Determinants and Impact of Subcontracting: Evidence from India's Informal Manufacturing Sector

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Determinants and Impact of Subcontracting: Evidence from India's Informal Manufacturing Sector*

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Abstract

There are two divergent perspectives on the impact of subcontracting on firms in the informal sector. According to the benign view, formal sector firms prefer linkages with relatively modern firms in the informal sector, and subcontracting enables capital accumulation and technological improvement in the latter. According to the exploitation view, formal sector firms extract surplus from stagnant, asset-poor informal sector firms that use cheap family labour in home-based production. However, direct, firm-level evidence on the determinants and impact of subcontracting is thus far lacking in the literature. We apply a modified Heckman selection model to Indian National Sample Survey data on informal manufacturing enterprises (2005–06). We find that home-based, relatively asset-poor, and female-owned firms are more likely to be in a subcontracting relationship. Further, we perform selectivity-corrected Oaxaca-Blinder Decomposition and calculate treatment effects to show that subcontracting benefits smaller firms, firms in industrially backward states and rural firms; it is harmful for larger firms, firms in industrially advanced states, and urban firms. Our results suggest that the effects of subcontracting are more complex than those predicted by the divergent perspectives. Policy-makers need to engage with this complexity.

JEL Classification: C31, O17, O53

Keywords: sub-contracting, informal sector, Heckman sample selection, Blinder-Oaxaca decomposition.

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1 Introduction

The informal manufacturing sector in India accounts for nearly two-thirds of manufacturing employment (NCEUS, 2008). Given the centrality of the informal sector to employment, enhancing poverty-level incomes prevalent in this sector is a major policy concern (NCEUS, 2007). Linkages to the more dynamic growth sector, i.e. the formal sector composed of larger private sector and public sector units are believed to be important in achieving this goal (Meagher, 2013). One kind of linkage that has been of long-standing concern for policy-makers and scholars in India is subcontracting or the outsourcing of a part of the production process by a larger firm to a smaller one (Nagraj, 1984). The incidence of subcontracting has increased greatly in India after the economic reforms of 1991 (Sahu, 2010; Kotwal et al., 2011).[1] National Sample Survey data show that, in 2005, around 30% of an estimated 17 million informal manufacturing enterprises worked on subcontract (Bhattacharya et al., 2013).

There exist two different views in the literature regarding the impact of subcontracting on the informal sector. One view sees it as a beneficial or benign relationship, which encourages technological up-gradation, productivity growth and accumulation of capital in subcontracted firms as well as eases demand and credit constraints experienced by them (House, 1984; Ranis and Stewart, 1999; Arimah, 2001; Marjit, 2003; Moreno-Monroy et al., 2012). We term this the "benign view" of subcontracting. These authors also argue that the formal sector firms subcontract to the more modern/dynamic segment of the informal sector, not only because of the latter's static labour-cost advantages, but also the ability to increase its productivity. If this is indeed the case we expect to find that relatively large informal sector firms – based outside home and employing more workers, as well as possessing more assets – are more likely to report being in a subcontracting relation. A related prediction that emerges from this viewpoint is that firms in subcontracting relationships should be more productive than their non-subcontracted counterparts.

According to another view, subcontracting linkages hurt small firms due to unfavorable terms of trade resulting from asymmetric bargaining power. This leads to surplus extraction and reinforces stagnation in the informal sector (Moser, 1978; Tokman, 1978; Portes and Walton, 1981; NCEUS, 2007). Thus sub-contracting is largely about cost-cutting by large formal sector firms (Mehrotra and Biggeri, 2007). We term this the "exploitation view" of subcontracting. By taking advantage of lower wages in the informal sector and by exploiting the terms of contract with the vulnerable segment of the informal sector, formal sector firms benefit at the expense of the sub-contracting

[1] In the initial years after independence (until the early 1960s) the Indian manufacturing sector had a very high degree of vertical integration and low subcontracting intensity (Nagraj, 1984). Subcontracting intensity increased slowly between 1970 and 1992–93 (Ramaswamy, 1999) and then sharply between 1996–97 and 2007–08 (Moreno-Monroy et al., 2012).

counter-party. This viewpoint leads to the prediction of greater prevalence of sub-contracting in the traditional/stagnant part of the informal sector and and lower productivity in subcontracted firms compared to non-subcontracted firms.

Despite the importance of this question for development policy-making in India, there have been very few studies on the productivity differences between informal sector firms within and outside subcontracting relationships; even fewer studies have used nationally representative data to address this or related questions (Ramaswamy, 1999; Moreno-Monroy et al., 2012; Sundaram et al., 2012). One hurdle in directly addressing the question is the lack of nationally representative datasets at the firm-level linking the formal and informal sectors directly.

One approach in the literature has been to construct industry-level pseudo-panels using National Sample Survey (NSS) data on the informal manufacturing sector and merging it with Annual Survey of Industries (ASI) data on the formal sector.[2] Two recent papers use this approach to explore the impact of subcontracting on the informal sector (Moreno-Monroy et al., 2012; Sundaram et al., 2012). While this approach controls for unobserved heterogeneity at the industry and State levels, it necessarily aggregates over thousands of firms, losing important firm-level variation in the process.

On the other hand, firm-level cross-sectional analysis is restricted to just the formal or the informal sector firms by themselves and it also cannot control for unobserved heterogeneity at the firm-level. But it gives valuable direct estimates of the determinants subcontracting and of firm productivity. We believe that both approaches are necessary to give a fuller picture of the impact of subcontracting on the informal sector. While there are studies that have taken the pseudo-panel route, no study has thus far used firm-level NSS data to measure productivity differences between subcontracted and non-subcontracted firms.

The impact on firm productivity of being in a subcontracting relation cannot be estimated in an unbiased way simply using a dummy-variable in a regression model estimated by OLS because of sample selection bias. The same characteristics that influence a firm's decision to undertake work on contract may also influence the firm's productivity, i.e., firms are not randomly assigned to the subcontracting relationship. We report the results of a full-information maximum likelihood implementation of a Heckman-type model modified for selection on unobservables (Greene, 2012; Imbens and Wooldridge, 2009) using firm-level data from the 62nd Round of the NSS (Survey of Unorganized Manufacturing Enterprises) conducted in 2005–2006. Our model allows us to perform a Oaxaca-Blinder decomposition corrected for selection bias (Neuman and Oaxaca, 2004; Yun, 2007) and to compute an average treatment effect on the treated (ATET) conceptualizing subcontracting

[2]The NSS surveys on the informal sector are large nationally-representative sample surveys carried out every five years. NSS data have been extensively used by scholars to explore the effects of trade liberalization, growth of the formal sector, and of subcontracting, on the informal sector (Nataraj, 2011; Moreno-Monroy et al., 2012; Sundaram et al., 2012).

as a "treatment." To the best of our knowledge, this is the first paper to offer direct firm-level evidence of the impact of subcontracting on informal manufacturing firms in India.[3]

Our measure of firm productivity is gross value added per worker-hour. Raw averages reveal that gross value added (GVA) per worker-hour in subcontracted (SC) firms is 64% of that in non-subcontracted (NSC) firms. Consistent with the "exploitation view" selection-corrected Oaxaca-Blinder decomposition shows that a large part of this GVA gap is explained by poorer endowments (such as human and physical capital) on part of SC firms. However, contrary to this view, the decomposition also shows that SC firms, despite being more poorly endowed than NSC firms, are able to make better use of their endowments (i.e., have higher marginal returns to key endowments). This result is corroborated by a positive treatment effect. In this sense, we find that for the full sample of informal manufacturing firms in 2005–06, there is a small "subcontracting premium," i.e. controlling for endowments, SC firms are more productive than NSC firms.[4]

An important prediction from the existing literature is that larger and more modern firms benefit more from being in a subcontracting relation compared to smaller, traditional firms. We test this hypothesis in three different ways. First, we re-estimate our model for two sub-samples: own account manufacturing enterprises (OAMEs) (which are firms employing no hired workers) and non-OAMEs (which are firms employing at least one hired worker).[5] We show that, contrary to expectations, it is OAMEs that display a subcontracting premium (in the above sense). Second, we re-estimate our empirical model for industrially backward states, and industrially advanced States of India. We find the existence of a subcontracting premium in backward states while in advanced states we find a "subcontracting penalty" in the sense that SC firms display poorer returns to (poorer) endowments compared to NSC firms. Lastly, we also show that rural firms show a premium while urban firms face a penalty.

Taken together our results suggest that the relatively traditional parts of the informal sector are more likely to be in subcontracting relationships. While these firms are more poorly endowed than non-subcontracted firms, they are able to make better use of their poor endowments. Thus, our findings paint a more complex picture than the one presented in either of the two competing

[3]In India, official statistics use the terms "organized" and "unorganized" instead of formal and informal. The "unorganized" manufacturing sector consists of all firms not registered under the Factories Act, 1948. These are firms using power, employing less than ten workers, and firms without power, employing less than twenty workers. In this paper all such unregistered firms are called "informal." Restricting the sample only to firms employing less than ten workers does not alter our results significantly.

[4]The NSS data does not allow us to distinguish between formal-informal and informal-informal subcontracting, a limitation acknowledged by Sundaram et al. (2012). Thus our conclusions are about the subcontracting relationship in general (described in greater detail below), rather than about formal-informal linkages *per se*.

[5]What we are calling non-OAMEs are referred to by the National Sample Survey Organization (NSSO) as "establishments". Establishments, in turn, are divided into two types of firms: (1) non-directory manufacturing enterprises (NDMEs), and (2) directory manufacturing enterprises (DMEs). NDMEs are establishments that employ less than 6 workers, and DMEs are establishments that employ 6 or more workers.

views on subcontracting. The fact that relatively less endowed firms are more likely to enter into subcontracting relations implies that the subcontracting relation might be characterized by asymmetric bargaining firm between the parent and the subcontracted firm. On the other hand, the fact that subcontracted firms tend to enjoy a subcontracting premium implies that they might be worse off in generating incomes from their endowments without subcontracting. Thus subcontracting in the Indian context may illustrate the phenomenon where the exploited are worse off without exploitation.

The rest of the paper is organized as follows. In Section 2, we briefly review the literature on subcontracting in the Indian context, drawing out two strands of the literature, one emphasizing a benign view and the other an exploitative view of subcontracting. Section 3 is devoted to discussion of the data used in this paper and also offers some exploratory empirical analysis. Section 4 describes the specification of our econometric model, discusses identification, and derives expressions for the Oaxaca-Blinder decomposition and ATET. Section 5 presents the main findings of our empirical analysis: marginal effects, Oaxaca-Blinder decomposition and ATET. We discuss the results and conclude in Section 6.

2 Literature Review

Linkages between the formal and informal sectors have been the subject of a large literature (Meagher, 2013). Several studies have suggested that subcontracting linkages, in particular, can act as channels via which growth in the formal sector can be transmitted to the relatively modern part of the informal sector resulting in specialization, technological up-gradation, productivity growth and accumulation of capital in the latter (House, 1984; Ranis and Stewart, 1999; Arimah, 2001; Marjit, 2003; Moreno-Monroy et al., 2012). Subcontracting can also improve firm productivity by facilitating access to working capital and markets for finished products, and by improving capacity utilization (Sahu, 2010).

A key aspect highlighted by this literature is that large firms prefer to subcontract to the relatively more dynamic and modern, as opposed to stagnant and traditional, portions of the informal sector.[6] The dynamic segment consists of firms that are of the modern industrial type, i.e., with hired workers, located outside the household, with a certain minimum level of capital-intensity of production and skill level of the workers. The surplus produced in these dynamic enterprises can be substantial and they are capable of undertaking growth-oriented strategies. On the other hand, the stagnant segment of the informal sector consists of manufacturing firms that share characteristics

[6]See House (1984); Ranis and Stewart (1999) for two early perspectives on the dichotomy. Other terminologies used to highlight this dichotomy include "growth" versus "survival" entrepreneurs (Berner et al., 2012) and necessity-driven versus opportunity-driven entrepreneurs (Gurtoo and Williams, 2009).

of traditional peasant farms, i.e., they are family enterprises using predominantly family labor, with insignificant capital inputs and low skill levels of workers. They are mainly located within the household premises and operated by women. The surplus produced in the enterprises is too low for self-financed growth.

Subcontracting can also aid in structural transformation of the economy. Ranis and Stewart (1999) present a model in which given certain demand patterns, technology and policies, the expansion of the formal sector leads to expansion of the dynamic component of the informal sector; the latter expands by drawing labor from the stagnant component of the informal sector and ultimately from the overpopulated agricultural sector. Thus, linkages with the formal sector (e.g., subcontracting) lie at the heart of transformation of the informal sector. The formal sector transfers better business practices like quality controls and production standards to the subcontracted firms, thus allowing them to improve the organization of their production. Further, by providing access to assured markets, they provide an economic motive for accumulation and expansion for informal sector firms.

Marjit (2003) argues that formal sector enterprises subcontract to the capital-intensive segment of the informal sector, purchasing intermediate inputs from the latter. In Kar and Marjit (2009), the decline in the import-competing formal sector due to trade liberalization is accompanied by an expansion of the export-oriented formal sector. As a result, that segment of the informal sector which supplies intermediate inputs to the export sector grows. The authors present econometric results based on data on informal manufacturing sector in India to argue that this has been the case in India over the period 1984–85 to 2000–01. In order to focus on the relatively dynamic part of the informal sector, they restrict their sample to the NDMEs (see note 4). This strand of the literature argues that expansion of the formal sector leads to expansion of the dynamic (capital-intensive) segment of the informal sector, shrinking the traditional segment of the informal sector in the process. Thus, if this view is accepted, then policy should be focused on enabling faster accumulation in the formal sector and promoting and enabling linkages like sub-contracting with the informal sector. This view is substantiated by empirical findings in Maloney (2004) in the context of Mexico, Arimah (2001) in the context of Nigeria, Moreno-Monroy et al. (2012) in the context of India and House (1984) in the context of Kenya, among others. One prediction of the foregoing theory is that informal sector firms in a subcontracting relation should perform better than independent firms.

However contrary to this, Sahu (2010) and Bhattacharya et al. (2013) present evidence from NSS data that productivity per worker and asset-base are higher for non-subcontracted compared to subcontracted firms. This finding is consistent with a competing theoretical perspective that views subcontracting as harmful to micro and small enterprises in the informal sector. According to this

view, subcontracting linkage is an exploitative relationship, where large firms extract surplus from smaller subcontracted firms due to asymmetric bargaining power over input and output prices, reinforcing stagnation in sub-contracted firms (Moser, 1978; Tokman, 1978; Portes and Walton, 1981; NCEUS, 2007). Formal sector firms will subcontract the labor-intensive parts of the production process to the informal enterprises as a cost-cutting measure in the face of stiff competition in the markets for formal sector output. Intense competition among informal sector enterprises for securing linkages with the formal sector units leads to further cost-cutting among informal units, strengthening survivalism over accumulation. The unequal bargaining position between formal and informal sector enterprises enables the former to extract most of the value-added in the informal enterprises through the pricing mechanism, leaving most of them with little surplus for accumulation. Moreover, formal sector firms, in an attempt to cut labor costs, use homeworkers, sweatshops, etc., in the informal sector. Owner-operators of informal firms appear to be self-employed, but in reality are disguised workers stripped of the legal protection and benefits of formal sector employment (Portes and Walton, 1981; Mehrotra and Biggeri, 2007).

Consistent with this view, NCEUS (2007) reports that in India, subcontracting is predominantly of the traditional putting-out type with the subcontracting firm often being a home-based enterprise. Putting-out type relationships signifies a high degree of dependency of the subcontracting firm on the master-enterprise, which significantly reduces the bargaining power of the former. According to the NCEUS (2007), 50% of the 9 million women in the informal manufacturing workforce are homeworkers. They have weak bargaining power and earned close to Rs. 27 per day (just over a dollar in PPP terms) in 2005–06, less than their counterparts in other enterprises. Homeworkers tend to continue with the same master-enterprise, probably due to debt bondage, deferred payments, competition from other suppliers, and other similar reasons (Mehrotra and Biggeri, 2007). Chen et al. (2001) (citing evidence from across the world) and Mehrotra and Biggeri (2007), based on surveys in five Asian countries (India, Pakistan, Indonesia, Philippines, and Thailand), illustrate the importance of female and child labour, respectively, in home-based subcontracted enterprises. Thus, according to this view, subcontracting would lead to an expansion of the traditional component of the informal sector, even when they are linked to the dynamic formal sector.

Sahu (2010) presents findings from a survey of 399 small and micro enterprises in rural and urban areas of three Indian states (West Bengal, Haryana and Maharashtra) that point to the exploitative nature of the subcontracting relationships involving low wages, delayed payments, irregular orders and rejection/cancellation of orders, absence of financial assistance and contractually specified regulation of conditions of work. Sahu (2010) also presents data from two NSS rounds (2000–01 and 2005–06) to show that most of the subcontracted work is labour-intensive and involves low skills, that subcontracted firms exhibit lower productivity than non-subcontracted firms and that

they do not appear to do better in terms of employment generation. Bairagya (2013) has empirically explored differences in technical efficiency between subcontracted and non-subcontracted firms for two states – Delhi and Orissa – at very different in levels of economic development. He found that firms on contract are less efficient in Delhi (a more developed state) but more efficient in Orissa (less developed).

Uchikawa (2011) looks at relatively capital-intensive industries like those manufacturing various kinds of machinery, transport equipment and vehicles. In these industries, subcontracting must ensure reduction of labour cost along with quality assurance. Such subcontracting between multinational enterprises and local suppliers involves several layers of subcontracting and informal sector firms can only insert themselves in the lowest tiers due to their huge technological deficiency. Although such contractual relations carry the possibility of technological spillovers Uchikawa (2011) found that the informal sector enterprises were not able to benefit from participating in such subcontracting relations and from knowledge spillovers because they could not comply with the quality requirements. Thus, Uchikawa (2011) supports the modernization view of Ranis and Stewart (1999) but finds that the informal sector is mostly unable to engage in such relationships.

Moreno-Monroy et al. (2012) find that the incidence of subcontacting in the Indian manufacturing sector is low, that informal manufacturing growth is concentrated in the traditional component over the period 1994–95 and 2005–06, that growth of the traditional component of the informal sector is not due to subcontracting relations with the formal sector and that there is a significant positive relationship between subcontracting and the expansion of the modern segment of the informal sector. The authors agree with the view that increased subcontracting relationships lead to an expansion of the modern segment of the informal sector, while conceding that the expansion of the informal sector is mostly in traditional activities. Sundaram et al. (2012) find that the employment, output and the value added of the informal sector of a given industry are strongly positively correlated with the same variables for the formal part. The authors interpret these results as providing support for complementarities between formal and informal manufacturing. Thus the evidence in the Indian context is quite mixed as far as the two competing perspectives are concerned.

To the best of our knowledge, the current study is the first econometric investigation of firm-level NSS data on informal manufacturing at an all-India level focussing on two issues: (a) determinants of subcontracting, and (b) productivity differences between subcontracting and non-subcontracting firms. In this paper we look at subcontracting from the informal end and try to determine firm-level characteristics that make informal firms attractive for subcontracting. Further we econometrically explore determinants of firm-level productivity for subcontracted and non-subcontracted firms, compute overall differences in productivity between the two groups of firms, and decompose the GVA gap between them into two components, one due to difference in firm-level characteristics

("endowments") and the other due to differences in returns to firm-level characteristics ("returns"). This paper thus aims to strike at the heart of the issue, by bringing in firm-level characteristics as the principal determinants of subcontracting and studying the impact of subcontracting on informal firms. Thus we bring the empirical analysis closer to its theoretical counterpart.

3 Data and Descriptive Statistics

3.1 Data Source

The dataset used in this paper is the 62nd round Survey of Unorganized Manufacturing Enterprises conducted in 2005–06 by the National Sample Survey Organization.[7] The sample consists of 82897 firms. We restrict our analysis to manufacturing firms and exclude repairing enterprises. We also exclude all firms with more than 20 total workers (paid or unpaid) as well as firms that do not operate on a proprietary basis (i.e. are public or corporate enterprises or cooperatives), to conform to the Indian definition of the unorganized sector. In India, official statistics use the terms "organized" and "unorganized" instead of formal and informal. The Annual Survey of Industries (ASI) defines the organized sector as consisting of production units registered under the Factory Act, 1948. All enterprises where ten or more workers work with power, and where twenty or more workers work without the aid of power have to be registered. The "unorganized" manufacturing sector then consists of all unregistered firms. In this paper all such unregistered firms are called "informal." Restricting the sample only to firms employing less than ten workers (which is the usual definition of the informal sector) does not alter our results significantly.

The survey provides information on the degree of dependence of the subcontracted unit on the master unit. This gives three possibilities: complete independence (no sub-contract), partial dependence (the firm sells part of the output directly to customers), and complete dependence (all output is sold to the master-unit). To make for a sharper analysis and interpretation of productivity differences between subcontracted and non-subcontracted firms, we exclude firms that combine both subcontracted work and independent work (4.8% of all informal manufacturing sector enterprises in the data for the 62nd round). Since we are interested in controlling for state and industry effects in our empirical analysis, we also discard those states and industry categories that

[7]While data for a later year (67th Round Survey data for 2009–10) are available, we have not used them for two principal reasons. First, the survey questionnaire was changed in 2009–10 and it leaves out questions relating to the educational background of the entrepreneur, which we felt was too important for our purpose to omit. Second, the 67th Round yielded results that drastically departed from the trend–for example, a sharp fall in the incidence of subcontracting from around 30% (as found in the 2000–01 and 2005–06 surveys) to around 20% in 2009-10 for the entire informal sector. The results from other NSS surveys for the year 2009–10, e.g., a drastic fall in the female labour force participation rate and almost no growth in the labour force over a five-year period (Thomas, 2014) – reinforce our doubts that there might be something special about data thrown up by NSS surveys for the year 2009–10 that is yet to be accounted for. Hence, we have left it out of our analysis.

have very few observations.[8] With these adjustments, our final sample includes 63733 firms. After applying frequency weights supplied by the NSSO, this sample represents a population of 15.3 million firms. Throughout our analysis we apply sampling weights to estimate population averages and parameters. In the next sub-section we present some descriptive statistics that are useful in motivating the subsequent analysis.

3.2 Characteristics of Subcontracted and non-subcontracted firms

The principal survey question of interest is the following: "did the enterprise undertake any work on contract basis during the reference period?" We use this question to divide the sample of firms into two groups, subcontracted firms (hereafter SC firms) and non-subcontracted firms (hereafter NSC firms). A firm that reports being in a subcontracting relationship receives raw materials and product specifications from the master unit. It typically owns its own equipment. In our sample, 81.85 % of SC firms use their own equipment, 86.68% receive raw materials and 94.8% receive product design from the master unit. Thus the most dominant mode of sub-contracting seems to be of the classic "putting-out" variety, implying a high degree of dependence of the subcontracted firm on the master firm.

Informal manufacturing enterprises exhibit much diversity in firm-level characteristics. The heterogeneity of size and composition of workers is recognized in the official classification of informal manufacturing sector enterprises into Own Account Manufacturing Enterprises (OAMEs) that employ no hired worker, Non Directory Manufacturing Enterprises (NDMEs) that employ less than six workers (household and hired workers taken together) with at least one hired worker, and Directory Manufacturing Enterprises (DMEs) that employ more than six total workers, both hired and household, with at least one hired worker. In 2005–06, about 30% of OAMEs entered into subcontracting relationships; the corresponding proportions for DMEs and NDMEs are 17% and 23% (Table 1). Thus, in terms of simple averages, firms relying solely on family labor (and hence, small in size) are more likely to work on contract than larger firms using hired labor. Further, female-owned and home-based firms are relatively more likely to be on subcontract than male-owned and workshop-based firms (see Table 1).

[Table 1 here]

[8] We use 2-digit National Industrial Classification (NIC) codes for identifying industries. Our final sample includes the following industries: food and beverages, tobacco products, textiles, garments, leather, wood products, paper products, chemicals, rubber and plastics, other non-metallic mineral products, basic metals, machinery and equipment, and furniture. The States in the final sample are: Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu-Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal, and Delhi.

We measure firm productivity by gross value added (GVA) per worker hour. NSS data supply figures for gross value-added at the firm level, calculated as the difference between total receipts minus total operating expenses (excluding factor payments). Although this measure does not allow us to distinguish between price and non-price determinants of productivity (i.e. we are measuring nominal productivity), we believe this is a good measure because it indicates both, the surplus available to informal firms for growth, as well as incomes generated in informal enterprises, which inform us as to living standards of informal workers. We divide gross value-added by total number of full-time equivalent workers, including working owner(s), family members working in the firm and hired workers. Following NCEUS (2007), we take two part-time workers as equivalent to one full-time worker. Finally we divide gross value-added per worker by the number of hours the enterprise normally worked in the day during the reference month to get gross value-added per worker hour.

In terms of raw averages, how do SC firms perform compared to NSC firms? How do their endowments compare? Table 2 summarizes data on GVA, key endowments (physical and human capital) and location characteristics in 2005–06 for all firms, and for SC and NSC firms separately. While median log GVA per worker hour of SC firms is 4.60 (i.e., GVA is Rs. 99.5), it is 5.05 (i.e., GVA is Rs. 156) for NSC firms. Thus, in terms of raw averages, SC firms perform worse than NSC firms. Part of this raw difference must be accounted for by observable characteristics like location, human and physical capital, and mix of worker types.[9] SC firms have mean log assets of 8.92 (i.e., assets worth Rs. 7480), and NSC firms have mean log assets of 9.9 (i.e., assets worth Rs. 19930). Thus, NSC firms are, on average, larger than SC firms. This can also be seen in the larger proportion of NDMEs and DMEs (10.4% and 3.6%) among NSC firms compared to SC firms (5.3% and 2.6%). In terms of location and gender, we see that 92% of SC firms are home-based and 66.7% are female-owned; the corresponding proportions for NSC firms are only 68% and 28.5% respectively. Finally, the education distribution is clearly right-shifted for NSC firms: while 41% of NSC firm owners have above primary level education, only 25% of SC firm owners have the same.

[Table 2 here]

To summarize, we see in the descriptive statistics, that SC firms have lower GVA per worker hour, are endowed with lower physical and human capital, and are more likely to be home-based and operated by women. They also have fewer paid workers compared to NSC firms. Since absence of hired workers (which define OAMEs), female-ownership and home-based production are characteristics associated with the relatively "traditional" or stagnant part of the informal sector, descriptive data suggest that firms in the traditional part of the informal manufacturing sector are

[9]The mix of worker types is important because the presence of hired workers require greater management skill and command over profit-calculation than the presence of only family labor; thus presence of hired labor may indicate a more 'modern' orientation of the entrepreneur.

more likely to enter into subcontracting relationships. Further SC firms appear to perform worse than their NSC counterpart in terms of productivity. One of the main aims of this paper is to investigate how much of the difference can be explained by differences in firm characteristics and what part by returns to characteristics.

4 Empirical Model

4.1 A modified Heckman approach

To move from raw averages to an investigation of causal mechanisms, this study brings the tools developed in labor economics and the economics of program evaluation to bear on the question of the impact of subcontracting in the informal manufacturing sector in India. Our primary interest is in comparing firms – in terms of log GVA per worker hour – within and without subcontracting relationships. But an OLS regression of firm productivity on observable characteristics with a subcontracting dummy will give us inconsistent parameter estimates due to sample selection problems (Heckman, 1979). The main issue is that firms are not randomly assigned to be in subcontracting relationships. Whether or not a firm will enter into a subcontracting relationship is a decision variable that is the result of the interaction of demand and supply of subcontracting. Hence, failure to account for the non-random nature of subcontracting will give rise to biased estimates of the effect of subcontracting on firm producitvity.

Drawing on a strand of the existing literature in labour economics, we deal with this problem with a modified Heckman sample selection procedure (Heckman, 1979; Idson and Feaster, 1990; Main and Reilly, 1993). In the first step, firms are selected into subcontracting relationships, which is captured by a probit model. Thus, the probability that any firm enters into a subcontracting relationship is a function of observed characteristics and a stochastic error term; this is the "selection equation". In the second step, conditional on subcontracting status, productivity (log GVA per worker hour) is determined by observed covariates and an unobserved stochastic error term (with separate regression models for subcontracted and non-subcontracted firms); these are the two "observation equations". The three error terms – from the selection equation, from the observation equation for subcontracted firms, and from the observation equation for non-subcontracted firms – are jointly normally distributed. Thus, we can write an expression for the joint probability of log GVA per worker hour *and* subcontracting status for every firm. Maximizing this likelihood function gives us consistent parameter estimates, and allows us to arrive at unbiased estimates of the effect of subcontracting.

The contemporary treatment evaluation literature in economics calls a model such as ours the model with "selection on unobservables". Such a model is distinguished from a model with "se-

lection on observables", which involves one selection-corrected observation equation with a subcontracting dummy. Having two separate observation equations post-selection (as opposed to one selection-corrected equation with a subcontracting dummy) is less restrictive because it dispenses with the conditional independence assumption (Greene, 2012, pp. 892). It also allows us to decompose the difference in log GVA gap between subcontracted and non-subcontracted firms using a standard Oaxaca-Blinder decomposition corrected for selection bias (Neuman and Oaxaca, 2004; Yun, 2007). In the next sub-section, we present details of the econometric model.

4.2 Model Specification

Let z_i be a dummy variable that takes the value 1 when firm i is a subcontracted (SC) firm, and 0 when firm i is a non-subcontracted (NSC) firm. Let z_i^* be an unobserved latent variable that determines whether firm i is a SC firm or a NSC firm as follows

$$z_i = \mathbb{1}(z_i^* > 0),$$

where $\mathbb{1}(.)$ is the indicator function. The latent variable is, in turn, determined by observed covariates and an unobserved stochastic error term in the following manner,

$$z_i^* = \mathbf{w}_i'\boldsymbol{\gamma} + u_i,$$

where $\mathbf{w}_i'$ is a $(k \times 1)$ vector of covariates, $\boldsymbol{\gamma}$ is a $(1 \times k)$ vector of parameters, and u_i is a stochastic error term (we will explain its distributional properties below). Thus, the determination of the firm type can be summarized as

$$z_i = \begin{cases} 1 \quad if \quad z_i^* > 0 \quad \text{(SC firm)} \\ 0 \quad if \quad z_i^* \leq 0 \quad \text{(NSC firm)} \end{cases} \tag{1}$$

Let y_i be the outcome variable of interest, in our case log GVA per worker hour. Following the convention in the treatment evaluation literature, each firm can be thought of as having two potential outcome variables given by the following equation:

$$\text{Potential outcome} = \begin{cases} y_{1i} & \text{if } z_i = 1 \\ y_{0i} & \text{if } z_i = 0 \end{cases}$$

where y_{1i} is understood as log GVA per worker hour of the i^{th} firm *were it to be* subcontracted, irrespective of whether it is actually subcontracted; and y_{0i} is understood as the log GVA per worker hour of firm i were to be non-subcontracted, again irrespective of its actual state (Angrist

and Pischke, 2009, pp. 13-14).

The observed outcome can be written in terms of the potential outcomes as

$$y_i = \begin{cases} y_{1i} & \text{if } z_i = 1 \\ y_{0i} & \text{if } z_i = 0 \end{cases}$$

so that

$$y_i = y_{0i} + (y_{1i} - y_{0i}) \times z_i. \tag{2}$$

We complete the specification of our empirical model by specifying separate observation equations for each type of firm.

For NSC firms,

$$y_{0i} = \mathbf{x}_i'\boldsymbol{\beta}_0 + \varepsilon_{0i}, \quad \begin{pmatrix} u_i \\ \varepsilon_{0i} \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho_0\sigma_0 \\ \rho_0\sigma_0 & \sigma_0 \end{pmatrix} \right], \tag{3}$$

where $\boldsymbol{\beta}_0$ is a vector of parameters that capture the behavior of NSC firms. Similarly, for SC firms,

$$y_{1i} = \mathbf{x}_i'\boldsymbol{\beta}_1 + \varepsilon_{1i}, \quad \begin{pmatrix} u_i \\ \varepsilon_{1i} \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho_1\sigma_1 \\ \rho_1\sigma_1 & \sigma_1 \end{pmatrix} \right], \tag{4}$$

where $\boldsymbol{\beta}_1$ is a vector of parameters that capture the behavior of SC firms.

The vector of covariates, $\mathbf{x}_i'$ in both observation equations includes firm assets (which include land and building, tools and equipment, and machinery), a dummy for whether a firm employs hired workers (which distinguishes between OAMEs and non-OAMEs), the ratio of male workers to total workers, a dummy variable for the gender of the working owner, a categorical variable for education of the working owner (the categories being illiterate, schooling up to primary school, and schooling beyond primary), a dummy for location (urban versus rural), categorical variables for the source of a firm's inputs and the destination of its output (whether directly from/to another enterprise or consumer or via a middleman), and state and industry (at the NIC 2 digit level) dummies.

We expect there to be a gender penalty for firms in the informal sector because women are structurally constrained to combine housework (including a disproportionate share of care-work) with market work (Antonopoulos and Hirway, 2010; Sethuraman, 1998). Female entrepreneurs are also likely to suffer from information scarcity because of their restricted mobility in Indian society. Educational qualification of the enterprise-owner is crucial because it might indicate better managerial ability as well as higher entrepreneurial ability to process information, engage with

formal institutions (like banks for loans, government departments for support schemes, etc.), access input and product markets independently and hence, as a result of all of these, negotiate better terms of contract with the master-unit. The presence or absence of hired workers is a proxy for a certain basic level of managerial ability and profit orientation. We do not include the number of workers employed as a variable because the dependent variable has been normalized for the total number of workers.

Variations of our empirical model – given by (1), (3) and (4) – have been used widely in the empirical literature, including the analysis of education (Willis and Rosen, 1979; Goldberger, 1972), the analysis of wage differential across different firm sizes (Idson and Feaster, 1990; Main and Reilly, 1993), and a host of other settings (Greene, 2012, pp. 892).

The parameters of the model in (1), (3) and (4) can be consistently estimated by the method of maximum likelihood or a Heckman-type two step procedure. We use the method of maximum likelihood because it gives more efficient parameter estimates. Under the assumption of joint normality of the errors, the log-likelihood function for the model represented by (1), (3) and (4) can be written as

$$
\begin{aligned}
l = & \sum_{i=1}^{N_0} \left\{ \log(\frac{1}{\sigma_0}) + \log \phi \left(\frac{y_{0i} - \mathbf{x}_i' \boldsymbol{\beta}_0}{\sigma_0} \right) + \log \Phi \left(\frac{-\mathbf{w}_i' \boldsymbol{\gamma} - \frac{\rho_0}{\sigma_0} (y_{0i} - \mathbf{x}_i' \boldsymbol{\beta}_0)}{\sqrt{1-\rho_0^2}} \right) \right\} \\
& + \sum_{i=N_0+1}^{N} \left\{ \log(\frac{1}{\sigma_1}) + \log \phi \left(\frac{y_{1i} - \mathbf{x}_i' \boldsymbol{\beta}_1}{\sigma_1} \right) + \log \Phi \left(\frac{\mathbf{w}_i' \boldsymbol{\gamma} + \frac{\rho_1}{\sigma_1} (y_{1i} - \mathbf{x}_i' \boldsymbol{\beta}_1)}{\sqrt{1-\rho_1^2}} \right) \right\}, \qquad (5)
\end{aligned}
$$

where i indexes firms, N_0 is the number of NSC firms, N is the total number of firms, $\phi(.)$ is the probability density function and $\Phi(.)$ is the cumulative distribution function of a standard normal random variable. We maximize the log-likelihood function in (5) to get consistent parameter estimates $\hat{\boldsymbol{\gamma}}, \hat{\boldsymbol{\beta}}_0, \hat{\boldsymbol{\beta}}_1, \hat{\sigma}_0, \hat{\rho}_0, \hat{\sigma}_1, \hat{\rho}_1$, and compute estimates of the marginal effects and their standard errors by the Delta method.

4.3 Identification

Identification of the parameters of the observation equations in the Heckman-type model rests on two factors, the nonlinearity of the inverse Mills ratio and possible exclusion restrictions. An exclusion restriction takes the form of a variable that has some power to predict selection and is thus included in the selection equation, but does not affect the outcome (except via variables included in the observation equation) and is therefore left out of the observation equation. We use the following exclusion restriction in our empirical strategy: a dummy variable for location of the

firm, i.e., whether the firm is located within the household premises or outside.[10]

The justification for our exclusion restriction comes from an understanding of the structural constraints on small informal sector firms. First, from the selection perspective, home-based entrepreneurs suffer from reduced access to information about product and factor markets which can be compensated by entering into subcontracting arrangements with bigger firms. From a big firm's point of view, home-based workers may present a vulnerable group to outsource to, with the intention of saving labor costs (Bajaj, 1999; Kantor, 2005; Mehrotra and Biggeri, 2007; NCEUS, 2008). Thus, being home-based is expected to be a predictor of subcontracting status.

For the exclusion restriction to hold, being home-based should not have an impact on log GVA per worker hour independent of the covariates included in the observation equation. If we identify the channels through which firm location can affect GVA and control for them in the observation equations then our exclusion restriction is valid conditional on the included controls. Pursuing this reasoning, we think that location can impact log GVA per worker hour through two channels: (a) the gender of the owner, and (b) size of the firm.

The disadvantages to being home-based are experienced in a gendered manner. Firstly, studies show that women are much more likely than men to work from home and that when they work at home, women are much more likely to be involved in low-paid manual activities (Chen et al., 1999; Felstead et al., 2000; Mehrotra and Biggeri, 2007). Women home-based workers are more likely to be invisible in workforce statistics, and to lack access to markets, credit, and other information (Chen et al., 1999). Women also carry out a disproportionately large part of housework which can impact productivity because of differential claims of the household on the woman's time and attention as opposed to the man's (Floro and Pichetpongsa, 2010). Finally, female-owned firms in the informal sector (whether home-based or not) also suffer from systematic disadvantages that lead to lower levels of efficiency (Amin, 2011).

A second channel through which being home-based can affect firm productivity is firm size and asset position. Home-based firms are relatively smaller in size (measured in terms of employees or assets) than firms based outside household premises. In our sample of informal sector firms in 2005–06, home-based firms employed an average of 1.5 workers, reported an average gross valued added of Rs. 1769 and average assets of Rs. 27948. The corresponding figures for firms located outside household premises was 2.6 workers, Rs. 22689 of average gross value added, and Rs. 190273 in average assets. Location thus has an impact because of the inability of within-household firms to exploit scale economies and adopt large scale technological innovations. There is a large literature that has documented that various efficiency-enhancing activities, like the adoption of information

[10]Without exclusion restrictions, identification relies solely on the functional form, i.e., joint normality of the error terms (which gives us the expression for the inverse Mills ratio) and is usually difficult to justify in any particular case.

and communications technology, spending on research and development, running training programs for employees, are positively related to size (Taymaz, 2005; Leung et al., 2008). These are among some of the important factors that could account for the well known finding that larger firms are more productive than their smaller counterparts (LaPorta and Shleifer, 2008).

These two strands of the existing literature suggest that location of the firm imparts its effect on productivity through gender and size. Thus, controlling for gender of the owner and size of the firm (measured by the total number of workers as well as value of assets), we argue that the location of the firm will not have any significant additional impact on log GVA. This is what makes our exclusion restriction plausible.

4.4 Decomposition of Log-GVA Differential

An important question with regard to the impact of subcontracting is whether the difference in observed productivity between SC and NSC firms arises from differences in endowments or from differences in returns to endowments. To address this question, we decompose the observed differential in log GVA per worker hour between SC and NSC firms into (i) a part that arises from differences in endowments, (ii) a part that comes from differences in returns to endowments, and (iii) a part that arises due to selection bias (i.e., non-random assignment of firms into subcontracting).[11]

To work out the decomposition in terms of our model in (1), (3) and (4), we start out by computing average log GVA per worker hour for SC firms

$$E(y_i|z_i=1,\mathbf{x}_i',\mathbf{w}_i') = \mathbf{x}_i'\boldsymbol{\beta}_1 + E(\varepsilon_{1i}|u_i > -\mathbf{w}_i'\boldsymbol{\gamma}) = \mathbf{x}_i'\boldsymbol{\beta}_1 + \rho_1\sigma_1 \times \frac{\phi(-\mathbf{w}_i'\boldsymbol{\gamma})}{1-\Phi(-\mathbf{w}_i'\boldsymbol{\gamma})}$$

and for NSC firms

$$E(y_i|z_i=0,\mathbf{x}_i',\mathbf{w}_i') = \mathbf{x}_i'\boldsymbol{\beta}_0 + E(\varepsilon_{0i}|u_i \leq -\mathbf{w}_i'\boldsymbol{\gamma}) = \mathbf{x}_i'\boldsymbol{\beta}_0 + (-\rho_0\sigma_0) \times \frac{\phi(-\mathbf{w}_i'\boldsymbol{\gamma})}{\Phi(-\mathbf{w}_i'\boldsymbol{\gamma})}.$$

The sample analog of the difference between the two give us the selectivity-corrected Oaxaca-Blinder decompsotion of log GVA per worker hour as

$$\bar{y}_{SC} - \bar{y}_{NSC} = \boldsymbol{\beta}_0\left(\bar{\mathbf{x}}'_{SC} - \bar{\mathbf{x}}'_{NSC}\right) + \bar{\mathbf{x}}'_{SC}\left(\boldsymbol{\beta}_1 - \boldsymbol{\beta}_0\right) + \left(\bar{\Lambda}_{SC} - \bar{\Lambda}_{NSC}\right), \tag{6}$$

where bar over a variable denotes sample average, the subscript SC (NSC) refers to the sample of subcontracted (non-subcontracted) firms, so that $\bar{\mathbf{x}}'_{SC}$ is the average of observable characteristics for SC firms, $\bar{\mathbf{x}}'_{NSC}$ is the average of observable characteristics for NSC firms, $\boldsymbol{\beta}_1$, and $\boldsymbol{\beta}_0$ refer

[11] Building on Blinder (1973) and Oaxaca (1973), the literature has asked this question in very different contexts (Idson and Feaster, 1990; Main and Reilly, 1993; Neuman and Oaxaca, 2004; Yun, 2007).

to the coefficients of SC and NSC firms, and Λ_{SC} and Λ_{NSC} refer to the selection bias in the observation equation for SC and NSC firms respectively with

$$\Lambda_{SC,i} = E(\varepsilon_{1i}|u_i > -\mathbf{w}_i'\boldsymbol{\gamma}, \mathbf{x}_i') = \rho_1\sigma_1 \times \frac{\phi(-\mathbf{w}_i'\boldsymbol{\gamma})}{1 - \Phi(-\mathbf{w}_i'\boldsymbol{\gamma})} \tag{7}$$

and

$$\Lambda_{NSC,i} = E(\varepsilon_{0i}|u_i \leq -\mathbf{w}_i'\boldsymbol{\gamma}, \mathbf{x}_i') = (-\rho_0\sigma_0) \times \frac{\phi(-\mathbf{w}_i'\boldsymbol{\gamma})}{\Phi(-\mathbf{w}_i'\boldsymbol{\gamma})}. \tag{8}$$

The first term in (6) gives the contribution to observed difference in log GVA per worker hour coming from differences in endowments, the second term gives the contribution of differences in returns to endowments, and the third term gives the contribution of selectivity bias.

4.5 Average Treatment Effect on the Treated

While the Oaxaca-Blinder decomposition is useful in allocating the GVA gap between an average SC and an average NSC firm to their endowments and returns, researchers have often been interested in a slightly *different* question: what is the effect of subcontracting on log GVA per worker hour for subcontracted firms? To answer this question, we need to compare subcontracted firms with the counter-factual scenario that these same firms were not on subcontract. The average treatment effect on the treated (ATET), as the average difference between two potential outcomes, provides us a way of answering this question in precise quantitative terms.

In the context of our study, the ATET is the difference in log GVA per worker hour of a SC firm between two possible scenarios: (a) if it were a SC firm, and (b) if it were a NSC firm. Thus, the ATET is given by

$$ATET \equiv E(y_{1i} - y_{0i}|z_i = 1, \mathbf{x}_i', \mathbf{w}_i') = E(y_{1i}|z_i = 1, \mathbf{x}_i', \mathbf{w}_i') - E(y_{0i}|z_i = 1, \mathbf{x}_i', \mathbf{w}_i'). \tag{9}$$

For our argument, the ATET can be understood as the "subcontracting penalty or gain" of the subcontracted firms, i.e., the average difference in log GVA per worker hour of a firm were it a SC firm versus were it to be a NSC firm, where the averaging is restricted to the group of SC firms. Thus, the ATET captures *the decline or gain in log GVA per worker hour due to the subcontracting relationship for the subcontracted firms.*

Using the distributional assumptions of our empirical model, the expression for the average

treatment effect on the treated is given by the following:

$$ATET = E(y_{i1}|z_i = 1, \mathbf{x}_i', \mathbf{w}_i') - E(y_{i0}|z_i = 1, \mathbf{x}_i', \mathbf{w}_i') = \mathbf{x}_i'(\boldsymbol{\beta}_1 - \boldsymbol{\beta}_0) + (\rho_1\sigma_1 - \rho_0\sigma_0) \times \frac{\phi(\mathbf{w}_i'\boldsymbol{\gamma})}{\Phi(\mathbf{w}_i'\boldsymbol{\gamma})}.$$

The sample analogue of the above expression can be written, after some algebraic manipulation, as

$$\widehat{ATET} = \frac{1}{N}\sum_{i=1}^{N}\left\{\hat{y}_{1i} - \hat{y}_{0i} - (\hat{\rho}_0\hat{\sigma}_0) \times \phi(\mathbf{w}_i'\hat{\boldsymbol{\gamma}}) \times \left(\frac{1}{\Phi(\mathbf{w}_i'\hat{\boldsymbol{\gamma}})} - \frac{1}{\Phi(-\mathbf{w}_i'\hat{\boldsymbol{\gamma}})}\right)\right\} \tag{10}$$

where N is the size of the sample, $\hat{y}_{1i}$ is the selectivity-corrected predicted value from the observation equation for SC firms,

$$\hat{y}_{1i} = \mathbf{x}_i'\hat{\boldsymbol{\beta}}_1 + \hat{\rho}_1\hat{\sigma}_1\frac{\phi(\mathbf{w}_i'\hat{\boldsymbol{\gamma}})}{\Phi(\mathbf{w}_i'\hat{\boldsymbol{\gamma}})}$$

and $\hat{y}_{0i}$ is the selectivity-corrected predicted value from the observation equation for NSC firms

$$\hat{y}_{0i} = \mathbf{x}_i'\hat{\boldsymbol{\beta}}_0 - \hat{\rho}_0\hat{\sigma}_0\frac{\phi(-\mathbf{w}_i'\hat{\boldsymbol{\gamma}})}{\Phi(-\mathbf{w}_i'\hat{\boldsymbol{\gamma}})}.$$

Our primary interest is in addressing the following questions: (a) is ATET for the whole sample significantly different from zero? (b) how does ATET vary between OAME and non-OAME firms? (c) is the difference in the ATET between OAME and non-OAME firms statistically significant? (d) does the ATET change if we compare backward and advanced states, or urban and rural areas?

5 Regression Results

We have seen that, in terms of raw averages, SC firms perform worse than NSC firms as measured by GVA per worker hour. We have also seen that subcontracted firms are on average smaller in terms of number of workers and assets owned, and are more likely to be home-based and operated by women. We would like to know if, after controlling for such differences in firm characteristics, SC firms are still relatively worse-performing.

If informal firms were randomly sorted into SC and NSC types, this question could be answered by including a "subcontracting dummy" in an OLS regression, or by stratifying the regression by firm type and performing a Oaxaca-Blinder decomposition. However, as we have argued above, it is much more likely that firms are selected into subcontracting on the basis of the same characteristics that affect productivity. The empirical strategy we employ in this paper accounts for this non-random sorting of firms into subcontracting.

5.1 Analysis of the Full Sample

We now turn to a discussion of the main results of this paper for the full sample of firms. We discuss, in turn, marginal effects of key covariates in the selection and the two observation equations, the Oaxaca-Blinder decomposition, and finally, ATET..

5.1.1 Marginal Effects

Table 3 presents *average marginal effects* and standard errors of key covariates of the empirical model in (1), (3) and (4).[12] We start with the interpretation of the probit results that pertain to the selection equation in Table 3. Statistically significant marginal effects come from the home-based dummy, the gender dummy, the dummy for presence of hired workers (which means that the firm is a non-OAME), location of firm (urban versus rural) and log assets. All else equal, a home-based firm is 7.3% more likely to enter into subcontracting relationships than a firms that is not home-based; similarly, a female-owned is 6.8% more probable to be subcontracted than a male-owned firm. We also see that every log-rupee of assets reduces the probability of subcontracting by about 2.5%. Thus we find that asset-poor, home-based, female-owned firms are more likely to be on subcontract. These results are consistent with the descriptive statistics reported in the previous section and are noteworthy because they challenge the view that subcontracting is more likely in the modern part of the informal manufacturing sector. Instead, it appears that relatively backward firms are more likely to be in a subcontracting relations.

However, the picture is somewhat more complex, because we also find that firms employing at least one hired worker (i.e., non-OAME firms) and firms based in urban areas are more likely to report being on subcontract compared to rural firms and firms operating purely with family labor (OAMEs). If presence of a hired worker is taken as a sign of a basic amount of managerial skill and profit-oriented operation, then these results can be interpreted as follows. Two sets of factors may be operational in determining the existence of a subcontracting relation: the vulnerability of an informal firm (resulting from its home-based, asset-poor, or female-owned status) on the one hand, and its accessibility (urban location) and basic management capability (presence of hired labor) on the other hand.

[Table 3 here.]

The second and third columns in Table 3 present the average marginal effects of key covariates in the observation equations for SC and NSC firms, respectively. These marginal effects indicate

[12]The empirical model given in (1), (3) and (4) has been estimated by the method of maximum likelihood. Coefficient estimates have not been reported to save space; they are available upon request from the corresponding author.

the selection corrected effect of each covariate on firm productivity as measured by log GVA per worker hour. Several interesting results emerge from a comparison of columns 2 and 3 in Table 3.

First, the asset elasticity of GVA is higher for SC (0.146) as compared to NSC firms (0.096). This shows that even though SC firms are relatively asset-poor, they are better than NSC at converting their asset into output at the margin. Likely reasons for this may include better capacity utilization on part of SC firms due to smoothing of demand for output.

Second, there is a large and significant gender penalty for SC firms: firms with women owner-operators that enter into subcontracting relationships produce about 40% ($=100 * [\exp(-0.511) - 1]$) less GVA per worker hour than firms with male owner-operators. On the other hand, the gender penalty is statistically insignificant for NSC firms. This clearly shows that, all else equal, women entrepreneurs in the informal sector are significantly disadvantaged within a subcontracting relationship, but operating independently they do not perform significantly worse than their male counterparts. This is consistent with an exploitation view of subcontracting.

Third, the human capital coefficients trend in the expected direction (increasing as we move from primary to higher education) for both SC and NSC firms, but achieve statistical significance only for NSC firms. A possible interpretation of this result is that higher returns to education of the owner are observed when the operation of the firm requires significant entrepreneurial and managerial decisions. In the case of SC firms, when product specifications and marketing are removed from the purview of the owner, formal education plays a less important role.

Fourth, even though the presence of hired workers emerges as a significant determinant in the selection equation, in the observation equation for subcontracted firms, there is no statistically significant difference in the productivity of OAME and non-OAME (i.e., NDME and DME) firms. On the other hand non-OAME firms perform significantly better (44%) among the group of NSC firms. We expect larger firms (non-OAMEs) to show higher GVA per worker-hour due to superior entrepreneurial skills as well as economies of scale. And we see this result in the case of NSC firms. However, the fact that GVA is flattened out across different firms sizes for SC firms is surprising. It is possible that SC firms are not able to reap the rewards of entrepreneurial skills or scale due to an exploitative subcontracting relationship. However it is also possible that inadequate sample size prevents us from identifying an effect (there are very few non-OAMEs among SC firms).

Fifth, there is an important difference in how rural versus urban location affects SC and NSC firms. While urban firms perform better than rural ones for the groups of NSC firms, the reverse is true for SC firms. One possibility is that subcontracting is more beneficial for firms located in relatively backward areas because these firms are more disadvantaged with respect to access to working capital and market for finished products. We explore this question further in Section 5.2.3.

5.1.2 Oaxaca-Blinder Decomposition and Treatment Effects

Marginal effect analysis presented above allows us to draw some conclusions about the determinants of subcontracting in the Indian informal manufacturing sector. We also find that SC and NSC firms show very different returns to key endowments such as physical and human capital, gender of the owner, and rural/urban location.

The question arises, taking all firm characteristics together (instead of the few analyzed above), how much of the GVA gap between SC and NSC firms is a result of poorer endowments on part of SC firms, versus an effect of being in the subcontracting relationship? To answer this question, we present results of a selection-corrected Oaxaca- Blinder decomposition in Table 4. The difference in log GVA per worker-hour, between NSC and SC firms, can be decomposed into a component explained by the difference in endowments (such as human and physical capital, gender of the owner, composition of the workforce, State and industry of operation), a component explained by the difference in returns to those endowments (sometimes called the "unexplained" component of the decomposition), and finally a selection bias term (Neuman and Oaxaca, 2004).

The "endowments" component of the decomposition answers the following counter-factual question: by how much would log GVA per worker hour change for SC firms if they were to have the average characteristics of NSC firms? The "returns" component of the decomposition answers another related counter-factual question: by how much would log GVA per worker hour change for SC firms if they had the same returns to characteristics as NSC firms?

Consistent with the descriptive data and the marginal effects of covariates on selection probability, we see that difference in endowments explains a very large part of – in fact over-explains – the observed difference in log GVA per worker hour between SC and NSC firms. Thus, while the difference in predicted log GVA per worker hour between NSC and SC firms is 0.44 (i.e. NSC GVA per worker hour is $\exp(0.44) = 1.55$ times SC GVA per worker hour), the endowment component of the decomposition is 0.64 and the returns component is -0.18. That is, going only by the difference in endowments, NSC productivity *should* be 1.9 times higher, but is in fact less than that. The fact that the returns component has a negative sign indicates that subcontracting firms would do *worse* if they had NSC returns. In other words, SC firms do better at converting their (poorer) endowments into value-added per worker. Note that this result is consistent with the higher asset elasticity observed for SC firms in Table 3. This is a "subcontracting premium" in a restricted sense that controlling for the differences in their endowments, SC firms perform better. It does not imply that SC firms perform better than NSC firms, in general.

[Table 4 here.]

Another way to test the presence of a potential "subcontracting premium" is to consider sub-

contracting as a "treatment" and calculate an Average Treatment Effect on the Treated (ATET) as outlined in Section 4.[13] The ATET for the entire sample of firms was small (0.06) but positive and significantly different from zero.[14] This shows that, for all firms taken together, controlling for differences in firm endowments, being in a subcontracting relationship improves productivity as measured by log GVA per worker-hour.

We can summarize our findings thus far, as follows. Across the entire population of informal manufacturing firms, the relatively poorly endowed firms tend to be on subcontract. This difference in endowments explains the bulk of the GVA gap between the two types of firms. But SC firms are better able, than NSC firms, to convert endowments into output. Thus, it is beneficial to enter into a subcontracting relationship, i.e., the data suggests the existence of what might be called a subcontracting premium. However the magnitude of the subcontracting premium for SC firms, as measured by the ATET, is small at about 6% higher productivity.

5.2 Analysis by Firm Type, State, and Sector

As mentioned in the Introduction, the informal sector is often modeled as consisting of relatively modern/profit-oriented and relatively traditional/survival-oriented sub-sectors. It has been argued that engaging in a subcontracting relationship is more beneficial for modern informal firms than their traditional counterparts (House, 1984; Ranis and Stewart, 1999; Arimah, 2001; Marjit, 2003; Moreno-Monroy et al., 2012). The foregoing analysis of the entire sample does not allow us to test this hypothesis. For example, it is possible that firms that hire wage-workers (and hence have an accumulation rather than a survival motive), or firms located in urban areas as well as more industrially advanced areas stand to gain more from being in a subcontracting relation. The small overall treatment effect we report in the previous section could hide such variation.

We now test this hypothesis by estimating the subcontracting effect separately on OAMEs (firms that do not hire any wage-worker) and nonOAMEs (firms that do hire workers). Such a stratification can be justified on the grounds that employment of hired workers indicates a shift from a traditional, subsistence motive to a modern, accumulation motive. Further, since larger and more dynamic informal firms are more likely to be found in urban locations and in the more industrially advanced regions of the country, we can also test this hypothesis by estimating the effects of subcontracting separately on rural and urban firms, and on firms found in industrially

[13]Fortin et al. (2011) argue that the "returns" (or "unexplained") component in a Oaxaca-Blinder aggregate decomposition can be interpreted as the average treatment effect on the treated (ATET). In our case this would be the effect of subcontracting on SC firms.

[14]We calculate the reported magnitude of ATET as follows: using (4), we compute a TET for each firm and then do a t-test with sampling weights of the null hypothesis that the mean of TET is zero. The mean of TET is reported as the ATET and the standard error of the test as the standard error of the ATET. We follow the same procedure for relevant sub-samples in the following sub-sections.

advanced and industrially backward States.

In the next three sub-sections, we report results from re-estimating the maximum likelihood model for these different sub-samples and performing selection corrected Oaxaca-Blinder decomposition as well as calculating average treatment effects on the treated for SC firms.[15]

5.2.1 Firm Type

First, we separately estimate the subcontracting premium/penalty on OAME and nonOAME firms. The descriptive statistics for SC and NSC firms stratified by OAME-nonOAME status are broadly along the lines we expect from the analysis of the full sample. NonOAMEs are better endowed in terms of physical and human capital and are more productive than OAMEs (in terms of raw averages). Within each subsample, SC and NSC firms also differ exactly as they do in the full sample: productivity is lower for SC firms in both subsamples. Home-based and female-owned firms are also more preponderant among the SC category for both sub-samples, though female owned firms are rare in the nonOAME subsample. Human capital variables are also as expected, with SC firm owners being relatively less likely to have passed beyond the primary school stage, in both subsamples.

To obtain an aggregate sense of the effect of subcontracting on SC firms for the two sub-samples, once again, we turn to Oaxaca-Blinder decomposition and ATET. Table 4 present the results of the Oaxaca-Blinder decomposition and the ATET, for both sub-samples. Both sets of results highlight a striking difference of the effect of sub-contracting.

For the OAME sub-sample, we see that, once again, the endowments component over-explains the GVA gap (the predicted difference in log GVA per worker hour between NSC and SC firms is 0.39 and the endowments component is 0.63), and correspondingly, the returns component is negative (-0.22), indicating that SC firms would perform *worse* if NSC coefficients were applied to SC endowments. This is in line with the results for the full sample and indicates that the treatment effect of subcontracting on subcontracted firms should be positive (i.e., there should be a subcontracting premium for OAMEs). That is exactly what we see in Table 4: the ATET for OAMEs is 0.106 and statistically significant. Thus, the subcontracting premium for SC firms within the category of OAMEs is higher productivity of 11%.

The behavior of the non-OAME firms is very different. The endowments component from the Oaxaca-Blinder decomposition exercise reduces substantially in magnitude while the returns component is larger and positive in sign. Both the components contribute almost equally to the GVA gap: the predicted difference in log GVA per worker hour between NSC and SC firms is

[15] We do not present descriptive statistics for different sub-samples to save space. These are available upon request from the corresponding author.

0.34, the endowments component is 0.18, and the returns component is 0.20). Thus, as compared to OAMEs, in the non-OAME sub-sample, the difference between SC and NSC firms is explained to a lesser extent by the difference in their endowments and to a larger extent by the difference in the returns to those endowments. The positive sign on the returns component suggests that SC firms would perform better, in a counter-factual sense, had they been given NSC coefficients. Thus, for the non-OAME sub-sample, we observe a "subcontracting penalty", in stark contrast to a "subcontracting premium" for OAME firms. This means that the ATET is expected to be negative for the non-OAME sample, which is indeed what we find: the ATET for non-OAMEs is -0.29 and statistically significant (Table 4). Thus, the subcontracting penalty for SC firms within the category of non-OAMEs is lower productivity by 25%.

Why might entering a subcontracting arrangement be better for OAMEs but not for non-OAMEs (i.e., NDMEs and DMEs)? One possibility is that OAMEs are unable to make full use of their existing productive capacity due to lack of a stable source of demand (demand constraint) and due to lack of access to working capital (a credit constraint). Entering a subcontracting arrangement ensures better access to both and thus improves productivity. One indication that this may indeed be the case comes from firm responses to questions regarding problems faced during production. While 45.8% of OAMEs of the NSC type report problems with shortage of capital, only 27.78% of SC type OAMEs report the same. Similarly, while 22.11% of OAMEs of the NSC type report marketing problems, only 5.94% of SC type OAMEs report the same (Table 5). This clearly indicates that being in a subcontracting relationship is beneficial to OAMEs in terms of availability of credit to finance working capital and market access. In contrast, for non-OAMEs the difference between SC and NSC firms with regard to credit and demand constraints, is much less pronounced. In fact, more SC type non-OAMEs report shortage of capital than NSC type firms, exactly the opposite of that observed for OAMEs. This data, while only suggestive and in need of further investigation, is nevertheless consistent with the findings reported above, viz., being in a subcontracting relation is more beneficial for OAMEs than non-OAMEs.

[Table 5 here.]

5.2.2 Advanced and Backward States

Another way to assess whether subcontracting benefits modern firms within the informal sector is to stratify the sample into relatively more industrially advanced states and more backward states. We construct a measure of a State's industrial status by taking the share of the State's formal sector industrial output in the industrial output of the whole country adjusted by the State's share of the population. Using a suitable cut-off with this measure, our sub-sample of industrially advanced

states includes Andhra Pradesh, Gujarat, Haryana, Karnataka, Maharashtra, Punjab, and Tamil Nadu; and our sub-sample of industrially backward states include Assam, Bihar, Madhya Pradesh, Odisha, Rajasthan, Uttar Pradesh, and West Bengal.

Using this stratification, we would like to investigate if there is a difference in the effect of subcontracting for informal firms in the industrially advanced as opposed to the industrially backward states. The motivation for using this stratification is that in the industrially advanced states, it is more likely that the informal sector is also composed of larger, more dynamic firms. Further, it is also more likely that the subcontracting relationships we observe in the informal sector actually originate in the formal sector (since the latter is, by definition, larger in industrially advanced states).

Summary statistics for firms in the two groups of states show that GVA per worker-hour is higher in the advanced states as are physical and human capital endowments. Correspondingly, the proportion of home-based and rural firms is lower in the industrially advanced states. Interestingly, the percentage of female entrepreneurs is higher in advanced states (47.5% in the industrially advanced as opposed to 33.9% in the industrially backward states). Within each group of States, SC firms have lower GVA per worker hour than NSC firms and are relatively poorly endowed in physical and human capital. They are also more likely to be home-based and female owned.

The Oaxaca-Blinder decomposition and treatment effect results for these two sub-samples are presented in Table 4. For the backward states, the predicted difference in log GVA per worker hour between NSC and SC firms is 0.31, the endowments component is 0.70 and the returns component is -0.37; for the industrially advanced states, the predicted difference in log GVA per worker hour between NSC and SC firms is 0.61, the endowments component is 0.50 and the returns component is 0.11. Thus, a much larger part of the GVA gap between NSC and SC firms is explained by differences in endowments for the backward states as compared to the sub-sample of industrially advanced states. Moreover, for backward states, the returns component of the Oaxaca-Blinder decomposition is negative at -0.37, and the ATET is positive at 0.284 (32% higher GVA). This indicates the existence of a "subcontracting premium" in backward states. For advanced states, the evidence points in exactly the opposite direction: the returns component of the Oaxaca-Blinder decomposition is 0.112, and the ATET is -0.141 (13% lower GVA). This suggests that advanced states have a "subcontracting penalty."

Although the magnitude of the treatment effects are not strictly comparable between the analysis for firm types and states, it is worth noting that the qualitative trends are consistent across both dimensions of stratification: subcontracting is beneficial for smaller firms and for firms located in industrially backward states; subcontracting is harmful for larger firms and for firms located in industrially advanced states.

5.2.3 Rural and Urban Sectors

Finally, we address the issue of the effects of subcontracting on modern versus traditional parts of the informal sector by creating sub-samples of urban and rural firms. Based on the foregoing discussion, we would expect that urban firms experience a penalty while rural firms enjoy a premium.

Descriptive statistics for rural and urban samples show trends that are similar to those described above for OAMEs and nonOAMEs as well as for backward and advanced States. Urban firms are more productive and are better endowed in terms of physical and human capital. The proportion of nonOAMEs is also greater in the urban sector than in the rural sector.

The decomposition and treatment effect results for these two sub-samples are presented in Table 4. Consistent with the foregoing results, we see that subcontracting is beneficial for firms located in the rural areas: the returns component of the Oaxaca-Blinder decomposition is negative at -0.26; correspondingly, the ATET is positive at 0.20 (22% higher GVA). This indicates the existence of a subcontracting premium in rural areas. By contrast, for urban areas, the returns component of the Oaxaca-Blinder decomposition is -0.01 and the ATET is -0.12 (11% lower GVA), indicating a subcontracting penalty. Once again, the magnitude of the treatment effects are not strictly comparable with the other sub-samples, but the trends are consistent: there is a subcontracting premium for rural firms but a subcontracting penalty for urban firms.

Summarizing our finding for the analyses of different sub-samples, we see that subcontracting is beneficial for smaller firms, for rural firms, and for firms located in industrially backward states; on the other hand, subcontracting is harmful for larger firms, for urban firms, and for firms located in industrially advanced states.

6 Discussion and Conclusion

Subcontracting relations with larger, formal sector firms have been proposed as one mechanism through which micro and small informal sector firms can modernize and accumulate capital, resulting in growth in incomes for the majority of the manufacturing workforce. On the other hand, these relation have also been seen as reinforcing the stagnant parts of the informal sector. However, direct evidence that formal sector firms prefer to subcontract to relatively more modern/dynamic informal sector firms or that subcontracting positively affects informal firms has been hard to obtain. In the present study, we have used firm-level data from the Indian informal manufacturing sector to address these questions.

Based on evidence from the 62nd round of the Indian National Sample Survey of the Unorganized Manufacturing Sector (2005–2006), we have shown that the relatively traditional parts of the

informal sector are more likely to be in a subcontracting relationship. Probability of being on subcontract is higher for home-based, female-owned, and asset-poor firms. We also show that SC firms perform worse than NSC firms in terms of gross value added per worker-hour and that differences in firm endowments explain most of this GVA gap. But controlling for this difference in endowments, we also show the existence of a subcontracting premium, i.e. being in a subcontracting relationship is beneficial for the informal subcontracted firm, though the effect is small.

The second major finding of this paper is that subcontracting is beneficial for the relatively traditional or backward part of the informal sector but not for the modern part. We use three different approaches to test the differential impacts of subcontracting on modern versus traditional firms. First, stratification of the sample by OAME-nonOAME status – OAME firms do not use hired workers – allow us to distinguish between firms that operate only with family members versus those that hire wage-workers. Second, we stratify the sample by the level of industrial development of state in which firms are located. This stratification arises from the understanding that informal sector firms in States with a relatively better developed formal industrial sector could benefit more from subcontracting than those located in industrially backward states due to better infrastructure, access to the market, and economies of agglomeration (Sundaram et al., 2012). Our method for the division of states into two groups – industrially advanced and industrially backward – is based on the states' share of formal sector industrial output adjusted for population. This criterion for classification suggests that sub-contracting with the formal manufacturing sector should be more prevalent in the industrially advanced due to economies of agglomeration and better industrial infrastructure. Thus, our analysis of these two sub-samples also indirectly throws some light on the effects of formal-informal sector subcontracting, something which cannot be directly addressed due to data limitations. Third, we analyze the impact of subcontracting separately for rural and urban firms, on the premise that firms located in urban areas are likely to have better access to crucial market-related information, more impersonal relations, better infrastructure and more modern institutions.

How can we understand this result? As suggested earlier, one possibility is that home-based, female-headed, asset-poor, rural firms in industrially backward areas suffer from severe lack of access to working capital, information about markets, and product designs, are as a result are not able to use their capacity fully (Sahu, 2010). Engaging in a subcontracting relation under such circumstances brings benefits of ready access to both working capital and market, in addition to giving a supply of orders that enable fuller capacity utilization. The positive impacts of this may outweigh the negative effects resulting from unfavorable terms of trade. However, for firms that hire wage-workers and are based outside the home, in urban or relatively industrially advance areas, lack of access to working capital, markets, and product designs may not present such severe

bottlenecks. For such firms, the negative effects of subcontracting (such as unfavorable terms of trade or delayed payments) could outweigh the positive. The analysis presented in this paper does not allow us to test these channels, so the above comments are necessarily speculative. Testing these possible mechanisms will form the basis of future research.

Ours results are thus partially consistent with both the benign and the exploitative views of subcontracting outlined in Section 2 but they also force us to reconsider these paradigms. Consistent with the exploitation view but going against the benign view we find that subcontracting is more prevalent among relatively poorly endowed firms in the informal sector. But consistent with the benign view and going against the exploitation view, we find that a subcontracting linkage is beneficial for these poorly endowed firm, specially if they are OAMEs, rurally located, or in industrially backward states.

Policy-making with regard to the informal sector needs to engage with the complexity illuminated by our results. Subcontracting linkages with the formal sector cannot simply be assumed to benefit informal firms. Instead, linkages should be encouraged under those circumstances where market and credit constraints are particularly severe and the possibility of alleviating them outweighs potential harmful effects. On the other hand, for those informal firms which are already large enough to employ hired workers and are not home-based, providing access to credit and to a market independent of a subcontracting relation be prove to be more beneficial. This would represent a growth path for the informal sector independent of subcontracting links with the formal sector.

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Table 1: *Subcontracting Proportion by Firm Type, Gender and Location*[a]

		No Contract (% firms)	**Contract** (% firms)	**Sample**
Firm Type				
	OAME	69.36	30.64	45050
	NDME	82.54	17.46	12531
	DME	76.92	23.08	6152
Gender of Owner				
	Male	83.91	16.09	47017
	Female	50.83	49.17	16716
Location of Firm				
	Outside Home	91.06	8.94	29084
	Within Home	64.12	35.88	34649

[a] Data are from Round 62 the NSS. OAME (Own-Account Manufacturing Enterprise) employs no hired workers. NDME (Non-Directory Manufacturing Establishment) employs at least one hired worker and no more than six total workers. DME (Directory Manufacturing Establishment) employs at least one hired worker and more than six but less than ten total workers.

Table 2: *Descriptive Statistics for Full Sample (2005)*[a]

	ALL FIRMS	**NSC FIRMS**	**SC FIRMS**
	Mean/SD	Mean/SD	Mean/SD
Log GVA per labor hour	4.922	5.054	4.602
	(0.99)	(1.05)	(0.76)
Home-based	0.753	0.682	0.924
	(0.43)	(0.47)	(0.26)
Log Assets	9.611	9.895	8.923
	(1.76)	(1.64)	(1.84)
Total Workers	1.804	1.862	1.665
	(1.65)	(1.71)	(1.50)
OAME	0.877	0.860	0.920
	(0.33)	(0.35)	(0.27)
NDME	0.089	0.104	0.053
	(0.29)	(0.31)	(0.22)
DME	0.033	0.036	0.026
	(0.18)	(0.19)	(0.16)
Female Owner	0.397	0.285	0.667
	(0.49)	(0.45)	(0.47)
No school	0.258	0.238	0.306
	(0.44)	(0.43)	(0.46)
Primary	0.378	0.350	0.445
	(0.48)	(0.48)	(0.50)
Above Primary	0.365	0.412	0.249
	(0.48)	(0.49)	(0.43)
Urban	0.274	0.269	0.285
	(0.45)	(0.44)	(0.45)
Observations	63733	54940	8793

[a] Data are from Round 62 of the NSSO (2005). All estimates in this table have been computed by using sampling weights. SC: subcontracted firms; NSC: non-subcontracted firms.

Table 3: *Average Marginal Effects for All Firms: 2005*[a]

	Selection Equation	**Observation Equation (SC firms)**	**Observation Equation (NSC Firms)**
Home-Based	0.0728***		
	(0.0214)		
Log Assets	-0.0254***	0.146***	0.0957***
	(0.00860)	(0.0321)	(0.0233)
non-OAME	0.0465***	0.151	0.368***
	(0.0165)	(0.132)	(0.0764)
Female owned	0.0685***	-0.511***	-0.137
	(0.0202)	(0.126)	(0.115)
Primary School	0.0221	-0.0354	0.120
	(0.0160)	(0.0746)	(0.0875)
Above Primary	-0.00572	0.106	0.216***
	(0.0159)	(0.0910)	(0.0607)
Urban	0.0680***	-0.300***	0.233***
	(0.0207)	(0.0941)	(0.0532)
Source and Destination Controls	N	Y	Y
State Dummies	Y	Y	Y
Industry Dummies	Y	Y	Y

[a] The "selection equation" is a probit model for getting selected into a subcontracting relationship. Each "observation equation" has logarithm of gross value added per worker hour as the dependent variable. The sample size for the estimation is 63733. Sampling weights have been applied for estimation, which implies a population of about 15.3 million observations (firms). Standard errors, clustered by state and industry, are given in parentheses below parameter estimates. Significance levels: * p<0.1, ** p<0.05, *** p<0.01. SC: subcontracted firms; NSC: non-subcontracted firms.

Table 4: *Oaxaca-Blinder Decomposition and ATET*[a]

	Oaxaca-Blinder Decomposition				**ATET**	**Sample**
	Pred diff (NSC-SC)	Endow	Return	Selection		
Full Sample	0.4415	0.6388	-0.1824	-0.0096	0.060***	61662
					(0.014)	
OAME	0.391	0.626	-0.222	-0.004	0.106***	44447
					(0.016)	
non-OAME	0.341	0.187	0.203	-0.055	-0.290***	17215
					(0.015)	
Backward States	0.308	0.703	-0.370	0.01	0.284***	28562
					(0.028)	
Advanced States	0.614	0.496	0.112	-0.007	-0.141***	25103
					(0.015)	
Rural	0.384	0.663	-0.262	0.011	0.200***	33018
					(0.022)	
Urban	0.607	0.613	0.005	-0.027	-0.119***	28664
					(0.008)	

[a] Authors' calculation using data from Round 62 of the NSSO. We calculate the reported magnitude of ATET as follows: using (4), we compute a treatment effect on the treated (TET) for each firm and then do a t-test with sampling weights of the null hypothesis that the mean of TET is zero. The mean of TET is reported as the ATET and the standard error of the test as the standard error of the ATET. We follow the same procedure for all sub-samples in the following sub-sections.

Table 5: *Shortage of capital and marketing problems as reported by firms: 2005–2006*[a]

	OAME (% firms)	**non-OAME** (% firms)
Shortage of Capital		
SC firms	27.78	50.79
NSC firms	45.80	43.54
Marketing Problems		
SC firms	5.94	11.62
NSC firms	22.11	17.80
Sample	44821	18582

[a] Source: authors' calculation from unit-level data from Round 62 of the NSS.