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Competition and labor productivity in India's retail stores

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ABSTRACT

Using newly available data compiled by the World Bank's Enterprise Surveys, we analyze the relationship between competition and output per worker for retail stores in India. The OLS and IV regressions show a significant positive relationship between competition and output per worker. There is also considerable scope for pro-competitive reforms with 62 percent of the surveyed stores reporting facing no significant competition. According to our conservative estimates, pro-competitive reforms could improve labor productivity by as much as 36 percent of its current level.

1. Introduction

The World Bank's Enterprise Surveys conducted a survey of 1948 retail stores in 16 states and 41 cities of India in 2006. The survey shows that 62 percent of the retailers do not face any significant competition in the product market (henceforth, competition). Exploiting existing variation in the level of competition in these data, we find a strong positive effect of greater competition on labor productivity or output per worker. On the conservative side, results show that greater competition in the sector could increase labor productivity among retail stores by 36 percent. We believe that this is an important finding given that the retail sector in India contributes about 14 percent to the national GDP and is the second largest employer after agriculture providing 10 percent of all jobs.

Existing work (reviewed below) on the nexus between competition and performance for the retail sector is restricted to a handful of developed countries. Evidence for the developing countries is rare or almost non-existent. Even for the case of developed countries, studies that do exist suffer from a number of limitations. For example, many of the studies analyze how productivity of retail stores is affected by entry of new large stores under the assumption that entry of large retail firms increases competition in the sector (see for example, Foster, Haltiwanger, & Krizan, 2006; Maican & Orth, 2012; Schivardi & Viviano 2011). However, the link between entry of large retail firms and competition in the retail market is typically not empirically verified (Koster, van Stel, & Folkeringa, 2012; Carree & Thurik, 1994). In fact, Koster et al. (2012) find evidence of greater competition due to new entry in the manufacturing sector but not in the services sector. Another problem is that the bulk of retailing in developing countries like India is dominated by small sized retailers, especially in the relatively smaller

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cities. Hence, it is not clear to what extent predictions based on the pro-competitive effects of the entry of large stores are relevant for the developing world.

Nevertheless, broad principles highlighted in the literature that link competition and productivity as well as their empirical verification serves to inform and motivate the present study. At the theoretical level, the literature is marked by a general belief that competition in the product market is good for the productivity of the firm (Djankov & Murrell, 2002; Aghion & Griffith, 2005; Holmes & Schmitz, 2010; Syverson, 2011; Pavcnik, 2002; Bloom, Draca, & Reenen, 2011). There are two general mechanisms through which competition affects productivity of the firms and industry–Darwinian selection or industry rationalization and X-inefficiency. According to Darwinian selection, greater competition moves market share toward more efficient (less costly) producers, shrinking relatively high-cost firms, sometimes forcing their exit, and opening up room for more efficient producers. It also raises the productivity bar that any potential entrant must meet to successfully enter. The X-inefficiency argument is associated with higher productivity following greater competition among existing firms. That is, heightened competition can induce firms to take costly productivity raising actions such as greater managerial effort and product innovation that they may otherwise not. Besides raising producers' own productivity levels, this effect of competition leads to aggregate productivity growth via the "within" component (see for example, Syverson, 2011; Djankov & Murrell, 2002).

Empirical studies on the relationship between competition and productivity (reviewed below) are diverse not just in terms of the country but also the industry. Studies range from the iron-ore sector to retailing. Nevertheless, these studies serve as a useful guide and motivation for the present study since the underlying forces that drive the competition-productivity nexus are common across industries and countries. For example, reviewing a number of case studies that focus on specific industries and economies, Syverson (2011, page 352–353) states: "... these detailed case studies appear emblematic of much broader competitive effects that act across numerous industries and economies." Of course, quantitatively, the strength of the relationship between competition and productivity is likely to vary, being strong in some countries and industries and weak in others. This is confirmed in the existing literature that shows mixed results for the competition-productivity relationship. We provide a few examples from the literature to illustrate the point.

In an influential study, Schmitz (2005) finds that productivity of iron ore producers in the US increased dramatically in the early 1980s when they faced stiff competition from abroad (Brazilian producers) for the first time. The study attributes the improvement in productivity to better X-efficiency of existing firms–cost reductions obtained by drastic changes in production operations such as loosening the strict work rules. It is plausible that higher competition may have resulted in similar cost reductions and productivity improvements in India's retail sector. The present paper attempts to shed light on the issue.

Another study, Pavcnik (2002), looks at how trade liberalization during the 1970s affected productivity growth in Chilean manufactures. The study finds that sectors facing new import competition saw faster productivity growth than sectors producing primarily non-tradables. Further, the study points out that the industry-level gains from higher import competition were driven by both, the Darwinian selection effect as well the X-efficiency effect. Among others, Bloom et al. (2011) find roughly similar results for twelve European nations facing increased competition due to China's entry into the WTO. The extent to which the X-inefficiency and/or Darwinian selection effects highlighted in the above studies apply to India's retail sector remains an important gap in the literature. The present paper attempts to take one step towards filling this gap.

Focusing on the retail sector, Schivardi and Viviano (2011) exploit regional differences in entry barriers in the retail sector in Italy. The underlying motivation for this study is that high entry barriers reduce competition in the sector, thereby lowering the performance of the retail stores. The study looks at a number of performance measures including labor productivity (sales per worker). It finds strong evidence that higher entry barriers reduce labor productivity in Italy's retail sector. Maican and Orth (2012) use data on all retail food stores in Sweden to measure the impact of increased competition from the entry of large stores on incumbent store's productivity. The study finds robust evidence of an increase in productivity of incumbent stores following entry by large stores. At a broad level, these studies serve as a motivation for exploring the relationship between competition and labor productivity in India's retail sector.

In addition, a number of studies have shown that increased competition through, for example, the entry of large retail stores, tends to lower profit margins and retail prices and also improve the quality of services provided by retail stores (see for example, Freeman, Nakamura, Nakamura, Prud'homme, & Pyman, 2011; Matsa, 2011; Igan & Suzuki, 2012; Basker, 2005). While empirical verification is required, these changes are most likely to be associated with higher productivity of the retail stores, implying a positive link between competition and productivity in the retail sector. Also see for example, Parente and Prescott (2000), Galdon-Sanchez and Schmitz (2002), Dunne, Klimek, and Schmitz (2009), Syverson (2004), de Loecker (2009), and Fabrizio, Rose, and Wolfram (2007) for additional results linking productivity and competition in various sectors. Holmes and Schmitz (2010) provide an excellent survey of these and other related studies.

It is important to note that the micro or retail store level data we use is a pure cross-section. Information on the entry and exit of retail stores is not available in the data we use or outside. Even information on various cost elements such as the stock of inventory maintained by the stores is also not available. Due to these data limitations, it is beyond the scope of the present paper to suggest whether our results for the competition-productivity relationship are driven by Darwinian selection or X-efficiency or some other possible mechanism. Theoretically, our results are consistent with either or all these mechanisms at play. A richer data than the one currently available on retail stores in India would be needed to distinguish between the mechanisms listed above. This is a fruitful area for future research.

Another strand of the literature focuses on the determinants of competition and we draw on this literature to generate exogenous variations in the level of competition for the instrumental variables estimation strategy. Studies show that price

Table 1
Summary statistics.

Variable	Mean	Standard deviation	Minimum	Maximum	Observations
Labor productivity	12.42	1.18	8.11	16.12	1907
Competition	2.20	0.56	1	4	1937
Size	5.15	1.17	2.08	11.41	1927
Traditional stores (dummy)	0.64	0.48	0	1	1937
Consumer durable stores (dummy)	0.097	0.295	0	1	1937
Modern format stores (dummy)	0.26	0.44	0	1	1937
Employment	5.74	24.63	1	501	1937
Age	14.49	12.82	1	102	1937
Outage	2.17	3.66	0	18	1933
Overdraft	0.22	0.42	0	1	1913
Computers	0.17	0.37	0	1	1937
Inventory	11.59	16.20	1	180	1937
Informal_Competition	1.68	0.45	1	4	1937
Non-payment	1.35	3.22	0	30	1937
Audited	0.30	0.46	0	1	1903
Female	0.06	0.23	0	1	1931
Theft_{cs}	0.08	0.10	0	1	1937
Non-workers	−5.87	0.13	−6.21	−5.55	1937
Literacy	4.36	0.07	4.14	4.55	1937
Children	−0.31	0.20	−0.71	0.04	1937
Retailer density	2.12	0.20	1.41	2.41	1937
Sex ratio	0.89	0.07	0.76	1.06	1937
Metro	0.30	0.46	0	1	1937
Skill_shortage_c	0.55	0.39	0	1.88	1937
Courts_c	0.47	0.29	0	1	1937
Tax rates_c	1.30	0.59	0.38	2.38	1937
Corruption_c	1.30	0.81	0.10	3.91	1937
Land laws_c	1.04	0.63	0	3.09	1937
Permits_c	0.89	0.54	0.03	2.15	1937

dispersion is lower and competition higher in retail and other sectors when consumers search more intensively for best prices (see for example, Lewis & Marvel, 2011; Amin, 2011; Baye, Morgan, & Scholten, 2006; Brown & Goolsbee, 2002; Sorenson, 2000; Hortacsu & Syverson, 2004; Goldman & Johansson, 1978; Calem & Mester, 1995; Knittel, 1997). Direct measures of search intensity are typically not available and the approach in the literature is to use some proxy measure instead. Proxy measures of greater search intensity and hence greater competition include for example, greater frequency of purchases (Sorenson, 2000), larger proportion of poor and elderly in the community (Ohler & Smith, 2012), per capita car availability (Talukdar, 2008), and the proportion of non-working adults in the population (Goldman, Ramaswami, & Krider, 2002). Elaborating, Goldman et al. (2002) propose that the opportunity cost of time spent shopping is lower for non-working than working adults. Hence, competition in retail increases with more non-working adults in a community. Using the same data as the present study, Amin (2011) puts this idea to test and finds that competition is indeed higher in cities with more (adult) non-workers per household. We follow Amin (2011) to instrument for competition with the number of adult non-workers per household at the city level. Below, we argue that our instrument is likely to yield results on the conservative side.

2. Data and main variables

We use store level data collected by the World Bank in 2006 (Enterprise survey)[1]. The data are a cross section of 1948 retail stores spread over 16 major states and 41 large cities of India. Some stores sell grocery items while others consumer durables. The National Industrial Classification groups retailers into those operating through established stores and the rest who usually operate from home (NIC 1998, Industry Division 52). All stores in our sample belong to the former group.

Information on products carried by stores is not available. However, the survey does classify stores into the following types: (i) traditional stores—which include general and departmental stores, grocers, chemists, food stores, etc., (ii) consumer durable stores—which are specialized stores carrying durable items like televisions, home appliances, etc., (iii) modern format stores—which are large stores and part of a shopping complex. These three *store-types* account for 64, 26 and 10 percent of the sample, respectively. Summary statistics of all the variables used in the regressions are provided in Table 1.

2.1. Dependent variable

The literature highlights significant conceptual and practical problem in measuring productivity of services sectors including retail (see for example, Baily & Solow, 2001; Cainelli, Evangelista, & Savona, 2006). We follow this literature and

[1] The survey and methodology for data collection are available at www.entersurveys.org.

measure productivity of the retail stores by labor productivity. That is, our dependent variable is (log of) total value of sales (in Rupees) of the store in 2005–2006 divided by the number of employees at the store during the year (*Labor productivity*). *Labor productivity* varies from 8.1 to 16.12 with a mean value of 12.4 and standard deviation is 1.18. Consumer durable stores have the highest level of labor productivity (12.8) followed by the modern format stores (12.7) and then the traditional stores (12.2). Across cities, the mean value of *Labor productivity* is highest in Kochi (traditional stores), Cuttack (consumer durables) and Faridabad (modern format stores). The corresponding cities with lowest mean value of *Labor productivity* are Mysore, Nagpur and Coimbatore.

2.2. Explanatory variables

Our main explanatory variable, competition, is constructed from responses of stores to the following question asked in the survey: "For this store, how important are each of the following influences over prices of its main products? (a) Pressure/influence from domestic competitors, (b) Pressure/influence from foreign competitors, (c) Pressure/influence from unorganized trade (hawkers, traders sitting on pavement, people selling from home, people selling spurious good)." The responses to parts (a)–(c) were recorded separately on a 1–4 scale defined as: not at all important (1), slightly important (2), fairly important (3) and important (4).

We define our measure of competition as the average score on part (a) of the question above where the average is taken at the "city-store type" level (*Competition*). The "city-store type" is obtained as the Cartesian product of the cities in our sample and the type of store (traditional, consumer durable and modern format store). In other words, for any given city, we average the response of all the traditional stores on the level of competition they face from domestic competitors and use this average value as the level of competition faced by all traditional stores in the city. The same holds for consumer durable and large format stores. The exercise is repeated for each city. The mean value of *Competition* is 2.2 and standard deviation is 0.56 (Table 1).

A few points are to be noted. First, foreign competition is virtually non-existent in the sector and informal competition (part (c) of the question above) is also small[2]. Further, policy implications of more competition via an expanded informal sector are not clear[3]. For these reasons we focus on formal competition from domestic competitors. Second, store-level responses (perceptions) about the level of competition cannot be used directly in the regressions because they could be endogenous to store characteristics such as size, age, etc. *Competition*, as defined above, is a group average and therefore less likely to suffer from measurement errors and endogeneity problems (see for example, Krueger & Angrist, 2001; Fisman & Svensson, 2007; Dollar, Hallward-Driemeier, & Mengistae, 2006) although these problems cannot be ruled out completely. Third, there is substantial variation in the reported scores on domestic competition across store-types within cities (Fig. 1). Averaging these scores at the city-store type level (as opposed to averaging at the city or store-type level) allows us to exploit this variation for a better identification of our main results. Fourth, one could argue that *Competition* captures price-competition alone which is too narrow a measure of the overall competition. For example, pricing restrictions for certain products (by law) may blunt price-competition but stores may still compete with each other for the precious few buyers (sales competition). While this problem cannot be ruled out completely, we provide some evidence which suggests that it is unlikely to be serious. Specifically, in one survey question, stores were asked how important is the influence of domestic competitors for their decision to introduce new product lines. Responses were recorded on the same 1–4 scale as above. The correlation coefficient between the reported scores here (averaged at the city-store type level) and *Competition* equals 0.894. The high correlation is reassuring in that it suggests that *Competition* captures the broader competitive environment rather than the narrow specifics of price-competition.

In the full sample, 36 percent of all stores report domestic (price) competition as "not at all important", 26 percent as "slightly important", 20 percent as "fairly important" and the rest 18 percent as "important". That is, only 38 percent of the retailers find competition as significant (more than slightly important). This is much lower than the corresponding figure of 82 percent that we find in the survey of manufacturing firms in India conducted by Enterprise Surveys in 2005. That is, there seems to be substantial scope for increasing competition in the retail sector in India. Focusing on India's retail sector and across store-types, the value of *Competition* is highest for consumer durable stores (2.42), followed by the modern format stores (2.17) and then the traditional stores (2.11). Fig. 2 shows the average value of *Competition* across cities. The metropolitan cities of Mumbai, Delhi, Chennai, Bangalore, Kolkata and Hyderabad show intermediate levels of competition while some smaller cities like Madurai and Jalandhar show much higher levels of competition.

2.2.1. Other controls

Reverse causality from *Labor productivity* which varies at the store level to *Competition* which varies at the city-store type level is unlikely, although it cannot be ruled out completely. A relatively more serious problem relates to measurement errors with the competition variable and estimation bias due to omitted variables. We provide a few examples of these problems to motivate the identification strategy.

[2] Sixty percent of all stores report informal competition as "not at all important" and another 21 percent report it as "slightly important". Corresponding figures for formal domestic competition (part (a) of the question above) are 36 percent and 26 percent, respectively.

[3] For example, street hawkers hardly seem to be in a position to make large investments necessary for the future growth and development of the sector.

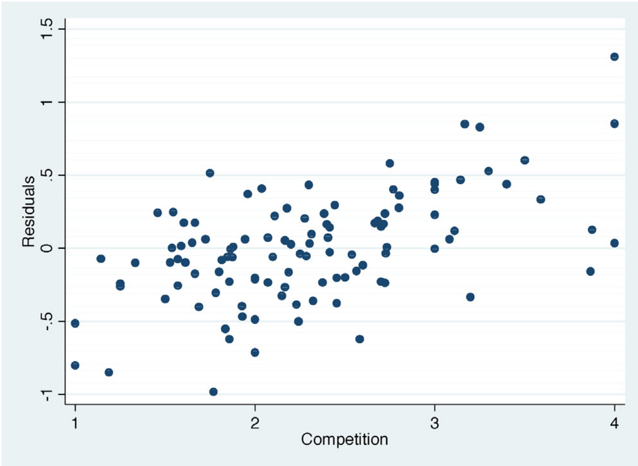

Fig. 1. The level of competition experienced varies substantially across retail stores within a given city-store type cell. The *Y* axis in the graph above plots residuals obtained by regressing *Competition* on city and store-type fixed effects. The *X* axis plots *Competition* as defined in the sections above.

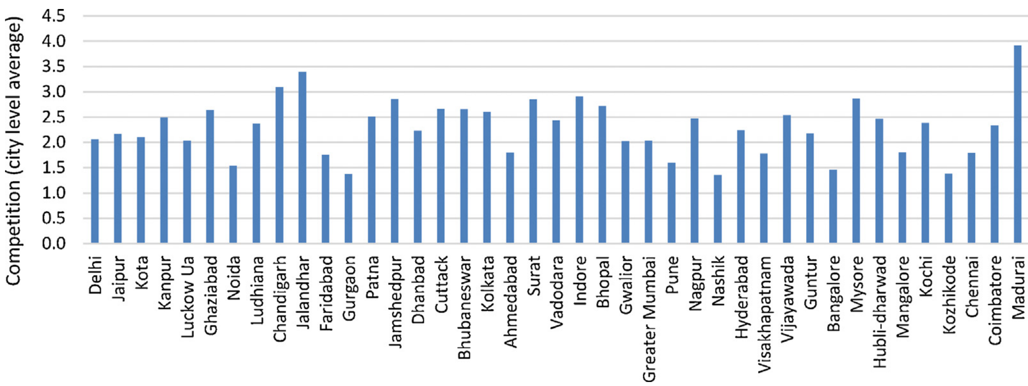

Fig. 2. There is significant variation in the level of competition experienced by the stores across cities in India. *Source*: Enterprise Surveys. *Note*: *Y*-axis plots the average value of the Competition variable as defined in the text above with the average taken across store-types (traditional, consumer durable and modern format stores) for each city.

First, consider aspects of the overall business climate such as regulation, infrastructure, etc., that are, to some extent, commonly shared by stores in a given region. Failure to control for the overall quality of the business climate may bias the estimated coefficient of *Competition* upwards because (better quality of) business climate is likely to be correlated with labor productivity and competition in the same (positive) direction. Our empirical specification controls for city and store-type fixed effects which implies that the bias here will survive only if either the business climate varies across store-types (otherwise city fixed effects eliminate the bias) *and* that this variation across store-types is not uniform across all cities (otherwise store-type fixed effects eliminate the bias).

Second, some store characteristics may be correlated with both labor productivity and competition causing omitted variable bias problem. We expect this problem to be less severe in our specification than is otherwise the case because our measure of competition is obtained by averaging across stores of different characteristics. That is, in our specification, the problem of spurious correlation could arise from variation in store attributes across but not within city-store type cells. To the extent that this source of bias does exist, it is difficult to sign its direction. For example, managers/owners with higher ability are likely to be achieve higher labor productivity but do these managers face more competition than others? The answer is not certain. Higher ability managers may like to compete more because they expect to win (upward bias) but their very presence may drive out the less productive competitors or prevent new ones from entering the market (less competition and a downward bias).

Perception or understanding of what is, for example, "slightly important" level of influence (as asked in the survey question) could vary across stores. Hence, some noise or measurement error with *Competition* cannot be ruled out. We hope that averaging our competition variable at the store type-city level and the use of instrumental variables estimation method helps to mitigate the problem.

We address the problems discussed above by directly controlling for a large number of observables and by using the instrumental variables estimation approach. We discuss the main or baseline controls here for our OLS specification and the remaining (robustness) controls are discussed in the next section.

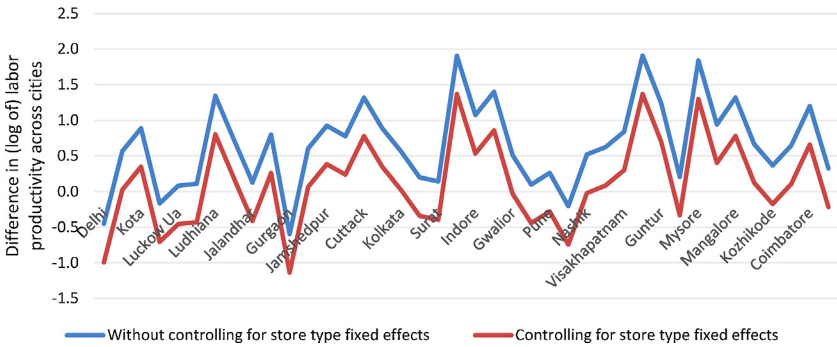

Fig. 3. Labor productivity level averaged at the city level varies significantly between consumer durable and traditional stores. *Source*: Enterprise Surveys. *Note*: The *Y*-axis is the log (Sales/Employment) (dependent variable as defined above) averaged across cities for consumer durable stores minus the same for traditional stores. The average for each store-type across cities was taken over original values of log (Sales/Employment) (without controlling for store type fixed effects above) and also after controlling for store-type fixed effects (shown above).

We begin by controlling for store-size as measured by the (log of) floor area of the shop (in square feet). Floor area of the shop is correlated with a number of observable store characteristics in our sample which suggests that it may be a good proxy for unobservable store characteristics as well[4]. One advantage of using floor area over other observables is that the floor area is largely predetermined and therefore unlikely to suffer from simultaneity problem. In India, land is acquired primarily for opening a new store rather than expanding an existing one[5].

Labor productivity could vary across stores due to different product lines carried by the stores. For example, we mentioned above that relative to traditional stores, consumer durable stores are more competitive and also have higher labor productivity (in 36 out of 41 cities). Does this pattern reflect the competition-labor productivity nexus in the sense discussed above or simply the fact that compared to traditional stores, consumer durable stores sell higher valued products (computers vs. bread) and they also happen to be face more competition for extraneous reasons?

We address this identification problem by showing that our main results hold with and without controlling for dummy variable indicating if the store is a traditional store, consumer durable or modern format store (store-type fixed effects). The assumption here is that product lines carried by stores of a particular store-type (e.g. televisions for consumer durable stores) are roughly similar across cities and therefore absorbed by the store-type fixed effects. To see this, we regress *Labor productivity* on store-type fixed effects and take the residuals. These residuals show that consumer durable stores have higher labor productivity than the traditional stores in only half of the cities compared to 36 out of 41 cities earlier (Fig. 3).

Next, we control for dummy variables indicating the city where the store is located (city fixed effects). This controls for all determinants of labor productivity which vary across cities but are common to stores within a city. Examples include the quality of roads, crime, tax rates and income and expenditure levels.

3. Estimation

In this section we estimate the relationship between competition and labor productivity using the OLS method. The base specification is as follows:

$$Labor\,productivity_{ics} = \alpha_0 + \beta\,Competition_{cs} + \alpha_1 Size_{ics} + CFE_c + SFE_s + u_{ics}$$

subscript i denotes the ith store, c the city in which it is located and s the store-type (traditional, consumer durable or modern). CFE_c and SFE_s denote city and store-type fixed effects, respectively. u_{ics} is the error term. The coefficient of interest in the equation is β which we expect to be positive. In all our regressions we use Huber–White robust standard errors clustered on city-store type.

3.1. Base regression results

Results from the estimation of the previous equation are provided in Table 2. Without any other controls, the estimated coefficient value of *Competition* equals 0.143 significant at the 10 percent level (column 1). The coefficient value remains roughly unchanged in magnitude but becomes significant at the 5 percent level when we control for *Size* (column 2). *Size* is

[4] For example, access to finance, computer usage, days of inventory maintained by the store and the availability of power supply show significant correlation with the floor area of the shop.

[5] In one survey question stores were asked if they had acquired new land in the last three years to expand operations of the current store. Less than 2 percent of the stores reported doing so.

Table 2
OLS, dependent variable: log (sales/employment).

	(1)	(2)	(3)	(4)
Competition	0.143^{*} (0.063)	0.141^{**} (0.044)	0.391^{***} (0.001)	0.343^{***} (0.002)
Size		0.216^{***} (0.000)	0.181^{***} (0.000)	1.33^{***} (0.000)
CFE (City fixed effects)			Yes	Yes
SFE (Store-type fixed effects):			Yes	Yes
Traditional			−0.026 (0.861)	-0.317^{**} (0.016)
Consumer durable			0.340^{**} (0.022)	0.002 (0.991)
$Size^2$				-0.106^{***} (0.000)
R^2 (adjusted)	0.005	0.050	0.165	0.212
Sample size	1907	1897	1897	1897

p-Values in parentheses; all regressions use Huber–White correction for heteroskedasticity allowing for clustering by city-store type. Sample size varies across columns due to missing observations on *Size*.
*** Denotes significant at 1% or less.
** Denotes significant at 5% or less.
* Denotes significant at 10% or less.

positively correlated with labor productivity, significant at the 1 percent level. Controlling for city and store-type fixed effects increases the estimated coefficient value of *Competition* from 0.141 above to 0.391, significant at the 1 percent level (column 3). The coefficient value of *Size* decreases from 0.216 to 0.181 but remains significant at less than the 1 percent level. We also check for a possible non-linear relationship between *Size* and labor productivity by adding $Size^2$ (square of *Size*) to the set of controls above. Estimation results in column 4 of Table 2 show that labor productivity rises with size but at a sharply decreasing rate. The estimated coefficient value of *Competition* is equals 0.343 compared with 0.391 above but still significant at the 1 percent level.

The results above imply a fairly large positive relationship between competition and labor productivity. For example, based on the largest and smallest coefficient values of *Competition* in Table 2, an increase in the level of competition faced by the traditional stores in the city of Ghaziabad (median value of *Competition*) to the level faced by the modern format stores in the city of Madurai (highest value of *Competition*) is associated with an increase of 36 to 87 percent in the average productivity of labor for the former set of stores. Given the relatively low level of competition in the sector, our findings suggest substantial scope for improvement in labor productivity through pro-competitive reforms.

3.2. Robustness of OLS results

Robustness checks for the OLS estimation method are provided in Table 3. We begin by controlling for store's current level of employment (*Employment*) and age (*Age*). Diminishing returns to labor implies that average productivity of labor may decline with *Employment* while learning-by-doing or selection effects imply a positive relationship between *Age* and *Labor productivity*. Our results for the relationship between competition and labor productivity could be biased if age or employment happens to be systematically correlated with the level of competition reported by the stores. Controlling for age and employment, we find that the estimated coefficient value of competition remains significant at the 1 percent level although it decreases in magnitude from 0.343 above to 0.307 (column 1, Table 3). As predicted, *Employment* shows a negative correlation while *Age* a positive correlation with labor productivity, significant at the 1 percent level.

In the Enterprise survey, stores reported irregular power supply and access to finance as the two biggest problems they faced in running their business. We therefore expect some effect of these variables on labor productivity. The danger here is that these variables could also be correlated with competition because they are in the nature of what Bliss and Di Tella (1997) call "deeper competition parameters". We control for the duration of power outage faced by a store per day on an average during the last fiscal year (*Outage*) and a dummy variable equal to 1 if a store has overdraft facility and 0 otherwise (*Overdraft*)[6]. Regression results controlling for *Outage* and *Overdraft* are contained in column 2 of Table 3. As expected, *Outage* has a negative relationship while *Overdraft* has a positive relationship with labor productivity; however, only the latter is significant at the 5 percent level. The estimated coefficient value of competition here equals 0.282 which is slightly smaller than in the previous specification (0.307); however, it is still significant at the 1 percent level.

In our next robustness check, we control for a dummy variable equal to 1 if a store reports using a computer for running its business and 0 otherwise (*Computers*)[7], level of informal competition faced by stores which is equal to the average score (at the city-store type level) on part (c) of the competition question stated in Section 2 (*Informal_Competition*), and the number of days of inventory maintained by the store (*Inventory*). The control for computer use is motivated by existing studies which find a strong positive effect of computer usage on labor productivity[8]. We have already discussed the issue of informal

[6] The survey also reports on a number of additional measures of power supply and access to finance. Controlling for these measures here or elsewhere in the paper does not make any difference to our main results. We discuss this point in more detail towards the end of the section.
[7] Data on the number of workers using computers or hours of computer usage are not available.
[8] See, for example, Autor, Katz, and Krueger (1998) and Autor, Katz, and Kearney (2006).

Table 3
OLS dependent variable: log (sales/employment).

	(1)	(2)	(3)	(4)
Competition	0.307*** (0.004)	0.282*** (0.010)	0.269** (0.011)	0.245** (0.018)
Size	0.930*** (0.000)	0.925*** (0.000)	0.968*** (0.000)	0.914*** (0.000)
Size^2	−0.063*** (0.000)	−0.065*** (0.000)	−0.073*** (0.000)	−0.070*** (0.000)
City & store-type fixed effects	Yes	Yes	Yes	Yes
Employment	−0.010*** (0.001)	−0.010*** (0.001)	−0.010*** (0.001)	−0.010*** (0.001)
Age	0.006***(0.003)	0.005*** (0.008)	0.006*** (0.004)	0.005** (0.028)
Outage		−0.009 (0.481)	−0.011 (0.413)	−0.011 (0.409)
Overdraft		0.266*** (0.001)	0.218*** (0.008)	0.169** (0.028)
Computers			0.376*** (0.001)	0.357*** (0.003)
Inventory			0.005***(0.004)	0.005*** (0.004)
Informal_Competition			−0.071 (0.547)	−0.048 (0.691)
Non-payment				−0.019** (0.026)
Audited				0.246*** (0.008)
Female				−0.218* (0.060)
Theft$_{cs}$				−0.584 (0.121)
R^2 (adjusted)	0.233	0.239	0.251	0.259
Sample size	1897	1869	1869	1844

p-Values in brackets; all standard errors are Huber–White robust and clustered by city-store type.
*** Denotes significant at 1% or less.
** Denotes significant at 5% or less.
* Denotes significant at 10% or less.

competition above (Section 2). The stock of inventory is the productive capital of the store which should have a positive (complimentary) effect on labor productivity.

Regression results with the additional controls discussed in the previous paragraph are provided in column 3 of Table 3. The estimated coefficient value of competition here equals 0.269 (*p*-value of 0.011) which is only slightly lower than the value of 0.282 we found in the previous specification. Computer usage and inventory show positive correlations with labor productivity, significant at the 1 percent level.

We experimented with a number of additional controls. The controls include the percentage of a store's sales in 2005–2006 that were never paid for (*Non-payment*), a dummy variable equal to 1 if a store was audited in the last fiscal year and 0 otherwise (*Audited*), a dummy variable equal to 1 if a store has a female principal owner and 0 otherwise (*Female*), and a measure of overall business climate which equals the percentage of stores in each city-store type cell reporting an incidence of theft in the last fiscal year ($Theft_{cs}$). Regression results in column 4 of Table 3 show that our main results for the competition-labor productivity nexus are robust to these additional controls.

Last, we briefly report on some of the other controls we added to the previous specification but found that these controls did not change our main results significantly. First, we controlled for additional measures of power supply and access to finance which include a dummy variable equal to 1 if a store owns a generator and 0 otherwise, percentage of a store's electricity derived from generator, a dummy variable equal to 1 if a store has a checking account and 0 otherwise, a dummy variable equal to 1 if a store has a line of credit and 0 otherwise, a dummy variable equal to 1 if a store reported no need to borrow from external sources during the last fiscal year and 0 otherwise. Second, we controlled for a dummy variable equal to 1 if a store is part of a larger chain and 0 otherwise, years of store manager's experience in retailing and the amount of time spent by senior management of the store in dealing with business regulations. Third, we controlled for a number of regulatory and investment climate measures. Since our specification already controls for city fixed effects, we constructed these measures at the city-store type level using store's perceptions about the quality of the investment climate. The measures capture the degree to which the following are perceived as a problem by the store managers for their current operations: court inefficiency ($Courts_{cs}$), skill shortage ($Skill\_shortage_{cs}$), tax rates ($Tax\ rates_{cs}$), corruption ($Corruption_{cs}$), cumbersome land laws ($Land\ Laws_{cs}$) and difficulty in obtaining permits and licenses ($Permits_{cs}$). With all these controls added to the previous specification, the estimated coefficient value of *Competition* remained significant at the 5 percent level (*p*-value of 0.033) equaling 0.198 in magnitude[9].

Summarizing, we find robust evidence that labor productivity is higher among retail stores in India that face more competition. The positive relationship between labor productivity and competition survives a large number of controls for store characteristics, regulatory and business environment, store-type fixed effects and city fixed effects.

[9] The Enterprise Surveys also contains information on E-commerce or the use of email, own website and high-speed broadband connection by the stores to conduct their business. Given the importance of E-commerce in retailing, we experimented by controlling for three separate dummy variables indicating whether the store uses Email, its own website and high speed broadband internet connection. However, these controls do not change our results much. For example, adding these controls to the list of all the controls mentioned above only served to strengthen our main results, although marginally so. That is, the estimated coefficient value of *Competition* increased from 0.198 above to 0.215 and remained significant at the 5 percent level (*p*-value of 0.020).

4. Instrumental variables

4.1. IV identification strategy

As discussed above, we instrument for competition with *Non-workers* which equals the number of adult non-workers per household in the city (lagged 1991 values taken from Census of India)[10]. The correlation coefficient between *Competition* and *Non-workers* is 0.176 and 0.263 if we drop the city of Kozhikode which is an outlier (discussed below).

A few points are to be noted about the proposed instrument. First, the level of competition and labor productivity among retail stores is likely to be higher and number of non-workers per household lower in cities that are more developed. What this implies is that failure to control for overall economic development could weaken our first stage and second stage IV regression results. Second, greater number of children per household in the city is likely to increase the opportunity cost of time implying less intensive search and hence less competition. That is, the predicted effect on competition of children is the opposite of non-workers if search intensity is truly driving our IV strategy. However, the correlation between non-workers and children per household in our sample is positive (equal to 0.393) which is not surprising as the two tend to be driven by common underlying aspects of economic development. So, if search intensity is irrelevant and non-workers and children are a mere proxy for aspects of economic development then non-workers and children should have a similar (negative) effect on competition. This gives us a convenient falsification test for the relevance of our IV strategy. Third, we may still worry about possible correlation between non-workers and retailer density (retail shops per unit area of city) as this has been shown to be an important driver of competition in retailing. Fourth, one could argue that the logic of the downward bias mentioned above may not apply to some specific aspects of retailing and to certain characteristics of stores. We looked at some important firm attributes and found that the correlation coefficient between our instrument and *Size* (averaged at the city level) is negative (correlation of −0.19) which again implies a downward bias in our IV results given that *Size* and labor productivity are positively correlated in our data.

Based on the discussion in the previous paragraph, the IV strategy employs the following basic controls: (a) city-level (log of) adult literacy rate (*Literacy rate*) as a proxy for overall development of the cities (1991 values), (b) (log of) ratio of number of children to number of households in the city in 1991 (*Children*); (c) (log of) ratio of total employment in retail and distribution sector to adult city population in 1991 (*Retailer density*)[11]; and (d) store-size as defined above. Note that data on the number of retail shops in the city are not available.

4.2. IV regression results

IV regression results for the base specification are provided in Table 4. Robustness checks are provided in Table 5. Panel A in the two tables contains second stage IV results and Panel B contains first stage IV results. The robustness checks in Table 5 include all the controls used in the OLS specifications except for city fixed effects which we cannot use since our instrument varies across cities but not within cities. In lieu of city fixed effects, we do control for some city-level characteristics for additional robustness although doing so does not change the qualitative nature of the IV results. These additional city-level controls include the following: (a) frequently used proxy measure of overall economic development which is the ratio of females to males in 1991 (*Sex Ratio*) taken from Census of India; (b) a dummy variable indicating if the store is located in the rich and growing metropolitan cities or not (*Metro*)[12]; (c) city-level averages of the self-reports of the stores on the extent to which the following are an obstacle to the performance of stores: tax rates ($Taxes_c$), corruption ($Corruption_c$), land laws ($Land\ Laws_c$), difficulty in obtaining permits and licenses ($Permits_c$), functioning of courts ($Courts_c$) and availability of skilled labor ($Skill\_shortage_c$)[13].

The first stage IV results show a positive and significant relationship between non-workers and competition, significant at the 10 percent level without any other controls (column 1, Table 4), significant at the 1 percent level with the basic controls included in the specification (column 2–4, Table 4), and significant at close to the 1 percent level with the robustness controls in place (Table 5). The *F*-statistic for the significance of the instrument is somewhat low and below the recommended level of 10 with no other controls in place (column 1, Table 4) but still significant at the 10 percent level. It rises to slightly above 10 when we add the basic controls in the regressions (columns 2–4, Table 4) and is significant at the 1 percent level. Excluding the outlier city of Kozhikode from the sample causes the *F*-statistic to increase sharply in magnitude from 10.9

[10] We follow the Census definition of adults and household and use log values of *Non-workers* to ensure that our results are not sensitive to extreme values of the variable. Adults are individuals above 7 years of age. Distribution of non-workers by other ages at the city level is not reported in the Census. A household is defined as a set of individuals living in one house and sharing a common kitchen.

[11] We expect higher values of *Retailer density* to have a positive effect on labor productivity via greater competition. Further, higher values of the instrument will pick up lower values of *Retailer density* because of the negative correlation between the two. This implies a negative effect of *Non-workers* on labor productivity via *Retailer density* which counters the positive association between *Non-workers* and labor productivity (via competition) required for identification. The structure of correlations here suggests a downward bias in the estimated coefficient of competition from the failure to control for *Retailer density* and its covariates.

[12] The metropolitan cities are New Delhi, Mumbai, Kolkata, Chennai, Hyderabad and Bangalore.

[13] A formal definition of these measures is provided in Table 1. Controlling for the three E-commerce variables listed in footnote 9 does not make any difference to the IV results discussed above.

Table 4
IV base regressions.

	(1)	(2)	(3)	(4)	**(5)**
Panel A: Second stage IV regressions					
Dependent variable: log (sales/employment)					
Competition	0.244 (0.642)	0.402 (0.212)	0.604* (0.071)	0.620** (0.050)	0.417** (0.040)
Literacy		2.14** (0.024)	1.81* (0.059)	1.84* (0.053)	1.03 (0.190)
Children		0.054 (0.878)	0.141 (0.695)	0.246 (0.501)	0.044 (0.880)
Size			1.34*** (0.000)	1.33*** (0.000)	1.36*** (0.000)
Size^2			−0.101*** (0.000)	−0.101*** (0.000)	−0.103*** (0.000)
Retailer density				0.239 (0.493)	0.318 (0.253)
Sample size	1907	1907	1897	1897	1864
Panel B: First stage IV regressions					
Dependent variable: Competition					
Excluded instrument					
Non-workers	0.740* (0.066)	1.19*** (0.002)	1.22*** (0.001)	1.25*** (0.001)	1.69*** (0.000)
Included instruments					
Literacy		−1.32 (0.156)	−1.37 (0.146)	−1.35 (0.148)	−0.398 (0.637)
Children		−0.932*** (0.004)	−0.939*** (0.004)	−0.803** (0.016)	−0.733** (0.021)
Size			0.176** (0.028)	0.176** (0.026)	0.192** (0.015)
Size^2			−0.015** (0.039)	−0.015** (0.034)	−0.015** (0.029)
Retailer density				0.359 (0.183)	0.348 (0.157)
F statistic for the significance of the excluded instrument	3.45* (0.066)	10.2***(0.002)	10.8*** (0.001)	10.9*** (0.001)	24.2*** (0.000)

p-Values in parentheses; all regressions use Huber–White correction for heteroskedasticity allowing for clustering by city-store type. Sample size in columns 1–4 varies due to missing observations. The sample used for column 5 excludes all stores located in the city of Kozhikode.
*** Denotes significant at 1% or less.
** Denotes significant at 5% or less.
* Denotes significant at 10% or less.

(column 4, Table 4) to 24.2 (column 5, Table 4). Similarly, adding robustness controls in the regressions, the *F*-statistics remains significant at close to the 1 percent level but it does decrease in magnitude to below 10. However, this is again due to the outlier city of Kozhikode and excluding this city from the sample cause the *F*-statistic to rise above 10 and remain significant at the 1 percent level (not shown). Last, as predicted by our falsification test, children and non-workers show opposite effects on the level of competition, significant at less than the 5 percent level (see Panel B, Table 4).

The second stage IV regression results show a positive but weak relationship (insignificant at the 10 percent level) between (instrumented values of) competition and labor productivity when no other controls are included in the specification (column 1, Panel A, Table 4). The weak result could be due to the downward bias discussed above. To counter this, we add our basic controls for literacy, children and store size to the specification. Results confirm our prediction about the downward bias with the estimated coefficient value of competition increasing from 0.244 (column 1, Table 4) to 0.604 and is now significant at the 10 percent level (column 3, Table 4). Further, adding our last basic control for retailer density causes the coefficient value of competition to increase further from 0.604 above to 0.620 significant at the 5 percent level (column 4, Table 4). Excluding Kozhikode from the sample causes the coefficient value to decline in value from 0.620 above to 0.417 but it is still large and significant at the 5 percent level (column 5, Table 4). Adding the various robustness controls to the specification does not change the second stage IV results qualitatively, although it does cause the estimated coefficient value of competition to increase from 0.620 above to 1.79 (column 2, Table 5).

A comparison of OLS and IV results show a quantitatively stronger relationship between labor productivity in the IV results. One possible explanation of this is that in the OLS estimation method, reverse causality and omitted variable bias, if any, tend to weaken the true relationship between labor productivity and competition. Another possibility is that measurement errors with our main variables may be a relatively more important problem with the OLS estimation method and endogneity a relatively less serious problem.

We experimented with one more specification which we briefly discuss here. The IV results discussed above suggest that *Children* and *Retailer density* do not have any significant direct effects on labor productivity. This implies that we could use these two variables as additional instruments. The advantage of using these additional instruments is that it makes our system overidentified, allowing us to test for the exogeneity of the instruments. Regression results for this specification (not reported) are roughly similar to the ones discussed above and the overidentification test does not reject the exogeneity of the instruments. For example, for our base specification in column 4, Table 4, the estimated coefficient value of competition equals 0.712 with a *p*-value of 0.018. Hanson overidentification *J* test statistic equaled 0.339 (*p*-value of 0.560) for the null hypothesis that the instruments are exogenous.

For more robustness, we added a number of additional controls to the specification in column 2 of Table 5 but found that this did not change the qualitative nature of the IV results discussed above. Some of these additional controls are: dummy variable equal to 1 if a store owns a generator and 0 otherwise, percentage of a store's electricity derived from generator, a dummy variable equal to 1 if a store has a checking account and 0 otherwise, a dummy variable equal to 1 if a store has a line

Table 5
IV robustness.

	(1)	(2)
Dependent variable: log (sales/employment)		
Competition	1.53** (0.042)	1.79** (0.045)
Size	0.891*** (0.000)	0.847*** (0.000)
Size^2	−0.066*** (0.000)	−0.061*** (0.000)
Retailer density	−1.41 (0.246)	−1.48 (0.205)
Children	0.377 (0.462)	0.720 (0.294)
Literacy	0.480 (0.665)	.639 (0.618)
Sex ratio	1.83 (0.264)	2.19 (0.234)
Metro	1.03* (0.078)	1.35* (0.064)
Store-type fixed effects	Yes	Yes
Employment	−0.011*** (0.000)	−0.011*** (0.000)
Age	0.005* (0.062)	0.004 (0.142)
Outage	0.001 (0.937)	0.016 (0.511)
Overdraft	0.159* (0.095)	0.162*** (0.086)
Computers	0.395*** (0.005)	0.369*** (0.006)
Inventory	0.002 (0.355)	0.002 (0.476)
Informal_Competition	−1.24** (0.034)	−1.34** (0.043)
Non-payment	−0.021* (0.055)	0.023** (0.045)
Audited	0.174 (0.105)	0.101 (0.386)
Female	−0.230* (0.087)	−0.278* (0.054)
Theft$_{cs}$	0.816 (0.352)	0.215 (0.796)
Skill_shortage$_c$		0.397 (0.235)
Courts$_c$		0.452 (0.250)
Tax rates$_c$		−0.121 (0.698)
Corruption$_c$		0.098 (0.567)
Land laws$_c$		−0.190 (0.315)
Permits$_c$		−0.364 (0.341)
Sample size	1844	1844
Panel B: First stage IV regressions		
Dependent variable: Competition		
Non-workers	0.690** (0.011)	0.734** (0.013)
F statistic for significance of the excluded instrument	6.71** (0.011)	6.43** (0.013)

p-Values in parentheses; all regressions use Huber–White correction for heteroskedasticity allowing for clustering by city-store type. Sample size varies due to missing observations.
*** Denotes significant at 1% or less.
** Denotes significant at 5% or less.
* Denotes significant at 10% or less.

of credit and 0 otherwise, a dummy variable equal to 1 if a store reported no need to borrow from external sources during the last fiscal year and 0 otherwise, percentage of stores' senior management's time spent in dealing with business regulations and years of managerial experience. With all these controls added to the previous specification, the estimated coefficient value of competition remained almost unchanged at 1.73 (compared to 1.79 in column 2, Table 5) and was significant at the 5 percent level (*p*-value of 0.049).

5. Conclusion

The article analyzes the relationship between competition and labor productivity among retail stores in India. Our results predict a large positive impact of pro-competitive reforms on the level of labor productivity of stores. Also, there is considerable scope for such reforms with over 60 percent of the retailers facing no significant competition. A retail boom from more competition is a likely outcome.

A number of issues need further analysis. First, it is not clear why competition is low in the sector. A formal analysis of this question is important given the significant gains from more competition predicted. Second, the present article uses self-reports of the retailers for determining the level of competition they face. While this has some advantages, it will be useful to check if we get similar results using an alternative objective measure of competition such as the number of retail shops in the neighborhood. Third, data limitations do not allow us to pinpoint the mechanisms that drive the positive relationship between labor productivity and competition. Greater competition in the sector could improve labor productivity through Darwinian selection or X-efficiency related effect. These mechanisms have different implications for the design and targeting of policies for improving the productivity in the sector. More research is required in this direction. Fourth, there is precious little work on the retail sector in developing countries even though the sector is one of the largest sources of employment and income in these countries. Data collection efforts in the future need to focus on the retail sector and more research is required on for example, the determinants of labor productivity and competition in the sector. We hope that the present paper motivates future research along these lines.

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