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Impact of Elasticities of Substitution, Technical Change, and Labour Regulations on Labour Welfare in Indian Industries

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Abstract

This paper primarily investigates the issue of labour welfare in Indian industries, and seeks to make a contribution to the debate on labour reforms currently underway in India. It investigates the relative importance of technical change, elasticities of substitution, and labour regulations for labour welfare, proxied by the income shares of skilled and unskilled labour in total costs. Three primary conclusions arise. First, pure technical change has no discernible impact on income shares. Second, there is a clear pattern between the magnitudes of and changes in elasticities of substitution and associated incomes shares. Elasticity changes have tended to favour skilled labour and hurt unskilled labour. Finally, pro-worker labour regulations have a somewhat positive impact on unskilled labour shares, by mitigating the negative impact of substitution elasticities, but not completely reversing them. Pro-employer regulations, by contrast, do not have a good record of safeguarding labour interests. Based on these conclusions, the paper makes the case that a clear articulation of the goals for labour reforms should precede their designing.

Keywords: Labour force & employment, labour policy, manufacturing, production structure, technological change

JEL Codes: J21, J78, L6, L11, O33

I. Introduction and Context

Ever since their first initiation in 1991, economic reforms in India have increased steadily in both scale and scope, touching almost every aspect of economic activity, from FDI and trade reforms, to financial reforms and delicensing, etc. The one area where reforms have been conspicuously absent is that of labour reforms. The bulk of labour laws pre-date Indian independence, and are universally accepted as harsh, archaic and grossly out of touch with the new and evolving industrial realities of India.[1] There is little doubt that restrictive labour laws create a virtual stranglehold on industries and stifle their ability to realise their full potential.

Most of these laws were designed to protect the interest of workers against exploitation by employers. However, as table 1 shows, the share of labour in total income (*aggregated over the entire industrial sector*) has fallen inexorably in the 24-year period since 1980, from about 11% in 1980 to just under 6% in 2003. This trend is even more marked when labour is disaggregated into unskilled and skilled components, with the share of the former falling from about 7.3% in 1980 to 3% in 2003, while that of skilled labour experiencing a far more muted reduction by comparison (3.8% to 2.8%). Interestingly, the share of skilled labour has remained largely stable at 2.8% since 1991. These differential fates of the two types of labour are in sharp contrast to each other. The share of capital, by contrast, experienced a predictable increase, from 1980-81 till 2000-01 (from 8% to 10.7%). These patterns help illustrate the perceived ineffectiveness of Indian labour laws, and raise the important question of whether labour laws have had *any* positive benefits for unskilled labour to justify their further continuation or adaptation.

Why has skilled, non-production labour been able to hold its ground, while unskilled labour has performed so poorly, despite all the labour laws being heavily skewed in its favour? This question gains increased relevance and significance in the present time, with the adverse effects of labour laws getting increasing recognition, and finally coming under critical government scrutiny[2]. A common refrain heard from supporters of labour laws is that the advent of newer and more capital-intensive technologies will lead to large scale layoffs and unemployment, and that the restrictive labour laws are needed to safeguard workers' interests.

[1] See http://www.businessweek.com/magazine/content/11_04/b4212013616117.htm
[2] See the article in The Economic Times, dated 31 May 2011.
http://articles.economictimes.indiatimes.com/2011-05-31/news/29604263_1_labour-laws-contract-labour-firms

Even the Prime Minister of India, Manmohan Singh, has acknowledged 'the need to strike a balance between the needs of a growing economy and the interests of working people' (The Hindu, 14 October 2011).[3] However, he has also publicly questioned whether restrictive labour laws in their current form are actually hurting labour, rather than helping it (The Hindu, 23 November 2010).[4]

Table 1: % Share of Inputs in Total Cost – All Industries

	1980-81	1985-86	1990-91	1995-96	2000-01	2003-04
Labour	11.1%	9.6%	8.0%	7.4%	6.7%	5.8%
- Unskilled	*7.3%*	*6.2%*	*5.2%*	*4.6%*	*3.7%*	*3.0%*
- Skilled	*3.8%*	*3.3%*	*2.8%*	*2.7%*	*3.1%*	*2.8%*
Fuels	6.9%	8.4%	7.4%	7.7%	7.9%	9.1%
Materials	74.0%	73.4%	75.1%	75.3%	74.7%	77.0%
Capital	8.0%	8.7%	9.5%	9.5%	10.7%	8.1%
	100%	**100%**	**100%**	**100%**	**100%**	**100%**

Average % Share of Inputs in Total Cost

	1980-84	1985-89	1990-94	1995-99	2000-03
Labour	10.7%	9.2%	7.8%	7.2%	6.3%
- Unskilled	*6.9%*	*6.0%*	*4.9%*	*4.3%*	*3.4%*
- Skilled	*3.7%*	*3.2%*	*2.8%*	*2.9%*	*2.9%*
Fuels	7.5%	8.0%	7.8%	7.9%	8.0%
Materials	73.4%	73.7%	74.4%	73.9%	76.1%
Capital	8.4%	9.1%	10.0%	11.0%	9.7%
	100%	**100%**	**100%**	**100%**	**100%**

Source: Author's own computations, based on data from the Annual Survey of Industries

This applies standard, well-established production economics frameworks to get a fair and balanced assessment of the important and topical issue of labour welfare. Specifically, it investigates the relative importance and differential impacts of technical change, elasticities of substitution, and labour policies on income shares of various factors of production. In doing so, it attempts to show under what conditions labour policies support or contradict the effects of exogenous technological change on factor income shares, i.e. whether labour policy can enhance the positive effects or mitigate the negative effects of technological change. An ideal policy regime would be one where policy and technology can work in tandem to enhance welfare. Finally, it contributes to the empirical arguments in favour of labour reforms by articulating some of the key questions that must be addressed when devising an effective reforms programme; questions that are conspicuous by their absence in the current debate environment.

[3] See http://www.thehindu.com/news/national/article2535326.ece
[4] See http://www.thehindu.com/news/national/article907297.ece

The plan of the paper is as follows: section II summarises the relevant, representative literature; section III articulates the literature gaps and research questions; section IV presents the theoretical and empirical frameworks; and section V describes the data and any relevant modifications to data and variables. Section VI details the results and discusses policy implications, while section VII concludes.

II. Literature Review

This paper seeks to synthesise several strands of literature. The literature on the empirical estimation of both elasticities of substitution and technical change has a long and distinguished history, and covering it in its entirety is beyond the scope of this paper. Consequently, this literature review covers a brief and illustrative sampling of the relevant literature, as it pertain to the research goals of this paper.

In a very general sense, there are two disparate strands of literature that are relevant to this paper: the first deals with the estimation of elasticities of substitution and bias of technical change, while the second considers the impact of government (labour) policies on industrial output and performance.[5] The first strand itself comprises three broad sub-strands, the evolutions of which are expectedly chronological. The first sub-strand deals with simply estimating elasticities of substitution and technical change bias (Berndt and Wood, 1975; and Binswanger, 1974a, 1974b). The most conspicuous aspect of this early literature (up till the mid-1980s) was the emphasis on *joint* estimation of both elasticities of substitution and bias of technical change. The work of Berndt and Wood (1975), while pioneering in its scope, is also one of the few studies based on aggregate data for the overall whole manufacturing sector. The usual pattern is for studies to be based on time series data for one industry or a small, specific group of industries. Ball and Chamber's (1982) analysis of the U.S. meat products industry and Batavia's (1979) analysis of the U.S. textiles industry are just two illustrative examples. Industry-specific applications in the Indian context include those of Jha et al.'s (1991a,b) analysis of the cost structures of the Indian iron and steel, and cement industries. Following Berndt and Wood, Field and Grebenstein (1980) also explore capital-energy substitution in ten 2-digit manufacturing industries at the U.S. state level.

[5] This strand of the literature is extensively reviewed in my working paper, 'The Differential Effects of Financial Development on India's Industrial Performance'. Owing to the length constraints for this paper, the present literature review only focuses on Elasticity of Substitution and Technical Change. Please see http://www.crawford.anu.edu.au/acde/asarc/pdf/papers/2011/WP2011_12.pdf.

A shift in focus away from elasticities of substitution and exclusively towards technical change represents the second phase of this literature. The second sub-strand of literature focuses on a more in-depth investigation of the nature of technical change, its decomposition and its effects. Betts (1997) investigated technical change in 18 2-digit Canadian industries, and also found evidence of skill-using technical change. On average, biased technical change was found to be the most important determinant of the downward trend in the income share of unskilled workers, with the weighted average reduction between 4.5% across 17 of the 18 industries considered. The impact of technical change on skilled labour share was close to zero.

Yuhn (1991) addresses the puzzle that 'shares of both capital and labour have tended to remain fairly constant in advanced economies despite a rapidly growth capital-labour ratio'.[6] This anomaly could be explained either by an aggregate production function with unitary elasticity of substitution, or by inelastic substitution *and* a labour-saving bias. Comparing the substitution elasticity and technical change estimates for South Korea and the Unites States, Yuhn rejects the *a priori* assumption of unitary elasticity as unrealistic, and presents a framework for assessing the relative distributive effects of elasticity of substitution and technical change.

Unlike the earlier tendency to use translog cost functions for such estimation, Yuhn's work is based on a factor-augmenting production function, where the factor-augmenting parameter is introduced as an exponential multiple of the respective inputs. Other non-standard objective functions used in the literature are the indirect production function (Kim, 1988, 1992; Gajanan and Ramaiah, 1996), Generalised Box-Cox functions (Berndt and Khaled, 1979), the translog price function (Jin and Jorgensen, 2010), the CES-Translog production function (Kymn and Hisnanick, 2001), and a cost function modified to allow for learning effects (Gupta and Taher, 1984). Gajanan and Ramaiah's (1996) primary justification for using an indirect production function is that it allows estimation of both substitution *and* output effects, unlike in the case with cost function (which allow only substitution effects). They estimate both Hicksian and Marshallian elasticities of demand for sever major Indian industrial groups, in addition to the Morishima elasticities of substitution.[7] To the best of my knowledge, this is

[6] See Yuhn (1991), pp. 340.
[7] Please see the section on Empirical Framework for the justification of preference for Morishima elasticities over Allen elasticities of substitution.

the only paper that estimates Morishima elasticities of substitution in the Indian context. Hulten (1992), Kahn and Lim (1998), Acemoglu (2002), Dupuy (2006) are relatively more recent efforts in this literature strand.

The third sub-strand, with a relatively recent genesis, further reinforces the shift in focus away from substitution elasticities and towards technical change. In fact, the issue of elasticity of substitution appeared to have virtually dropped off the radar, while interest in technical change not only exploded, but also evolved from a narrow focus on its components to its determinants and downstream impacts on factor productivity, growth, and income distribution. This move away from the 'what' to the 'why', i.e. from simply estimating the variables of interest, to investigating the causes of differentials in them across units of observation, has important implications for industrial policy and labour welfare.

In this context, several authors have looked at the impact of information technology and skill-biased technical change on productivity improvements (Kahn and Lim, 1998; Stiroh, 2002; Jorgensen et al. 2005, 2007). Bartelsman and Doms (2000) and Syverson (2011) present detailed surveys of empirical research focusing on the causes of productivity, based on micro-level longitudinal data.

III. Literature Gaps and Research Questions

Literature Gaps

As the survey in the preceding section indicates, the estimation, decomposition, and downstream effects of elasticities of substitution and technical change on the one hand; and the impact of government policies on industrial outcomes on the other, represent two distinct and (mutually) exclusive strands of literature. To the best of my knowledge, even though both substitution elasticities and technical change affect labour welfare (through their impact on factor income shares), they have never actually been used to explicitly analyse it. Similarly, the debate on labour reforms focuses on the need to remove restrictions on businesses to hire and fire workers, and on the purported need to increase employment, but it has never taken explicit note of how technical change and price movements affect employment, or how these exogenous forces can undermine even the best-intentioned employment-generation policies.

Technology changes are often rapid and exogenously driven; policy is fairly static and deliberate; yet it is their *interplay* which has the most profound impact on labour welfare.

Failure to synthesise the elasticity and technical change concepts with government policy in a unified framework to analyse policy issues represents a clear gap in the literature. And it is filling this gap that is the focus of the present paper. An innovative application of well-established and well-used techniques to a policy problem of such importance and timeliness is its primary contributions to the literature. The results help articulate the 'first-principles' that must be addressed before an effective policy can be designed. In essence, they caution against 'putting the cart before the horse'.

In addition to the broad goals of this paper, the empirical framework also incorporates four procedural changes to elasticity of substitution estimation that collectively represent a significant departure from and contribution to the literature. First, unlike earlier empirical estimations of substitution elasticities, this paper separates out the consolidated labour variable into skilled and unskilled components. This is done to increase the relevance of the results for the labour reforms debate, since most industrial laws were instituted primarily to protect the interests of unskilled labour. Second, elasticity estimates in this paper are based on Morishima elasticities of substitution (MES) rather than Allen elasticities of substitution (AES). As Blackorby and Russell (1989) show, the Allen elasticity, owing to its assumption of symmetry, is a grossly inadequate measure of substitutability between inputs, especially in cases with more than two inputs. Third, empirical estimates of MES are rare generally, but even rarer still in the Indian context. To the best of my knowledge, there is only one paper that estimates MES for Indian data, and none that explains the observed patterns of income shares for Indian factors of production; so the scope for further applications definitely exists. Finally, this paper estimates elasticities for every year in the sample period and averages them over time sub-groups,[8] to get a sense of how elasticities have evolved over time, and how this evolution affects *changes* in factor income shares. To the best of my knowledge, earlier papers only estimate a *single* set of elasticities, based on average values. This is probably due to disengagement between correct interpretation of theory, *and* its correct empirical application. Standard theory defines a *given* substitution elasticity as the relationship between relative input prices and relative factor use. Empirical estimation commonly, and erroneously, assumes this to mean that only a single elasticity estimate must be computed for the entire sample, even though the *formula* for elasticity of substitution can be correctly applied to every time period in the sample (Greene, 2003). Measuring changes in

[8] The averaging was done to remove the year-to-year volatility or 'noise' that invariably creeps into the estimates.

estimated elasticities is therefore important, because the *actual* elasticities themselves change as economies evolve and the nature of capital itself changes.

Research Questions

The previous section established the importance of investigating how and why labour welfare had changed in the post-reforms period. A satisfactory analysis of this requires answering a series of questions, which can be grouped into three categories:

1. *What is the relative impact and importance of elasticity of substitution and technical change for factor income shares? Does one of these consistently dominate the other in their growth effects?*
2. *What is the pattern of relationship between unskilled income shares and the various elasticities of substitution? A related, but separate issue involves the co-movements in income shares of skilled and unskilled labour, and the elasticities of each with respect to capital.*
3. *What, if any, impact have state-level labour regulations had on income shares of skilled and unskilled labour? What is the relative importance of the potential explanations of factor income shares?*

The first two questions relate to the underlying structure of production technology in industries, while the third relates to impact of labour policies that have already been implemented. These questions will show whether or not labour policies, while generally accepted as having a detrimental effect on industries, have in fact had some mitigated effect in terms of enhancing labour welfare. If this is actually found to be true, then a case can be made for incorporating them in any new labour policy regime in future.

IV. Theoretical and Empirical Frameworks

Technological Change: Definition and Components[9]

Technological change is one of the most important and well-studied in the field of production economics. Yotopoulos and Nugent (1976) identify four distinct characteristics of technology that bear upon production: (1) technical efficiency of production; (2) scale effects; (3) the bias of technical change; and (4) the elasticity of substitution. Measuring changes in any of these will therefore give some idea of magnitude and direction of technological change.

[9] This section is a summary of the excellent exposition of technological change by Yotopoulos and Nugent (1976).

An increase in technical efficiency implies reduction in the quantities of the all factors of production to produce the same output as was produced before, or an increased output using the same quantities of factor as used before. It must be stressed that technical efficiency changes involve calculating changes in either output or input, *holding the other constant*. Scale effects, by contrast, refer to a change in output from an equiproportionate change in all inputs. Thus *both* inputs and output change. Bias of technical change refers to the change in factor intensity, *holding factor prices constant*, i.e. what would happen to factor usage due to purely technological reasons, irrespective of factor prices. Finally, elasticity of substitution refers to the ease with which one factor can be substituted for another.

The first two of these, i.e. technical efficiency and scale effects, are independent of the marginal products of the inputs, whereas both technical bias and elasticity of substitution are intimately related to them. More importantly, this relationship to marginal products implies that both technical bias and elasticities are closely linked to and help explain observed patterns in income shares movements. It is this linkage to income shares that has implications for development policy.

The effects of technical bias on factor incomes are fairly straightforward. For example, technical change that is capital-using or labour-saving will result in increased employment of capital and reduced employment of labour, respectively. The factor shares will respond accordingly to changes in relative factor use due to the critical assumption of constant factor prices, i.e. how would technological change affect relative factor use if factor prices were unchanged.

The effects of substitutability are more complicated. High or increased substitutability can be bad for a factor such as unskilled (production) labour, because they can be easily replaced and made unemployed/unemployable. But on the other hand, increased substitutability of a factor might even somehow increase its value to employers. In the case of increased substitutability between skilled and unskilled labour, for example, not only could skilled labour replace unskilled labour, but the opposite could also hold true, especially if returns to skilled (non-production) workers were deemed to have risen too much or too fast. The *a priori* expectations are that the substitutability between capital and unskilled labour far exceeds that between capital and skilled labour. The substitutability between unskilled and skilled labour would depend on specific industry characteristics.

Interpreting Elasticities of Substitution

The explanation of elasticities of substitution effects follows straight from textbook explanations of price elasticities of demand, i.e. how price changes affect total revenue for goods with elastic, inelastic, or unitary-elastic demand. A price reduction of a particular product will lead to an increase in total revenue accruing to that product only if demand for that product if elastic. Conversely, the same reduction in price will result in a reduction of the total revenues accruing to that product, if demand is inelastic. This is because in the former case, a proportional reduction in price causes a greater-than-proportional increase in demand, which increases total revenue; in the latter case, a proportional reduction in price leads to a less-than-proportional increase in demand, thereby reducing overall revenues.

The same logic extends to the concept of elasticity of substitution, which involves the impact of changes in *relative* factor prices on *relative* factor usage, and consequently on share of different factors in total income (i.e. the *revenues* accruing to each factor). If labour-capital elasticity of substitution is being considered, then a reduction in the relative price of capital will lead to a greater than proportional shift away from labour if the elasticity is greater than one, thereby resulting in a reduced income share for labour and increased income share for capital. Similarly, if the elasticity between labour and capital is less than one, a reduction in the relative price of capital will lead to a less than proportional shift away from labour and towards capital, thereby increasing the share of labour, to the detriment of capital. To summarise, relative prices and factor income shares move in the same direction for *inelastic* elasticities of substitution (<1), and in opposite direction for *elastic* elasticities of substitution (>1).

Empirical Framework

Empirical analysis in this paper employs a translog cost function, which can be written as:

$$\begin{aligned}\ln C = {} & \alpha_0 + \alpha_y \ln Y + \alpha_t t + \alpha_w wkr + \alpha_e emp + \frac{1}{2}\beta_{yy} \ln Y^2 + \frac{1}{2}\beta_{tt} t^2 + \beta_{Yt} t.\ln Y \\ & + \sum_{i=1}^{4} \alpha_i \ln P_i + \frac{1}{2}\sum_{i=1}^{5}\sum_{j=1}^{5} \beta_{ij} \ln P_i \ln P_j + \sum_{i=1}^{5} \beta_{Yi} \ln Y \ln P_i + \sum_{i=1}^{5} \beta_{ti} t.\ln P_i + \beta_{wY} wkr.\ln Y \\ & + \beta_{wt} wkr.t + \sum_{i=1}^{5} \beta_{wi} wkr.\ln P_i + \beta_{eY} emp.\ln Y + \beta_{et} emp.t + \sum_{i=1}^{5} \beta_{ei} emp.\ln P_i \end{aligned} \quad (1)$$

where C is total cost, Y is real output, and P_i's are the prices of factor inputs. *wkr* and *emp* are the dummy variables for states with pro-worker and pro-employer labour regulations,

respectively. States classified as having neutral labour laws are the control. Subscripts for industry, state, and time are suppressed for expositional purposes.

The derived demand function for each factor input can be estimated by the partial derivates of the cost function w.r.t. the associated factor price which, by Shephard's Lemma, gives the share of each input in total cost.

$$\frac{\partial \ln C}{\partial \ln P_i} = \frac{P_i X_i}{C} \equiv S_i = \alpha_i + \sum_{j=1}^{5} \beta_{ij} \ln P_j + \beta_{Yi} \ln Y + \beta_{ti} t + \beta_{wi} wkr + \beta_{ei} emp \qquad (2)$$

Standard restrictions apply to ensure that the cost function is the dual of a well-behaved production function. The cost function must be homogeneous of degree one in input prices, i.e. for any given level of output, total cost must increase proportionally when all input prices increase proportionally. This implies the following restrictions.[10]

$$\sum_i \alpha_i = 1 \qquad (3)$$

$$\sum_i \beta_{ij} = \sum_j \beta_{ij} = 0 \qquad (4)$$

$$\sum_i \beta_{Yi} = 0 \qquad (5)$$

As Greene (2003) shows, Restrictions (3)-(5) can be simply imposed by dividing the first M–1 prices by the Mth price, thus eliminating the last term in each row and column in the parameter matrix. Moreover, a non-singular system is obtained by dropping the Mth share equation altogether. In this paper, all the input prices are divided by the price index for materials, and the share equation for materials is dropped to avoid the problem of perfect multicollinearity.

Implementing the above-mentioned modification yields a generic share equation of the form:

$$S_i = \alpha_i + \sum_{j=1}^{4} \beta_{ij} \ln\left(\frac{P_i}{P_M}\right) + \beta_{Yi} \ln Y + \beta_{ti} t + \beta_{wi} wkr + \beta_{ei} emp \qquad \forall i \neq M \qquad (6)$$

It must be noted that unlike in equations (1) and (2), now there are only 4 input share equations (and therefore only 4 input prices) whose parameters are being estimated. These inputs are skilled labour, unskilled labour, capital, and fuels. The objective cost function of equation (1) and the four share equations in (6) collectively form a system of equations that is estimated simultaneously using *iterated seemingly unrelated regression* (SUR). Iteration ensures invariance to which share equation is dropped from the estimation.

[10] See Christensen and Greene (1976).

In terms of specific parameters of importance, β_{ti} shows the bias of technical change. A negative and significant parameter of *t* in either of the labour equations will imply labour-saving technical change, while a positive coefficient in the capital equation would imply capital-using technical change. Other combinations of magnitudes and signs could be interpreted accordingly. The parameters of the input prices do not have any meaningful economic interpretation by themselves, but along with actual income shares, are needed for calculation of the own- and cross-price elasticities of demand, and the elasticities of substitution. The generic formula for Morishima elasticity of substitution is:

$$M_{lk} = \varepsilon_{kl} - \varepsilon_{ll} \tag{7}$$

Where ε_{kl} & ε_{ll} are the cross- and own-price elasticities, respectively.

V. Data

The analysis in this paper is based on a panel of 22 industries (at the 2-digit level of industrial classification), 15 Indian states, and a 12-year timeframe (from 1991-2002). The primary variables are cost; output; input prices and costs shares for skilled labour, unskilled labour, capital, fuel, and materials. Most of the data was obtained from the Annual Survey of Industries (ASI).[11]

The price deflator for materials was created as the weighted average of price indices of products used as inputs in any given industry. The weights were derived from the Input-Output Table for 1993-94 and the detailed price indices were obtained from the website of the Central Statistical Organisation of India. The deflator used for capital is the implicit price deflator, derived from the real and nominal series for Gross Fixed Capital Formation, both of which were obtained from the website of the Reserve Bank of India. The detailed price indices were also used as output-specific deflators; in most cases, there was a one-to-one correspondence between the 2-digit industry and the associated industry price index. Where more than one industry price index corresponded to a given 2-digit industry, a simple average of the multiple indices was taken.

[11] The actual ASI data is based on financial year rather than calendar year, for example, 1991-92 rather than 1991. However, the paper employs the calendar year notation purely for notational simplicity. The reforms, first implemented in September 1991, would still have had an impact on industrial performance during the remainder of the 1991-92 period.

For the purposes of meaningful estimation and for increasing the degrees of freedom, industries were categorised according to four broad and common characteristics rather than being used individually. The categories considered are: Private Final Consumption Expenditure (PFCE), Gross Fixed Capital Formation (GFCF), initial Capital-Labour Ratios (KL90), and Exposure to International Markets (INTL). Except for the initial capital-labour ratio, all other categories were derived from the 1993-94 I/O Table, while the initial capital-labour ratios are from the year 1990, which predates the sample period. Categorisations were done in this way to ensure exogeneity. As an illustration, Private Final Consumption Expenditure as a category shows whether a small, medium, or large proportion of an industry's output is used for final consumption by consumers or by other industries as intermediate inputs. For example, it is to be expected that Food Products and Tobacco industries would largely cater to the final consumption market, while the Machinery industries would be primarily serving other industries. Similar small, medium, and large sub-categories apply to GFCF and initial K/L ratios as well. Four subcategories were identified for Exposure to International Markets category, based on actual observed patterns: Low or no exposure to international markets (industries with typically less than 1% of inputs being sourced from, or output getting exported to international markets), medium exposure to imports, high exposure to imports, and high exposure to exports. It was noteworthy that there were no industries that could be classified as having intermediate exposure to export markets. In all, 13 subcategories were identified across the four broad classifications, and results were obtained separately for each of these 13 subcategories. It must be stressed that while all these sub-categories are based on the same dataset, regressions for each of these sub-categories will be based on different numbers of observations, since classifications of industries according to categories will not be uniform.

VI. Results

This section details and discusses the results of the empirical analysis. The results are organised into three broad sections. First, the relative importance of biased technical change and elasticities of substitution for factor income shares; second, the pattern between magnitudes of *static* elasticities and factor income shares; third, the patterns between *changes* in elasticities and factor income shares, and the implications of these for different factor inputs; and finally, the differential impact of state-level labour regulations on income shares. The bulk of the results are focussed on aggregate insights that can be gleaned from all the 13

industrial sub-categories described earlier, though individual cases will be discussed as well where appropriate.

A brief description of the naming convention used for describing factor income shares and elasticities of substitution, and of the organisation of the results themselves, is in order. The factor income shares for skilled labour, unskilled labour, capital, and fuel are *sshare*, *ushare*, *cshare*, and *fshare*, respectively. The three primary elasticities of substitution of interest are those between unskilled labour and capital, skilled labour and capital, and unskilled and skilled labour. These elasticities are abbreviated, respectively, as SK-EOS, UK-EOS, and US-EOS. To understand the correct interpretation of these elasticities, consider the SK-EOS as an illustration: this shows the effect of a change in price of capital, relative to the price of skilled labour, on the skilled labour-capital ratio used in production. It is again stressed that these elasticities are the Morishima Elasticities of Substitution, and are as such asymmetric. In other words, SK-EOS will be different for the symmetrically opposite case of KS-EOS, and so forth.

All the empirical results are based on equation 6, which sets of the income share of each input as a function of factor prices, output, time trend, and regulations. The coefficients of the time trend from (interpreted as bias of technical change) and of the two categorical variables (representing pro-worker and pro-employer labour regulations)[12] *each share equation* are given in table 2. The analysis therefore assumes a constant annual rate of technical change, and a constant marginal impact of government regulations. However, the price variables do not have a direct interpretation, and must be used along with actual factor income shares to derive the elasticities of substitution (table 3). These elasticities are time-varying, estimated for each year in the sample, and averaged over 1991-96 and 1997-2002, respectively, to distinguish the early and later halves of the post-reform decade.

A second, inevitable complication is that the relative impacts of technical change and substitution elasticities are not directly comparable (Yuhn, 1991). Instead, the relative impacts of these must necessarily depend on subjective analysis, based on the signs and relative magnitudes of these variables.

[12] Given that separate regressions were run for each of the 13 industrial subcategories, presenting all the results here was not feasible. Consequently, only the most relevant results and the most relevant coefficients are presented here. The rest are available from the author on request.

Elasticities of Substitution and Technical Change

All the regression results conclusively show that bias of technical change has, at best, a negligible impact on factor shares (often less than 0.5%). In several cases, the bias is not even statistically significant. In other words, pure technical change, i.e. impact on factor shares for reasons other that price-driven ones, is negligible. This result is consistent with that of Betts (1997). In other words, firms will not switch over to newer technologies *just because they are there*, unless costs of those new technologies justify the effort. The robustness and conclusiveness of this result pattern is both illuminating and consistent with logical entrepreneurial reasoning. Therefore, any statements that just the pure advent of newer technologies will harm labour will not hold water. Explanations of inter-temporal movements in factor shares must therefore be gleaned from how the various elasticities of substitution evolve and interact with each other.

The second set of results, given in Table 3, relate to the pattern, across industrial categories, between static magnitudes of elasticities of substitution and the income shares for skilled and unskilled labour. Unskilled labour is the only factor for which there appears to exist an apparent relationship between income share on the one hand and the UK-EOS and US-EOS elasticities on the other. Within the **Private Final Consumption Expenditure** category, industries with low PFCE and high PFCE have unskilled labour shares of around 12.5% and 9.3%, respectively (for the period 1991-96). The more surprising result is that these shares increase marginally to 12.8% in the low PFCE industries (which would typically be more capital-intensive, technology-driven companies), and fall significantly in high-PFCE industries to 7.5% (where one would expect the unskilled labour to hold their ground). That notwithstanding, these shares are higher than in industries with intermediate levels of PFCE, where the *ushare* is 5.4% and 4.9% in the two time groups, respectively. The UK-EOS and US-EOS in low-PFCE industries are around 1.5 and 1.3, respectively, while in high-PFCE industries these are around 1.6 and 1.7, respectively. Moderate-PFCE industries present a contrasting picture, with UK-EOS being very close to one (over 0.993) and US-EOS being 0.683 and 0.717, respectively, in the two time groups.

Within the **capital-labour ratios** category, industries with low K/L ratios (KL90 = 1) have the highest share of unskilled labour at 9.1% in 1991-96 (dropping to 7.3% in 1997-02). The associated elasticities are approx. 1.5 for UK-EOS and 1.6 for US-EOS. This is followed by industries with moderate and high K/L industries (see attached table for the results),

respectively. In terms of **Gross Fixed Capital Formation**, unskilled labour in both industries with low (GFCF=1) and high (GFCF=3) rates of capital formation have higher income shares relative to that in industries with moderate capital formation. Low capital industries have a unskilled labour share of 7% in 1991-96, while in high capital industries this share amounts to 7.7%. Both these industries have the relevant elasticities being greater than one, although the US-EOS in the low capital case (1.042) and the UK-EOS in the high capital case (1.054) are both arguably close to one. By contrast, for moderate capital industries, the UK-EOS is around 1.2 but the US-EOS is around the 0.72 mark. Finally, the same pattern is also repeated in the case of industries with differential levels of exposure to the international markets.

To summarise the foregoing results; across all industrial subcategories, the highest unskilled labour shares are associated with those industrial subcategories for which **both elasticities (UK-EOS and US-EOS) are greater than one**. Industry categories with intermediate magnitudes of unskilled labour shares are typically those where at least one of these elasticities is less than one, while categories with comparatively lower magnitudes are those with both elasticities being less than one, and either of these being closer to the 0.5 mark. A ore specific pattern appears to be that relatively lower income shares of unskilled workers are associated with lower elasticity of substitution between unskilled and skilled labour, rather than between unskilled labour and capital. By contrast, across industrial categories, the industrial subcategories with relatively higher shares of skilled workers are also those with high SK-EOS.

The elasticity of substitution between skilled and unskilled labour appears to have a greater significance for unskilled labour than for skilled labour. Income shares for skilled workers are, by contrast, more dependent on substitutability between these workers and capital. In other words, changes in the relative prices of skilled labour have a far greater impact on *ushare* than vice versa. By contrast, *sshare* is more affected by changes in price of capital than by price of unskilled labour; with the latter having no discernible impact on *sshare*. This close relationship between capital and skilled labour also attests to the existence of *capital-skill complementarity*, shown by the fact that SK-EOS is consistently lower than UK-EOS (in fact, SK-EOS is consistently inelastic while UK-EOS is consistently elastic) (Bergstrom and Panas, 1992). There are four industrial categories where this capital-skill complementarity does not hold: industries with intermediate K/L ratios, high GFCF formation, and both low and high import-dependent industries.

Table 2 - Bias of Technical Change; and Effects of Pro-Worker and Pro-Employer Regulations

	PFCE = 1				PFCE = 2				PFCE = 3			
Coefficient	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare
Tech Change	-0.002*	-0.001**	0.007*	0.11*	*0*	-0.001*	0.1*	*-0.001*	-0.002*	-0.003*	*-0.002*	0.002**
Pro-Worker	0.012*	0.024*	0.019*	*0.006*	0.005**	0.007*	0.013**	-0.01*	0.012*	0.041*	*0*	-0.012
Pro-Employer	0.004***	-0.007**	0.017*	*-0.014*	*0.002*	*0.002*	*-0.003*	-0.14*	*0*	-0.01**	*0.004*	-0.018
	KL90 = 1				KL90 = 2				KL90 = 3			
Coefficient	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare
Tech Change	-0.002*	-0.003*	0.002**	0.001**	0.003*	*0*	0.003**	*0.001*	0.001*	0.001*	0.012*	0.004**
Pro-Worker	0.008*	0.028*	0.011**	-0.008*	0.021*	0.019*	0.037	*-0.002*	0.005*	0.017*	*0*	*-0.005*
Pro-Employer	-0.004*	-0.011*	*0.003*	-0.012*	0.008*	*-0.003*	0.012**	-0.006*	*-0.002*	-0.004**	0.013**	*-0.004*
	GFCF = 1				GFCF = 2				GFCF = 3			
Coefficient	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare
Tech Change	-0.002	-0.003	0.005	0.001	0	-0.002	0.01	0	0.002	0	0.003	0.002
Pro-Worker	0.003***	0.023*	*-0.006*	-0.021*	0.015*	0.018*	0.012**	*-0.004*	0.019*	0.034*	0.047*	*0.003*
Pro-Employer	*-0.002*	*-0.002*	*0.001*	-0.021*	0.007**	*-0.001*	*-0.003*	-0.022*	0.007*	*-0.002*	0.022*	-0.004
	INTL = 1				INTL = 2				INTL = 3			
Coefficient	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare
Tech Change	-0.002	-0.003	0	0.002	0	0.001	0.012	0.005	0.002	0	0.004	0.002
Pro-Worker	0.011*	0.033*	0.008***	-0.009*	0.013*	0.021*	*0.005*	*0.002*	0.010*	0.011**	0.028*	*-0.003*
Pro-Employer	*-0.001*	-0.008**	*0.004*	-0.012*	0.011*	*0*	*-0.006*	-0.031*	*-0.001*	-0.007***	0.014**	-0.006*
	INTL = 4											
Coefficient	sshare	ushare	cshare	fshare								
Tech Change	-0.003	-0.002	0.01	0.003								
Pro-Worker	*0.003*	0.008***	*0.008*	-0.028**								
Pro-Employer	*-0.002*	*-0.003*	0.021*	*-0.010*								

*, **, & *** represent, respectively, statistical significance at 1%, 5%, & 10%. *Italics* represent statistical insignificance.

Industrial Category Legends

PFCE – Private Final Consumption Expenditure. Categories 1, 2, & 3 represent, respectively; industries having a low, intermediate, and high proportion of their final output going towards final consumption.

KL90 – Capital/Labour ratio in 1990. 1, 2, & 3 represent, respectively; low, intermediate, and high K/L ratios in 1990

GFCF – Gross Fixed Capital Formation. 1, 2, & 3 represent, respectively; industries with low, intermediate, and high rates of capital formation.

INTL – Exposure to International Markets. 1, 2, 3, & 4 represent, respectively, industries with low or no exposure, medium dependence on imports, high dependence on imports, and high dependence on exports.

Table 3 - Factor Income Shares and Elasticities of Substitution

Shares		PFCE = 1				PFCE = 2				PFCE = 3		
	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare
1991-96	0.066	0.125	0.101	0.098	0.035	0.054	0.109	0.048	0.042	0.093	0.094	0.038
1997-02	0.062	0.128	0.105	0.097	0.039	0.049	0.111	0.056	0.047	0.075	0.100	0.046
EOS		PFCE = 1				PFCE = 2				PFCE = 3		
	SK	UK	SU	US	SK	UK	SU	US	SK	UK	SU	US
1991-96	0.810	1.520	1.209	1.379	0.866	0.993	0.521	0.683	0.816	1.595	0.876	1.742
1997-02	0.824	1.502	1.209	1.392	0.889	0.996	0.522	0.717	0.840	1.662	0.955	1.783
Shares		KL90 = 1				KL90 = 2				KL90 = 3		
	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare
1991-96	0.040	0.091	0.090	0.040	0.051	0.063	0.127	0.031	0.026	0.043	0.123	0.136
1997-02	0.043	0.073	0.097	0.049	0.066	0.063	0.122	0.040	0.029	0.041	0.131	0.134
EOS		KL90 = 1				KL90 = 2				KL90 = 3		
	SK	UK	SU	US	SK	UK	SU	US	SK	UK	SU	US
1991-96	0.671	1.496	0.927	1.622	1.246	0.779	0.854	0.602	0.699	0.969	0.383	0.615
1997-02	0.692	1.547	0.983	1.666	1.244	0.779	0.846	0.655	0.740	0.978	0.412	0.674
Shares		GFCF = 1				GFCF = 2				GFCF = 3		
	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare
1991-96	0.033	0.070	0.098	0.085	0.038	0.058	0.120	0.059	0.052	0.077	0.123	0.035
1997-02	0.036	0.061	0.109	0.087	0.046	0.054	0.120	0.072	0.062	0.068	0.118	0.040
EOS		GFCF = 1				GFCF = 2				GFCF = 3		
	SK	UK	SU	US	SK	UK	SU	US	SK	UK	SU	US
1991-96	0.736	1.213	0.587	1.042	0.995	1.200	0.744	0.729	1.260	1.054	1.023	1.144
1997-02	0.760	1.236	0.611	1.082	1.005	1.202	0.740	0.783	1.268	1.069	1.018	1.166
Shares		INTL = 1				INTL = 2				INTL = 3		
	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare	sshare	ushare	cshare	fshare
1991-96	0.040	0.085	0.102	0.043	0.039	0.044	0.144	0.104	0.040	0.061	0.095	0.033
1997-02	0.045	0.069	0.103	0.052	0.052	0.046	0.144	0.108	0.047	0.056	0.108	0.041
EOS		INTL = 1				INTL = 2				CAT_INTL = 3		
	SK	UK	SU	US	SK	UK	SU	US	SK	UK	SU	US
1991-96	0.800	1.574	1.009	1.822	1.325	0.824	0.921	0.451	0.887	0.622	0.563	0.509
1997-02	0.820	1.661	1.081	1.865	1.284	0.836	0.891	0.531	0.908	0.645	0.570	0.564

Shares		INTL = 4		
	sshare	ushare	cshare	fshare
1991-96	0.036	0.068	0.106	0.115
1997-02	0.037	0.064	0.114	0.118
EOS		INTL = 4		
	SK	UK	SU	US
1991-96	1.023	1.205	0.647	0.851
1997-02	1.016	1.210	0.644	0.870

The static income share notwithstanding, another important consideration is with respect to the associated *patterns of co-movements* between in income shares of skilled and unskilled labour on the one hand, and the changes in SK-EOS and UK-EOS on the other. This forms the third set of results from this analysis, and follows on from and adds to the preceding results. It is needed for determining which elasticities of substitution matter more for the *evolution* of which factor's income shares. These results extend existing theoretical postulates, which assume *static* elasticities of substitution, to cover *changes* in them as well. This extension is a significant contribution of this paper, for it seeks to extend in a meaningful way, the framework for evaluating industrial performance in any fast evolving economy (like that of India). Industrial landscapes in such economies are hardly likely to be characterised by static elasticities of substitution, and failure to account for this dynamism will result in wrongful attribution of the effects of technology changes to price changes, thus overestimating the latter. In essence, this analysis raises the distinct possibility that technological evolution in a country's manufacturing sector can have labour welfare implications quite independent from those envisioned by policy makers, and failure to account for these could derail the best-intentioned labour policies.

The share of skilled labour has increased in 12 of the 13 industrial categories considered and fallen in only one. The income share of unskilled labour, by contrast, has fallen in 10 of the categories, increased in two, and remained unchanged in one category. Each of the 10 categories where unskilled labour share has fallen is **also associated with increased income share of skilled labour, and increases in *both* SK and UK elasticities of substitution**. Significantly, in 7 of these 10 cases, the UK-EOS is greater than one; for two categories, this elasticity is arguably close to one (0.996 and 0.978, respectively, in 1997-02); and in only one remaining case is this elasticity definitively lower than one (0.645 in 1997-02). Similarly, in 7 of these *same* 10 cases, the SK-EOS is less than one; in two of these categories, this elasticity is very close to one (1.005 and 1.026, respectively, in 1997-02), and in only one remaining case is this elasticity definitely higher than one (1.268 in 1997-02).

In terms of the remaining three sub-categories, i.e. where the *ushare* did not fall, the first involves industries with low PFCE ratios. This was the only category where *sshare* actually fell. The second and third sub-categories are of industries with intermediate levels of K/L ratios in 1990, and with relatively low import-dependence, respectively. These show the greatest percentage point increase in income share of skilled workers, with increases being

1.5% and 1.3%, respectively. In the intermediate K/L ratio sub-category, the increase in share of skilled labour (the largest such increase across *all* sub-categories) is associated with a small reduction in the high SK-EOS, with unchanged UK-EOS and *ushare*.

Finally, in low import-dependence industries, both *sshare* and *ushare* recorded gains, with the gains for the former being 2nd largest relative to their performance across all categories. Skilled labour-capital elasticities fell from 1.325 to 1.284, while unskilled labour-capital elasticities increased from 0.82 to 0.836.

The overwhelming conclusion that arises from these patterns (at least as pertaining to 10 of the 13 industrial subcategories) is that reductions in the price of a factor input relative to price of other inputs will decrease (increase) the other input's income share, if the associated elasticities of substitution are greater than one and *increasing* (*decreasing*). Conversely, the same reduction in relative price will increase (decrease) the other input's income share, if the associated elasticities are less than one and *increasing* (*decreasing*). Stated another way, this principle states that even an *elastic* elasticity of substitution will help factors who's relative price increases, if the magnitude of *'elastic-city'* if falling; and even inelastic EOS will hurt the same factor from an increase in its relative price, if magnitude of *'inelastic-city'* is increasing. These results are important because it validates a conceptually logical hypothesis: with highly substitutable inputs, a reduction in the price of one input increases the attractiveness of the other input, and the high substitutability makes the actual switch between the two easier.

Finally, changes in EOS have systematic implications for both the labour shares, but not for fuel or capital shares. Changes in labour income shares undoubtedly do get reflected in fuel and capital shares, though there is no systematic pattern of correlation between these and any elasticities of substitution.[13] Collectively, these results show not just which elasticities are important for which factor income shares, but also specifically which factor's price changes are most important for other factors' income shares.

[13] We also know by comparing factor price indices that the price of capital has fallen relative to prices of both skilled and unskilled labour, while price of skilled labour has risen relative to that of unskilled labour.

Impact of labour Regulations — The Interaction of Policy and Technology

The preceding section showed how technological evolution can affect factor income shares, and through them, labour welfare. However, this is only one part of the picture. The other important result relates to the role of labour regulations in helping or hurting labour welfare. Lost in the increasing clamour on labour reforms is the important question of whether Indian labour laws, while undoubtedly being restrictive from businesses perspective, have yielded any intended benefits for unskilled labour. To the best of my knowledge, no previous paper has addressed this issue in an empirical and systematic manner. Addressing this problem empirically in turn raises the problem of how differential labour regulations should be represented and applied. Since labour regulations would appropriately apply to different Indian states rather than to industries, the question becomes one of whether states can be aggregated according to their labour regulation regimes, and whether there is a precedent in the literature for such aggregation. As was mentioned earlier in the section on empirical issues, aggregation across units of observations (such as states) allows for non-neutral efficiency differences *between* groups, so long as these differences *within* the respective groups are neutral. Binswanger (1974a) specifically allows for this possibility in his highly influential paper:

> If the index is not available, but the cross-sectional units can be grouped into regions, within which no non-neutral differences exist, regional dummies will again insure unbiased estimates of the parameters of the cost function, because they allow the regions to have differing shares at equal factor prices (Binswanger, 1974a, pp. 381).

The present paper uses an appropriate measure of labour regulations to group states according to the broad orientation of their labour laws, i.e. whether they tend to favour workers or businesses, or whether they remain largely neutral. The labour regulation measure used here is adapted from that used by Aghion et al (2008). Their original labour regulation measure is computed by tabulating and classifying each amendment to different states' labour laws according to their pro-worker or pro-business tilt, and cumulating the scores to get an overall measure. They classify each state a 5-point scale, encompassing Highly Pro-Employer, Pro-Employer, Neutral, Pro-Worker, and Highly Pro-Worker categories, whereas in contrast, this paper uses a simpler 3-point classification: Pro-Employer, Neutral, and Pro-Worker.[14] The Neutral states were those which have either not implemented any reforms to their labour

[14] Where Aghion et al. (2008) uses Highly Pro-Worker or Pro-Worker, I only use Pro-Worker. Similarly, Highly Pro-Employer and Pro-Employer states are collapsed into a singular, Pro-Employer. There main reason for this was to keep the estimation of the translog cost function tractable; with output, time, 5 inputs, their squares and interactions, there were many coefficients to estimate. And adding just two dummy variables would have increased the number of coefficients to be estimated in a non-linear manner.

laws, or those where the various amendments were deemed to have cancelled each other out in terms of their cumulative effects.

The **pro-employer states** identified through this analysis are: Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Rajasthan, and Tamil Nadu. **Pro-worker states** are: Kerala, Orissa, and West Bengal. States with **neutral** labour regulations are: Assam, Bihar, Haryana, Madhya Pradesh, Punjab, and Uttar Pradesh. Following Binswanger's (1974a) influential paper, indicator variables for Pro-Employer and Pro-Worker states were used, with Neutral states being the control variable. The estimated effects of labour laws are therefore relative to states classified as having Neutral labour laws.

The results for the effects of labour regulations are given in Table 2. As with the effects for technical change, the Table 2 shows the coefficient values for the pro-employer and pro-worker indicator variables in each of the four factor share equations, across all 13 industrial subcategories. In each of these, pro-worker labour regulations are shown to exert a positive impact on income shares of unskilled workers, relative to the case in neutral states. Moreover, in 11 of these 13 subcategories, the effects are significant at the 1% level. Pro-worker laws help not only unskilled workers, but skilled workers as well. They have a statistically significant positive impact in 12 out of the 13 industrial subcategories, with the impact in 10 out of these 12 categories being significant at the 1% level; the highly export-dependent subcategory is the only one where this effect is not statistically significant. It is also noteworthy that in 10 subcategories, the marginal impact on unskilled labour share exceeds that on skilled labour shares, often by a large margin (and in some cases, by several multiples).

The impact on labour in states having pro-business regulations is predictably quite different. The impact of such laws on unskilled labour shares is significant in only 6 subcategories, and in each of these cases, the effects are negative. Moreover, there are only 2 instance (across both types of labour), where the statistically significant effects are greater than or equal to 1% (1.1% for skilled labour in low import-dependent industries and -1% for unskilled labour in consumption-driven industries). In all other cases, the pro-business regulations have a very small or statistically insignificant impact on either type of labour. These results reinforce an *a priori* expectation that pro-business labour laws are indifferent at best and detrimental at worst, to the goals of labour welfare.

Policy Implications

These results present the first such empirical validation of the hypothesis that India's labour laws, though restrictive, are providing some benefits to the intended target, i.e. unskilled labour. Most significantly, **they highlight *two* important policy issues and associated tradeoffs in the formulation of labour reforms policy**.

The **first** relates to the fundamental goals of the labour policy reform agenda itself, i.e. the yardstick for evaluating subsequent success or failure of specific labour reforms. Should it be economic growth, employment growth, wage growth, or sustainability/growth of unskilled labour's share of total income? Failure to articulate a basic objective such as this would invariable result in a situation where *any* outcome is justified as a success. In other words, *shooting an arrow first and then drawing a bullseye around the point where it lands*. This is a highly pertinent and timely question, and yet one which is conspicuous by its absence. As the Appendix shows, the share of unskilled labour in total industrial employment across 2-digit industry groups has remained largely stable over time. So even though unskilled (manufacturing) employment has not risen substantially, it has not fallen either. Unskilled wages, on the other, hand present a different picture.

Appendix 1 further shows the average growth rates of unskilled and skilled wages, respectively, in the 1980s and 1990s. Unskilled wages experiences respectable growth during the 1980s (both absolute and relative to skilled wages). However, the growth rates slows down significantly in the 1990s, relative to skilled wage growth, and the difference in average wages of the two type of labour correspondingly increases for almost all the 2-digit industry groups. The differences are more pronounced for some of the heavier, capital-intensive industries.

Overall, unskilled share of employment has remained stable while unskilled wages have fallen substantially (both relative to comparable metrics for skilled labour). Despite this pattern, the results of the section on elasticities of substitution show that income share of unskilled workers have mostly fallen, though by a far smaller margin than would be the case otherwise. A reasonable explanation could be that while labour laws prevented significant layoffs (and hence maintained employment patterns), wages bore the brunt of employers' efforts to circumvent these laws. If labour reforms do succeed in increasing employment, as is claimed by the incumbent government, what would happen to unskilled wage rates? Will they increase, decrease, or remain stable? And what will happen to income shares? The former has socio-economic implications workers, while the latter will have more

macroeconomic implications. The obvious ***tradeoffs in this case would be between employment growth and wage (income share) growth***. From an economic standpoint, it appears counter-intuitive to think that reforms can achieve *both* employment and wage growth, at least without further regulating business to ensure these effects, in which case the reforms would be undermined by default.

The **second** important issue relates to the relative impact of evolving production technology and static labour policy on factor income shares. Elasticities of substitution, their impact on factor shares notwithstanding, is essentially a technical concept, reflecting the state of and changes in production technology characteristics. Production technology is quite dynamic, changing fairly rapidly. More importantly, the stimulus for such changes is usually exogenous, driven by what is happening on the technology frontier elsewhere in this highly integrated and globalised world. Businesses face no less than the existential choice between 'adapt or perish'. Government policies, by contrast, at both Central and state levels, are quite static and slow to evolve. No matter how well-intentioned and forward-looking, policies in reality are often 'behind the curve'; as a common anecdote states, 'policy lags technology'. Policies cannot and should not be made in isolation, without due regards to the evolution in the technological landscape. Without taking into account the technical parameters, the policy will often fail to achieve its intended goals, and sometimes even yield unintended negative consequences. At the same time, policies do exert a differential impact across industries, and no industry can hope to succeed without due regard to the policy environment in which it operates. Recognising this mutual inter-dependence, and identifying the relative importance of policy and technology, are important for the formulation of correct, forward-looking policies.

The introduction of labour regulations provisions that are currently in force pre-dated the time period used for this paper. In this respect, this paper serves the important purpose of showing whether and how the effects of labour policy are being reinforced or undermined by exogenous changes in the technological frontier. Elasticities patterns show a negative impact on unskilled labour shares in most of the industrial sub-categories considered, across Indian states. Pro-worker regulations have a partial positive impact that only moderates some of these negative effects, but do not completely reverse them. This raises the second important issue and associated trade-off: ***even though pro-worker regulations achieve partial success in preserving some of the income share for unskilled labour, are they a good idea? Is sacrificing growth for labour welfare really worth it?*** How can the apparently conflicting goals of labour welfare and economic/employment growth be reconciled? The analysis of this

paper shows that these goals are often at odds with each other, and realising one of these often comes at the expense of the other. While pro-labour regulations have a consistent and overwhelming positive impact, pro-employer regulations are shown to have a negative impact. However, states having more pro-business regulations are more dynamic and have faster growth (e.g. Maharashtra and Gujarat), while those with more pro-labour regulations are amongst the most economically stagnant in the country (e.g. West Bengal and Orissa).

VII. Conclusions

This paper investigates the relative importance and differential impacts of technical change, elasticities of substitution, and labour policies on income shares of various factors of production. In doing so, it essentially applies standard, well-established production economics frameworks to the timely and topical issue of labour welfare. The results have important implications for the overall debate on labour reforms.

The paper's main conclusions are that pure technological change had a negligible impact on factor income shares, while both input price-driven substitution effects and labour policies implemented at the state-level had significant effects on these income shares. However, these effects were not uniform, with elasticities of substitution having a more significant impact relative to that of labour policies. Substitution elasticities between skilled labour and capital are generally inelastic, while those between unskilled labour and capital are generally elastic. The relative magnitudes of these indicate the presence of capital-skill complementarities. These help explain increases in skilled labour shares and decreases in unskilled labour shares over the post-reform decade. Pro-worker regulations at the state level mitigate some of the negative effects of substitution elasticities on unskilled income shares, but do not completely reverse them; unskilled labour (and in some cases, even skilled labour) fared better in states with more pro-labour policies than in states considered as having 'neutral' labour policies. Pro-employer legislation, on the other hand, exerts a negative or statistically insignificant influence on unskilled labour shares.

The dominance of technological factors over policy ones in terms of their relative impacts has two important implications for designing of reforms policies. First, it highlights the importance of clearly articulating what labour welfare really entails, *before* devising policies or reforms to achieve that welfare. The second implication is that care must be taken to ensure that reforms policies do not go against the 'technological tide', for doing so will only lead to undermining of policy goals and other adverse consequences.

Appendix

Detailed Employment and Wage Statistics for 2-Digit Industry Groups

Industry Group	15	16	17	18	19	20	21	22	23	24	25
% of Blue Collar Workers in Total											
% BC in Total Emp	76.7%	93.9%	85.2%	83.0%	81.5%	77.5%	76.7%	69.6%	72.3%	68.5%	73.1%
SD BC share in total empl	0.7%	4.0%	1.1%	1.9%	1.1%	1.2%	1.0%	4.1%	3.1%	0.9%	2.1%
Share of BC Employees in Total Wage Bill											
Ave (80-90)	62.6%	79.6%	80.0%	66.7%	71.2%	68.8%	64.1%	65.1%	58.7%	52.0%	60.6%
Ave (91-99)	61.2%	85.1%	76.8%	68.3%	67.1%	69.4%	64.7%	56.6%	61.0%	51.0%	57.4%
Ave (00-03)	55.6%	78.3%	69.4%	63.4%	61.6%	59.3%	58.4%	39.5%	53.4%	42.0%	53.4%
Ave WC (00-03)	44.4%	21.7%	30.6%	36.6%	38.4%	40.7%	41.6%	60.5%	46.6%	58.0%	46.6%
Wage Rate for BC Workers											
BC: Ave % change (80s-90s)	227%	174%	150%	178%	138%	173%	183%	193%	224%	170%	148%
BC: Ave % change (90s-00s)	61%	59%	39%	72%	45%	68%	55%	48%	117%	49%	52%
Wage Rate for WC Workers											
WC: Ave % change (80s-90s)	260%	130%	174%	218%	178%	194%	196%	253%	220%	186%	181%
WC: Ave % change (90s-00s)	101%	136%	103%	138%	95%	114%	114%	119%	193%	99%	99%
Difference in average growth rates of wages for BC and WC workers (WC-BC)											
Wage growth differential in 80s	33%	-44%	24%	39%	41%	21%	13%	60%	-4%	16%	34%
Wage growth differential in 90s	40%	77%	64%	66%	50%	46%	58%	71%	76%	50%	47%
Relative average wage rates for BC and WC workers											
Ave (All)	44%	26%	53%	36%	43%	55%	49%	51%	50%	43%	47%
Ave BC/WC wage rate (80-89)	51%	26%	64%	46%	54%	64%	57%	69%	56%	49%	57%
Ave BC/WC wage rate (91-99)	47%	31%	59%	40%	46%	60%	54%	57%	57%	46%	50%
Ave BC/WC wage rate (00-03)	37%	21%	40%	29%	35%	47%	39%	39%	42%	35%	38%

Appendix contd.: Detailed Employment and Wage Statistics for 2-Digit Industry Groups

Industry Group % of Blue Collar Workers in Total	26	27	28	29	30	31	32	33	34	35	36
% BC in Total Emp	80.0%	74.9%	72.7%	66.7%	56.4%	66.0%	64.7%	67.4%	71.1%	77.3%	76.9%
SD BC share in total empl	1.6%	1.0%	1.3%	4.3%	5.4%	1.6%	5.3%	2.8%	1.3%	1.4%	1.1%
Share of BC Employees in Total Wage Bill											
Ave (80-90)	66.7%	66.6%	49.4%	60.8%	41.4%	53.2%	54.8%	57.5%	59.3%	69.9%	69.1%
Ave (91-99)	63.6%	62.2%	52.2%	56.3%	33.5%	52.5%	45.6%	54.1%	59.8%	66.2%	67.9%
Ave (00-03)	58.1%	57.1%	53.0%	44.3%	25.7%	46.7%	37.1%	38.3%	51.8%	53.8%	59.1%
Ave WC (00-03)	41.9%	42.9%	47.0%	55.7%	74.3%	53.3%	62.9%	61.7%	48.2%	46.2%	40.9%
Wage Rate for BC Workers											
BC: Ave % change (80s-90s)	195%	177%	221%	188%	117%	163%	162%	219%	186%	161%	132%
BC: Ave % change (90s-00s)	56%	90%	73%	54%	64%	47%	71%	49%	48%	55%	55%
Wage Rate for WC Workers											
WC: Ave % change (80s-90s)	211%	224%	174%	197%	177%	185%	202%	246%	200%	204%	166%
WC: Ave % change (90s-00s)	112%	132%	87%	152%	175%	107%	158%	158%	126%	134%	112%
Difference in average growth rates of wages for BC and WC workers (WC-BC)											
Wage growth differential in 90s	15%	47%	-46%	9%	61%	23%	40%	26%	14%	42%	34%
Wage growth differential in 00s	56%	42%	15%	98%	111%	60%	87%	109%	78%	80%	56%
Relative average wage rates for BC and WC workers											
Ave BC Wage Rate / Ave WC Wage Rate											
Ave (All)	41%	53%	40%	57%	35%	51%	43%	47%	51%	50%	55%
Ave BC/WC wage rate (80-89)	47%	65%	36%	70%	52%	61%	57%	62%	62%	66%	68%
Ave BC/WC wage rate (91-99)	45%	56%	42%	68%	41%	56%	49%	57%	59%	56%	60%
Ave BC/WC wage rate (00-03)	33%	46%	39%	42%	24%	40%	33%	33%	39%	37%	44%

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