

## INTERNATIONAL TRADE AND DEVELOPMENT<sup>‡</sup>

# Markup and Cost Dispersion across Firms: Direct Evidence from Producer Surveys in Pakistan<sup>†</sup>

By DAVID ATKIN, AZAM CHAUDHRY, SHAMYLA CHAUDRY, AMIT K. KHANDELWAL,  
AND ERIC VERHOOGEN\*

How do markups differ across firms in the same narrow industry? The question is key to answering a number of bigger questions—How do firms respond to trade liberalization or industrial-policy interventions? How large are the welfare gains from trade? How do firms transmit international price shocks to local markets? How should productivity be measured?—but there is little consensus in the literature either about how to model markups or about how to estimate them.

<sup>‡</sup>*Discussants:* Treb Allen, Northwestern University; Ann Harrison, Wharton School; and Samuel Bazzi, Boston University.

\* Atkin: Department of Economics, University of California-Los Angeles, 8283 Bunche Hall, 315 Portola Plaza, Los Angeles, CA 90095 (e-mail: [atkin@econ.ucla.edu](mailto:atkin@econ.ucla.edu)); Chaudhry: Lahore School of Economics, Intersection Main Boulevard Phase VI DHA, Burki Road Lahore 53200, Pakistan (e-mail: [azam@lahoreschool.edu.pk](mailto:azam@lahoreschool.edu.pk)); Chaudry: Lahore School of Economics, Intersection Main Boulevard Phase VI DHA, Burki Road Lahore 53200, Pakistan (e-mail: [shamyla@lahoreschool.edu.pk](mailto:shamyla@lahoreschool.edu.pk)); Khandelwal: Columbia Graduate School of Business, Columbia University, 3022 Broadway, Uris Hall 606, New York, NY 10027 (e-mail: [ak2796@columbia.edu](mailto:ak2796@columbia.edu)); Verhoogen: Department of Economics and School of International and Public Affairs, Columbia University, 420 W. 118th St., Room 1022, MC 3308, New York, NY 10027 (e-mail: [eric.verhoogen@columbia.edu](mailto:eric.verhoogen@columbia.edu)). We are grateful to Tariq Raza for excellent project management assistance, to Research Consultants (RCONS) for very ably carrying out the surveys described in the text, and to the International Growth Center (IGC) and the DfID-CEPR initiative on Private Enterprise Development in Low-Income Countries (PEDL) for funding. Yale IRB Approval #1109009047; Columbia IRB Approval #AAA17550. We thank Treb Allen for comments on a preliminary draft.

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The most common theoretical approach is to assume that firms are monopolistically competitive and that representative consumers have constant elasticity of substitution (CES) preferences (e.g., Melitz 2003), with the result that markups are *constant* in multiplicative terms. Recently, there has been growing interest in more flexible approaches to modeling markups. Researchers have developed tractable models with variable markups by combining, for instance, CES preferences and other forms of imperfect competition (e.g., Atkeson and Burstein 2008; Edmond, Midrigan, and Xu 2015; Amiti, Itskhoki, and Konings 2014), or other demand systems and monopolistic competition (e.g., Melitz and Ottaviano 2008; Zhelobodko et al. 2012). But it is not clear how to discriminate among these models based on existing empirical evidence.

Empirically, there are two main approaches to estimating markups. The most common is to estimate markups from the “demand side,” which entails specifying functional forms for consumer utility and making assumptions on the market structure of firms (e.g., Berry, Levinsohn, and Pakes 1995; Goldberg 1995; Feenstra and Weinstein 2010). Alternatively, one can estimate markups through the “supply side” using an approach pioneered by Hall (1986) and more recently implemented by De Loecker and Warzynski (2012) and De Loecker et al. (2012). This approach does not require functional-form assumptions about preferences or the competitive environment, and instead relies on cost minimization and two additional assumptions: that input adjustment is costless and that firms in the same industry face different, exogenously given, input prices. Studies adopting either approach find that markups do in

fact vary tremendously across firms. But while each approach to estimating markups has its merits, both require a measure of faith in their respective assumptions.<sup>1</sup> Ideally, one would like to have direct measures of markups that do not depend on these theoretical assumptions.

In this short paper, we take a different approach: we have directly asked firms about their markups. Since 2011, we have been studying a cluster of soccer-ball manufacturers located in Sialkot, Pakistan and have learned a great deal about the ins and outs of producing soccer balls. In Atkin et al. (2014), we study the adoption of a new cost-saving technology that we invented and randomly introduced to a subset of firms. In conjunction with that study, we have directly collected information on prices and profitability, as well as the unit costs of manufacturing a standardized ball. Asking firms directly about their markups is not a guarantee of accurate information. However, the fact that the producers use similar production techniques that we understand well and that we have been able to build up a modicum of trust with the firms over the course of our several-year project give us confidence that there is signal in the self-reported markups.<sup>2</sup>

As we discuss in more detail below, we have six main findings. First, dispersion in markups is greater than dispersion in costs, at least in proportional terms. Second, both costs and markups are positively related to firm size, arguably the best observable proxy for the entrepreneurial-ability parameter in many heterogeneous-firm models (e.g., the “Melitz draw,”  $\varphi$ ). Third, the elasticity of markups with respect to firm size is significantly greater than the elasticity of costs. Fourth, larger firms have greater costs primarily because they use higher-quality inputs (which are costly). Fifth, larger firms charge higher markups on average both because they produce a greater share of higher-quality ball types, which carry higher markups, and because they charge higher markups for a given type of ball. Sixth, there is suggestive evidence

that marketing efforts may play an important role in generating higher average markups: markups are more highly correlated with whether an entrepreneur attends an annual trade expo and sells to richer countries than with available measures of technical efficiency. In the conclusion we discuss what we consider to be the main implications of these findings for theoretical and empirical work on heterogeneous firms.

## I. Data

Between January and April 2012 we carried out a baseline survey of the 135 soccer-ball firms located in Sialkot, Pakistan, and have since conducted eight additional survey rounds. There are four main phases of production: “lamination,” which involves gluing layers of cotton or polyester to an artificial leather called rexine; cutting; printing; and stitching the cut and printed panels (usually hexagons and pentagons) around an inflatable bladder. To be considered a firm for our purposes, an establishment had to be cutting its own rexine sheets; we excluded firms that marketed themselves as selling soccer balls but outsourced the cutting process. For details on the production process, the cluster, and our survey design, we refer the reader to Atkin et al. (2014).

In each survey round, we asked firms the price and profit per ball for each ball type they manufactured in the previous month. The two main ball types are “match/training” balls, higher-quality balls that use more layers of cotton or polyester and higher-quality (often imported) rexine, and “promotional” balls, lower-quality balls that use fewer layers of cotton or polyester and cheaper, locally produced rexine. Soccer balls come in five standard sizes, with size 5 (regulation size for adults) making up 86 percent of total production. We collected the share of production of each ball type and use it to construct average prices and markups at the firm level. To reduce noise, throughout the paper we report firm-level averages across rounds.<sup>3</sup>

<sup>1</sup> See De Loecker and Goldberg (2014) for a discussion of the different approaches to estimating markups.

<sup>2</sup> Our approach is in line with the recommendation of de Mel, McKenzie, and Woodruff (2009) that, at least in the context of microenterprises in Sri Lanka, asking entrepreneurs directly about their profits can be more accurate than inferring profits from reported revenues and costs.

<sup>3</sup> The wording of the price question was “For each type, what is the average price per ball in rupees on the orders you have received in the past month?” and the profit question was “For each type, what is the average profit per ball in rupees on the orders you have received in the past month (e.g., your profit per ball after paying all costs)?” The set of types varied slightly across rounds; we focus on responses

We define the markup as the level of profit per ball, such that markup plus cost per ball equals price. We have two ways of measuring costs. First, from the price and profit data, we infer the cost of producing each ball as price minus markup. Second, at baseline, we asked firms to give a detailed breakdown of the cost of a standard ball: a size-5, two-layer (cotton and polyester) promotional ball.<sup>4</sup>

## II. Markup and Cost Dispersion

### A. Distributions of Markups and Costs

We begin by reporting the distributions of prices, markups, and costs across firms. We define the average price as an average of the prices of promotional and training balls, weighted by production shares. Average markups are defined analogously. Column 1 of Table 1 reports the distribution of average prices across firms.<sup>5</sup> The mean price is Rs 379.3 (US\$3.79 given the exchange rate of Rs 100/dollar in July 2013, approximately the midpoint of our study period). The 90–10 ratio is 2.48, while the 75–25 ratio is 1.58. Column 2 reports the distribution of average markups across firms. The mean markup is Rs 31.3. This implies a mean profit rate of 8.26 percent, which suggests that the sector is reasonably competitive. The dispersion in markups is large: the 90–10 ratio is 5.14 while the 75–25 ratio is 2.65. Column 3 reports the distribution of average costs, defined as the difference between prices and markups. Compared to markups, the dispersion in costs is lower: the 90–10 ratio is 2.45, while the 75–25 ratio is 1.53. The coefficient of variation of markups is 0.73 compared to 0.45 for costs. We consider the observation that dispersion in markups is greater

for two types, “Size 5 Promotional,” and “Size 5 Training, Club and Match,” which were elicited in each round.

<sup>4</sup>We collected eight cost components: (i) the rexine type; (ii) the cotton layer; (iii) the polyester layer; (iv) the latex and chemical mix that binds the cotton, polyester, and rexine; (v) a 60–65 gram latex bladder; (vi) thread and stitching cost; (vii) labor costs for lamination, sheet and cloth cutting, printing, washing, packing, and matching; and (viii) overhead.

<sup>5</sup>Note that while markup plus cost equals price for each firm, this will not hold at a given quantile across the univariate distributions, since different firms are at a given quantile for the different variables.

TABLE 1—DISPERSION IN MARKUPS AND COSTS

	Weighted average of promotional and match/training ball (Rs)		
	Price (1)	Markup (2)	Cost (3)
Min	178.1	4.5	164.2
P5	195.0	6.6	190.5
P10	229.4	10.0	216.4
P25	274.3	15.3	253.3
P50	343.1	26.8	311.4
P75	433.0	40.7	387.6
P90	569.3	51.4	530.0
Max	1,160.0	160.0	1,000.0
Mean	379.3	31.3	348.0
SD	171.7	22.8	154.9
P90–P10	2.48	5.14	2.45
P75–P25	1.58	2.65	1.53
Coef. var.	0.45	0.73	0.45
Observations	93	93	93

*Notes:* Table reports measures of prices, markups, and costs. Columns 1 and 2 report a weighted average of prices and markups, where the weight is the share of promotional balls in total production. Column 3 is the inferred cost that is equal to the weighted-average price minus weighted-average markup.

than dispersion in costs, at least in proportional terms, to be our first main finding.

### B. Markups and Costs versus Firm Size

To provide guidance for the theoretical modeling of markups, one would like to know not just how dispersed markups are, but also how markups (and costs) relate to other key firm characteristics. It is common in the theoretical literature to model firms as heterogeneous along a single dimension, commonly referred to as entrepreneurial ability or simply productivity. One of the most robust predictions in these models is that firms run by more able entrepreneurs will be larger in equilibrium. It is thus arguable that firm size is the best easily available and directly observable proxy for the entrepreneurial ability parameter.<sup>6</sup> Motivated by these

<sup>6</sup>Estimated total factor productivity is another obvious candidate, but estimating productivity requires making assumptions about the distribution of markups, which seems against the spirit of our exercise of characterizing the distribution of markups without relying on a particular theoretical model.

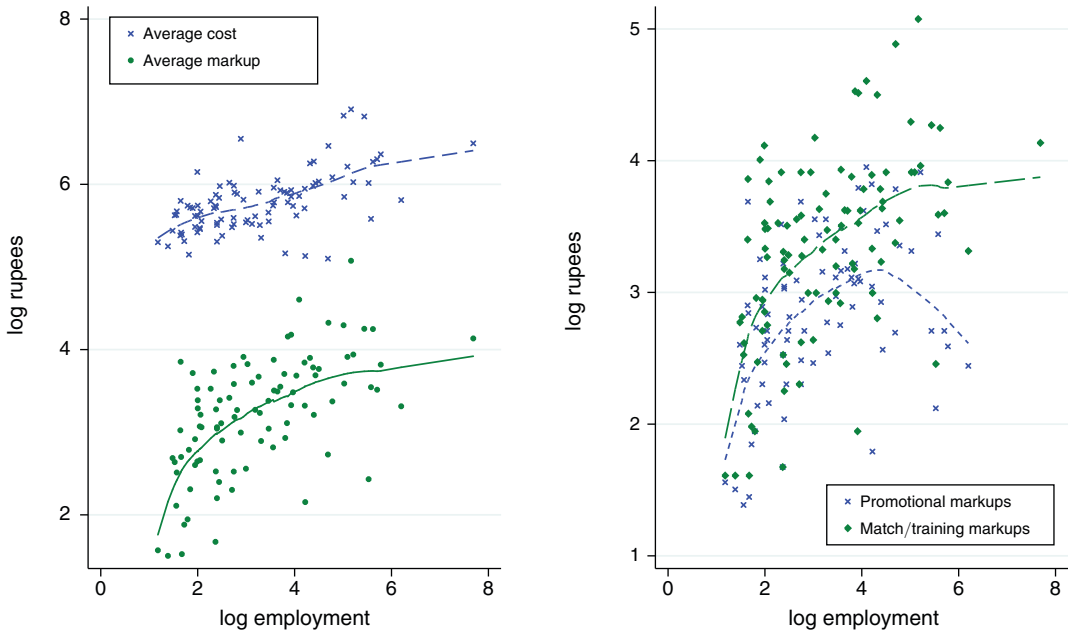


FIGURE 1. MARKUPS AND COSTS VERSUS FIRM SIZE

arguments, we focus on how markups and costs relate to firm size.

The left panel of Figure 1 plots log average markups and log average costs against log firm size (as measured by employment).<sup>7</sup> Overlaid on the raw data are nonparametric plots of log costs and log markups against firm size. There are two important points to notice. First, both average costs and average markups are positively correlated with firm size. Second, the elasticity of markups with respect to size exceeds that for average costs. Columns 1–2 of Table 2 estimate the elasticities of the same three variables with respect to employment using linear OLS regressions. The average markup elasticity is 0.31 and the average cost elasticity is 0.16, both highly significant and statistically different from each other. These numbers confirm the patterns observed in the left panel of Figure 1. We consider the facts that markups and costs are

<sup>7</sup>We measure employment by taking a firm-level average of the answer to the following question: “How many total employees working inside the firm (including yourself, active partners, and contract workers. Exclude stitchers that do not work inside the factory)?”

increasing in firm size, with a greater elasticity for markups, to be the second and third main finding of this paper.

What lies behind the positive cost-size relation? As mentioned earlier, we asked firms at baseline to report the cost of manufacturing a standardized promotional two-layer ball, allowing only for differences in rexine types. We use data on the subset of firms that were willing to break down the cost of a ball into eight subcomponents to create a standardized cost that corrects for differences in the rexine type.<sup>8</sup> Using this standardized cost measure, the elasticity with respect to size is markedly smaller than for average costs, 0.06 compared to 0.16, and only marginally significant (Table 2, column 3); see online Appendix Figure A.1

<sup>8</sup>We regress the rexine cost per ball on a categorical variable that captures eight possible rexine types, replace a firm’s rexine cost with the constant and firm-specific residual from that regression, and then sum across the eight sub-components to compute the total (standardized) cost. We asked firms about imported rexine from Japan and Korea, two types of rexine sourced domestically from Lahore, three types of rexine produced within Sialkot, and an “other” catch-all category.

TABLE 2—MARKUPS, COSTS, AND PRODUCTION SHARE ELASTICITIES

	Weighted averages		log (std. ball cost) (3)	Promotional ball		Match/training ball		Share of match/training balls (8)
	log (markup) (1)	log (cost) (2)		log (markup) (4)	log (cost) (5)	log (markup) (6)	log (cost) (7)	
log employment	0.31*** (0.04)	0.16*** (0.02)	0.06* (0.03)	0.19*** (0.05)	0.07*** (0.02)	0.28*** (0.05)	0.15*** (0.02)	6.70*** (1.84)
Constant	2.22*** (0.16)	5.25*** (0.08)	5.12*** (0.11)	2.24*** (0.16)	5.18*** (0.07)	2.41*** (0.17)	5.47*** (0.07)	-58.40*** (6.71)
R <sup>2</sup>	0.34	0.35	0.09	0.16	0.11	0.27	0.34	0.10
Observations	93	93	42	83	83	100	100	117

Notes: Table reports the elasticities of markups, costs, and production shares with respect to employment. Columns 1–2 are constructed using weighted average markups and costs. Column 3 uses the standardized ball cost. Columns 4–5 are constructed using promotional balls, and columns 6–7 are constructed using match/training balls. Column 8 uses the share of production on match/training balls.

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

for the nonparametric plot. That is, the cost-size correlation appears to be largely explained by observable differences in the characteristics of inputs. This is consistent with the hypothesis that the differences in average input costs primarily reflect differences in input quality, which are in turn reflected in output quality (Kugler and Verhoogen 2012). We believe that the remaining positive correlation between standardized costs and firm size is likely to be explained by unobservable characteristics of inputs, which our standardized measure was not able to control for. We consider the finding that costs increase with firm size primarily because larger firms use expensive, higher-quality inputs to be our fourth main finding.

What lies behind the positive markup-size correlation? In the right panel of Figure 1, we look separately at how markups and costs vary with firm size by ball type. Three points are salient. First, markups are higher for (higher-quality) training/match balls than for (lower-quality) promotional balls: the training/match ball long-dash curve is always above the promotional ball short-dash curve. In online Appendix Table A.1, we find that markups for match/training balls are 46 percent higher than promotional balls when including firm fixed effects (and the difference is statistically significant). Second, within a segment, larger firms generally have higher markups, and this is particularly true for match/training balls. Columns 4–7 of Table 2 estimate the elasticities of markups and costs for

each ball type using OLS. The numbers indicate that 10 percent greater employment is associated with 1.9 percent and 2.8 percent higher markups for promotional and match/training balls, respectively. These elasticities are higher than the cost elasticities, and this fact remains true when we consider output (physical quantity of balls) as an alternative measure of firm size in online Appendix Table A.2. Third, product composition is also systematically related to firm size: larger firms produce a greater share of (higher-quality) match/training balls (column 8 of Table 2). (Again, similar results hold in online Appendix Table A.2 using total output.) In sum, average markups increase with firm size because larger firms produce disproportionately more high-quality balls, and within each type of ball obtain higher markups. We consider this to be our fifth main finding.

### C. Suggestive Evidence on the Role of Marketing

What is it about larger firms that allows them to generate orders for higher-quality balls and sign contracts that provide higher markups? Our discussions with firms suggest that customer-building and marketing activities are important. In order to shed further light on this possibility, Table 3 reports pair-wise correlations between four variables in our dataset that proxy for either marketing intensity or productivity and the four outcome metrics studied above.



TABLE 3—MARKUPS, COSTS, AND EMPLOYMENT CORRELATIONS

	Average markup (1)	Average cost (2)	Standardized ball cost (3)	Employment (4)
Share of balls to high-income destination	0.20	0.22	0.01	0.13
Attend ISPO?	0.48	0.44	-0.08	0.11
(Self-reported) Balls per sheet	0.02	-0.11	-0.08	-0.05
Output per employee	0.02	-0.15	-0.11	-0.19

*Note:* Table reports pairwise correlations between the outcome variables and the proxies for marketing and technical efficiency described in the text.

(The pair-wise correlations among the four outcome metrics are reported in online Appendix Table A.3.) We find that average markups are positively correlated with both the share of output sold to high-income countries and with an indicator for whether the firm attended the major international sports goods trade fair (called ISPO) in Germany in 2012. The correlation between markups and two productivity measures, the self-reported average number of balls cut from a single rexine sheet and total output per employee, is far weaker.<sup>9</sup> Columns 2 and 3 report correlations with average costs and standardized ball costs. Average costs are positively correlated with the share of balls sold to high-income countries and attending ISPO, consistent with the hypothesis that rich-country customers demand higher-quality balls that require expensive inputs. Consistent with this explanation, the correlation falls to zero or becomes small and negative for the standardized ball cost that largely controls for input costs. The correlations with the two productivity measures are negative as expected, but again small in magnitude. Column 4 reports the correlations with firm size. We see that the two marketing proxies correlate much more strongly with employment than the two productivity measures (although the negative correlation with output per employee is somewhat mechanical).

<sup>9</sup>In addition, if technical efficiency varied significantly with firm size, we might have expected the correlation between standardized ball cost and firm size to be negative in Table 2, column 3 and online Appendix Figure A.1. While unobservable input-quality differences could be more than offsetting any differences in technical efficiency by size, in our view the more plausible explanation, consistent with the evidence from Table 3, is simply that technical efficiency varies relatively little with firm size.

Caution is warranted in interpreting these correlations. It may be that marketing skill is part of what is typically thought of as entrepreneurial ability, or the firms that attend the ISPO and sell more to rich countries may be ones that have benefited from fortuitous demand shocks from rich-country customers in the past. In addition, although we did not find much of a gradient in standardized ball costs for a simple, relatively low-quality ball, it may be that entrepreneurial ability matters more for high-quality balls, for which we did not collect a standardized cost measure. In short, there may be complicated interactions between marketing skill, demand shocks, and high-quality-specific know-how. But the correlations reported in Table 3 do suggest that markups are not a simple function of quality-neutral technical efficiency, and are sufficiently worthy of further investigation that we consider them to be our sixth main finding.

### III. Conclusion

In this paper, we have documented a number of facts about how markups and costs differ across soccer-ball producers in Sialkot, Pakistan. Although focused on a specific setting, our findings have the advantage that they are based on direct measures of markups and do not require the strong assumptions of common structural approaches.

What are the implications of our findings for the heterogeneous-firms literature? In relation to the existing literature on variable markups, perhaps our most important finding is that markups systematically increase in firm size. The positive elasticity of markups to firm size is greater than that of costs, and holds not only on average but also within narrowly defined product types. It will be important to investigate whether this

pattern holds in other settings. But assuming that the pattern proves to be general, it suggests that the theoretical literature should focus on models that can rationalize a positive relationship between markups and entrepreneurial ability.

The results that average costs are positively correlated with firm size, that the correlation is significantly reduced by controlling for input quality (as in our standardized cost measure), and that larger firms produce a greater share of higher-quality ball types are in line with the existing literature on quality and heterogeneous firms (Kugler and Verhoogen 2012). But the quality literature has had relatively little to say about markups, and this paper suggests variation in markups is a first-order feature of the data.

We believe that our findings point to several potentially fruitful directions for future work. A natural question to ask is why markups differ so significantly across firms. We have presented suggestive evidence that marketing and customer-building activities may play an important role. This evidence is consistent with a set of case studies by Artopoulos, Friel, and Hallak (2013), who found that a distinguishing feature of export pioneers in Argentina was their knowledge of (and “embeddedness” in) foreign markets, rather than purely technical expertise. Another topic that seems promising is the link between product quality and markups; our evidence confirms that higher-quality ball types carry systematically higher markups. While the idea that there is a systematic relationship between quality and markups has been “in the air” for many years (and has been formalized for instance in Manova and Zhang 2012), the reasons for the relationship remain poorly understood.

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