Impact of Labour Unions and Economic Reforms on the Number of Registered Factories in India

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Abstract: The ongoing economic reform of India has completely bypassed the labour policies, despite implementing dramatic changes in trade, industries and capital market. Notwithstanding this limitation, the registered manufacturing sector has witnessed a steady rise in the number of factories as well as expansion in aggregate output, which suggest an underlying trend of firm entry. Our purpose is to see how different components of reform, viz. trade, labour and industrial policies, affected this industrial expansion. We find that greater unionisation and increased wage-share of the organised workers (which might have resulted from the absence of labour reform) have restricted the growth of the number of factories. This effect is particularly strong in industries which are dominated by large factories. On the other hand, industrial policy reform has had a favourable effect and promoted competition. But trade liberalisation has shown a negative impact on the number of factories. This suggests that trade reform has led more bankruptcy of inefficient domestic firms than it created new exporting firms. Our results are robust to several specification changes.

Key words: Deregulation, Labour, Industry, Entry, Liberalisation

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1 Introduction

Over the last two decades there has been a global resurgence of market-oriented polices. India too adopted such policies in 1991, and have since then carried out systematic reforms in industries, foreign trade and capital market. Export and import have been freer, foreign investment welcomed and domestic competition freed from bureaucratic controls. In vindication of reform the GDP has been growing at a rate higher than the pre-reform period, conforming to an expected pattern of effects. But in one respect the Indian reform programme is an exception. Her labour market has remained unreformed, and there is no sign of any forthcoming changes in her rigid labour laws. This raises a concern about the durability of industrial reform. Rigid labour laws and trade unions continue to pose significant barriers to exit and restructuring, and in turn discourage entry. This is especially important because trade reform, which quickly followed industrial reform, had probably discouraged entry of many other firms, which were ready to enter, but shied away amidst fears of import competition. When such different forces are counteracting toward entry, it is natural to ask: How has the process of competitiveness been evolving in the Indian industry? Did entry deregulation promote competition? We address this question by examining an important structural measure of competitiveness, net entry of firms, largely measured in the Indian context by the number of registered factories.

A number of articles have examined the impact of trade and industrial policy reforms for India and many similarly successful countries. For example, Chand and Sen (2002) find that trade liberalisation has increased total factor productivity growth of India's manufacturing sector. Moreover, liberalisation of the intermediate-goods sector has had a larger favourable impact than the final-goods sector. Similarly, Thangavelu and Rajaguru (2004) argue that import competition has forced the Indian firms to improve product quality and to use resources efficiently. A few other studies such as Ray (2002) and Krishna and Mitra (1998) also find similar results. An additional source of output and productivity growth has been identified by Ramaswamy (1999) in the entry of new plants with improved technology. While these papers focus on productivity, Kambhampati and Parikh (2005)

find that reform has significantly affected profit margins of the Indian firms by altering the behaviours of the firms as manifested in advertising, R&D and managerial remuneration.[1] These findings are broadly consistent with the experiences of other countries, such as Mexico (Iscan, 1998), EU (Cincera and Galgau, 2005), and Chile (Pavcnik, 2002). In case of Chile it has also been found that exit of relatively less efficient plants significantly contributed to the reshuffling of resources within the economy enhancing productivity, a phenomenon less likely to be true for India due to unchanged exit barriers.

Though there is a literature that has identified adverse effects of labour legislations on India's industrial output and employment (see Fallon and Lucas (1993), Dutta Roy (2003) and Besley and Burgess (2004)), its relevance is largely confined to the pre-reform period, and entry during this period was government controlled. For the post-reform period, the analysis is going to rest on examining various forces unleashed by reform. While delicensing created opportunities for entry, trade reforms exposed the domestic industry to foreign competition too much too soon and thereby reduced the incentive to enter. Trade unions and labour laws might have also discouraged entry. Our aim is to identify individual effects of these factors on entry by using panel data on manufacturing industries (disaggregated at 3-digit level) from 1981-82 to 1997-98.

In terms of summary statistics, the overall picture of entry displays a structural break in 1991. Clearly there has been a marked increase in the annual flow of net entry after 1991. In comparison to the pre-reform period, the 'average' industry has expanded in terms of employment, output and, more importantly, the number of factories. But simultaneously the 'average' factory has contracted in terms of employment, output and also real profit, suggesting the competitive effects of increased entry. But in somewhat anomaly to these, average wage per worker and the share of wages in total revenue have both risen in the post-reform period. This is *prima facie* a reflection of rigid labour institutions.

Here, we should add a caveat that factories are not synonymous with firms. An increase in the number of factories can also be a result of rapid consolidation of market power by

[1] See Konings et al. (2005) for how privatisation unleashes competitive pressure which then improves profitability.

existing firms, which respond to expanding demand by replicating separate production facilities. However, in India's case the evidence was overwhelming in favour of competition (as given by other studies cited above). The increasing trend of factories indeed reflects an underlying trend of firm entry, though it is foolish to expect one-to-one correspondence between factory and firm.

From our econometric analysis, we find that the industrial deregulation has indeed boosted competition by directly increasing the number of firms, and also indirectly by enhancing the effect of industry profitability on entry. But trade policy changes have had negative effects on entry. This suggests that import competition caused more bankruptcy than export opportunities created entry. Also as expected greater unionization and increased wage-share of the organised workers have restricted net entry, and thereby countered the favourable effect of industrial deregulation. This effect appears to be particularly strong in industries where average factory employment is in excess of hundred employees, the critical mark above factories are subject to rigorous labour regulations.

These findings are broadly consistent with the literature. On the question of labour, it is well known from the theoretical literature and it has also been documented from cross-country studies that pro-labour institutions tend to inhibit business entrepreneurship and firm entry. See Klapper et al. (2004), Botero et al. (2004), Freeman (1988), Nickell and Layard (2000), and Besley and Burgess (2004). A recent article by Aghion et al. (2005) has shown that those Indian states which had passed pro-employer legislations have enjoyed an extra mileage of industrial reform (in terms of state industrial output) as compared to the states that passed 'neutral' legislations. Conversely, the states with pro-labour legislations have suffered a loss after 1991. On trade, though our findings are slightly different from that of some of the work in the literature, they can be reconciled. While our study shows that the negative effect of import competition has outweighed the positive effect of export opportunities, it appears from other studies namely Chand and Sen (2002) and Thangavelu and Rajaguru (2004) that firms which survived import competition were able to improve their productivity.

The rest of the paper is organised as follows. We begin in Section 2 by providing a brief

description of the policy background, and then construct a simple theoretical model in Section 3 to derive some insights, which could be tested in our econometric model. Section 5 presents the econometric model and estimation issues and Section 4 describes data, summary statistics and variables for our econometric analysis. Finally the econometric results are analysed in section 5. Section 6 offers some concluding remarks. Most of the definitions of our econometric variables, data issues and results of robustness test have been relegated to the Appendix.

2 The policy background

After gaining independence from Great Britain in 1947 India adopted economic planning to achieve rapid industrialisation. But unlike the major socialist economies of that time, India retained the market economy and private ownership in all sectors. This necessitated a certain amount of control on private industries in order to ascertain the authority of the state as well as to reflect its preferred destination for investment. The Industries (Development and Regulation) Act, 1951 introduced industrial licensing, a system of approval for new private firms. Over the subsequent years this control became more elaborate ranging from entry to product, plant location, capacity choice, and even to price setting in some cases. Another important decision quickly followed in the Industrial Policy Resolution of 1956, which earmarked heavy and capital goods industries as the exclusive domain of the public sector, and substantial government investments were subsequently directed to these industries through five-year plans.[2] The process of applying for a license was also cumbersome and the license approval system became discretionary and manipulable. Essentially, entry was a government decision variable with at least two important consequences. The firms which did not have licenses faced significant barriers to entry, and the firms which

[2]There were two other groupings identified in 1956. The industries of least 'strategic' significance (such as ordinary consumer goods) would be left in the hands of the private producers, and in the remaining industries both public sector and private firms could co-exist. In all cases, firms above a certain size were required to have a license. This size criterion was given in the Factories Act, 1948.

had the licenses were automatically granted some 'market power', though there were additional restrictions on their abilities to exploit this market power. Such restrictions were gradually introduced in the form of monopoly control.

Once the industrial sector came under significant control and public sector had grown to a commanding height, a series of policy measures followed to shield the economy from foreign competition. The Import Trade Control Order of 1955 subjected almost all imports to quantitative restrictions, and it was supplemented by high tariff rates.[3] Restrictions were also imposed on exports, especially of the agricultural products, in order to ensure domestic 'food security' and also to maintain low food prices to help industrialisation. Simultaneously capital and foreign exchange markets were directly controlled. Purchases of foreign technology and foreign equity holdings were also tightly regulated.

By mid-seventies the self-defeating nature of restrictive regulations became evident. Most industries lost international competitiveness; public sector failed to generate profit, and above all industrial employment grew at a snail's pace. Various regulations ended up favouring capital-intensive technologies, much to the detriment of the economy's needs (See Mookherjee (1997) for an in-depth analysis). Once such problems were recognised, attempts were made to weaken the regulations, and these attempts gathered momentum during mid-eighties. Industrial licensing process was simplified and small firms were exempted from the scope of Licensing Policy.[4] Controls on capacity choice and prices were significantly relaxed. To acquire new technologies foreign investment was particularly welcomed *albeit* in a very selective manner.

[3]During 1970's almost all imports were subject to import licensing or were "canalised" by government monopoly trading organisations, except a select list of commodities under Open General License (OGL), whose imports were permitted without a license by actual users. Over the 80s, the list of OGL goods increased considerably. The number of capital goods on the OGL list increased from 79 in 1976 to 1,170 in 1988. Also, in case of intermediate goods there was a steady shift of items from the restricted and limited permissible categories to the OGL category. The average effective rate of protection (ERP), a measure of tariff protection, reached a height of 126 percent between 1986-87 and 1990-91.

[4]The monopoly prevention act was relaxed significantly. Diversification of firms' product mix in about 30 industries was no longer subject to prior approval.

Finally, against the threat of an imminent foreign exchange crisis came the new industrial policy on 24 July, 1991, which dispensed with industrial licensing and announced measures facilitating foreign investment and technology transfers, and threw open many industries hitherto reserved for the public sector. In high priority industries automatic approval of foreign technology agreements and up to 51 percent foreign equity was also introduced. Subsequently, quantitative controls on imports and tariff rates were reduced. This comprehensive wave of deregulation was further accentuated in latter years.[5] Now entry is determined by the domestic market conditions and also to some extent by the import prices.

Surprisingly enough, while such rapid changes were taking place, there was no serious attempt to change the labour laws or to modify the regulatory framework for labour. In part, this is due to divergent legislative powers shared by the states and the central government (with respect to labour). But this is also to some extent a legacy of a 'social justice' approach predominantly followed during the planning period. Unlike trade and industrial policies, labour policies were more driven by redistributive concerns, than by state control. Labour regulations aim at enforcing two broad provisions: collective bargaining and job-security. The first provision directly follows from the Trade Unions Act, 1926, which confers union right to workers in all firms, domestic and foreign, private and public. Though for small and informal sector firms this provision is useless, it does allow for outsiders' involvement ostensibly to represent the workers. In large firms, the act is responsible for giving rise to multiple unions and also to large centralised unions (see Anant (2000) for more).[6] In both cases, the outsiders can play a crucial role in collective

[5]The list of industries reserved for the public sector now stands reduced to 6. Private participation is permitted in some specific areas in this list as well, such as mining; oil exploration, refining and marketing; and parts of the railway transport sectors. As for import, the scope of canalization was narrowed in 1991. In 1993-94 imports of certain petroleum products and fertilizers were decanalised, and the negative list of imports was pruned by removing 146 entries. The list of freely importable goods expanded in 1995-96. A large number of consumer goods shifted from negative list to the export-linked special import license list and 488 items were moved from the restricted list to the OGL in 1996-97.

[6]Essentially, India promoted a pluralist industrial relations model; but the institutions conducive to

bargaining that may have significant bearings on individual firms. The labour laws are also dualistic in granting a great deal of protection and benefits to 'permanent' workers, and nothing at all to 'temporary' or 'contract' workers.[7] This inevitably created incentives among firms to substitute temporary for permanent workers.

But the key central legislation is the Industrial Disputes Act, 1947, which sets out an elaborate procedure for conflict resolution in the process of collective bargaining. Though various states have passed their own legislations strengthening or weakening various provisions of this act, one central provision has remained controversial over the last three decades or so. First in 1976 and then in 1982 and 1984, the Industrial Disputes Act was amended by the central government to prevent large firms (employing at least 100 permanent workers) from carrying out any layoff, retrenchment or closure without the government's approval. This particular provision has been perceived as very restrictive.[8] Significantly it reduced the firms' ability to restructure, particularly in an environment when no longer firms are shielded from outside competition. Thus it appears, old labour policies strike a discord with the new economic policies, and therefore the effects of industrial and trade reform need to be understood in the light of unchanged labour institutions.

3 A theoretical model

From the discussion of the Indian economy it appears that prior to 1991, the number of firms that could enter an industry was predominantly an exogenous variable to that

a marriage of pluralist industrial relations and bilateral collective bargaining were largely controlled by the state. This 'state-dominated' pluralism, coupled with ambiguous labour laws regarding trade union recognition and 'industrial disputes', eventually led to a multiplicity of political party based trade unions (Bhattacherjee, 1999).

[7]The Industrial Employment (Standing Orders) Act, 1946 deals with terms and conditions of employment and the status of employees (permanent or temporary). It allows for layoff compensation and severance pay for permanent workers in firms employing 50 or more workers.

[8]See Basu et al. (2000)for a theoretical analysis of its adverse effects, and also Fallon and Lucas (1993) and Dutta Roy (2003) for its effect on labour demand.

industry. Labour institutions also encouraged a practice of hard collective bargaining. Further, trade restrictions gave rise to substantial rent to be shared by the firms and labour unions. This motivates us to consider a union-oligopoly model, where wage is bargained before employment is chosen. The number of firms is exogenously given, and the high tariff rate ensures that the equilibrium price is below the effective import price. This captures the reality of the pre-reform period.

Next, we introduce industrial deregulation by allowing free entry, and trade reform by allowing the effective import price to fall so low that it effectively reduces the wage negotiated by the unions. Although, unions still retain bargaining power, and firms cannot easily shed employment, the adverse impact of import competition is nevertheless felt through a fall in wage.

Let us consider a market for a homogeneous good with linear demand such as $p = a - Q$. The good is supplied by n identical profit maximizing firms, denoted by $i = 1, 2, \ldots, n$. Initially we assume that $n = n_0$ exogenously given by the erstwhile licensing policy of the Indian government.

Firms produce under constant returns to scale with respect to labour, the only variable input. Let the production function of firm i be $q_i = \theta l_i$, where q_i is output and l_i is employment. At this stage we abstract from non-labour costs, though they can be included with some modifications. Firms are Cournot competitors, and prior to the output competition, each firm is engaged in collective bargaining with its labour union to determine the wage rate.

Each union has a fixed membership, say m_i in the i-th firm. If hired by firm i, a member supplies one unit of labour, and if not, he goes to an outside sector and earns a minimum wage of r. The i-th union's objective function is $U_i = (w_i - r)l_i$. The wage bargaining process is completely decentralised.

Formally, we conceive the following game. In the first stage each union/firm pair bargains over wages simultaneously, and in the second stage firms simultaneously choose their level of employment. As usual, we will be deriving the subgame perfect Nash equilibrium through backward induction.

In the last stage of the game, taking the wage rate as given, firm i tries to maximise its profit,

$$\begin{aligned}\pi_i &= pq_i - w_i l_i \\ &= (a - \theta \sum_{i=1}^{n} l_i)\theta l_i - w_i l_i \\ &= (a - \theta \sum_{i=1}^{n} l_i - \frac{w_i}{\theta})\theta l_i.\end{aligned}$$

Its output choice is expressed as a reaction function of all other firms' outputs,

$$l_i = \frac{a\theta - w_i - \theta^2 l_{-i}}{2\theta^2}, i = 1, 2, \ldots, n,$$

where $l_{-i} = (\sum_{i=1}^{n} l_i) - l_i$.

The solution of the Cournot competition subgame is

$$l_i = \frac{a\theta - nw_i + w_{-i}}{(n+1)\theta^2}, i = 1, 2, \ldots, n, \; where \; w_{-i} = (\sum_{i=1}^{n} w_i) - w_i. \tag{1}$$

$$q_i = \theta \frac{a\theta - nw_i + w_{-i}}{(n+1)\theta^2}, i = 1, 2, \ldots, n \tag{2}$$

$$Q = \theta \frac{na\theta - \sum_{i=1}^{n} w_i}{(n+1)\theta^2}. \tag{3}$$

In the first stage, each union-firm pair bargains over the wage simultaneously and independently taking wages in other firms as correctly anticipated at their equilibrium level. We assume that the unions are identical in terms of both bargaining power and reservations wage.

The collective bargaining subgame is formulated as a generalized Nash bargaining problem, which for a typical union-firm pair, say i $(i = 1, 2, \ldots, n)$, can be written as follows:

$$Max_{w_i} \; B_i = U_i^{\gamma} \pi_i^{1-\gamma}$$

subject to,

$$l_i = \tfrac{a\theta - nw_i + w_{-i}}{(n+1)\theta^2}, \; i = 1, 2, \ldots, n,$$

where γ $(0 \leq \gamma \leq 1)$ is the bargaining power of the union and $(1-\gamma)$ is the bargaining power of the firm. With simple algebraic manipulations the maximand of the bargaining problem reduces to

$$Max_{w_i}\,[(w_i - r)^{\gamma}(a\theta - nw_i + w_{-i})^{2-\gamma}],\ where\ w_{-i} = (\sum_{i=1}^{n} w_i) - w_i \tag{4}$$

The solution to (4), by symmetry, is

$$w = r + \gamma\frac{a\theta - r}{2n - \gamma(n-1)} \tag{5}$$

From (5) it follows that the bargained wage is an increasing function of γ and a decreasing function of n. Further, for $n \to \infty$, the bargained wage converges to the reservation wage r and the oligopoly output approaches to the perfectly competitive output.

It is straight forward to derive the equilibrium employment in a given firm (l) and in the industry (L), aggregate output (Q), firm profit (π), union payoff (U) and the market price (p^*) as follows.

$$l = \frac{n(2-\gamma)(a\theta - r)}{\{2n - \gamma(n-1)\}(n+1)\theta^2} \tag{6}$$

$$L = \frac{n^2(2-\gamma)(a\theta - r)}{\{2n - \gamma(n-1)\}(n+1)\theta^2} \tag{7}$$

$$Q = \frac{n^2(2-\gamma)(a\theta - r)}{\{2n - \gamma(n-1)\}(n+1)\theta} \tag{8}$$

$$\pi = \frac{n^2(2-\gamma)^2(a\theta - r)^2}{\{2n - \gamma(n-1)\}^2(n+1)^2\theta^2} \tag{9}$$

$$U = \frac{\gamma n(2-\gamma)(a\theta - r)^2}{\{2n - \gamma(n-1)\}^2(n+1)\theta^2} \tag{10}$$

$$p^* = a - \frac{n^2(2-\gamma)(a\theta - r)}{\{2n - \gamma(n-1)\}(n+1)\theta} \tag{11}$$

We presume that the equilibrium price is far below the effective import price for this product. Suppose $\hat{p}$ is the international price, and $\hat{p}+\tau$ is the effective price at home. Even though $\hat{p} < p^*$, τ is so high that $\hat{p} + \tau > p^*$. So the firms and unions are both beneficiaries of two restrictions, fixed n and high τ.

It is, however, plausible that a social welfare maximizing government might choose n higher than the market determined level. However, in the absence of any subsidy on entry cost, no firm would enter (or use the license), if its post-entry profit did not exceed the entry cost. Thus historical entry, and the ever present demand for licenses in the pre-reform period suggest that the number of licenses issued was probably far less than what the market could accommodate.

Let the entry cost be denoted by F. Then by solving

$$\pi - F = \frac{n^2(2-\gamma)^2(a\theta - r)^2}{\{2n - \gamma(n-1)\}^2(n+1)^2\theta^2} - F = 0 \tag{12}$$

we determine $n^*(F)$ as the market determined entry. In the pre-reform period (exogenously given) n_0 must have been less than $n^*(F)$. In Figure 1, we depict the (inverse) $n^*(F)$ curve. Point A denotes the pre-reform configuration of (F, n), while point B would have been the market determined n, assuming the same collective bargaining procedure remaining in place.

If only the licensing is removed keeping the tariff unchanged, we will get $n^*(F)$ as the equilibrium number of firms, and wage and profit can be recalculated by replacing n by $n^*(F)$. Further, $[n^*(F) - n]$ would be identified as the new set of entrants, while the old firms remain in place. Clearly, the incumbent firms' profit falls (though they remain positive), while all the new entrants earn zero profit. All unions experience a wage reduction and lower utility, despite having the same bargaining power as before. Increased competition in the product market reduces their payoff.

What happens now if trade reforms are introduced? Suppose the tariff is eliminated, and the domestic price must be at the most $\hat{p}$, otherwise the firms will face a threat of closure. If unions could maintain their collective bargaining, then matching the international price would require entry of many more firms, presumably in excess of $n^*(F)$, say n_1 as given in Figure 1. But entry of n_1 firms with the same collective bargaining practice is simply unprofitable.

One possible solution is to reform the labour laws so that the bargaining power of the union γ is significantly reduced, or allow firms to switch to more efficient technology (with higher θ). All these would lead to an outward shift of the curve, and the industry might be able to meet the international competition by having n_1 firms.

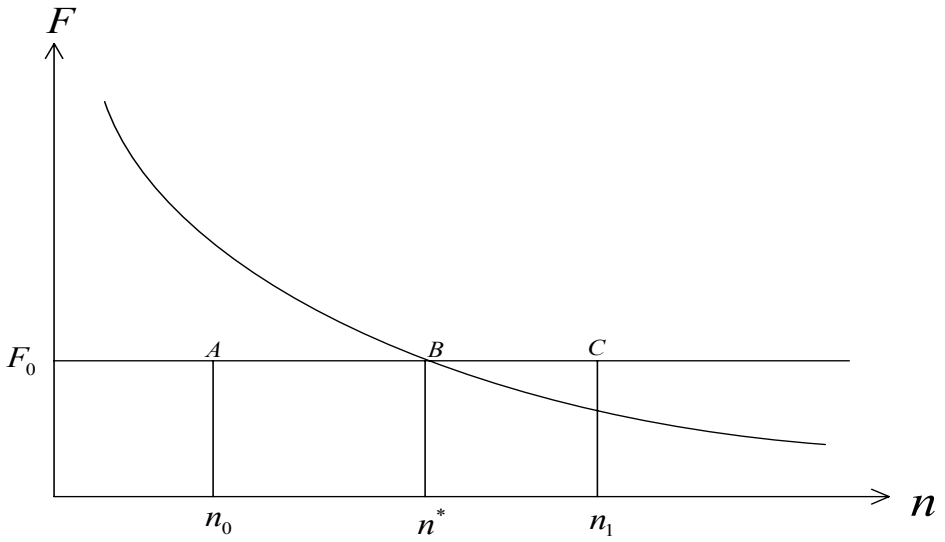

Figure 1: Entry cost and number of firms

In the absence of labour reforms or significant technological progress (though there is evidence of some), collective bargaining must accept the condition that p must not exceed $\hat{p}$. This can be explicitly imposed as a constraint on the Nash bargaining problem. If we do so, then the symmetric equilibrium wage and entry must satisfy the following two

equations:

$$\begin{aligned} \hat{p} &= \frac{a\theta + nw}{(n+1)\theta} \\ \pi_i &= \frac{(a\theta - w)^2}{(n+1)^2\theta^2} - F = 0. \end{aligned}$$

The first equation says that the wage must be such that the resultant market price is just $\hat{p}$. As long as this wage is greater than r, the unions are better off accepting this wage than facing closure. The second equation says that new entrants must be able to break even. These two equation together give a (w, n) combination such that the import competition is met. We may call this a 'constrained' collective bargaining outcome.

The above two equations can be rewritten as,

$$w = \hat{p}\theta - (a - \hat{p})\theta\{\frac{1}{n}\} \quad (13)$$

$$w = \theta[a - (n+1)\sqrt{F}]. \quad (14)$$

In Figure 2 we plot these two curves. Equation (13) is represented by the EE curve, which is upward sloping and converges to $\hat{p}\theta$ when n becomes very large. This curve tells us how many firms are needed at a given wage to meet the import competition induced by a given $\hat{p}$. A lower $\hat{p}$, (say $\hat{p}'$) which will intensify competition, will make the EE curve shift rightward (such as $EE(\hat{p}')$)indicating the need for even more entry. Equation (14) is represented by the FF curve, which simply gives various combinations of w and n that ensures zero profit after covering the entry cost. Free entry will force zero profit on the last entrant (and by symmetry on all new entrants). So a solution to the constrained bargaining problem with free entry must satisfy both (13) and (14).

It is worth acknowledging that the two curves under some conditions may not meet at all. For their intersection it is necessary that the horizontal intercept of FF must exceed the horizontal intercept of EE. This gives rise to the condition,

$$\hat{p} > \sqrt{F}.$$

This says that if the import competition is not too severe (i.e. $\hat{p}$ is not too low), or if the entry cost is not too large, the domestic industry will survive the external competition,

in spite of rigid labour laws and collective bargaining. As long as the workers realise the threat of closure, a compromise wage can be agreed upon to meet the competition.

Explicitly, the solutions for w and n are,

$$\hat{w} = \theta[\hat{p} - \sqrt{F}] \tag{15}$$

$$\hat{n} = \frac{(a - \hat{p})}{\sqrt{F}}. \tag{16}$$

Further, for $\hat{w} > r$, it is necessary that $\hat{p} > \sqrt{F} + \frac{r}{\theta}$. As can be seen from Figure 2, the increasing pressure of foreign competition can be met this way, by shifting the EE curve downward, along the FF curve, until point D' is reached. At D' wage can fall no further.

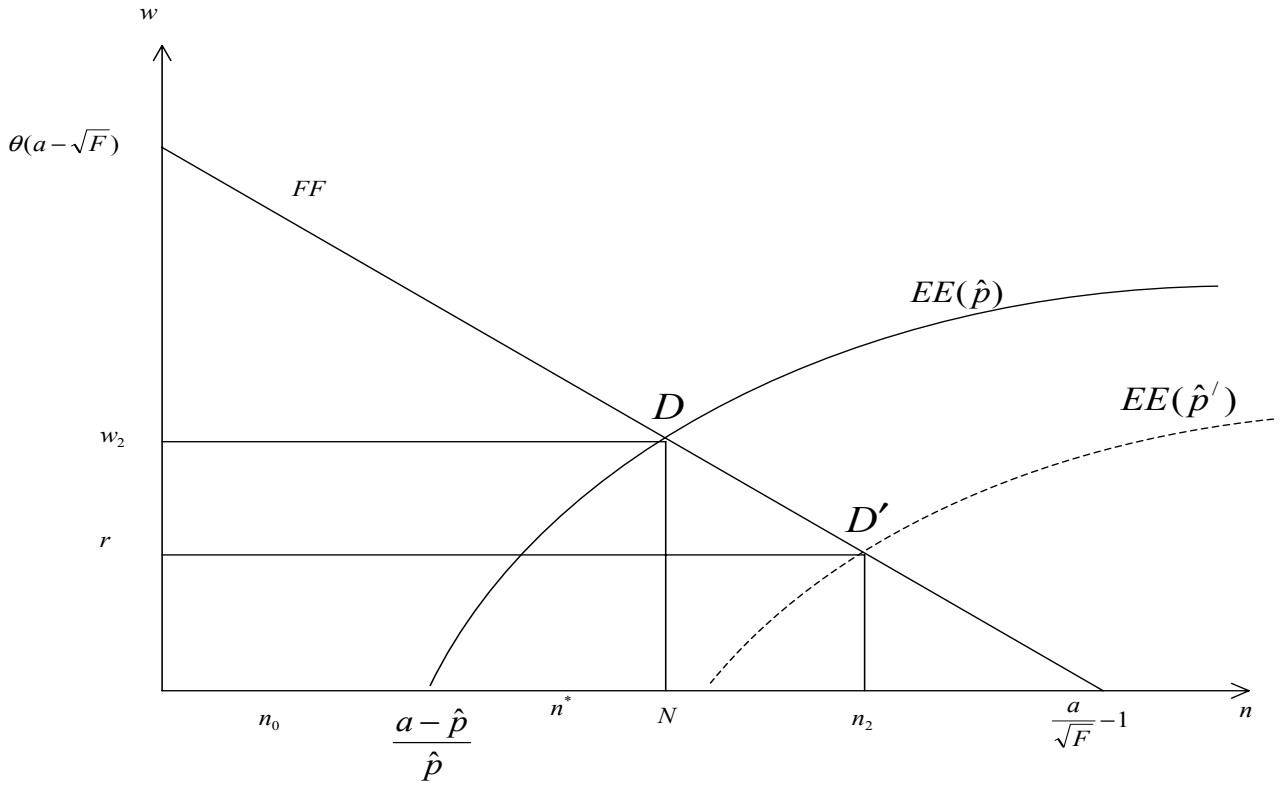

Figure 2: Wage and number of firms in a liberalised trade regime

The process described in Figure 2 shows how labour unions can be pragmatic even when labour laws allow them to take a hard line. Inevitably, they end up making concessions. We believe that to some extent this has indeed happened in India. A significant decline

in the the number of strikes suggests that unions have become more restrained in their bargaining posture. But perhaps this is not the only story one could tell, because the data tell us that the average industrial wage has actually risen after liberalisation. How do we reconcile the rising wage with increasing external competition?

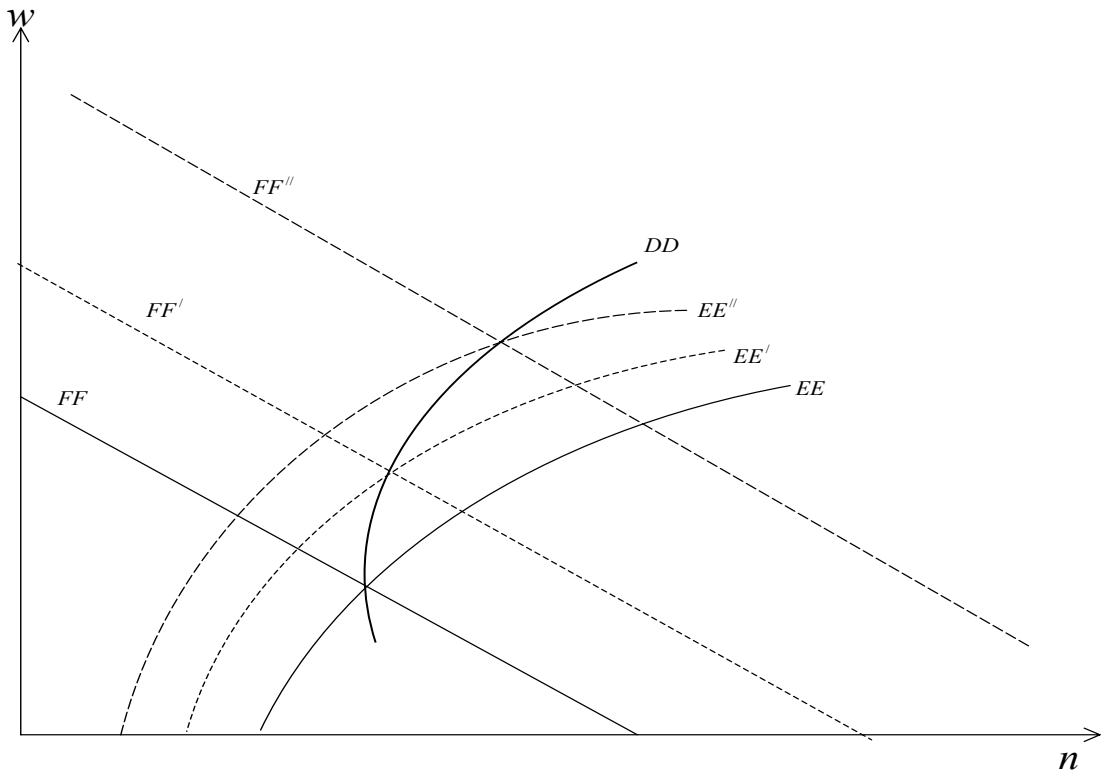

Figure 3: Increased wage in the post-reform period

This can be done by considering two other possibilities: increase in domestic demand (a) and productivity (θ). With significant growth in GDP since the 1980s, demand for industrial goods must have risen considerably to offset some of the pressure of foreign competition. If that were so, we would see an upward shift in both the EE and FF curves. In turn the equilibrium point will move northward. Wage *must* increase and entry may or may not increase. The same story emerges from a possible increase in θ. This is shown by the DD curve in Figure 3.

4 Methodology

Motivated by the theoretical model of the previous section, we postulate the following econometric model:

$$z_{it} = \alpha + \theta z_{i(t-1)} + \sum_{j=1}^{k} \beta_j x_{it}^j + + \sum_{g=1}^{G} \delta_g D_{it}^g + v_i + u_{it}, \tag{17}$$

where i refers to industry, t to time period, $i = 1, 2, ..., I$ and $t = 1, 2, ..., T$. The left hand side variable z refers to the number of firms in the i-th industry at time t. On the right hand side, apart from the lagged variable z, we have k number of x^j variables which consist of profitability, trade protection and labour union characteristics of the industry. There is also a set of dummy variables D^g which capture the policy changes. These dummies could be industry specific. Next, we also include an unobservable industry-specific effect, v_i. As usual, u_{it} is the error term. We assume that $v_i \sim IID(0, \sigma_v^2)$ and $u_{it} \sim IID(0, \sigma_u^2)$.

The inclusion of the lagged dependent variable as a regressor appears necessary to acknowledge that entry and exit are not frictionless. They take time, and generally occur sequentially. But then we run into a problem. The (time-invariant) fixed effect term v_i is bound to be correlated with $z_{i(t-1)}$, because $z_{i(t-1)}$ is also a function of v_i. This makes the OLS estimator biased and inconsistent, even if u_{it} is not serially correlated (Sevestre and Trognon, 1985). However, one can wipe out v_i by carrying out a 'within group' transformation, which involves taking deviations of every variable from its time mean; but then the transformed error term and transformed lagged dependent variable will be correlated. As a result, the 'within group' estimator will be biased of order $(\frac{1}{T})$ and its consistency will depend on T being large, where T is the length of the panel (Nickell, 1981). The same problem occurs with the random effects GLS estimator.

An alternative transformation that sweeps out the fixed effects is first differencing (Anderson and Hsiao, 1981). While the differenced error will still be correlated with the differenced lagged dependent variable, the resultant bias can be overcome by using appropriate instrumental variables. Instruments dated $(t-2)$ and earlier are valid as

long as levels error does not exhibit serial correlation. If the levels error is MA(1), then instruments dated $(t-2)$ are invalid, though instruments dated $(t-3)$, $(t-4)$ etc. will be valid. Arellano and Bond (1991) have proposed a generalized method of moments (GMM) that uses this principle to generate consistent estimates of coefficients. Efficiency is gained by exploiting all available orthogonality conditions.

We estimate our model by using the Arellano and Bond (1991) method, and also confirm the validity of the instruments used by running two tests, Sargan test of over identifying restrictions, and serial correlation(2) test for the absence of second order serial correlation in the differenced residuals.[9] This means that our coefficients will be obtained from GMM 2-step estimation and p-values will follow from GMM 1-step estimation. Needless to say, we treat all regressors as exogenous. These results are reported in Table 2. We also test for robustness and this is reported in the Appendix.

5 Data and descriptive statistics

5.1 Data

Our analysis is based on a dataset of 73 three-digit industries (see Appendix 7.3 for the list of industries) in India from 1981-82 to 1997-98.[10] The choice of 73 industries is determined by data availability, and together they account for about 60 percent of total value added

[9]For some recent applications of this method see Bhalotra (1998), Paus et al. (2003), Podrecca and Carmeci (2001).

[10]It is to be noted that till 1988-89 the classification of industries followed in ASI was based on the national industrial classification 1970 (NIC-1970). The switch to the NIC-1987 from the year 1989-90 necessitated some matching of the NIC-1970 with NIC-1987. We treated the NIC-1987 as the base and accordingly carried out data adjustment at the 3-digit industries level. Some industries had to be merged (such as 315+316, 338+339, 343+349, 363+364, 365+366, and 373+374) to build a comparable series for pre 1989-90 and post 1989-90. We have followed the table of concordance from NIC 1987 to NIC 1970 provided in Supplementary Item S.1 of ASI data base, maintained by EPW Research Foundation, Mumbai to merge the industry.

in the organised manufacturing sector of India.[11]

The dependent variable of our model is the number of factories, which is taken as a proxy for the number of firms. As argued before, though they do not bear one-to-one correspondence, the underlying trend of firm entry is reflected on the trend of the factories. We define the natural logarithm of the number of factory units (*NFac*) as the dependent variable.[12]

Our right hand side variables can be classified into several groups: (1) profitability, (2) trade protection, (3) labour union, (4) industrial policy changes. We capture profitability and certain technological characteristics by using average (real) profits per factory (*Avg-Profit*) and capital output ratio (*Cap/Lab*). Trade protection is measured by the effective rate of protection (*ERP*) and import coverage ratio (*ICR*).

Labour union characteristics are given by union membership (*Unionisation*) and share of wages in net revenues (*WageShare*). We also include an industrial relations variable to capture the work environment, namely the average mandays lost due to dispute (*AvgMan-Lost*). Further, to capture the effect of different (central) labour legislations, we use two dummy variables, *EmploymentSize1* and *EmploymentSize2*, and also interact them with *Unionisation*. The first dummy is activated when the average employment of a factory in an industry exceeds 50 but falls short of 100; the second dummy is activated when it exceeds 100. This is to take into account the effects of severance pay and job-security provisions, respectively.

Government policy changes are captured by a series of dummy variables switched on

[11]We collected our data from multiple sources: (i) Annual Survey of Industries (Central Statistical Organisation, Government of India). This includes all establishments with more than nine workers. (ii) Indian labour Statistics (Labour Bureau, India). (iii) Indian Labour Year Book (Labour Bureau, India). (iv) Handbook of Industrial Policy and Statistics (Ministry of Industry, Government of India). The estimates of effective rates of protection (ERP) and import coverage ratio (ICR), available at disaggregated level in Das (2003), have been used as measures of trade barriers. All the nominal data has been deflated by wholesale price indices (Source: Index Number of Wholesale Prices in India, Central Statistical Organisation, Government of India). The year 1981-82 acts as the base year.

[12]To over come the integer problem, we have taken natural logarithm of number of factories.

from the year of announcement of those policies. The most important dummy is *NoLicense* that captures industry- and year-specific abolition of industrial licenses starting form 1991.[13]. The second most important change was the withdrawal of public sector monopoly captured by *Dereservation*. Again this is also a year- and industry-specific dummy.[14] The final dummy variable is *(FtechEquity)*, which captures the policy changes regarding foreign technology agreements and equity holding.[15] The details of all variables are given in Appendix 8.1.

With the above variables we specify the following regression model:

$$\begin{aligned} ln(NFac)_{it} = \alpha &+ \beta_1\ ln(NFac)_{it-1} + \beta_2\ (AvgProfit)_{it-1} + \beta_3\ (AvgProfit)_{it-2} \\ &+ \beta_4\ (Unionisation)_{it-1} + \beta_5\ (WageShare)_{it-1} + \beta_6\ (Cap/Lab)_{it-1} \\ &+ \beta_7\ (AvgManLost)_{it-1} + \beta_8\ (NoLicense)_{it} + \beta_9\ (Dereservation)_{it} \\ &+ \beta_{10}\ (FtechEquity)_{it} + \beta_{11}\ (ERP)_{it} + \beta_{12}\ (ICR)_{it} \\ &+ \beta_{13}\ (EmploymentSize2)_{it} + \beta_{14}\ (EmploymentSize1)_{it} + v_i + u_{it} \end{aligned} \quad (18)$$

As explained before our model will be used by the GMM estimation methods suggested by Arellano and Bond (1991). Nevertheless some remark on a few variables may be in order. One might presume that $(AvgProfit)_{i(t-1)}$, $(AvgProfit)_{i(t-2)}$, and $(AvgManLost)_{i(t-1)}$ may be (partially) predetermined, and these are to be constructed by using the appropriate lags of $(NFac)$ as a deflator. Therefore, we also estimate our model separately by treating these three variables as predetermined (see Appendix 8.2). It is found that results of initial GMM estimation are robust to such variations.

[13]In 1991-92, out of 197 industries, 161 were freed from licensing. The following year another 9 industries were also freed. In our sample, licensing was abolished in 59 industries in 1991-92 and in 5 industries in 1992-93.

[14]In 1991-92, 8 broad product groups (according to HS classification) out of 17 product groups hitherto reserved for the public sector, were de-reserved. The list was further reduced in 1993-94.

[15]In 64 (35 in our sample), out of total 197 (73 in our sample), industries automatic approval of foreign technology agreements and for 51 percent foreign equity holdings were introduced in 1991-92. This trend got further momentum in latter years.

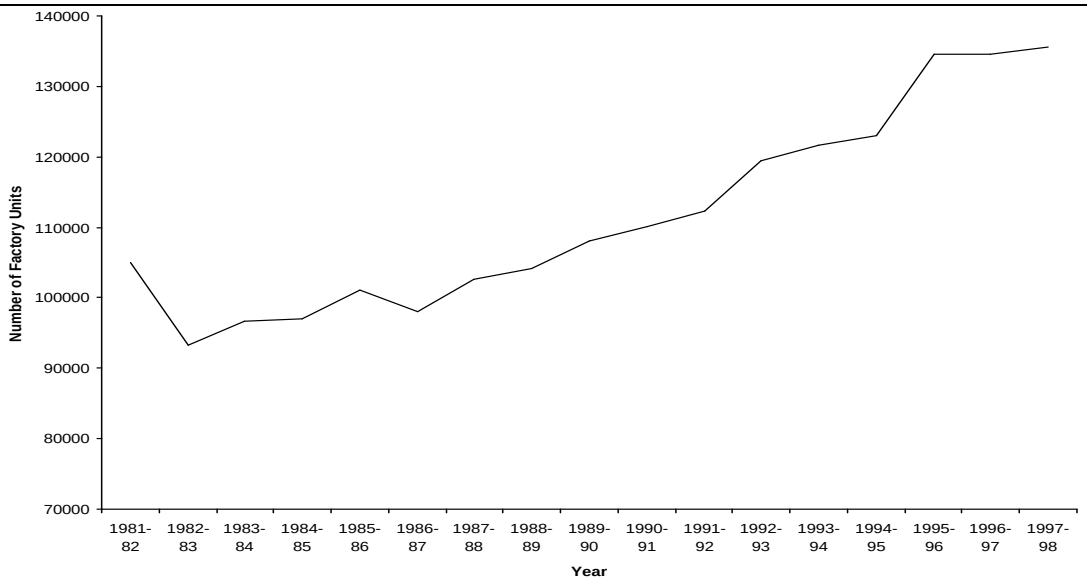

Figure 4: Total number of registered factories in India

5.2 Descriptive statistics

Figure 4 gives a visual presentation of the trend in the number of factories. It has steadily increased from 105,038 in 1981-82 to 112,286 in 1991-92, and then to 135,549 in 1997-98. Clearly there is a noticeable spurt around 1992-93 and a much bigger spurt in 1995-96. The average number of factory units per industry per year has increased to 919 in the post 1990-91 period from 748 between 1981-82 to 1990-91 (significant at 1 percent level). See Table 1. However, this trend is not uniform across industries. In some industries, for example NIC 262, 352, 358, etc., the number of factories has declined on an average.[16] This variability demands considerable attention, and it needs to be investigated. In Figure 5 we depict the trends in average employment (of workers) per factory and average wage rate of a worker. The employment has fallen, and the wage rate has gone up.

Table 1 also reports changes in the mean levels (along with their statistical significance) of some other important variables between the pre-and post-reform periods. Overall we get a picture of increased competition, contraction in the average factory size (nearly 20

[16]NIC 262: Embroidery work, zari work and making ornamental trimmings industry. NIC 352: Prime movers, boilers, steam generating plants and nuclear reactors manufacturing industry. NIC 358: Office computing and accounting machinery and parts (excluding computer and computer based systems) manufacturing industry.

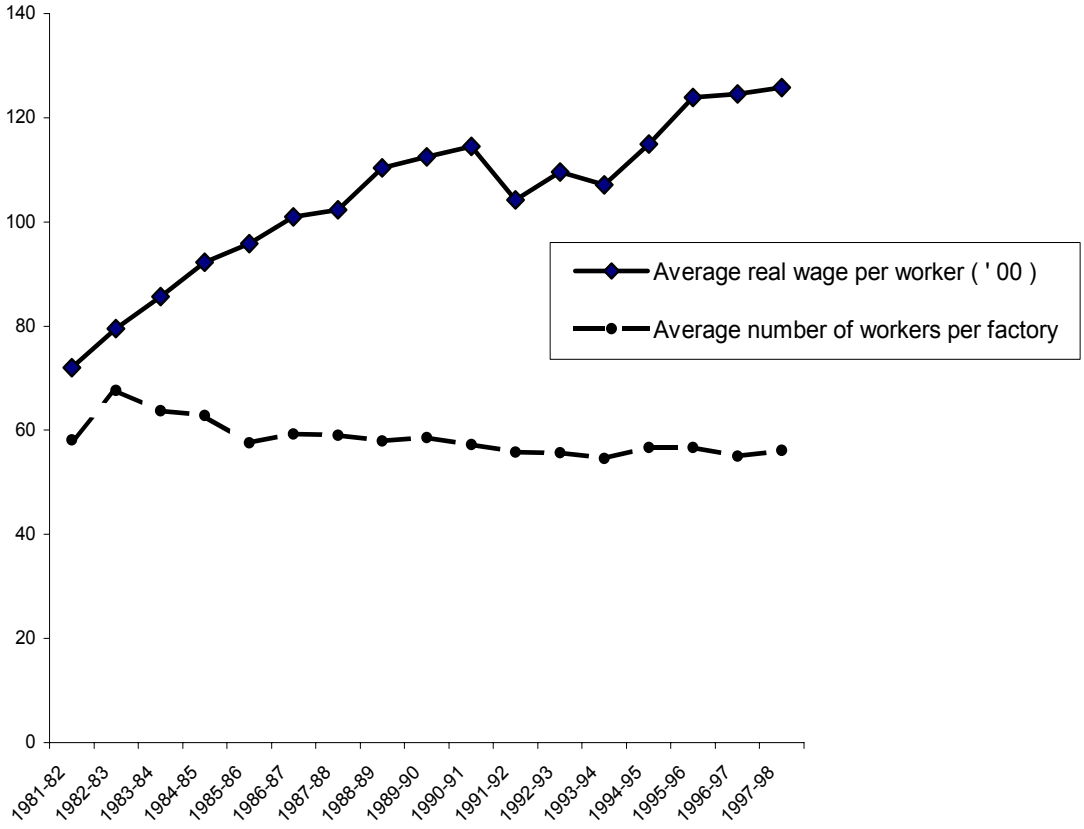

Figure 5: Average wage and average employment per factory

%)significant at 10 percent) and profit (33%), expansion in aggregate employment and output. This was, of course, accompanied by significant reduction in trade barriers, both tariff and non-tariff, evident from EPR and ICR. However, unionisation has significantly increased, which might have encouraged firms to increase capital intensity.[17] The capital-labour ratio has increased by more than 83 percent. The average mandays lost due to disputes has decreased by 70 percent, an encouraging factor for entry.

[17]It may appear odd that the rate of unionisation exceeds 1. By the Trade Unions Act, a laid off worker can remain a union member. In addition, a worker can be member of multiple unions. These facts can give rise to more than 100 percent unionisation. However, there is a considerable variation among industries.

Table 1: Summary statistics

	$1991-92$ to $1997-98$		$1981-82$ to $1990-91$		$Ho: x = y$		
	Mean (x)	S.D.	Mean (y)	S.D.	$Ha: x < y$ $p < t$	$Ha: x \neq y$ $p > \|t\|$	$Ha: x > y$ $p > t$
No. of Factory per industry	918.891	802.201	747.654	668.034	1.000	**0.000**	**0.000**
No. of Employees per industry	70087.13	4641.652	61085.18	4193.478	0.922	0.157	**0.078**
Unionisation	1.435	11.236	0.419	1.350	0.984	**0.031**	**0.016**
Wage-share	0.441	2.099	0.378	1.018	0.734	0.532	0.266
Capital labour ratio (Rs. 1000)	112	166	61	108.007	1.000	**0.000**	**0.000**
Effective Rate of Protection (%)	67.758	29.209	121.252	69.788	**0.000**	**0.000**	1.000
Import Coverage Ratio (%)	30.445	37.136	86.642	31.093	**0.000**	**0.000**	1.000
Profit per Factory (Rs. 1000)	3104	19181	4174	32910.530	0.279	0.558	0.721
Mandays Lost per Factory	170.543	19.208	586.697	165.036	**0.017**	0.037	0.981

Notes: (a) Mean = Average over years and across industries. (b) Nominal variables are in 1981-82 prices. (c) Unionisation and wage-share are fractions, as defined in Section 3.

6 Results

Dynamics: The econometric analysis throws up several dimensions of India's economic reform (See Table 2). First and foremost, there is great deal of dynamics with entry, the key structural condition for competition. Entry in period t is inexplicably linked to entry or exit observed in period $(t-1)$. Since the dependent variable is expressed in log terms, the coefficient of its one period lag gives the time elasticity of entry. This elasticity is negative (-0.33) and it is significant. That is, an 100 percent increase in the number of factories in the current period is going to induce a less than 100 percent decrease in the number of factories in the next period. In other words, entry is followed by exit (but by a smaller proportion) and vice versa. This volatility is perhaps natural in an environment of rapid policy changes. Nevertheless it appears that the industries are moving towards an entry equilibrium.[18] In a way, the sequentiality in firms' decision process is quite evident,

[18]For example, suppose that there were 100 plants in year t_0 in an industry and it increases by 10 percent in year t_1, due to entry of new plants. In year t_2 it will decrease by 3.3 percent (of year t_1), and in year t_3 it will again increase by 1 percent (of year t_2) [considering average elasticity = -0.33]. So, there will be 110 plants in year t_1, 107 plants in year t_2, and 108 plants in year t_3. According to such dynamic

though in our theory we abstracted from this aspect.

Table 2: GMM (Arellano and Bond) estimation results

Dependent Variable: ln(NFac)								
	(1)		**(2)**		**(3)**		**(4)**	
Explanatory Variables	Coefficients	p Values	Coefficients	p Values	Coefficients	p Values	Coefficients	p Values
$ln(NFac)$, $Lag1$	-0.327013	**0.011**	-0.336694	**0.012**	-0.382026	**0.007**	-0.275877	**0.057**
$AvgProfit$, $Lag1$ (Rs. 10000000)	0.002816	0.695	0.002499	0.733	-0.002615	0.846	0.002255	0.841
$AvgProfit$, $Lag2$ (,,)	0.022221	**0.000**	0.021705	**0.000**	0.021801	**0.000**	0.019438	**0.000**
$AvgProfit^*Dereservation$, $Lag1$(,,)					0.005117	0.676	0.001824	0.910
$AvgProfit^*Dereservation$, $Lag2$(,,)					0.022280	**0.032**	0.017166	**0.004**
Cap/Lab, $Lag1$ (Rs. 10000000)	-0.985400	**0.070**	-2.379340	**0.023**	-3.261552	**0.009**	-3.121685	**0.063**
$Unionisation$, $Lag1$	-0.014998	**0.000**	-0.013530	**0.002**	-0.011934	**0.000**		
$WageShare$, $Lag1$	-0.004979	**0.000**	-0.005065	**0.001**	-0.005473	**0.038**	-0.005615	**0.000**
$AvgManLost$, $Lag1$	-0.000020	**0.018**	-0.000021	**0.017**	-0.000022	**0.015**	-0.000021	**0.001**
$EmploymentSize2$			-0.288818	0.112	-0.296163	0.107	-0.075711	0.185
$EmploymentSize1$			-0.114850	0.103	-0.102564	0.101	-0.072149	**0.070**
$EmploymentSize2^*Unionisation$, $Lag1$							-0.073089	**0.000**
$EmploymentSize1^*Unionisation$, $Lag1$							-0.011034	**0.078**
$NoLicense$	0.033192	**0.020**	0.031865	**0.018**	0.036820	**0.018**	0.028021	**0.015**
$Dereservation$	0.020351	**0.040**	0.020048	**0.019**	0.019075	**0.025**	0.018056	**0.035**
$FtechEquity$	-0.019682	0.138	-0.018258	0.127	-0.019225	0.125	-0.014313	0.109
ERP (%)	0.000131	**0.057**	0.000103	**0.042**	0.000149	**0.029**	0.000148	**0.044**
ICR (%)	0.000149	0.172	0.000121	0.206	0.000149	0.231	0.000073	0.249
Number of Observations	739		739		739		739	
F	$F(12, 726) = 24.66$		$F(14, 724) = 30.87$		$F(16, 722) = 52.63$		$F(17, 721) = 1986.81$	
Serial Correlation(2)	$Prob > z = 0.2433$		$Prob > z = 0.2084$		$Prob > z = 0.2039$		$Prob > z = 0.2294$	
Sargan	$Prob > \chi^2 = 0.6123$		$Prob > \chi^2 = 0.4847$		$Prob > \chi^2 = 0.6067$		$Prob > \chi^2 = 0.5404$	

Notes: Following Arellano and Bond (1991) the coefficients have been obtained by using GMM 2-step estimation and p-values from GMM 1-step estimation. F is the test statistics for overall significance test of the model ($Prob > F = 0.000$ in all the four cases). The Serial Correlation(2) test is an N(0,1) test for second-order serial correlation. Sargan is a chi-square test of the over identifying restrictions. These tests suggests that the model is overall significant, there is no serial correlation of order 2 and the instruments used for estimation are valid ($ln(NFac)_{t-3}$, $ln(NFac)_{t-4}$, and $ln(NFac)_{t-5}$ were used as instruments). Nominal variables are in 1981-82 prices.

Profitability: As expected, industry profitability has a positive impact on entry. Higher average profit in an industry will lead to more number of factory units in that industry. Interestingly, while coefficients of both *AvgProfit* of lag1 and lag2 are positive, only *AvgProfit* of lag2 is significant. So, it is the recent history of industry profitability, rather than

adjustment process the average number of plants is moving towards the equilibrium with more than 105 plants, if there is no external shock in between.

the immediately previous year's profitability, which exerts a significant effect. It is further noteworthy that the effect of past profit on entry has been accentuated after reform. It is particularly the dereservation aspect of reform, i.e. the withdrawal of the public sector monopoly, which has increased the effect of profitability, as is evident from its interaction with average profit. The total effect of profitability has nearly doubled after reform.

Capital intensity: The coefficient of the lagged capital labour ratio (Cap/Lab, $Lag1$) is negative and significant (at 6.9 percent). Increase in capital intensity will affect the number of factories in the following way. First, an increase in average capital intensity of an industry might be due to technology upgradation by some of the existing firms, or due to entry of more advanced technology endowed firms. This will force relatively inefficient plants to exit. Second, if existing firms are efficient and have higher capital intensity, then entrants must also acquire similarly capital-intensive technology. But higher fixed cost in itself reduces the scope of entry. If such technologies are profit enhancing, then their positive effect is captured by the profitability variable.

Unionisation: We also see that unionisation has a negative and significant impact on entry. If workers are more unionised, employers will face a loss in flexibility in organising their production, and this in turn will discourage entry. In a recent study of locational pattern of new investments in India, Chakravorty (2003) has blamed the militancy of unions for costing investment.

We also tried to examine any labour market rigidities by considering the effects of two central regulations, severance pay (in firms above 50 employees) and job-security (in firms above 100 employees) in two dummy variables, namely, $EmploymentSize1$ and $EmploymentSize2$, respectively. Both are negative, but their significance initially fails the 10 percent test. However, when we drop the union variable and instead interact it with the two dummy variables, we see that at least one dummy, namely $EmploymentSize1$, now becomes significant. We also witness that the union effect significantly varies across firm sizes. Specifically for industries in which average factory employment exceeds 100, the negative effect of unionisation is much stronger, nearly seven times the effect experienced by industries with average factory employment lying between 50 and 100. This suggests

that the rigid labour laws and regulations have hurt the entry prospects of large firms much more than that of smaller firms, and this effect might have worked through labour unions.

Labour unions' bargaining power: Another variable $WageShare$, which has been used as a proxy for unions' bargaining power, is also showing detrimental effect on entry.[19] So, we can possibly say that the bargaining power of the labour union acts as a negative signal to potential entrants, and an increase in labour unions bargaining power may also force some relatively inefficient existing plants to exit. However, the adverse impact of union's bargaining power is lower, about one-third, than that of unionisation. On an average, an increase in the union's bargaining power by 0.1 in year t will reduce the number of factory units by 0.5 percent in year $t + 1$, whereas the same amount of increase in unionisation will reduce the number of factory units by 1.5 percent.

Work environment: It is found that the coefficient of $AvgManLost$ (lag1) is negative and significant. This implies that existence of more hostile labour unions and/or less effective industrial dispute settlements induce existing factory units to exit and discourage potential entrants. In other words, better work environment has positive impact on the number of factory units. Here it is worth recalling that mandays lost from dispute have substantially declined after 1991. If this is a measure of regulatory success, then indeed it has facilitated greater entry.

Abolition of Licensing Policy: Since the licensing policy was a major barrier to entry, the removal/relaxation of this policy should lead to greater entry. Our empirical finding confirms this expectation. Moreover, it is worthy of emphasis that while most studies in the literature use a general dummy for 1991, we use a sequential industry-specific dummy, which should provide a more precise picture of the effects of de-licensing. Removal of licensing, as shown in Table 2, has led to about 3 percent increase in the logarithmic scale of the number of factories.

[19] It is conceded possible, however, that wage share may increase for other reasons than higher bargaining power, such as higher demand for labour, employment bias towards skilled labour, efficiency wage, and so on. Though, more research is needed to ascertain this, here we take the view that rigid labour laws have enabled the workers to take a hard stand against liberalisation, at least immediately after 1991.

Withdrawal of public sector monopoly: The positive and significant coefficient of '*Dereservation*' dummy implies that withdrawal of public sector monopoly has helped to increase the number of factory units in that industry. One possible avenue that has channelled this effect is the availability of investible funds in the private sector. By the end of 1980s, the Indian public sector began to wear a tired look. Shortage of funds plagued several industries that otherwise appeared attractive to private investors; but exclusive domain of public sector kept these investors away. Removal of such restrictions indeed prompted the private investors to enter.

Foreign technology transfer and equity holding: Surprisingly enough, deregulation of foreign capital and technology agreements has led to a reduction in the number of factories. Theoretically, this is not hard to understand. Foreign technology immediately confers a competitive advantage; but then many firms may not be able to succeed in getting foreign technology. And when they succeed, other entrants who has more traditional technology may stay away. However, we see that this effect, though negative, was not significant for Indian industries. Greater freedom on using foreign technology did not really trigger a significant effect on entry. Nor did foreign investors find the Indian industries more attractive after such deregulations were announced.

Many authors have argued that there exists positive spillovers from the available improved technological capital stock in the industry. That is, larger the disembodied technology imported to the industry, the higher would be the productivity growth of that industry. But it is also important to recognise the prospect of some inefficient firms leaving the industry in consequence of such technological upgrades. Perhaps our result is hinting at some story about the nexus between technology import, foreign direct investment and degree of market concentration.

Trade reform: Reductions in tariff rates after 1991 have reduced the number of factories. Trade reforms generally lead to two broad opposing effects. Greater export opportunities leads to greater entry of export-oriented firms, but increased import will also lead to exit of some inefficient firms, and will also discourage other eager (but inefficient) entrants. As we are unable to model these two effects separately, our results have to be read as the net effect

of trade reforms. Since both tariffs and non-tariff barriers were brought down, certainly imports became much easier, and their impacts would be more prominent. The net effect of tariff reduction, therefore, appears to be a reduction of entry predominantly because of another source of competition. The positive effect of export prospects on entry was clearly outweighed by the negative effect of a lower import price.[20] However, while the negative effect of trade reform is evident in the positive and significant sign of ERP, the removal of non-tariff barriers fails to be showing any significant effect, though the variable ICR bears a positive sign. This is not very surprising. Removal of non-tariff barriers will have its effects felt through introduction of new products, rather than by triggering an immediate price competition. Therefore, it may take long time for its effects to be significant.

7 Conclusion

We have investigated the impact of India's trade and industrial policy reform on the number of registered factories. An important aspect of our analysis is the incorporation of labour unions, work environment, and certain firm characteristics (notably size) that are subject of rigid labour regulations. We tried to study to what extent India's unreformed labour market poses a challenge to industrial reform. Before attempting a regression analysis, we present a theoretical model and show that after delicensing more entry should follow and wage is most likely to fall even with unchanged collective bargaining institutions. However, the latter may not always hold, if trade reform quickly follows. With increased import competition, the labour union adopts a compromising strategy by accepting wage cuts; but if the economy is also growing and if there is sufficient flow of entry, then this 'compromised or constrained wage' will actually grow with entry. This seems to be consistent with the empirical trend of wages after reform at least at the aggregate level.

In our econometric work we, however, concentrate on estimating a stock of factories equation, ignoring the wage relation found in our theoretical exercise. But we pay great

[20]There is some similarity of our findings with that Ramaswamy (1999), who has also found the adverse effect of ERP on entry. But his model has several limitations.

deal of attention to labour union variables, and also we have modelled the policy changes more carefully than previous researchers. Instead of giving a general liberalisation dummy in 1991, we introduced year- and industry-specific dummy variables to capture the sequential process of industrial reforms. Further, several aspects of industrial reforms are also modelled. Our data concern manufacturing industries (disaggregated at 3-digit level) from 1981-82 to 1997-98, which provide an almost equal balance between the time periods, before and after the initiation of reform.

We find that greater unionization and increased wage-share of the organised workers (which might have resulted from the absence of labour reform) have restricted the growth of the number of factories. On the other hand, industrial policy reform has had a favourable effect and promoted competition. In particular delicensing has had an overwhelming impact. But trade liberalisation has shown a negative impact on the number of factories. This suggests that trade reform has led more bankruptcy of inefficient domestic firms than it created new exporting firms. These results have been tested for robustness to several specifications.

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8 Appendix

8.1 Definitions of variables:

1. **Factory Unit**: A factory unit is one which is registered under sections 2m (i) and 2m (ii) of the Factories Act, 1948. The sections 2m (i) and 2m (ii) refer to any premises including the precincts thereof (a) whereon ten or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on with the aid of power, or is ordinarily carried on so; or (b) whereon twenty or more workers are working or were working on any day of the preceding twelve months and in any part of which a manufacturing process is being carried on without the aid of power, or is ordinarily carried on so.

2. **Profit**: Profit is the excess of net income over the cost of employees' compensation i.e. total emoluments and supplements to emoluments i.e. (i) contribution to provident and other funds, and (ii) workmen and staff welfare expenses. Net Income represents the factory shares of employees and entrepreneur in the value added and is obtained by deducting the rent paid and interest paid (as defined above) from the value added.

3. **AvgProfit**:
   $\text{AvgProfit} = \frac{total\ real\ profit\ in\ an\ industry\ (Base\ year\ 1981-82)}{number\ of\ factory\ units\ in\ that\ industry}$.

4. **Unionisation**:

   Unionisation $= \frac{Number\ of\ Trade\ Union\ Members}{Number\ of\ Workers}$.

   Statistics of trade unions' membership relate to the unions which have been registered under Indian Trade Unions Act, 1926. (Indian Labour Statistics 2000-2003, Government of India). Employees include all workers defined above and persons receiving wages and holding clerical or supervisory or managerial positions or engaged in administrative office, store keeping section and welfare section, sales department as also those engaged in purchase of raw materials etc. or production of fixed assets for the factory and watch and ward staff.

5. **Wage Share**: Wage Share $= \frac{Wages\ and\ Other\ Emoluments}{Net\ Income}$.

   Net Income represents the factory shares of employees and entrepreneur in the value added and is obtained by deducting the rent paid and interest paid from the value added (Rent Paid represents the amount of royalty paid in the nature of rent for the use of the fixed assets in the factory. Interest Paid includes all interest paid on factory account on loans, whether short term or long term, irrespective of the duration and the nature of agency from which the loan was taken. Interest paid to partners and proprietors on capital or loan are excluded).

   Wages and Other Emoluments includes all remuneration capable of being expressed in monetary terms and also payable more or less regularly in each pay period to workers as compensation for work done during the accounting year plus imputed value of benefits in kind.

6. **Capital/Labour**: It is Amount of fixed capital divided by the number of employees Fixed capital represents the depreciated value of fixed assets owned by the factory as on the closing day of the accounting year. Fixed assets are those, which have a normal productive life of more than one year.

7. **NoLicense**:

$$(NoLicense)_{it} = \begin{cases} 1, \text{if licensing is not compulsory in industry } i \text{ in year } t \\ 0, \text{otherwise} \end{cases}$$

8. **Dereservation**:

$$(Dereservation)_{it} = \begin{cases} 1, \text{if industry } i \text{ is not completely under public sector in year } t \\ 0, \text{if industry } i \text{ is completely under public sector in year } t \end{cases}$$

9. **FtechEquity**:

$$(FtechEquity)_{it} = \begin{cases} 1, \text{if industry } i \text{ has the approval of foreign technology aggreements} \\ \quad \text{and for 51 percent foreign equity in year } t \\ 0, \text{otherwise} \end{cases}$$

10. **ERP**:

    Letting b_{ijt} be the share of input i in the value of output j in year t, the ERP of industry j in year t is $ERP_{jt} = \frac{T_{jt} - \sum_i b_{ijt} T_{ijt}}{1 - \sum_{it} b_{ijt}}$, due to Corden (1966). That is, ERP is the percentage excess of domestic value added, vis-a-vis world value added, due to tariff barriers. When quantitative restrictions are the binding instrument of trade policy, which was effectively the case in India, tariff schedules are inadequate guides to protection. 'The nominal protection rate disregards the fact that the degree of protection conferred on an activity will depend not only on the any interventions which affect the price of the final good produced, but also by any interventions which affect the price paid for inputs into the production process' (Das, 2003). ERP over comes these shortcomings and that induces us to use ERP instead of nominal protection rates as a measure of protection to domestic industries due to tariffs.

    Das (2003) provides estimates of ERP for 3-digit industries for following phases: 1980-81 to 1985-86, 1986-87 to 1990-91, 1991-92 to 1994-95, and 1995-96 to 1996-97 to 1999-2000. We have used these average estimates of ERP and considered that average estimate of a particular time period as yearly estimates of that time period. For example, the average ERP of the period 1980-81 to 1985-86 has been considered as the ERP of 1981-82, 1982-83, 1984-85, and 1985-86. Since tariff rates has not changed dramatically during these five/four year time periods, average ERP is a good proxy for effective rate of protection.

11. **ICR**:

$$ICR_{it} = \frac{\sum_j D_{jt} M_{jt}}{\sum_j M_{jt}},$$

    where i stands for particular industry, j represents a product line within that particular industry i, and t represents year.

$$D_{jt} = \begin{cases} 1, \text{if the product is listed under R(banned/restricted, limited permisible, canalized)} \\ 0, \text{otherwise} \end{cases}$$

    Category R includes all products which are either banned or restricted or limited permissible or canalised to import. M_{jt} is the value of imports of the jth product in year t.

    Other measures of non-tariff barriers such as (i) frequency type measures, (ii) price comparison measures, (iii) quantity impact measures, (iv) the equivalent nominal rates of assistance suffers from aggregation problem.

12. **AvgManLost**: 'AvgManLost' defined as the total number of mandays lost per factory due to industrial disputes in an industry in a particular year

13. **EmploymentSize2**:

$$(EmploymentSize2)_{it} = \begin{cases} 1, \text{if number of employees per factory is greater than or equal} \\ \quad \text{to 100 in industry } i \text{ in year } t \\ 0, \text{otherwise} \end{cases}$$

14. **EmploymentSize1**:

$$(EmploymentSize1)_{it} = \begin{cases} 1, \text{if number of employees per factory is greater than or equal to 50, but less than 100, in industry } i \text{ in year } t \\ 0, \text{otherwise} \end{cases}$$

8.2 Estimation results: robustness analysis

Table 3: Explaining the number of factory units in manufacturing industries in India: GMM Estimates (Arellano and Bond, 1991) considering AvgProfit and AvgManLost as predetermined variables

Dependent Variable: ln(NFac)								
	(1)		**(2)**		**(3)**		**(4)**	
Explanatory Variables	Coefficients	p Values	Coefficients	p Values	Coefficients	p Values	Coefficients	p Values
$ln(NFac)$, $Lag1$	-0.406799	**0.000**	-0.408332	**0.000**	-.402948	**0.000**	-.355801	**0.007**
$AvgProfit$, $Lag1$(Rs. 10000000)	0.001307	0.896	0.001106	0.895	.000752	0.940	.004037	0.637
$AvgProfit$, $Lag2$ (,,)	0.022054	**0.000**	0.021670	**0.000**	.021428	**0.000**	.023291	**0.000**
$AvgProfit^*Dereservation$, $Lag1$(,,)					-.004214	0.429	-.003341	0.464
$AvgProfit^*Dereservation$, $Lag2$(,,)					.017787	**0.000**	.016508	**0.000**
Cap/Lab, $Lag1$(Rs. 10000000)	-3.076042	**0.004**	-3.419767	**0.000**	-5.072693	**0.004**	-4.084980	**0.006**
$Unionisation$, $Lag1$	-0.008935	**0.019**	-0.007976	**0.047**	-.007436	**0.052**		
$WageShare$, $Lag1$	-0.004061	**0.039**	-0.004263	**0.036**	-.003605	0.138	-.004399	**0.027**
$AvgManLost$, $Lag1$	-0.000022	**0.005**	-0.000023	**0.005**	-.000022	**0.009**	-.000021	**0.001**
$EmploymentSize2$			-0.297944	**0.094**	-.291495	**0.080**	-.105375	**0.067**
$EmploymentSize1$			-0.109869	0.107	-.099741	0.106	-.074835	**0.057**
$EmploymentSize2^*Unionisation$, $Lag1$							-.069261	**0.000**
$EmploymentSize1^*Unionisation$, $Lag1$							-.006321	0.220
$NoLicense$	0.029523	**0.012**	0.035266	**0.010**	.038396	**0.010**	.030457	**0.010**
$Dereservation$	0.019845	**0.050**	0.023943	**0.029**	.020130	**0.041**	.013802	**0.059**
$FtechEquity$	-0.017316	0.156	-0.015741	0.149	-.012084	0.126	-.012212	0.122
ERP (%)	0.000135	**0.041**	0.000123	**0.031**	.000158	**0.032**	.000173	**0.049**
ICR (%)	0.000117	0.196	0.000134	0.230	.000165	0.277	.000115	0.193
Number of Observations	739		739		739		739	
F	$F(12, 726) = 352.57$		$F(14, 724) = 364.12$		$F(16, 722) = 501.66$		$F(17, 721) = 1913.83$	
Serial Correlation(2)	$Prob > z = 0.2009$		$Prob > z = 0.1808$		$Prob > z = 0.183$		$Prob > z = 0.1637$	
Sargan	$Prob > \chi^2 = 0.9995$		$Prob > \chi^2 = 0.9995$		$Prob > \chi^2 = 0.9999$		$Prob > \chi^2 = 0.9999$	

Notes: Following Arellano and Bond (1991) the coefficients have been obtained by using GMM 2-step estimation and p-values from GMM 1-step estimation. F is the test statistics for overall significance test of the model ($Prob > F = 0.000$ in all the four cases). The Serial Correlation(2) test is an N(0,1) test for second-order serial correlation. Sargan is a chi-square test of the over identifying restrictions. These tests suggests that the model is overall significant, there is no serial correlation of order 2 and the instruments used for estimation are valid (In first two regressions, of which results are reported in columns (1) and (2), $ln(NFac)_{t-3}$, $ln(NFac)_{t-4}$, $ln(NFac)_{t-5}$, $(AvgProfit)_{t-2}$, $(AvgProfit)_{t-3}$, $(AvgManLost)_{t-2}$ and $(AvgManLost)_{t-3}$ were used as instruments; and in last two regressions $(AvgProfit^*Dereservation)_{t-2}$ and $(AvgProfit^*Dereservation)_{t-2}$ were used as additional instruments). Nominal variables are in 1981-82 prices.

8.3 Sample industries

Table 4: **List of 3-digit industries in the sample**

230	Cotton ginning, cleaning and bailing
231	Cotton spinning other than in mills (charkha)
232	Weaving and finishing of cotton khadi
233	Weaving and finishing of cotton textiles on handlooms
234	Weaving and finishing of cotton textiles on powerloom
235	Cotton spinning, weaving and processing in mills
236	Bleaching, dyeing and printing of cotton textiles
260	Manufacture of knitted or crocheted textile products
262	Embroidery work, zari work and making ornamental trimmings
263	Making of blankets, shawls, carpets, rugs and other similar textiles products
265	Manufacture of all types of textile garments and clothing accessories n.e.c (except by purely tailoring establishments) from not self-produced material (Note: in principle the raw material is cut and sewn together in the establishments covered in this group
267	Manufacture of made up textile articles; except apparel
268	Manufacture of waterproof textiles fabrics
269	Manufacture of textile/textile products n.e.c like linoleum, padding, wadding upholstering and filling etc.
290	Tanning, curing, finishing, embossing and japanning of leather
291	Manufacture of footwear (excl repair) except vulcanised or moulded rubber or plastic
292	Manufacture of wearing apparel of leather and substitutes of leather
293	Manufacture of consumer goods of leather and substitutes of leather other than apparel and footwear (excl. school bags and travelling accessories from water-proof textile materials)
299	Manufacture of leather and fur products n.e.c
300	Manufacture of industrial organic and inorganic chemicals other than those for Laboratory and technical uses
301	Manufacture of fertilisers and pesticides
302	Manufacture of plastics in primary forms; and, synthetic rubber
303	Manufacture of paints, varnishes and related products; artists colours and inks
304	Manufacture of drugs, medicines and allied products
305	Manufacture of perfumes, cosmetics, lotions, hair dressings, tooth pastes, soap in any form, detergents, shampoos, shaving products, washing and cleaning preparations and other toilet preparations.
306	Manufacture of man-made fibres
308	Manufacture of explosives, ammunition and fire-works
309	Manufacture of chemical products n.e.c
310	Tyre and tube industries
311	Manufacture of footwear made primarily of vulcanised or moulded rubber and plastics
312	Manufacture of rubber products n.e.c
313	Manufacture of plastic products n.e.c
314	Manufacture of refined petroleum products (e.g. liquid or gaseous fuel illuminating oils, lubricating oils, greases and similar products)
315 + 316	Bottling of Natural gas or liquified petroleum gas and Manufacture of refined petroleum products n.e.c (obtained from products or residues from petroleum refining)
318	Manufacture of coke oven products (e.g. coke and semi-coke from hard coal or lignite, retort carbon, and residual products)
319	Manufacture of coal-tar products and other coal products n.e.c
330	Manufacture of iron and steel in primary/self-finished forms
331	Manufacture of semi-finished iron and steel products in re-rolling mills, cold-rolling mills and wire-drawing mills
332	Manufacture of ferro alloys
333	Copper manufacturing
335	Aluminium manufacturing
336	Zinc manufacturing
338 + 339	Processing or Re-rolling of metal scraps except iron and steel scraps and Other non-ferrous metal industries
340	Manufacture of fabricated structural metal products
341	Manufacture of fabricated metal products n.e.c
342	Manufacture of furniture and fixtures primarily of metal
343	Manufacture of hand tools, weights and measures and general hardware
346	Manufacture of metal cutlery, utensils and kitchenware
349	Manufacture of metal products (except machinery and equipment) n.e.c
350	Manufacture of agricultural machinery and equipment and parts thereof
351	Manufacture of machinery or equipment used by construction and mining industries
352	Manufacture of prime movers, boilers, steam generating plants and nuclear reactors

353	Manufacture of industrial machinery for food and textile industry (incl. bottling and filling machinery)
354	Manufacture of industrial machinery except for food and textile industry
355	Manufacture of refrigerators, air conditioners and fire fighting equipment and their parts and accessories
356	Manufacture of general purpose non-electrical machinery/equipment, their components and accessories n.e.c
357	Manufacture of machine tools, their parts and accessories
358	Manufacture of office computing and accounting machinery and parts (excl. manufacture of computers and computer based systems incl. word processors)
359	Manufacture of special purpose machinery/equipment, their components and accessories n.e.c
360	Manufacture of electrical industrial machinery, apparatus and parts thereof
361	Manufacture of insulated wires and cables, incl. manufacture of optical fibre cables
362	Manufacture of accumulators, primary cells, and primary batteries
363 + 364	Manufacture of electric lamps and Manufacture of electric fans and electric or electro-thermic domestic appliances and parts thereof
365 + 366	Manufacture of apparatus for radio broadcasting, television transmission, radar apparatus, radio-remote control apparatus and apparatus for radio or line telephony and line telegraphy and Manufacture of television receivers, apparatus for radio broadcasting, radio telephony or telegraphy; video recording or reproducing, record or cassette players and other sound recording or reproducing apparatus as microphones, loudspeakers, amplifiers etc.
368	Manufacture of electronic valves and tubes and other electronic components n.e.c
369	Manufacture of radiographic X ray apparatus, X-ray tubes and parts and electrical equipment n.e.c
370	Ship and boat building
371	Manufacture of locomotive and parts
372	Manufacture of railway or tramway wagons and coaches and other rail road equipment
373 + 374	Manufacture of heavy motor vehicles; coach works and Manufacture of motor cars and other motor vehicles principally designed for the transport of less than 10 persons (incl. Manufacture of racing cars and golf-cars etc.)
375	Manufacture of motor cycles and scooter and parts (incl. three wheels)
376	Manufacture of bicycles, cycle-rickshaws and parts thereof
377	Manufacture of aircraft, spacecraft, and their parts

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