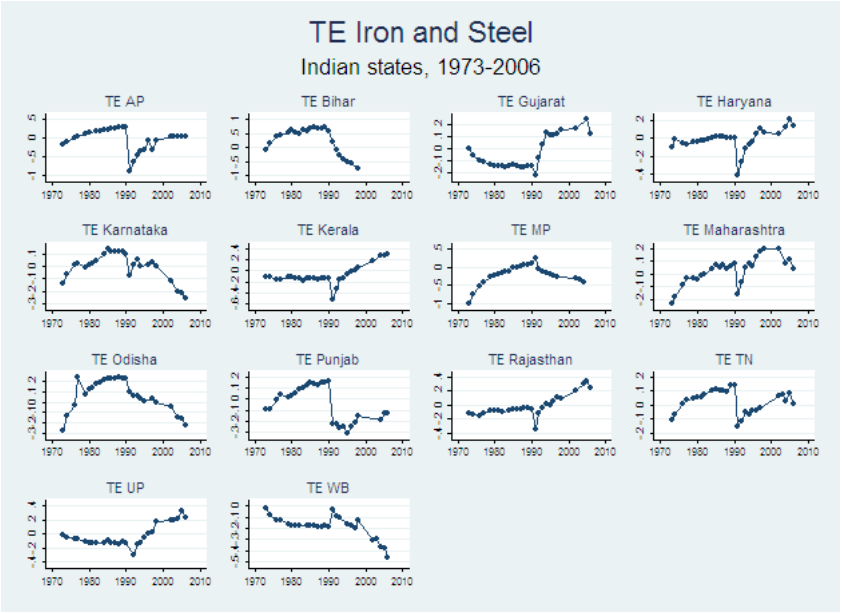

Figure 1: TE Indian states, 1973-2006

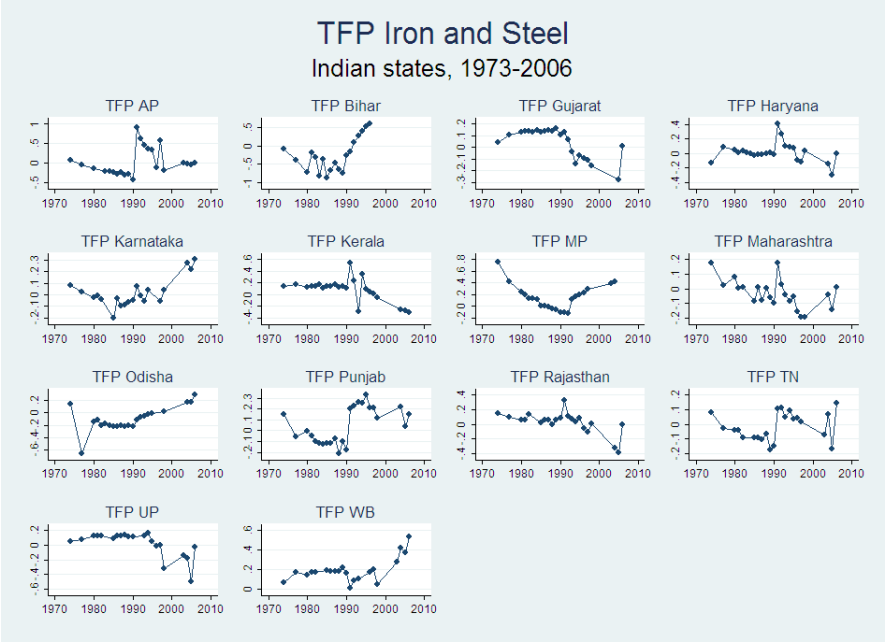

Figure 2: TFP, Indian states, 1973-2006

progress (increase in TE) in the Nineties in AP, Odisha and Gujarat. The whole shift towards (more) capital-using technology is most likely to be a consequence of the availability of higher-quality, lower-price capital goods due to machinery imports liberalisation.

There is a marked reduction of heterogeneity as regards scale-augmenting time effects. With the only exception of Kerala, γ^*_{ytr}'s turn clearly negative after '91 for all states, signalling a declining trend in cost increases due to the expansion of output, i.e., higher returns to scale. Pre-'91 estimates signal much greater diversity, with some states displaying decreasing along with others showing strongly increasing returns. The reforms seem hence to have spurred disciplining and rationalisation in the productive structure of the states, especially as regards size of production, whereas idiosyncratic (and mildly divergent) state dynamics seemed to prevail beforehand. This development clearly comes up in figure 3, with clear post-reform general decrease in SE and evident prereform divergence. This hints at removal of non-technological (i.e., quite possibly, political) drivers of inter-state productive allocation due to liberalisation. The issue will be further explored in the following.

Non-neutrality of technical change, as well as the presence of increasing returns to scale, can be tested via the Wald test. Expectedly, given the significance and values of estimated coefficients, the null hypotheses of neutrality and constant returns to scale are squarely rejected for all states at the 1% level. Results are presented in Table 5 and 6.

3.2 Determinants of production allocation

It can be hypothesised that the aforementioned post-reform dynamics of scale economies have induced some pattern of reallocation of interstate production shares. In particular, given the larger flexibility of investment in the post-reform period, lower scale-elasticity of costs (lower SE) in the recent past might have attracted production to the state. This might lead to disproportionate industry growth, being then reflected in increase in the state's production share. This should have resulted in the exploitation of such economies of scale and in higher SE's. To explore this possibility we regress state production shares against state shares of the overall number of factories, state average factory size, current SE, and lagged SE. Given

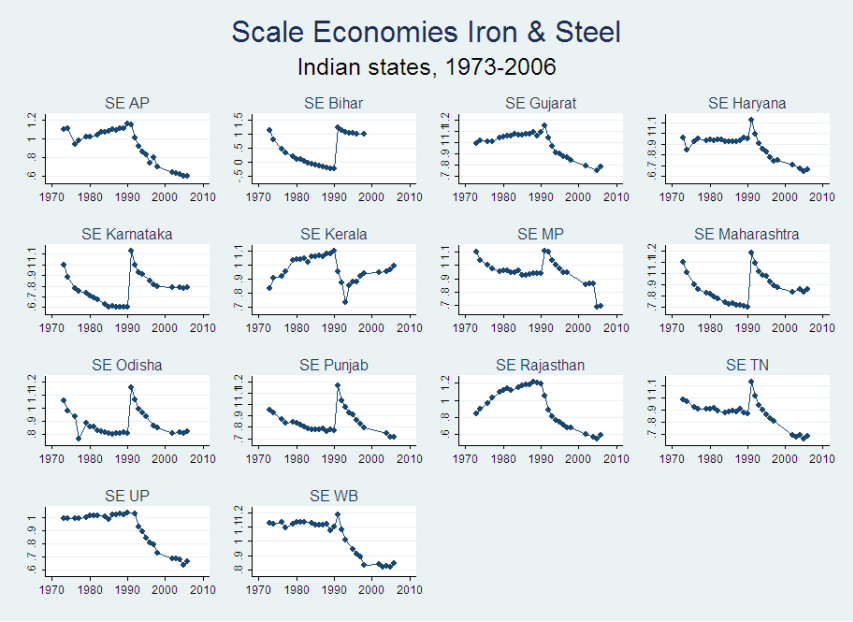

Figure 3: SE, Indian states, 1973-2006

H0: $\gamma^*_{Ktr} = \gamma^*_{Ltr} = \gamma^*_{Etr} = \gamma^*_{Mtr} = \gamma^*_{Str} = 0$		
STATE	1973-1990	1991-2006
Andhra Pradesh	115.83*** (0.0000)	185.11*** (0.0000)
Bihar	44.60*** (0.0000)	63.41*** (0.0000)
Gujarat	157.37*** (0.0000)	163.38*** (0.0000)
Haryana	168.47*** (0.0000)	365.33*** (0.0000)
Karnataka	107.91*** (0.0000)	195.57*** (0.0000)
Kerala	39.72*** (0.0000)	357.04*** (0.0000)
Madhya Pradesh	49.13*** (0.0000)	164.46*** (0.0000)
Maharashtra	102.08*** (0.0000)	185.65*** (0.0000)
Odisha	50.37*** (0.0000)	119.65*** (0.0000)
Punjab	259.07*** (0.0000)	370.69*** (0.0000)
Rajasthan	128.42*** (0.0000)	477.44*** (0.0000)
Tamil Nadu	72.16*** (0.0000)	247.41*** (0.0000)
Uttar Pradesh	145.68*** (0.0000)	387.66*** (0.0000)
West Bengal	28.01*** (0.0000)	167.03*** (0.0000)
India	39.72*** (0.0000)	200.14*** (0.0000)

Table 5: Wald test on biased technical change, 1973-1990 and 1991-2006

H0: $\alpha_{yy} = \alpha_{Ky} = \alpha_{Ly} = \alpha_{Ey} = \alpha_{My} = \alpha_{Sy} = \gamma^*_{ytr}$		
STATE	1973-1990	1991-2006
Andhra Pradesh	66.16*** (0.0000)	147.19***(0.0000)
Bihar	93.83*** (0.0000)	129.45*** (0.0000)
Gujarat	65.72*** (0.0000)	134.59*** (0.0000)
Haryana	67.16*** (0.0000)	137.90*** (0.0000)
Karnataka	71.99*** (0.0000)	130.51*** (0.0000)
Kerala	65.77*** (0.0000)	125.39*** (0.0000)
Madhya Pradesh	66.13*** (0.0000)	132.01*** (0.0000)
Maharashtra	66.94*** (0.0000)	133.69*** (0.0000)
Odisha	77.21*** (0.0000)	130.04*** (0.0000)
Punjab	67.63*** (0.0000)	134.97*** (0.0000)
Rajasthan	65.85*** (0.0000)	136.83*** (0.0000)
Tamil Nadu	66.36*** (0.0000)	133.41*** (0.0000)
Uttar Pradesh	65.78*** (0.0000)	137.24*** (0.0000)
West Bengal	66.29*** (0.0000)	132.32*** (0.0000)
India	89.69*** (0.0000)	132.01*** (0.0000)

Table 6: Wald test on economies of scale, 1973-1990 and 1991-2006

the fairly high serial correlation of SE's, including multiple lags of it would lead to multicollinearity and likely imprecise estimates. We choose to alternatively include $t-3$ and $t-4$ lags of SE (coefficients are largely robust to which lag is included). To capture other structural characteristics (e.g. geography, infrastructural endowment, historical legacy) affecting a state's production share, we add state fixed effects. Results for the two periods are reported in Table 7 (omitted group is Odisha).

It can be seen that, for the post-reform period, the $t-3$ lag of SE is *negatively* correlated with the share of production in the state, while the *current* SE has positive correlation (both significant at the 1% level); the relationship loses significance (and coefficients' signs are exactly reversed) before 1991. In other words, in the post-liberalisation period, enjoying high economies of scale (low SE) three or four periods in advance strongly predicts increases in a state's share of production, which bring about greater exploitation of such returns to scale (higher SE) in the current period. On the contrary, this effect is absent - and perhaps reversed - beforehand. We take this as evidence that liberalisation induced greater overall exploitation of increasing returns to scale and industrial rationalisation, thanks to enhanced possibility for efficient investment allocation.

We can look for further evidence by considering dynamics. To do this, we regress first difference of state production shares against first differences of the state's average factory size, of shares of factories, and of scale economies, both before and after 1991. Results are in Table 8.

Once again, the increase in exploitation of scale economies is linked to the increase in production share in the post-1991 period (with 5% significance), but the coefficient is insignificant (and takes a negative value) for the period before liberalisation. Scale economies exploitation seem to have become a major driver of expansion and investment in Iron & Steel.

The availability in the sample of fifteen years of post-liberalisation data consents further interesting findings. Splitting the post-'91 dataset into two sub-periods (1991-2000, 2001-2006) and performing the same analysis as above shows that the explanatory power of scale economies exploitation concentrates in the second time lapse (see Table 9).

In fact, the coefficient on SE's variation keeps its signs, but loses significance thoroughly during the first years after reform. In the Nineties, hence, most of the variation in production shares seems to be explained by extensive growth (*i.e.*, increase in the state share of the overall number of factories) and intensive growth (*i.e.* increase in average factory size) which did not translate into higher SE. Apparently, this is the stage photographed by T-P (2005), who fail to detect significant exploitation

VARIABLES	1973-1990 prod share	1991-2006 prod share
share of factories	0.877***	0.578***
	(0.149)	(0.0980)
average plant size	1.35e-05***	2.00e-05***
	(2.47e-06)	(1.43e-06)
SE, t-3	0.0280	-0.0878***
	(0.0242)	(0.0225)
SE	-0.0403	0.225***
	(0.0383)	(0.0426)
AP	-0.0185**	0.0507***
	(0.00803)	(0.00998)
Bihar	0.118***	0.0591***
	(0.0243)	(0.0104)
Gujarat	-0.0604***	0.0244**
	(0.0154)	(0.0108)
Haryana	-0.0188**	0.0296***
	(0.00829)	(0.00910)
Karnataka	-0.0256**	0.0134*
	(0.0119)	(0.00772)
MP	0.0676***	0.0489***
	(0.00810)	(0.00886)
Maharashtra	0.0217	0.0508***
	(0.0180)	(0.0119)
Punjab	-0.0535***	0.0131
	(0.0175)	(0.0114)
Rajasthan	-0.0223***	0.0291**
	(0.00834)	(0.0115)
TN	-0.0399***	0.0158
	(0.0126)	(0.00979)
UP	-0.0551***	0.0167
	(0.0165)	(0.0120)
WB	0.00890	0.0177**
	(0.0184)	(0.00818)
Constant	0.0187	-0.138***
	(0.0227)	(0.0222)
Observations	169	78
R-squared	0.928	0.963

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Determinants of output share, 1973-2006

VARIABLES	1973-1990 prod share, first diff	1991-2006 prod share, first diff
share of factories, first diff	0.318**	0.555***
	(0.138)	(0.0856)
average plant size, first diff	1.42e-05***	2.08e-05***
	(3.75e-06)	(1.86e-06)
SE, first diff	0.0311	0.0520**
	(0.0386)	(0.0222)
Observations	168	122
R-squared	0.143	0.607

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Determinants of output share growth, 1973-1990 and 1991-2006

VARIABLES	1991-2000 prod share, first diff	2001-2006 prod share, first diff
share of factories, first diff	0.563***	0.589**
	(0.106)	(0.217)
average plant size, first diff	2.60e-05***	3.15e-06
	(2.28e-06)	(3.61e-06)
SE, first diff	0.00633	0.304***
	(0.00755)	(0.110)
Observations	100	35
R-squared	0.576	0.812

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Determinants of output share growth, 1991-2000 and 2001-2006

of returns to scale in the time frame which they considered. After 2000, instead, exploitation of scale economies accounts for most of the variation in the production shares of the states: the coefficient on SE changes becomes six times higher than in 1991-2006 overall, improves significance and renders the coefficient on variation in average factory size insignificant (although the latter retains its sign). Also, the R-squared for the second sub-period is markedly higher than the one of the first, despite the just-mentioned loss in significance of an explanatory variable: this signals a clear turn-around on this respect w.r.t. the situation depicted by T-P.

Overall, this seems to hint at a prolonged stretch of brisk investment growth which, in a first period, occurred without significant diminution of returns to scale, plausibly due to the large potential for plant enlargement of the typical Indian Iron and Steel firm at the eve of liberalisation. Import competition forced Indian enterprises to exit dwarfism, which was facilitated by the region of high returns to scale in which they usually operated. During the latest decade, the prosecution of this process apparently brought to increased exploitation of such potential. Output share increases were not as strongly associated to increases in average plant size as before, signalling that a process of rationalisation of productive dimensions had already taken place. Instead, recently, further attraction of production came at the cost of using up scale returns, possibly removing the anomaly detected by T-P.

4 Conclusion

Escaping what might have been a legitimate fear, the Indian Iron and Steel industry has not given in to competition from international imports after '91. On the contrary, performances such as Mittal's suggest fledgling fulfilment of an enormous potential for growth. We explored the technical and scale-related dimensions of such growth, and their interaction with the evolution of the pattern of regional economic diversity which India is well-known to feature.

There is evidence of improved technical efficiency and increasing returns in the post-liberalisation period, which was already detected in recent literature. Nonetheless, this needs to be qualified by the recognition of a clear pattern of divergence at sub-federal level, whereby some states manage to stir technical progress whereas others fail to do so, at times markedly. As regards returns to scale, there is overall a clear movement towards greater such returns. This is plausibly associated with the well-

known investment spurt right after reform, likely to occasion the setting up of large productive capacities which bore fruit in subsequent years. This seems to constitute a peculiar Iron-and-Steel version of the J-curve of productivity hypothesised by Virmani (2005), Hashim, Kumar and Virmani (2009) and Hashim and Virmani (2011) for the more general evolution of post-reform Indian manufacturing: a near step-wise build-up in productive capacity in the early Nineties, not followed by immediate exploitation; an ensuing (late-90's) phase of productive rationalisation, and subsequently a blooming phase using it up in the 2000's.

This has had, of course, distributional consequences within the federation. After a period of decline in the Eighties and Nineties (w.r.t. *license-raj* times), geographic concentration of the industry among the considered states - as measured f.i. by a Herfindahl index based on state productive share, reported in table - has picked up again in later years, in the face of buoyant growth. In the specific case of the Iron and Steel industry, in other words, liberalisation seems to have had not as malign effects on inter-state divergence as in other sectors, despite the IRS productive technology which has been seen to characterise it. Nevertheless, in recent years, the forces of concentration seem to be kicking in. Despite the clear economic logic behind it, what the effects of this development will be on inter-state income discrepancies is anyone's guess. The notoriously low mobility of India's labour force does not seem to be a factor on which to rely to promote convergence. The policy response to the emerging issues, therefore, are clearly still - and will increasingly be - an open question.

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