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Trade openness, labour institutions and flexibilisation: theory and evidence from India

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Abstract

There has been increasing 'flexibilisation', in the formal labour markets of both developed and developing countries. Labour institutions and globalisation are often taken to be causally related to this phenomenon, but the evidence remains inconclusive. In India, there has been an increasing use of temporary workers employed through contractors (contract workers), who are not represented by trade unions and who do not fall under the purview of the labour laws that are applicable to directly employed workers (formal workers) in formal labour markets. We develop a model of labour demand where firms choose a mix of contract workers and formal workers, rather than formal workers alone. Then we test the model using state-industry-year panel data for Indian manufacturing from 1998 to 2005. We find that both pro-worker labour institutions and increased import penetration lead to greater use of contract labour in Indian manufacturing.

Keywords: flexibilisation, informalisation, contract workers, trade, labour institutions, India

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1. Introduction

A recent feature of labour markets in both developing and developed countries has been a shift in the hiring practice of formal sector firms in favour of informal workers outside the purview of trade unions and employment protection laws (ILO, 2002; IMF, 2010).[1] This phenomenon, known as 'flexibilisation' of labour, has given rise to some significant concerns. There is a fear that this might affect the welfare of the permanent workers and lead to increasing vulnerability of the workforce in developing countries (WTO, 2009). Moreover, since this trend has coincided with trade reforms around the world, one might wonder whether this is an unintended outcome of the trade reforms themselves.

Intuitively, import competition may force firms to seek short-run efficiency by resorting to low-wage employment. On the other hand, firms mindful of long-run efficiency or concerned about quality improvement (a key issue for exporting firms) may invest in productivity improvement of the regular workers. Currie and Harrison (1997) observed that Moroccan (private sector) firms responded to trade and labour reforms by trying to improve productivity rather than resorting to low-wage employment; and only the state-owned firms increased low-wage employment. Goldberg and Pavnik (2003) also noted that in Brazil trade reform did not lead to informality of employment, while in Colombia there was some evidence of it, and that too for a period prior to labour market reform. Thus, as far as informal employment is concerned, these studies suggest that the rigidity of labour institutions are more to be blamed than trade policy – a view shared by many other authors (see Botero *et al*., 2004; Djankov and Ramalho, 2009). This has not gone unchallenged, however, and the debate is far from over.[2] Empirically, it is also a challenge to separate the effects of trade reform from those of labour reforms, because these two reforms are generally concurrent.

In this paper, we analyse the determinants of the firm's choice between formal workers, who are represented by trade unions and are on long-term contracts with their employers, and informal workers, who are employed on a casual basis and do not benefit from representation by a trade union. We focus on the role of trade openness and labour institutions in determining this choice. Our empirical context is India, where there has been a sharp rise in the share of informal workers in the total employment of the formal manufacturing sector, from 12 percent in 1985 to 26 percent in 2004 (NCEUS, 2007). Indian labour laws are one of the most restrictive in the world and have remained largely unchanged (Dougherty, 2009), giving rise to a high degree of trade union activity (Panagariya, 2008). These laws are mostly applicable to firms in the formal sector in India, and differ greatly across Indian states. While workers directly employed by formal sector firms through

[1] The IMF reports that this trend has intensified among developed countries in the last two years, with recession and financial crisis (see IMF, 2010: 8-9).

[2] In a survey article Djankov and Ramalho (2009) find that developing countries with rigid employment laws tend to have larger informal sectors. This finding has been disputed by ILO (2002). With respect to international trade, in a systematic review of the literature on the relationship between trade and informality, WTO (2009) finds that the available evidence does not allow any general conclusions on the effects of trade opening on informality. It should be noted that the question we address in this paper is more specific than much of the previous literature – we are interested in whether trade openness and labour institutions are causally related to the phenomenon of flexibilisation of the formal labour market; we do not explore the link between trade, labour institutions and informality across the entire economy.

long-term contracts are represented in large part by trade unions, and fall under the ambit of employment protection laws (we call these workers interchangeably *formal* or *regular workers*), workers who firms employ via an intermediary (a contractor) do not (we call these workers interchangeably *informal* or *contract workers*).[3]

India has also witnessed rapid trade liberalisation since 1991, with trade openness increasing from 16 percent in 1990 to 25 percent in 2005.[4] The trade reforms were particularly targeted on the manufacturing sector, which was among the most protected in the developing world prior to the 1990s (Bhagwati and Srinivasan, 1975). In the mid-1980s, there was a move from quotas to tariffs, followed by a significant reduction in tariffs and the removal of quotas on all imports since the early 1990s (Sen, 2009). The opening up of the Indian manufacturing sector in the post-1990s, and the subsequent variation in trade openness across industries and over time, along with the variation in labour institutions across Indian states, offers a unique empirical context in which to examine the effects of trade openness and labour institutions on the flexibilisation of formal labour markets in developing countries, using India as a case-study.

There is an existing literature that has studied the impact of trade reforms and labour institutions on manufacturing outcomes in India. Among them, notably Hasan *et a.l* (2007) find that trade reform has had a significantly positive impact on labour demand; but the impacts have varied between different Indian states, depending on the rigidity of local labour institutions – the greater the rigidity, the lower the impact. Variations in state-level labour institutions have also been studied by Besley and Burgess (2004) and Aghion *et al.* (2008). Besley and Burgess (2004) find that states with pro-worker labour laws have seen a slower growth in industrial output and formal employment; in fact, pro-worker legislations caused a substitution away from formal to informal employment and output. Aghion *et al.* (2008) go further, to show that pro-worker states benefited less from the industrial reforms launched in 1991.

However, none of these studies has focussed on informality of employment in the formal sector, which is the key concern of our paper. We ask: can trade openness and labour institutions explain the recent increase in the informalisation of formal labour markets? The question is important, simply for the fact that there has been very little formal analysis on it, though a large literature has studied the determinants of informal employment in general (see for instance, Azuma and Grossman, 2002; Dabla-Norris et al., 2008; and Ulyssea, 2010), and a relatively small literature also addressed the problem of outsourcing of formal sector activity to the informal sector (see Ramaswamy, 1999). But less attention has been paid to the question of why a formal sector firm might choose to hire workers on two parallel tracks – one through the regular route, conforming to standard labour regulations including collective bargaining, and the other through a 'contract' route – when it is known that workers who will be willing to come through the 'contract' route are also likely to be less productive.

[3] It should be noted that the majority of workers in India are in the informal sector, and so when we refer to informal workers in this paper, we are only restricting ourselves to those employed in the formal sector. The question of what determines the size of the informal sector is a different question to the one addressed in this paper, and is not our focus here.

[4] Trade openness is defined as exports plus imports as a ratio of GDP.

Goldberg and Pavnik (2003) have offered an explanation based on the employment adjustment costs that firms might need to incur due to trade uncertainty and differential monitoring costs between two types of workers, who are otherwise equally productive. While their model suits the economies of Brazil and Colombia well, we feel a different argument may be needed for India, especially because of the unchanged labour laws and the importance of labour unions.

We put forward a model where regular workers have superior productivity, job protection and union support, so that they enjoy a rent over and above their opportunity cost. On the other hand, contract workers (whom we might interchangeably call informal workers) have lower productivity, no job protection and no union backing. They are paid less, but nevertheless they prefer to be in a formal sector firm than in the informal sector (for a variety of reasons). This willingness allows firms to offer them just the minimum wage. But, crucially, these workers provide an alternative force, which the firm uses to its strategic advantage against its unionised regular workers, in order to keep their wage demand in check. This is the key difference between our argument and the monitoring cost argument of Goldberg and Pavnik (2003).[5]

In our model, firms do not want to completely switch to informal employment, because the productivity of contract workers is lower (especially in modern firms). But they also do not want to hire only regular workers, because the consequent wage cost will be too high. A middle ground is optimal, as it balances the marginal loss in productivity with the marginal gains in reducing the unionised wage. Import liberalisation in this setup has a tendency to make the contract labour behave like an *inferior* input – its employment can go up when the price of the product falls. Employment of the regular workers will fall. But there is a countervailing effect as well; through a reduction in the wage rate of the regular workers, employment of the regular workers might get a boost and will in turn tend to discourage contract employment. The final effects (after taking the wage change into consideration) can go either way. Nevertheless, it can be ascertained that if the final effect of import penetration on the *level* of contract employment is positive (i.e. the contract labour acting like an inferior input), then the *share* of contract employment will also rise. The argument is symmetric (and will run in the opposite direction) for greater export orientation; in addition, for export quality maintenance can be an issue and that might encourage a reduction in informality. Finally, greater bargaining power of the regular workers will lead to higher wages for them, and in turn can encourage substitution in favour of informal workers.

We take these theoretical predictions of our model to the data, and examine the determinants of contract labour usage, using a three-dimensional panel of 58 industries over the period 1998 to 2004 for 15 major Indian states. We find that import penetration increases the share of informal employment in formal firms. In contrast, export orientation does not affect informality. Pro-worker labour institutions also increase the share of informal employment, and greater bargaining power of formal workers increases informality in employment.

[5] In their model, both types of workers are equally productive, but they vary in monitoring costs; in addition, firms face uncertainty. Informal employment allows firms to optimally adjust to random shocks. But our argument does not depend on uncertainty; if the regular workers had no bargaining power, the firm would not be hiring any informal workers in our model.

The remainder of the paper is in five parts. In the next section, we provide a brief introduction to the Indian labour market. We then develop our theoretical model in Section 3. Section 4 proposes the methodology for the empirical analysis, describes the data, and provides a discussion of some of the variables used. Section 5 discusses the econometric results. Section 6 concludes.

2. Indian labour market

The Indian labour market is highly segmented, with only 20 percent of all manufacturing workers employed in the formal sector.[6] The formal sector jobs, if employed in the regular category (generally called 'permanent' category), come with job security rendered by some of the most protective employment legislations in the developing world. A large proportion of regular workers are also members of trade unions, and they are able to collectively negotiate wage and working conditions.[7] In general, they extract significantly higher remunerations than those workers who are employed on short-term contracts and who do not have access to employment protection legislation (Karan and Selvaraj, 2008).

Contract workers are often employed through intermediaries, or employed directly by the firm itself, but on a very short-term basis, without any commensurate benefits that are rendered to their 'regular' colleagues within the same firm. The National Commission on Enterprises in the Unorganised Sector (NCEUS) set up by the Government of India estimated that 20.4 percent of informal workers in the urban formal sector were in poverty, just as 20.1 percent of informal sector workers were in poverty.[8] In contrast, only 4.3 percent of regular workers were estimated to be poor. NCEUS also found that 40 percent of contract workers had very low education (primary schooling and less), as compared to only 23 percent of regular workers. Thus, there seems to be a clear skill gap between the two types of employees – an observation that will be incorporated in our theoretical model in the next section.

Industrial relations in India fall under the joint jurisdiction of the central and state governments. The key piece of central legislation in industrial relations is the Industrial Disputes Act (IDA) of 1947, which sets out the conciliation, arbitration and adjudication procedures to be followed in the case of an industrial dispute. The IDA applies only to 'permanent' workers directly employed by formal sector firms, and not to workers supplied by contractors (intermediaries) or workers employed on a 'temporary' basis. The IDA specifies a multi-tier conciliation-cum-adjudication system, where the tiers are created and maintained by state governments. For this purpose, each state has amended the regulation many times since 1947 (particularly its details and operational aspects) in response

[6] By the formal sector, we mean the organised or registered sector in Indian manufacturing, where firms with 10 workers or more that use electricity, and 20 workers or more that do not use electricity, are required to register under the Factories Act of 1948. Formal sector firms with 100 or more workers fall under the purview of employment protection laws.

[7] An estimated 60 to 70 percent of regular workers in large-scale enterprises in the private sector are members of trade unions (Papola *et al*., 2008).

[8] The Commission's definition of informal workers in the formal sector includes both contract workers and other casual workers.

to their local conditions. Because of that there has emerged a natural variation of the IDA across the states, which has been the subject of several studies, such as Besley and Burgess (2004). In general, across all states IDA imposes significant restrictions on employers regarding layoff, retrenchment and closure.[9] As a consequence, India's labour laws earned notoriety for being among the most restrictive in the world, especially on the question of retrenchment. According to the rigidity of employment index proposed by the World Bank, which is a summary indicator of different aspects of labour legislation across countries, Indian labour laws are more protective than the international average or an average of a group of comparator countries composed of large developing countries and countries in East and South Asia (Ahsan, Pages and Roy, 2008).

While that is the level of protection enjoyed by regular workers, there is very little regulation for contract and temporary workers. There is, however, some legislation that aims to regulate their health and safety conditions. This legislation, known as the Contract Labour (Regulation and Abolition) Act of 1970, also provides for pension coverage and stipulated minimum wages for contract workers. This is seen as a significant premium over their counterparts in the informal sector, who have neither any pension provision nor any health and safety protection. On one count, though, both have a common fate – they can be dismissed at will; they are not protected by the IDA.

3. The model

Consider a set of identical firms, which use a mix of two types of employees differing in both wage and productivity. The higher wage workers are skilled and unionised; their wage is determined through firm-union bargaining. We refer to them as 'regular' workers, l_R. The lower wage workers are not unionised; they are also less skilled and their wage is equal to the (exogenously given) minimum wage. We call them 'contract' workers, l_C.[10]

The firms are generally price takers in all input and output markets, except in the market for regular labour. Each firm faces a firm-specific union, with which it negotiates the wage for regular workers. We focus on a representative firm, and capture its interaction with the union, as well as its input choice, via a stylised two-stage game. In the first stage of the game, the firm and its union negotiate the wage; then, in the second stage, the firm unilaterally decides how many regular and contract workers are to be hired. Potentially, it can hire only regular workers, or only contract workers; but the most interesting case is that of mixed employment.

In the firm's employment decision, the contract workers present a cheaper alternative; but they also present a trade-off for being less skilled. The skill difference, we assume, occurs on two

[9] Under Chapter VB of the IDA, labour courts and tribunals can set aside any discharge or dismissal referred to them as not justified. In units employing more than 100 workers, retrenchment requires seeking authorisation from the state government and this authorisation is rarely granted.

[10] As we have noted, in the Indian context, the difference between the regular and contract workers boils down to security of tenure and union rights. Since, in a static model, job security cannot be suitably modelled, we restrict our attention only to union rights and power of wage negotiation.

dimensions. Firstly, one unit of contract labour adds less to the firm's total output than one unit of regular labour. Secondly, greater use of contract labour reduces the marginal product of capital, while the opposite is true for regular labour.[11] It is reasonable to assume that unskilled workers are not only unfamiliar with, but also ill-suited to, modern technology. Regular workers here have a clear edge for having the necessary training and knowledge; however, institutional provisions of job security and union rights also enable them to extract a wage premium, and it is in this respect that the firm will use the contract workers as a strategic alternative. This, as we show later, turns out to be a strategy to keep the regular workers' wage demands in check.

The production technology of the firm is given by $y=F(l_C,l_R,k)$, where

$$\begin{aligned} F(l_C,l_R,k) &= f(k,l_R)+g(\gamma l_R+l_C)+a(l_C)k \qquad if \qquad l_C,l_R>0 \\ &= g(l_C)+a(l_C)k \qquad if \qquad l_R=0, \\ &= f(k,l_R)+g(\gamma l_R)+\bar{a}k \qquad if \qquad l_C=0. \end{aligned} \tag{1}$$

We assume that l_C and l_R are (imperfect) substitutes for each other. The direct skill difference between them is captured by γ(>1). g(.) captures the total contribution of labour when it is measured in the contract labour unit. Furthermore, production is possible with only one type of labour, and capital is better utilised in conjunction with regular labour. The following assumptions formalise these ideas, as well as imposing standard properties on F(.).

A1: (i) $g(.)$ is increasing and strictly concave.
(ii) $f(k,l_R)$ is increasing and strictly concave in k (i.e. $f_{11}<0$).
(iii) $f_{21}(.)>0$; $f_{22}=0$.
(iv) $a(.)$ is a decreasing function of l_C , i.e. $a'(l_C)< 0$; $a''(l_C)<0$, and in particular $a(0)=\bar{a}<\infty$.
(v) $F_1= a'(.)\,k+g'(.)> 0$ at some (finite) l_C, given k,l_R.

Assumptions (i) and (ii) are fairly standard. Assumption (iii) specifies complementarity between capital and regular labour ($F_{23}=f_{12}>0$). $f_{22}(.)=0$ is a simplifying assumption.[12] Assumption (iv) specifies substitutability between contract labour and capital; declining a(.) implies $F_{13}=a'(l\ )<0$. Further, $a''(.)<0$ implies that the absolute value of F_{13} increases with further employment of contract labour. The second part of (iv) states that, by withdrawing contract labour, the marginal productivity of capital can be raised only up to a finite level.[13] Assumption (v) says that contract labour is inferior, but not 'too inferior'. Marginal product of contract labour is strictly positive at some level of

[11] While we assume that skilled and regular workers are synonymous, we can relax this assumption at the cost of some complexity, and allow some regular workers to be less skilled and some contract workers to be equally highly skilled. Our results will not change in this case.
[12] This is to ensure that the second order effect of l_R on output is manifested mainly via the function g(.); $F_{22}= g''(.)\gamma^2<0$.
[13] Note that in (1) when $l_C=0$ the function g(.) still involves γ even if no contract labour is used. The reason is that the domain of the function g(.) is defined in the unit of contract labour .

l_C; $a'<0$, but ($g'+a'k$) can still be positive. However, $F_{12} = g''(.)\gamma < 0$ and $F_{13}=a'(.)<0$. That is, contract labour is substitute for both the regular labour and capital.

The wage of the regular workers, denoted as w_R, is determined through firm-union negotiation, while the firm unilaterally sets employment. This is known as right-to-manage bargaining (Oswald, 1982).[14] We model the wage negotiation as a generalised Nash bargaining problem. The bargaining power of the union is exogenously given by α and the bargaining power of the firm by (1- α), $0 \le \alpha \le 1$.[15] At the bargaining stage, both the firm and the union act as price takers, vis-à-vis other input prices and the output price p. The union tries to maximise the net wage bill,

$u = (w_R - \gamma w_C) l_R$,

where γw_C is the wage for the skilled workers that they can get from the outside market. In the event of disagreement in bargaining, both parties receive a zero payoff.[16]

3.1 Employment choice

We solve the game by backward induction, by considering the firm's employment choice first, which occurs in the second stage of the game. For the sake of simplicity and sharpness of analysis, we focus only on the short-run case, assuming k is fixed. The general case of k being variable is provided in the Appendix.

Given $w_R (>w_C)$ from the first stage of the game and the product price p, which we assume to depend on the export and import opportunities, the firm maximises profit

$$\pi = p\left[a(.)k + g(\gamma l_R + l_C) + f(k, l_R)\right] - w_R l_R - w_C l_C - rk \qquad (2)$$

by solving the following first order conditions:

$$\frac{\partial \pi}{\partial l_C} = p\left[a'(l_C)k + g'(.)\right] - w_C = 0 \qquad (3)$$

$$\frac{\partial \pi}{\partial l_R} = p\left[g'(.)\gamma + f_2\right] - w_R = 0 \qquad (4)$$

[14] There are other models of wage determinations; see McDonald and Solow (1981) for efficient bargaining. However, in the Indian case, right-to-manage bargaining is more plausible, as firms cannot easily reduce employment of regular workers, even if they wanted to, given the prevailing employment protection legislation.

[15] One may note that the unions need not be the same across firms. They may vary in terms of their objective function, size and bargaining power. One can easily allow for such differences.

[16] The firm's disagreement payoff can be negative, considering exit costs typically suffered by Indian firms. Wage bargaining compounds the exit cost, very much the way Grout (1984) argued long ago. Some of the costs can be mitigated by hiring contract workers as a fall-back option. We, however, do not go into such issues.

From (3) and (4) we obtain the following equation, specifying the optimal mix of regular and contract workers:

$$w_R - \gamma w_C = p\left[f_2 - a'(l_C)k\gamma\right]. \qquad (5)$$

The marginal contribution of the regular labour is measured by its direct contribution f_2 plus the loss avoided by not hiring (an incremental unit of) the contract labour, $a'k$. This total marginal contribution must be equal to the effective wage premium paid to the regular workers.[17]

The second order condition for profit maximisation easily holds. This condition requires,

$\Delta_1 = p(a''k+g'')<0$, and $\Delta_2 = p^2 a'' g'' k\gamma^2 > 0$.

Equations (3) and (4) implicitly give the labour demand functions, $l_C = l_C(w_R, p)$, $l_R = l_R(w_R, p)$. From (3) and (4), we obtain the following:

$$\frac{\partial l_R}{\partial w_R} = \frac{p(a''k + g'')}{\Delta_2} = \frac{1}{pg''\gamma^2} + \frac{1}{pa''\gamma^2 k} < 0. \qquad (6)$$

$$\frac{\partial l_C}{\partial p} = \frac{g''\gamma\{w_R - \gamma w_C\}}{\Delta_2} = \frac{(w_R - \gamma w_C)}{p^2 a''\gamma k} < 0 \qquad (7)$$

$$\frac{\partial l_R}{\partial p} = -\frac{1}{\Delta_2}\left[g''\gamma\{w_R - \gamma w_C\} + a''k(w_R)\right] = -\frac{(w_R - \gamma w_C)}{p^2 a''\gamma^2} - \frac{w_R}{p^2 g''\gamma^2} > 0. \qquad (8)$$

That is, two types of labour are substitutes, and contract labour is an inferior input. With a decrease in p (signifying import penetration), employment of the contract labour will rise, while employment of regular labour will fall (as is expected from a normal input). This may continue to hold, even if we allow capital to be adjusted, which we show in Appendix. But nevertheless this is conditional on holding w_R fixed. In the overall game w_R will not remain unchanged if p changes. So eqs. (7) and (8) capture only the direct effects of p on labour demand. There are indirect effects as well, for which we need to solve the wage bargaining problem. In the following proposition, we summarise the results obtained so far.

Proposition 1: *When contract labour reduces the marginal product of capital, it will be an inferior input, at least in the short run. Given the wage rates of the two types of workers, if the output price falls (for instance, due to import penetration), the employment of contract workers will rise and the employment of regular workers will fall.*

[17] It can be seen that wage premium is positive, even if $a'(.)>0$, as long as $f_2 > a'(.)k\gamma$.

3.2 Wage bargaining

Now we turn our attention to wage bargaining occurring at the first stage of the game. As was speculated earlier, it is precisely for the purpose of bargaining, that employment of contract labour may prove beneficial. By hiring a part of the workforce from the pool of contract workers, the firm employs fewer regular workers, and anticipating this, the union accepts a lower wage at the wage negotiation stage.[18]

Before we set out to solve the bargaining problem, let us note that from stage 2 of the game the firm will earn $\pi(w_R,p)$ = Max $\left[pF(l_C(.),l_R(.),k)-w_C l_C(.)-w_R l_R(.)-rk\right]$ by employing the two types of labour. The union will earn $u=\left[w_R-\gamma w_C\right]l_R(w_R,p)$. At stage 1 these are perfectly anticipated.

The bargaining problem is solved by choosing w_R to maximise the following:

$$z=\left[(w_R-\gamma w_C)l_R(w_R,p)\right]^{\alpha}\left[\pi(w_R,p)\right]^{(1-\alpha)}.$$

The first order condition is[19]

$$\frac{\partial z}{\partial w_R}=\alpha\pi(1+\varepsilon)-(1-\alpha)(w_R-\gamma w_C)l_R=0. \qquad (9)$$

Here $\varepsilon=\frac{(w_R-w_C)}{l_R}\frac{\partial l_R}{\partial w_R}$ (<0) represents the wage elasticity of the demand for regular labour. Since π and ε are functions of w_R and p, and p is a parameter, we rewrite (9) as

$$\alpha A(w_R;p)-(1-\alpha)(w_R-\gamma w_C)=0, \qquad (9.a)$$

where $A(w_R;p)=\pi(1+\varepsilon)/l_R$. From (9.a) we see that the gap between w_R and γw_C depends on the magnitudes of $A(.)$ and α. In particular, if α=0, (i.e. union has no bargaining power) then eq. (9.a) dictates that $w_R = \gamma w_C$. On the other hand, if α=1 (i.e. union has all the bargaining power), then by eq. (9.a) we should have $A(.)$=0. This gives rise to a w_R that sets $(1+\varepsilon)$=0, or ε=-1. This simply

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[18] From the game theoretic point of view it remains an issue how to make the threat of hiring contract labour credible. One solution is to choose the amount of contract labour before the wage negotiation. Another solution is to make the firm commit to an employment agency to hire contract workers later on. In the model we avoid these issues for simplification.

[19] The first order condition is $u^{\alpha-1}(\pi(.)-\pi_C)^{-\alpha}\left[\alpha(\pi(.)-\pi_C)l_R\{1+\varepsilon\}+(1-\alpha)u\frac{\partial\pi(.)}{\partial w_R}\right]=0$. Since by the envelope theorem we have $\frac{\partial\pi}{\partial w_R}=-l_R$ and by the solution to bargaining $\pi(.)$ must exceed π_C, the first order condition reduces to equation (9).

corresponds to the case of maximising the union's net wage bill. Let us denote this wage as w_R^M. This is the highest wage the union can expect. So, in the general case, the bargained wage, $w_R^*(p,\alpha)$, must be such that $|\varepsilon|<1$ (i.e. $1+\varepsilon>0$), and it will lie between γw_C and w_R^M, i.e. $w_R^* \in [\gamma w_C, w_R^M]$ in such a manner that the ratio of the two parties' payoffs will be proportional to the ratio of their bargaining powers.

To derive further results, we now make the following regularity assumptions:

A2: A(.) is strictly decreasing in w_R at all $w_R \in [\gamma w_C, w_R^M]$.

A3: $w_R^*(p,\alpha)$ will vary positively with w_R^M.

Assumption **A2** ensures that the second order condition is satisfied. Assumption **A3** says that if the union's highest possible wage has risen (due to, say, some favourable outside conditions), then its bargained wage should also rise. This is a regularity property commonly shared by all bargaining models.[20]

Now the following results can be immediately established regarding the effects of p and α. Denote these two parameters by μ, and differentiate eq. (9.a) with respect to μ, which gives:

$$\frac{\partial^2 z}{\partial w_R^2}\frac{\partial w_R}{\partial \mu} + \frac{\partial^2 z}{\partial w_R \partial \mu} = 0 .$$

Now writing $\mu=p$ and α respectively, and noting that

$$\frac{\partial^2 z}{\partial w_R^2} = \alpha A'(w_R) - (1-\alpha) < 0 \quad \text{(by } \mathbf{A2}\text{)},$$

we arrive at

$$\frac{\partial w_R^*}{\partial p} = -\frac{\alpha F(.)(1+\varepsilon)}{l_R[\alpha A'(w_R) - (1-\alpha)]} > 0 \qquad (10)$$

$$\frac{\partial w_R^*}{\partial \alpha} = -\frac{A(.) + (w_R - \gamma w_C)}{[\alpha A'(w_R) - (1-\alpha)]} > 0 . \qquad (11)$$

That is, with import penetration (i.e. a decrease in p) the bargaining wage should fall; this is because the demand for regular labour will fall and that will force a reduction in the wage. On the other hand, if the worker's bargaining power increases, then the bargained wage will rise.

[20] One can establish this formally with some effort for the general case, and without any difficulty for special cases like Cobb-Douglas production functions.

In Figures 1a and 1b below we have depicted the bargaining solution for a given α at point *E*, and then shown how this solution would change (point *E*'), in Figure 1a if α increases, and in Figure 1b if *p* increases. As specified in the assumption **A2**, A(.) is a declining curve in w_R. It starts from a positive number when $w_R=\gamma w_C$, and then reaches zero when $w_R=w_R^M$. At point E, equation (9.a) is satisfied, and thus w_R^* becomes the solution. Now if α rises, both the αA(.) and $(1-\alpha)[w_R-\gamma w_C]$ curves shift; but the former shifts upward, while the latter shifts downward, and hence we arrive at point *E*', which corresponds to a higher wage rate. In Figure 1b, we show that if *p* increases, on the other hand, only the aA(.) curve will shift out and this will cause not only the bargained wage to rise, but also w_R^M to increase.

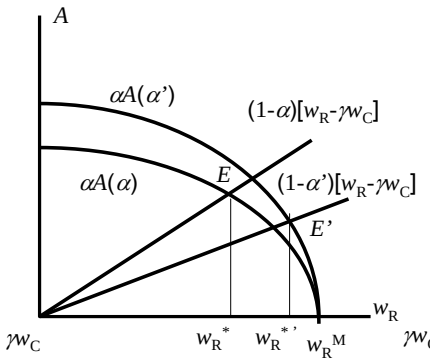

Fig. 1a: Effect of α

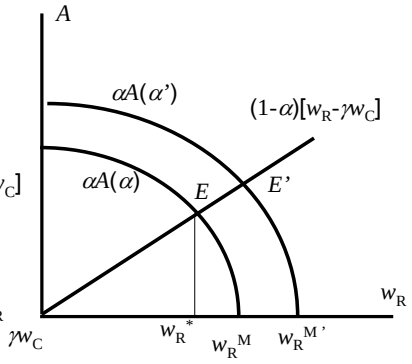

Fig. 1b: Effect of p

Benchmark case: Now we ask: how does w_R^* compare with w_R in the benchmark case where the firm does not hire contract labour at all? To answer this, let us assume that l_C is exogenously fixed (which we can suitably set at any values, including zero), and the stage-two demand for regular labour is given by equation (4), which we write as $l_R(w_R,p;l_C)$. One can easily establish that

$$\partial l_R / \partial l_C = -pg''(.)\gamma / \pi''(l_R) < 0 .$$

Now, coming to the wage bargaining stage, we note that the highest preferred wage for the union is (as before) w_R^M that maximises $u= [w_R-\gamma w_C]\, l_R(w_R,p;l_C)$. The first-order-condition for maximisation is

$$u'(w_R) = l_R(w_R, p; l_C) + (w_R - \gamma w_C)(\partial l_R / \partial w_R) = 0 .$$

This equation implicitly solves for the wage w_R^M as $w_R^M(l_C)$. How does w_R^M change with l_C? For this, differentiate the above equation by l_C, and obtain

$$u''(w_R)\frac{\partial w_R^M}{\partial l_C}+\frac{\partial l_R}{\partial l_C}+(w_R-\gamma w_C)\frac{\partial^2 l_R}{\partial w_R \partial l_C}=0.$$

In the above u''(.)<0 from the second order condition, and assume $\frac{\partial^2 l_R}{\partial w_R \partial l_C}\approx 0$ for simplicity. Then we obtain: $\frac{\partial w_R^M}{\partial l_C}=-\frac{\partial l_R}{\partial l_C}\times\frac{1}{u''(w_R)}<0$. Since this result holds at any arbitrary l_C and the above derivative is continuous, it will also hold at l_C=0. That is to say, if the firm did not hire any contract workers at all, the wage set by the all-powerful monopoly union would be much higher than it would be if some contract workers were hired. Now, by assumption **A3**, in the no contract labour case for any given 0<□<1, the negotiated wage must also be higher (because w_R^M is itself higher). This completes our answer.

Proposition 2: *w_R^* is increasing in the (regular) workers' bargaining power and the product price. Compared to the benchmark case where the firm does not hire contract workers, the bargained wage w_R^* will be lower (provided α>0).*

Now, returning to the case of mixed employment, let us examine the *total* effect of an increase in *p* on the employment of regular and contract workers. Now that w_R is a function of *p* and *α*, i.e. $w_R^*=w_R(p,\alpha)$, we write the labour demand functions as $l_C=l_C(w_R(p,\alpha),p)$ and $l_R=l_R(w_R(p,\alpha),p)$.

Differentiating the demand functions with respect to *p* we get

$$\frac{dl_C}{dp}=\frac{\partial l_C}{\partial w_R}\frac{\partial w_R}{\partial p}+\frac{\partial l_C}{\partial p} \qquad (12.a)$$
$$\quad +\quad +\quad -$$

$$\frac{dl_R}{dp}=\frac{\partial l_R}{\partial w_R}\frac{\partial w_R}{\partial p}+\frac{\partial l_R}{\partial p}. \qquad (12.b)$$
$$\quad -\quad +\quad +$$

As can be seen, the signs of both the effects are ambiguous. The direct effects are given by equations (8.a) and (8.b); but the indirect effects, occurring via w_R, go in the opposite directions. Therefore, this point remains a matter of empirical investigation.

For *α,* however, there is no ambiguity. With an increase in the union bargaining power, employment of contract labour will rise and employment of regular labour will fall.

$$\frac{dl_C}{d\alpha} = \frac{\partial l_C}{\partial w_R}\frac{\partial w_R}{\partial \alpha} > 0\,,\ \frac{dl_R}{d\alpha} = \frac{\partial l_R}{\partial w_R}\frac{\partial w_R}{\partial \alpha} < 0\,.$$

It will be helpful for our econometric analysis to restate these results in terms of employment shares, for instance share of the contract workers $l_C/(l_C+l_R)$. So we derive the following:

$$\frac{d\left(\frac{l_C}{l_C+l_R}\right)}{dp} = \frac{l_R\frac{dl_C}{dp} - l_C\frac{dl_R}{dp}}{\left(l_C+l_R\right)^2}\,. \qquad (13)$$

As can be seen, the sign is ambiguous. But if $\frac{dl_C}{dp} < 0, \frac{dl_R}{dp} > 0$, the above sign will be negative.

With respect to *α* we get unambiguously:

$$\frac{d\left(\frac{l_C}{l_C+l_R}\right)}{d\alpha} = \frac{l_R\frac{dl_C}{d\alpha} - l_C\frac{dl_R}{d\alpha}}{\left(l_C+l_R\right)^2} > 0\,. \qquad (14)$$

Proposition 3: *Suppose the total effect of price change on the contract labour is negative. That is, the contract labour is an inferior input. Then with an increase in import penetration the share of contract employment will rise.*

Proposition 4: *If the regular workers' bargaining power (α) increases, the share of contract employment will go up. Conversely, if the firm's bargaining power increases, the share of contract employment will fall.*

Finally, what can we say about the firm's preferred strategy? Will it always hire both types of workers, regardless of the strength of the union? The answer is illustrated in Figure 2. We plot firm's profit against the workers' bargaining power. The curve π_R^* represents the equilibrium profit from hiring only the regular workers, and π_M^* represents the equilibrium profit from hiring an optimal mix of (both regular and contract) workers. They are drawn linear for simplicity. If the workers had no bargaining power, i.e. α=0, hiring only the regular workers would be more profitable, due to their productivity superiority; two wages at this stage is equal (after adjusting for skill difference). As *α* begins to rise, the wage of the regular workers will rise too. Profit under both options will fall, but it will fall more under the 'only regular workers' option. Gradually, hiring some contract workers in place of regular workers becomes more profitable. When the workers' bargaining power is sufficiently high (above α^*), hiring the mix of workers will be clearly preferable to hiring only regular workers. That is to say, the workforce of the firm will be informalised.

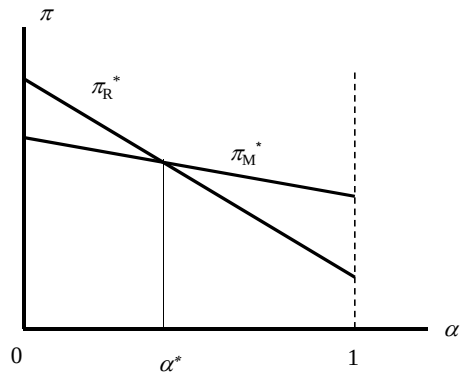

Figure 2: Informalisation of workforce

4. Methodology, data and variables

4.1 Methodology

Our interest centres around the choice of contract versus regular workers by firms, and whether and how trade (captured in our theoretical model by p) and worker bargaining power (captured in our theoretical model by α) can explain this choice. We estimate regressions of the following generic form:

$$c_{i,s,t} = \alpha_0 + \alpha_1 IM_{it} + \alpha_2 EO_{it} + \alpha_3 WBP_s + + \sum_{k \geq 3} \alpha_k X_k + \gamma_i + \delta_t + e_{ist}$$

where c is the logarithm of the ratio of contract workers to total workers (=contract workers + regular workers), the subscript i stands for industry, s stands for state and t for time. Thus, our specification is in three-dimensional panel data form, where the data vary across industry, state and year. We have a panel of 58 industries, 15 states and seven years.

IM and *EO* are the import penetration and the export-to-output ratios, respectively. Greater import penetration would lead to a decrease in the price of the product *p* while greater export orientation would lead to an increase in *p*. We lag both import penetration and export orientation by one year, to take into account endogeneity concerns – if industries that use contract labour are more competitive because of the lower wages that firms in these industries pay to contract workers, then they may be more likely to withstand import competition and be able to export more.[21]

[21] Import penetration is the ratio of imports-to-imports + domestic demand, where domestic demand is total output minus exports. Export orientation is the ratio of exports to gross output.

WBP is the bargaining power of regular workers (as captured in our theoretical model by α). We measure worker bargaining power both in its de jure and de facto dimensions. To capture de jure worker bargaining, we use the Besley-Burgess measure of labour regulations for the 15 Indian states, which captures the extent to which labour laws in the particular state are pro-worker (we describe the measure in some detail later). To capture de facto worker bargaining power, we use the strike-to-lockout ratio, lockouts being unilateral decisions by the firm's management to shut down the operations of the firm. We describe below why we consider the strike-to-lockout ratio as a good measure of de facto worker bargaining power. Finally, $\sum X_k$ is a vector of control variables, γ_i are industry-specific fixed effects and δ_t are the time-specific fixed effects (year effects).

The industry fixed effects capture industry-specific technological factors that may constrain the use of contract workers in certain industries. The year effects capture macro shocks that may have specific factor-specific productivity effects, and by doing so, impact on the choice between contract workers and regular workers by firms (for example, a positive shock to capital productivity may lead to a substitution of contract workers for regular workers).

We experiment with different control variables in some of the regressions. We are agnostic on what these could be – previous studies on the effects of labour regulations on industrial growth in India have used state development expenditures and per capita electricity consumption (see Besley and Burgess, 2004) and we do so too. We also include the literacy rate as a measure of the skill gap between regular and contract workers – in states where there is a larger literate population, it is more likely that regular workers would be better equipped with the skills necessary in production.

4.2 Data and variables

Our labour market data come from the Annual Survey of Industries (ASI) published by the Central Statistical Organisation (CSO), Government of India, which is an annual data-set on output, employment, capital stock, wages and so on, at the three-digit National Industrial Classification (NIC) industry level (corresponding broadly to three/four-digit International Standard Industrial Classification (ISIC)) and at the state level (CSOa, CSOb). We have data on the number of workers employed through contractors (*contract workers*) and workers directly employed by firms (*regular workers*). The time-period of our analysis is 1998-99 to 2004-05. While there are data available for an earlier period, the CSO changed the Indian industrial classification in 1998-99, which makes the earlier data virtually non-comparable with post-1998 data, at the level of disaggregation that would be possible for us to precisely estimate the effect of trade on contract labour usage.

We calculate import penetration and export orientation ratios from the trade and industrial output data of the World Bank Trade Data-base (Nicita and Olarreaga, 2007). The World Bank Trade Data-base provides the data at the ISIC three-digit level of classification, and we match the data to the NIC three-digit classification of the Annual Survey of Industries. Thus, our import penetration and export orientation variables vary across industries and over time (but not across states). One limitation, both of the World Bank Trade Data-base and the Annual Survey of Industries, is that the output data available in these two data sources are for the formal/registered/organised manufacturing sector in India, while the trade data cover both the formal and informal sectors (there

are no annual industry-level data on manufacturing output of the informal sector in India). This implies that our import penetration and export orientation variables would be higher values in most cases than would have been the case if we used total industrial output (combining formal and informal manufacturing output) in the denominator in the calculation of these two variables. However our interest is in capturing the effects of trade exposure on the formal manufacturing sector. It could therefore be argued that the use of formal manufacturing output in the denominator of the import penetration and export orientation variables captures more accurately the pressure of trade exposure on labour market adjustment in the formal manufacturing sector.

To measure de jure worker bargaining power or pro-worker labour institutions, we use the commonly used Besley-Burgess (2004) measure of labour regulation. As discussed in Section 2, the IDA has been extensively amended by state governments during the post-independence period. Besley and Burgess code each state amendment to labour laws as neutral, pro-worker or pro-employer. For neutral amendments, they assign a score of zero, for a pro-worker amendment a score of +1 and for a pro-employer amendment a score of -1. They then cumulate the scores over time for the period 1947-97. In their sample, the state of West Bengal has the most pro-worker labour institutions, with a score of +4 in 1997, and Andhra Pradesh and Tamil Nadu have the most pro-employer labour institutions, each with a score of -2 in 1997.

The Besley-Burgess measure captures the bias of labour laws, whether towards workers or towards employers, as they exist 'on the books'. In effect, state-level amendments to the IDA may not reveal sufficient information on the degree of workers' bargaining power – our variable of interest – if the enforcement of labour laws is lax, or if the strength of trade unions in a particular state may not be reflected in the pro-worker bias of labour laws in the state. We therefore supplement the Besley-Burgess measure with a more direct measure of the strength of the bargaining power of workers relative to employers – the lockout-to-strike ratio.

Lockouts are unilateral decisions of the management of the firm to shut down operations. Strikes are unilateral decisions of workers to disrupt activity in their place of employment. A lockout announcement is more likely to occur when employers feel that it allows them to exert stronger pressure on workers in wage negotiations. A call to strike is more likely in contexts where workers perceive that they will able to extract greater rent from employers, either explicitly through higher wages or implicitly through better working conditions. In the Indian context, the relative strength of trade unions vis-a-vis firm management in a particular state has been historically conditioned by the presence of a well organised and large working class in that state, and by the nature of the political regime in the state (for example, Indian states with left-of-centre governments have tended to be more sympathetic to trade union concerns). The lockout-to-strike ratio provides a de facto measure of the degree of worker bargaining power, with lower values of this ratio indicating higher bargaining power for workers. We compute this measure at the state level, as we have data on the number of lockouts and strikes for all the 15 major Indian states for the period 1998-2004.[22] We

[22] Since there are several cases of zero lockouts for a state in a given year, we took lockouts as the denominator rather than as the numerator to maximise the number of years and states for which we could compute the ratio.

also experiment with alternate ways of capturing de facto bargaining power – we include the absenteeism rate among regular workers (that is, the ratio of man days lost due to absence of workers from work to total man days) and union density (that is, the number of workers who belong to an union as a ratio of total regular workers in that state) in some regressions.[23] We would expect that higher values of these variables and a lower value of the lockout-to-strike ratio reflect the higher bargaining power of workers in the state in question.

We use the Besley-Burgess measure for the last year for which the measure has been calculated – that is, 1997. Therefore, we are not capturing time variation in de jure worker bargaining power, only the across state variation). While it is possible to update the measure taking into account state-level amendments to the IDA, in practice there have been few state-level amendments to the IDA in the 1990s and 2000s. Furthermore, by taking a beginning of the period measure of de jure labour regulations, we are less susceptible to the argument that changes in state-level labour institutions are themselves outcomes of changes in contract labour use (so that a state with a higher presence of contract workers may legislate in favour of regular workers to protect their employment).

With respect to control variables, such the literacy rate, government development expenditures and per capita electricity usage, which vary across Indian states and over time, the data are obtained from various issues of the *Statistical Abstract* of the Government of India.

5. Empirical analysis

We begin the empirical analysis by presenting the summary statistics, followed by a description of patterns of contract labour used by Indian state and industry, variations in de jure and de facto measures of worker bargaining power across Indian states, and trends in import penetration and export orientation by industry. We then present the main results of the econometric analysis.

A. Descriptive statistics

We present summary statistics of the key variables used in the empirical analysis in Table 1 below. The average share of contract workers across state-industry and year is 0.178, with a standard deviation of 0.185. The average import penetration ratio is 0.143 and the average export-to-output ratio is 0.221.

[23] The absenteeism rate and union membership data by state are obtained from the annual Labour Yearbooks published by the Ministry of Labour, Government of India (Ministry of Labour 1998-99 and 2004-05). The variables are only available at a point in time for most states, so vary only across state and not over time.

Table 1. Summary statistics

Variable	Mean	Standard deviation
Share of contract worker in total workers	0.178	0.185
Besley-Burgess measure	0.049	1.550
Lockout-to-strike ratio	1.005	1.945
Import penetration ratio (one-year lag)	0.143	0.226
Export-to-output ratio (one-year lag)	0.221	0.387
Literacy rate (percentage)	69.819	8.663
Development expenditures (as a ratio of GDP)	4.930	2.559
Per capita electricity consumption	496.617	287.898

B. Patterns in contract labour use across Indian states and across industries

In Table 2, we present the share of contract workers in the total number of workers for the 15 states in two points in time – 1998 and 2004. All states have seen an increase in the share of contract workers in total workers over the period 1998-2004. The state with the highest share of contract workers in total workers in 2004 is Bihar, with 53 percent. The state with the lowest share of contract workers in total workers in 2004 is Kerala with seven percent. Interestingly, there is no obvious correlation between the strength of worker bargaining power, as captured by the Besley-Burgess measure, and contract labour usage. States with pro-worker labour institutions, such as West Bengal, have one of the lowest levels of contract labour usage, while Bihar, also a state with pro-worker labour institutions, has the highest usage of contract labour. We also find that de jure and de facto measures of worker bargaining power are not strongly correlated – for example, the state with the most pro-worker labour institutions, as captured in the Besley-Burgess measure – West Bengal – has one of the lowest strike-to-lockout ratios. Union density and absenteeism rates also do not seem to correlate strongly with the Besley-Burgess measure. This indicates that it is important to use both de jure and de facto measures of the strength of worker bargaining power in the empirical analysis.

Table 2. Share of contract workers in total workers and measures of worker bargaining power by Indian state

State names	Share of contract worker in total workers		De jure measure of worker bargaining power	De facto measure of worker bargaining power			
			Besley-Burgess measure of labour regulation	Inverse of the lockout-to-strike ratio		Union density (%)	Absenteeism rate
	1998	2004		1999	2005		
Andhra Pradesh	0.15	0.51	-2	0.59	1.00	1.23	6.96
Assam	0.08	0.14	0	0.00	2.00	0.83	5.94
Bihar	0.46	0.53	1	1.67	5.32	8.68	6.32
Gujarat	0.26	0.33	0	8.33	5.56	n/a	9.36
Haryana	0.31	0.41	-1	12.50	4.55	0.88	11.58
Karnataka	0.08	0.13	2	3.33	6.25	1.07	6.55
Kerala	0.04	0.07	-1	0.57	2.13	4.64	11.46
Madhya Pradesh	0.16	0.28	2	4.35	2.00	1.46	12.63
Maharashtra	0.15	0.27	0	0.00	4.76	2.52	10.76
Orissa	0.27	0.36	1	4.17	0.00	2.49	8.15
Punjab	0.19	0.27	0	3.03	2.27	1.09	11.29
Rajasthan	0.21	0.33	-1	1.25	1.00	3.22	11.23
Tamil Nadu	0.09	0.13	-2	2.70	2.08	1.06	7.66
Uttar Pradesh	0.22	0.29	0	0.93	1.79	2.52	9.27
West Bengal	0.06	0.14	4	0.14	0.12	2.68	8.94

Source: Our calculations, from *Annual Survey of Industries* and *Indian Labour Yearbooks*.

Table 3. Share of contract workers in total workers, import penetration and export-to-output ratio by industry group

Industry group	Share of contract workers in total workers		Import penetration ratio		Export-to-output ratio	
	1998	2004	1997	2003	1997	2003
Food products and beverages	0.25	0.34	0.07	0.09	0.03	0.08
Tobacco products	0.12	0.61	0.02	0.02	0.00	0.00
Textile products	0.11	0.15	0.17	0.26	0.02	0.06
Wearing apparel	0.06	0.29	0.50	0.58	0.00	0.01
Leather products	0.10	0.17	0.39	0.49	0.06	0.10
Wood products	0.04	0.12	0.06	0.08	0.07	0.07
Paper and paper products	0.18	0.26	0.03	0.05	0.24	0.24
Publishing and printing	0.07	0.13	0.03	0.07	0.09	0.15
Chemicals and chemical products	0.18	0.24	0.11	0.15	0.16	0.19
Rubber and plastic products	0.11	0.20	0.06	0.11	0.03	0.05
Other non-metallic mineral products	0.32	0.35	0.08	0.03	0.06	0.02
Basic metals	0.24	0.30	0.20	0.20	0.59	0.37
Fabricated metal products	0.19	0.37	0.13	0.32	0.07	0.14
Machinery and equipment	0.09	0.17	0.15	0.43	0.40	0.67
Office, accounting and computing machinery	0.28	0.24	0.15	0.30	0.40	6.13
Electrical machinery	0.14	0.20	0.06	0.63	0.15	0.86
Radio, television and communication equipment	0.04	0.18	0.06	0.80	0.15	0.80
Medical precision and optical instruments	0.03	0.10	0.31	0.69	0.71	0.89
Motor vehicles	0.13	0.27	0.06	0.18	0.07	0.28
Other transport equipment	0.15	0.23	0.06	0.18	0.07	0.28

Source: Our calculations, from *Annual Survey of Industries* and World Bank Trade data.

In Table 3 above, we present the share of contract workers in total workers by two-digit NIC industry groups in 1998 and 2004, along with import penetration and export-to-output ratios for the same industry groups in 1997 and 2003. Contract labour usage has also increased in all industry groups, except Office, Accounting and Computing Machinery. There is significant variation in contract labour usage across industries, with the lowest being Office, Accounting and Computing Machinery, at 12 percent, and highest being Wood Products, at 61 percent. The variations in contract labour usage across industries will be determined by, among other factors, the technological parameters in each industry that allow ease of substitution between contract workers and regular workers, and the relative wage rates of contract and regular workers. Since we do not observe technological parameters by industry, and do not have industry-level data on wage rates of regular and contract labours, we control for these factors by using industry fixed effects in the empirical analysis.

We also find that import penetration rates have been increasing over the period 1997-2003 across all industries (col. 4 of Table 3). Export-to-output ratios, however, do not show a clear pattern. We also observe a wide variation in import penetration and export-to-output ratios across industry groups.

C. Results

Table 4 below presents the main results. In Col. (1), we begin with a basic specification (with no industry or year dummies), where we regress the share of contract workers in total workers against the two measures of labour institutions – the Besley-Burgess measure (BB) and the lockout-to-strike ratio. The coefficients on both variables are significant at the one percent level and of the right sign – more pro-worker labour institutions leads to a higher use of contract workers, and a greater bargaining power of firm management (as captured by a higher lockout-to-strike ratio) leads to a lower use of contract workers. In Col (2), we next introduce the import penetration and the export orientation variables, lagged by one year. We find that the coefficient on import penetration is negative and significant at the 10 percent level, but the coefficient on export orientation is not statistically significant from zero. We then introduce industry and year dummies in Col (3). Industry dummies control for the variations in contract labour usage across industry due to industry-specific technological factors that influence the ease of substitution between contract and regular workers. Year dummies control for common shocks to industry production functions, which may change relative productivity differentials between contract and regular workers and, consequently, the relative use of contract workers. When we introduce both industry and year dummies, we find the coefficient on import penetration is positive and significant at the five percent level, but the coefficient on export orientation is statistically insignificant from zero. Thus, we find that a higher level of import penetration leads to a rise in the share of contract workers in total workers, as predicted by our model. The coefficients on the Besley-Burgess measure and the lockout-to-strike ratio have the rights signs and are statistically significant as before.[24] In Col. (4), we drop the Besley-Burgess measure and retain the lockout-to-strike ratio as a measure of worker bargaining power, given the possibility of collinearity between the Besley-Burgess measure and the lockout-to-

[24] Previous studies using cross-country data-sets have shown that countries with more rigid employment laws have a larger informal sector (e.g., Botero *et al*., 2004, Djankov and Ramalho, 2009). Thus, our finding for India is similar to the findings of these papers.

strike ratio. The lockout-to-strike ratio has the right sign and remains significant at the one percent level. In Col. (5), we introduce additional controls – the literacy rate, per capita development expenditures undertaken by state governments, and per capita electricity consumption. We find that the literacy rate is positive and significant, as would be expected if the literacy rate can be seen as a measure of the skill gap between regular and contract workers (albeit an imperfect measure). Development expenditures and per capita electricity consumption have positive and significant effects on contract labour use. The inclusion of these variables does not change the signs or significance on our variables of interest – de jure and de facto worker bargaining power and import penetration.

We experiment with four alternate specifications, which follow from our theoretical model. Recall from Proposition 1 that higher wages of regular workers should have a positive effect on contract labour usage. Conversely, higher wages of contract workers should negatively affect contract labour usage. In addition, if contract labour is an inferior input, a decrease in price will lead to an increase in the usage of contract labour. We use a proxy for the wage rate of regular workers by industry, which we cannot observe directly – the total wage bill divided by the number of regular workers employed in the industry for a given year.[25] The wage rate of contract workers can be captured by the minimum wage rate, which would be expected to set the floor to the wage rate contract workers are paid. Minimum wages are determined in India by respective state governments, and thus vary across states and over time, but not by industry. We have data on the average minimum wage rate by state and year.[26] The price of the industry is measured by the wholesale price index of the commodity corresponding to the industry, deflated by the overall wholesale price index, to obtain the price in real terms.

In Col. (6), we estimate the determinants of contract labour usage, using the average wage rate of regular workers directly in the regression, rather than capturing it indirectly via worker bargaining power. In Col. (7), we use the minimum wage rate as a proxy of the wage rate of contract workers. In Col (8), we include real price directly in the regression, instead of capturing it by the trade variables.[27] We find that the two wage rates have opposite effects on contract labour usage, as may be expected – higher wages of regular workers lead to higher contract labour usage, and higher minimum wages lead to lower contract labour usage. The coefficients on the two wage rates are statistically significant at the one percent level. Particularly revealing is that the size of the coefficient on import penetration increases in magnitude in Cols. (6) and (7) from its benchmark value with industry and year dummies in Col. (3) – its value is now around 0.22 from 0.19 in Col (3). In a regression where we directly include wage rates, rather than capture their effects via our measures of worker bargaining power, we should expect the coefficient on price (as captured by import penetration) to be larger, as we find in Cols (6) and (7). In the regression where we include price in the regression instead of the trade variables (and retaining the Besley-Burgess measure and the lockout-to-strike ratio), we find that the coefficient on the price variable is negative and

[25] Thus, the wage rate of regular workers varies by industry and year. Note that this is an imperfect proxy, as we do not have data on the wage bill of regular workers, but only of all workers.
[26] The data are obtained from the various issues of the Indian Labour Yearbook. The Yearbook reports maximum and minimum values of the minimum wage rate for a given state for a given year, as some industries have different minimum wage rates – we take the average of the minimum and maximum values.
[27] We cannot include the wage and price variables simultaneously in the regression, as they are very likely to be collinear.

Table 4. Regression results

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	-1.90*** (0.000)	-1.88*** (0.000)	-1.96*** (0.000)	-2.02*** (0.0000)	-1.96*** (0.000)	-3.21*** (0.000)	-0.57 (0.138)	-2.23*** (0.112)	-1.71*** (0.000)
Besley-Burgess	0.13*** (0.000)	0.13*** (0.000)	0.13*** (0.000)	--	0.12*** (0.000)	--	--	0.13*** (0.013)	0.07*** (0.000)
Lockout-to-strike ratio	-0.14*** (0.000)	-0.14*** (0.000)	-0.14*** (0.000)	-0.08*** (0.000)	-0.10*** (0.000)	--	--	-0.14*** (0.011)	-0.05*** (0.000)
Import penetration	--	-0.13* (0.086)	0.19** (0.047)	0.18* (0.052)	0.18* (0.059)	0.23** (0.019)	0.22** (0.019)	--	0.22* (0.072)
Export orientation	--	0.02 (0.731)	0.03 (0.647)	0.02 (0.39)	0.04 (0.530)	-0.02 (0.782)	0.003 (0.951)	--	0.07 (0.477)
Development expenditure	--	--	--	--	0.03*** (0.001)	--	--	--	--
Literacy rate	--	--	--	--	-0.022*** (0.000)	--	--	--	--
Per capita electricity consumption	--	--	--	--	0.001*** (0.000)	--	--	--	--
Wage rate of regular workers	--	--	--	--	--	0.28*** (0.000)	--	--	--
Minimum wage	--	--	--	--	--	--	-0.01*** (0.000)	--	--
Real price	--	--	--	--	--	--	--	-0.29** (0.124)	--
Industry effects?	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects?	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Econometric model	Pooled, robust	Pooled, robust	Pooled, robust	Pooled, robust	Pooled, robust	Pooled, robust	Pooled, robust	Pooled, robust	Pooled, robust
R^2	0.03	0.22	0.24	0.23	0.25	0.25	0.25	0.24	0.20
No of obs.	3865	3706	3706	3706	3706	3803	2893	3706	3639

Note: a) In Columns (1) to (7), the dependent variable is the logarithm of the share of contract workers in total workers; in Col (8), the dependent variable is the logarithm of the ratio of contract workers to the capital stock; b) Figures in parentheses represent level of significance; c) * p<0.10, ** p<0.05, *** p<0.01

significant, as may be expected if contract labour is an inferior input, as is implied in our theory (Col. (8)).

Finally, we test the long-run prediction of the model, as in the Appendix, where we allow capital stock to be adjusted. The results are presented in Col. (9). In this case, we would expect that higher worker bargaining power and lower price (as captured by greater import penetration) would lead to a substitution for contract labour and away from capital. When we use the (logarithm of the) ratio of contract workers to capital stock as our dependent variable, we find that, as predicted, increasing in de jure and de facto worker bargaining power (the Besley-Burgess measure and the inverse of the lockout-to-strike ratio) has a negative and significant effect, and greater import penetration has a positive and significant effect on the ratio of contract workers to capital stock (the export orientation variable remains insignificant).[28]

In sum, we find that our results on import penetration and labour institutions are robust to the inclusion of industry and year fixed effects, and other relevant control variables, and to alternate specifications that are in accord with our theoretical model. Our results indicate that greater import penetration and stronger bargaining power of workers lead to a substitution of regular workers in favour of contract workers, while the effect of export orientation on contract labour is statistically insignificant in most specifications.[29]

We now undertake a set of additional regressions to check the robustness of our results, with the new results presented in Table 5 below. One set of concerns is to do with our measures of the worker bargaining power – the Besley-Burgess measure and the lockout-to-strike ratio. A limitation of the Besley-Burgess measure is that it treats all labour law amendments symmetrically – however, as has been argued by Ahsan and Pagés (2007, 2009), amendments to the Industrial Disputes Act of 1947 undertaken by state governments fall under two broad categories:

i. amendments to laws that regulate the procedures for the resolution of industrial disputes; and
ii. amendments to laws that affect the hiring and firing of workers.

Ahsan and Pagés code these amendments into two separate measures of labour regulation – *cpD*, which cover amendments to industrial dispute laws, and *cpA*, which cover the amendments to labour laws that deal with the hiring and firing of workers. We use the disaggregated labour

[28] Capital stock is real Gross Fixed Assets for each industry for a given year, where nominal values are taken from the Annual Survey of Industries.

[29] One other implication of our theoretical model is that industries located in states with pro-worker labour institutions will witness greater contract labour usage, with greater trade openness. We test for this prediction using interaction terms, where the Besley-Burgess measure and the lockout-to-strike ratio are interacted with import penetration and export orientation. As expected, we find that the interaction term between the Besley-Burgess measure and import penetration is positive and significant (and the Besley-Burgess, lockout-to-strike and import penetration variables, when included by themselves, retain their significance and original signs). This indicates that the positive effects of import penetration on contract labour use is particularly strong in pro-worker states.

Table 5. Robustness tests

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Constant	-1.96*** (0.000)	-3.11*** (0.000)	-2.50*** (0.000)	-1.87*** (0.000)	-1.44*** (0.000)	-2.62*** (0.000)
cpA	0.11*** (0.000)	--	--	--	--	--
cpD	0.08*** (0.000)	--	--	--	--	--
Besley-Burgess	--	--	--	0.12*** (0.000)	0.13*** (0.000)	0.24*** (0.000)
Lockout-to-strike ratio	-0.15*** (0.000)	--	--	-0.14*** (0.000)	-0.14*** (0.000)	-0.29*** (0.000)
Union density	--	0.01*** (0.000)	--	--	--	--
Absenteeism rate	--	--	0.04*** (0.000)	--	--	--
Urbanisation of state				-0.37* (0.085)		
Import penetration	0.19** (0.044)	0.19* (0.072)	0.18* (0.072)	0.18** (0.050)	0.19** (0.04)	0.20** (0.033)
Export orientation	0.03 (0.671)	0.04 (0.548)	0.03 (0.684)	0.03 (0.642)	0.03 (0.583)	0.03 (0.577)
Outsourcing				--	-0.51*** (0.000)	
Industry effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year effects?	Yes	Yes	Yes	Yes	Yes	Yes
Econometric model	Pooled, robust	Pooled, robust	Pooled, robust	Pooled, robust	Pooled, robust	IV, 2SLS
R^2	0.23	0.23	0.22	0.25	0.25	0.21
No of obs.	3706	3493	3805	3706	3706	3585

Note: a) In Columns (1) to (6), the dependent variable is the logarithm of the share of contract workers in total workers;
b) Figures in parentheses represent level of significance; c) * p<0.10, ** p<0.05, *** p<0.01

regulation measures proposed by Ahsan and Pagés in place of the Besley-Burgess measure in Col. (1) of Table 2 (with industry and year effects included, as in Col. (4) of Table 4).[30] We find that both *cpA* and *cpD* are positive and significant at the one percent level, though the effect of labour law amendments relating to labour adjustment is stronger than the effect of labour law amendments relating to industrial dispute. In Cols. (2) and (3), we experiment with two other measures of regular worker bargaining power – union density and worker absenteeism, each included in turn in place of the Besley-Burgess measure and the lockout-to-strike ratio. We find that both these proxy variables of worker bargaining power have the right sign – have a positive effect on contract labour usage – and are significant at the one percent level. An additional concern with the Besley-Burgess measure is that it varies across Indian states, but not over time (in contrast to the lockout-to-strike ratio, which varies both across state and over time). Given its lack of time-variation, it may be possible that the Besley-Burgess measure is simply capturing omitted state-specific variables that may explain the variation in contract labour usage across Indian states. It is difficult to envisage what these variables may be that can explain the *share* of contract labour usage across states, rather than absolute levels of contract labour employed. One candidate is the rate of urbanisation of the state, as measured by share of the state's population in urban areas. This variable may be a proxy for agglomeration effects that increase the productivity of regular workers, and hence lead to a substitution by firms from contract to regular workers. When we include this variable, in addition to the Besley-Burgess measure in Col. (4), we find that the Besley-Burgess retains its sign and significance at the one percent level. As may be expected if urbanisation is capturing agglomeration effects, states with a larger urban population have lower contract labour usage. We also experimented with other state-specific time-invariant variables, such as access to the sea and size of the state, with no change in our results. Our overall finding here is that the Besley-Burgess measure does not seem to be picking up the effects of other state-specific time-invariant variables.

One further potential area of concern with our estimates is that it is possible that firms which are seeking flexibility in labour use, in the face of greater trade exposure or stronger bargaining power of regular workers, may decide to outsource certain activities to firms in the informal sector, rather than undertake them in-house with the help of contract workers (Ramaswamy, 1999; Maiti and Marjit, 2008). To control for this possibility, we construct a variable that measures outsourcing of formal sector activities to informal sector firms. This variable is the share of informal sector output in total informal and formal sector output for the given three-digit NIC industry. We obtain informal sector output data from the National Sample Survey Organisation (NSSO) quinquennial surveys of informal/unorganised manufacturing – the output data are only available for 2001 and 2005. We compute the share of informal output in total output for these years, and we use the observations for 2001 for the years 1998 to 2001, and the observations for 2005 for the years 2002 to 2005. When we include the variable measuring outsourcing in Col. (5), we find that the variable has the right sign – the coefficient on it is negative – and is significant at the one percent level. This implies

[30] A further advantage of using the disaggregated Ahsan-Pagés measure is that it allows us to see whether the effect of de jure worker bargaining power is robust to alternate measures of the pro-worker or pro-employer bias of labour laws in India. As argued by Bhattacharya (2006, 2009), there may be measurement errors with the Besley-Burgess measure, on account of possible errors in coding of the amendments made to the IDA by state governments, as being either pro-worker or pro-employer when in fact they were not so. Given that Ahsan and Pagés recode labour law amendments in India from first principles, their measure is less susceptible to this criticism.

that industries that have higher levels of outsourcing are less likely to employ contract labour – outsourcing can be seen as a substitute for contract labour usage. However, the signs and significance on the explanatory variables of interest – de jure and de facto measures of labour institutions and import penetration – do not change with the inclusion of the outsourcing variable. Finally, we use the instrumental variable (IV) estimation method to handle possible endogeneity concerns with the lockout-to-strike variable – more intensive use of contract labour may lead regular workers to resort to more strikes, leading to a negative relationship between contract labour usage and the lockout-to-strike ratio. We use state-level land reform legislation as an instrument for the lockout-to-strike ratio, with the assumption that the outside option for regular workers to bargain for higher wages would be increased in states which passed more land reform legislation, given that these states had lower rural poverty and higher agricultural wages (Besley and Burgess, 2000).[31] The IV two stage least squares estimates in Col. (6) provide very similar results to the pooled Ordinary Least Squares estimates with respect to the negative and statistically significant coefficient on the instrumented lockout-to-strike ratio. Our main results are therefore robust to alternate measures of worker bargaining power and labour regulations, to possible omitted variable bias to do with the outsourcing of formal sector production to informal firms and state-specific time-invariant variables, and to possible endogeneity concerns with the lockout-to-strike ratio.

6. Conclusions

There has been increasing flexibilisation of labour use in both developed and developing countries. The previous literature has looked at informal and formal sectors as separate spheres of economic activity. One important feature of recent patterns of flexibilisation in India has been the use of informal (contract) workers by firms in the formal sector. This paper develops a model of labour demand where firms need to decide on the number of informal/contract workers versus formal/regular workers to use. We are specifically interested in the role of labour institutions and trade openness in determining this choice. The model predicts that greater bargaining power of regular workers will lead to higher contract labour usage in total employment, but that the effect of import penetration and export orientation on contract labour usage is indeterminate.

We then test this model using a panel of 58 industries for 15 Indian states over seven years. We find that pro-worker labour institutions and increasing exposure to imports lead to greater use of contract labour relative to regular labour. However, we do not find a clear relationship between export orientation and contract labour usage. Our results suggest that increased trade exposure, in the form of increasing import penetration, leads to greater informalisation of formal labour markets, as understood by a substitution of regular workers by contract workers by manufacturing firms. Our

[31] Land reform was implemented under the 1949 Indian Constitution, according to which states are granted the powers to enact (and implement) land reforms. Each state parliament implemented the reform through autonomous acts. There are significant differences in the intensity with which states have enacted the various types of land reform legislation over time. Such differences have been captured by Besley and Burgess (2000), who construct a panel data type land reform variable, by cumulating land reform acts between 1957 and 1992 in the major Indian states. Since there has not been any major land reform legislation since 1992 (see World Bank, 2007), we retain the same values for the land reform variable for the post-1992 period, and use it cross-sectionally as an instrument for the lockout-to-strike ratio.

results also indicate that stronger bargaining power of regular workers may have perverse negative outcomes on their employment, as firms substitute away from regular labour and in favour of contract labour.

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APPENDIX: Capital and employment choice

In the Appendix we present the long-run case where capital is also adjusted. The choice of contract and regular workers is given in (3) and (4). The capital choice condition is:

$$\frac{\partial \pi}{\partial k} = p[a + f_1] - r = 0 \qquad \text{(A.5)}$$

The second order condition for profit maximisation requires $\Delta_1 < 0$, $\Delta_2 > 0$, as before and in addition

$$\Delta_3 = p^3 \begin{vmatrix} a''k + g'' & g''\gamma & a' \\ g''\gamma & f_{22} + g''\gamma^2 & f_{12} \\ a' & f_{12} & f_{11} \end{vmatrix} < 0.$$

Next, we derive the input demand functions from equations (3), (4) and (A.5).

$$\frac{\partial l_C}{\partial w_C} = \frac{p^2}{\Delta_3}\left[\gamma^2 g'' f_{11} + \{f_{11}f_{22} - (f_{12})^2\}\right] < 0, \qquad \text{(A.6)}$$

$$\frac{\partial l_R}{\partial w_C} = -\frac{p^2}{\Delta_3}\left[\gamma g'' f_{11} - a' f_{12}\right] > 0, \qquad \text{(A.7)}$$

$$\frac{\partial k}{\partial w_C} = \frac{p^2}{\Delta_3}\left[g''\gamma(f_{12} - a') - a' f_{22}\right] > 0. \qquad \text{(A.8)}$$

In (A.6) the numerator is positive because by concavity of $f(.,.)$, $f_{11}f_{22} > f_{12}^2$, and everywhere $\Delta_3 < 0$ by the second order condition. Given our assumption of $f_{12} > 0$, we get $\frac{\partial k}{\partial w_C} > 0$, and $\frac{\partial l_R}{\partial w_C} > 0$. That is, both capital and regular labour will be substitutes for contract labour.

Next, with respect to w_R we obtain

$$\frac{\partial l_C}{\partial w_R} = -\frac{p^2}{\Delta_3}\left[f_{11} g''\gamma - f_{12} a'\right] > 0, \qquad \text{(A.9)}$$

$$\frac{\partial l_R}{\partial w_R} = \frac{p^2}{\Delta_3}\left[f_{11}\{g'' + ka''\} - (a')^2\right] < 0. \qquad \text{(A.10)}$$

The numerator of the expression in (A.9) will be positive due to the second order condition of profit maximisation (or equivalently due to the concavity of the $F(.)$ function); and

$$\frac{\partial k}{\partial w_R} = -\frac{p^2}{\Delta_3}\left[g''(f_{11} - a'\gamma) + ka'' f_{12}\right] < 0. \qquad \text{(A.11)}$$

Once again complementarity between capital and regular labour is evident, and the contract labour remains a substitute. Similarly, for a rise in the price of capital, one can derive $\frac{\partial l_C}{\partial r} > 0$, but $\frac{\partial k}{\partial r} < 0, \frac{\partial l_R}{\partial r} < 0.$

$$\frac{\partial \mathrm{l_C}}{\partial \mathrm{r}} = \frac{\mathrm{p}^2}{\Delta_3}\left[\mathrm{g''\gamma f_{12} - a'(f_{22} + g''\gamma^2)}\right] > 0, \qquad \text{(A.12)}$$

$$\frac{\partial \mathrm{l_R}}{\partial \mathrm{r}} = -\frac{\mathrm{p}^2}{\Delta_3}\left[\mathrm{(a''k + g'')f_{12} - a'g''\gamma}\right] < 0, \qquad \text{(A.13)}$$

$$\frac{\partial \mathrm{k}}{\partial \mathrm{r}} = \frac{\mathrm{p}^2}{\Delta_3}\left[\mathrm{a''k(f_{22} + g''\gamma^2) + g''f_{22}}\right] < 0. \qquad \text{(A.14)}$$

Note that for the contract labour and capital to be substitutes we do not need *a'*(.)<0. Even if *a'*(.)=*a''*(.)=0, i.e. capital and contract labour are unrelated in terms of marginal productivity, *r* will still exert a positive effect on l_C, indirectly via regular labour. Though the labour demand functions are long-run ones (when *k* is free), their short-run properties (when *k* is fixed) are still the same (with respect to w_C and w_R).

The comparative statics with respect to p can be derived as follows.

$$\frac{\partial l_C}{\partial p} = \frac{p}{\Delta_3}\left[f_{11}g''\gamma(w_R - \gamma w_C) + f_{12}\{w_C f_{12} - a'(w_R)\} - rg''\gamma(f_{21} - a') + ra' f_{22}\right]$$

$$- \frac{p}{\Delta_3} f_{11} f_{22} w_C \qquad (A.15)$$

$$(<0) \qquad\qquad (>0)$$

$$\frac{\partial l_R}{\partial p} = -\frac{p}{\Delta_3}\left[f_{11}g''\gamma(w_R - \gamma w_C) + f_{11}a''k(w_R) - rg''\gamma(f_{21} - a'\gamma) - ra''kf_{21}\right]$$

$$+ \frac{pa'}{\Delta_3}\{a' w_R - f_{21} w_C\} \qquad (A.16)$$

$$(>0) \qquad\qquad (<0)$$

$$\frac{\partial k}{\partial p} = -\frac{p}{\Delta_3}\left[\frac{r}{p^2}\Delta_2 - g''(w_R - \gamma w_C)(f_{21} - a'\gamma) - a''kw_R\right] + \frac{pa'}{\Delta_3} f_{22} w_C \qquad (A.17)$$

$$(>0) \qquad\qquad (<0)$$

As can be seen, in all three equations there is some ambiguity about the sign. Consider equation (A.15). In the short run we had $\partial l_C / \partial p < 0$. But in the long run, as *k* is adjusted the term is f_{22} is not zero; hence the ambiguity. However, if the product $f_{11}f_{22}$ is not large, here too we will have $\partial l_C / \partial p < 0$. Similarly, in equations (A.16) and (A.17) if *a*' is not large, we will get $\frac{\partial l_R}{\partial p} > 0$. That is to say, if the marginal impact of contract workers on capital (which is negative) is not too large, use of regular labour and capital will both rise when *p* rises.

We can also consider the output supply function. From the properties of the profit function we know $\frac{\partial y^S}{\partial p} > 0, \frac{\partial y^S}{\partial w_C} = -\frac{\partial l_C^D}{\partial p}, \frac{\partial y^S}{\partial w_R} = -\frac{\partial l_R^D}{\partial p}$. Thus, if the contract labour is an inferior input, then the output supply will be increasing in w_C.

We can assume that indeed $\partial l_C / \partial p < 0$. Then the short-run results regarding w_R will go through here as well.

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