

Price-setting Behavior and Competition in Developing Countries: An Analysis of Retail Outlets in Lesotho

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Abstract

We study the relationship between price-setting behavior and the degree of competition in a setting where markets and information flows are relatively imperfect. Using a unique dataset that combines survey data on retail outlets in Lesotho, and detailed historical information on their product prices, we find a non-monotonic relationship between the frequency of price changes and perceived competition, measured by the number of reported competitors. This non-monotonic relationship is consistent with a model of increasing costs of coordinating price changes under tacit collusion with few competitors, and a breakdown of collusion at higher levels of competition.

Key words: Price rigidity, Competition, Survey data, Micro price data, Emerging economies
JEL: E30, D40, D22, L21

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1. Introduction

Evidence of price rigidities is widespread. Prices are found to be sticky and price increases and decreases often respond asymmetrically to cost and demand shocks (Blinder *et al.*, 1998; Peltzman 2000). Accounting for these rigidities has key implications for economic theory (Carlton, 1986; Blinder, 1991; Blinder *et al.*, 1998; Peltzman, 2000), macro models (Klenow and Malin, 2011) and the conduct of monetary and other economic policies (Greenslade and Parker, 2012).

The literature posits that a firm's price-setting behavior is influenced by the degree of competition it faces (Rotemberg and Saloner, 1987). In competitive markets, a firm's pricing decision is expected to respond more closely to cost and demand shocks than in markets characterized by imperfect competition, where price adjustments may be delayed to avoid breaking tacit pricing agreements (Alvarez and Hernando, 2007b). Notwithstanding this theoretical prediction, the empirical literature that explores the link between price-setting behavior and the degree of competition is both diverse and contentious. While some empirical studies using high frequency product-level price data find supporting evidence for the positive association between competition and the frequency of price changes (Carlton, 1986; Hall *et al.*, 2000; Alvarez and Hernando, 2007b), other studies find the opposite effect (Domberger, 1979), or no effect at all (Weiss, 1993; Bils and Klenow, 2004).

One explanation for this empirical inconsistency might be that these studies assume a monotonic relationship between competition and the frequency of price changes, whereas the relationship may be non-monotonic, as is theoretically argued by Hanazono and Yang (2007). Alternatively, the inconsistency may reflect the fact that these available studies draw on

different data bases that are not necessarily comparable. Some studies, such as *Álvarez et al.* (2005) for Spain, draw on detailed producer price data, while others use information on price-setting behavior obtained from firm surveys (see Aucremanne and Druant [2005] for Belgium, Hall *et al.* [2000] for the UK, Apel *et al.* [2005] and Alvarez and Hernando [2007b] for the Euro Area). While the price-based studies are able to exploit detailed historical information on price changes, they lack information on firm characteristics, including perceived competition. On the other hand, studies that employ survey data can draw on rich information on firm characteristics, but may lack detailed and historical information on observed changes in prices.

In this study, we address both these limitations. First, we investigate potential non-monotonicity in the relationship between price rigidity and perceived competition explicitly. Particularly, we study the relationship between the frequency of price changes and perceived competition in retail outlets in Lesotho, a small economy in Southern Africa. Lesotho provides a relevant case study for our purpose, compared to other developing countries, since its markets remain relatively open, and government intervention in price-setting is relatively low.

We posit that in an environment of asymmetric information, the co-ordination costs involved with price changes when firms tacitly collude rise as the number of competitors initially increases, implying a negative association between the frequency of price changes and competition. However, as the number of firms rises, collusion is harder to sustain and finally breaks down, after which more competition is associated with more frequent price changes.

We utilise a unique dataset that combines survey data on retail firms (outlets) with detailed, historical information on prices of their products. The micro price database consists of monthly consumer prices for products over the period January 2011 through December

2012. The outlet survey data consist of 250 retail outlets drawn from face-to-face questionnaires administered to managers/owners of these outlets across Lesotho in 2013.¹ The survey questionnaire contains detailed information on outlet attributes, price-setting behavior, number of competitors and costs. Our integrated database combines the comprehensive nature of the micro price data in terms of product range and coverage over time, with detailed information on outlet characteristics and manager responses to how prices are set, reviewed and changed. This allows for a richer analysis of price-setting behavior than is possible in other studies that use either micro price or firm-level survey data.

Controlling for product-level, time-invariant demand and cost shocks, we find evidence of a non-monotonic relationship between the frequency of price changes and the perceived number of competitors. At low levels of competition, a rise in the number of competing outlets reduces the frequency of price changes within outlets, but the relationship switches to positive as competitors increase. Additionally, we find that evidence of non-monotonicity is stronger for homogeneous, relative to differentiated products, consistent with our conceptual framework. We also find that evidence of non-monotonicity is more pronounced for price decreases than for price increases. Finally, our results are robust to alternate estimation technique that accounts for the bounded and fractional nature of our dependent variable.

To our knowledge, our study is the first to document empirical evidence for a non-monotonic relationship between price rigidity and competition in the non-financial sector.²

¹ The survey sample is large relative to other studies, particularly when taking into account the relative sizes of the economies. For example, Blinder (1991) and Blinder *et al.* (1998) cover approximately 200 firms in the US, the survey of UK firms used by Greenslade and Parker (2012) covers 693 firms. These studies cover mostly producers, while the focus in this study is on retailers.

²Jackson III (1997) and Lago-González and Salas-Fumás (2005) provide evidence of a non-monotonic relationship between price rigidity of loan and consumer deposit interest rates and competition.

We show that in imperfectly competitive markets, an increase in the number of retail firms might lead to greater price rigidity. We hence underscore the need to coordinate macroeconomic policy and competition policy. Finally, there is strikingly little on the relationship between price rigidity and competition in developing countries, where markets are more rigid and where ‘thin’ markets create frictions to price adjustments different from advanced economies (Nchake *et al.*, 2015).

Our paper is structured as follows. Section 2 outlines our conceptual framework. Sections 3 and 4 describe the data and look descriptively at the price-setting behavior of outlets and at the relationship between the frequency of price changes and competition. Section 5 analyzes the latter relationship rigorously, in a regression framework and Section 6 concludes.

2. Conceptual Framework

We adapt the conceptual framework proposed in Hanazono and Yang (2007). They consider an infinitely repeated Bertrand game with two identical firms, where firms experience a demand shock in each period, and receive private information (a signal) on the nature of the shock. Due to asymmetric information, one firm cannot observe the other’s signal. At the end of the period, firms observe demand. Firms can either choose a sorting pricing scheme, where they charge different prices for different signals, or a pooling scheme, where they charge the same price regardless of the demand signal (price rigidity).

Under the sorting scheme, firms enjoy information gains because they exploit the information in the signal, though these gains are mitigated if the signal is noisy. However, for this scheme to be maintained in equilibrium, firms must have no incentive to charge a price assigned to a different signal. Given that the signal is private, deviations cannot be detected, and price distortions or future punishments are necessary to maintain this scheme. These

impose coordination costs. On the other hand, the pooling scheme involves no coordination costs. In an environment where signals are noisy, as is likely to be the case in most developing countries (and sometimes in advanced countries), where information flows are less than perfect, the authors show that firms may find a pooling scheme optimal, because the information gains associated with a sorting scheme are not sufficient to outweigh the associated coordination costs.

As the number of firms in a market increases, coordination costs increase. This is because, with a larger number of firms, the probability that one firm charges a price assigned to a different signal increases, increasing the punishments or price distortions necessary to sustain a sorting equilibrium. Hence, initially, a pooling scheme is more likely to be optimal with more competitors, implying a negative association between the frequency of price changes and the number of competitors. As the number of firms increases, collusion cannot be sustained, and prices become more flexible.

Formally, the frequency of price changes as a function of the number of competitors can be specified as:

$$(2.1) \quad \begin{aligned} f(n_i) &= b(s) - c(n_i) && \text{if } n_i \leq n_c \\ &= F(n_i) && \text{if } n_i > n_c \end{aligned}$$

Here, s captures the extent of demand fluctuations in the market, n_i is the number of competitors for firm i , n_c is the number of firms after which collusion is unsustainable. $b(s)$ captures the relationship between demand fluctuations and the frequency of price changes. $c(n_i)$ captures the costs of coordinating price changes as a function of the number of competitors. $F(n_i)$ captures the relationship between competition and the frequency of

price changes when there is no collusion. We assume that $F' > 0$, $b' > 0$ and $c' > 0$. Note that in a monopoly, $f(n_i) = b(s)$, that is, the frequency of price changes depends on the extent of demand fluctuations in the market.

Hence,

$$(2.2) \quad \begin{aligned} f'(n_i) &= -c'(n_i) < 0 \quad \text{if } n_i \leq n_c \\ &= F'(n_i) > 0 \quad \text{if } n_i > n_c \end{aligned}$$

This yields a non-monotonic relationship between n_i and f , which we estimate using our data on the perceived number of competitors reported by retail outlets and the frequency with which these outlets change product prices. We estimate:

$$(2.3) \quad f_{ip} = \beta_0 + X(\beta_1 n_i) + \beta_2 Y_i + \beta_3 I_p + \varepsilon_{ip}$$

Here, f_{ip} is the frequency of price changes in outlet i for product p and n_i is the number of competitors reported by the outlet. We first estimate $X(\beta_1 n_i)$ as a linear function, and subsequently explore non-monotonicity by introducing a linear and a squared term of the number of reported competitors. Y_i and I_p are outlet and product specific characteristics respectively, while ε_{ip} is an idiosyncratic error term.

3. Data

3.1 Outlet price-setting survey

The price-setting survey was designed to collect detailed information on outlet characteristics, with a particular focus on how prices were set and changed. The questionnaire was designed, using the World Bank Enterprise Survey questionnaires and those of Blinder (1991) and Fabiani *et al.* (2006), in consultation with researchers within SALDRU, University of Cape Town.³ The survey was administered to outlets that the Lesotho Bureau of Statistics (BOS) uses for the collection of monthly Consumer Price Index data during the first two weeks of March and April 2013.⁴

From the 413 retail and services outlets that were surveyed, we exclude all outlets that provide services, since we focus on goods retailers. Outlets whose price-setting strategies are not determined within the outlet, but by the head office, parent company, business council or government are also excluded, since the frequency of price changes in these outlets is likely not endogenous to the individual outlet. The final sample in this analysis consists of 250 retail outlets.⁵

³ The survey questionnaire and additional details on the implementation of the survey are available from the authors upon request. For additional information on the survey, also refer to the PEDL report at <http://pedl.cepr.org/content/consumer-price-rigidities-lesotho-role-outlet-characteristics-and-competition>

⁴ The BOS collects prices from 774 outlets, but we did not survey those outlets where prices are only collected once or twice a year (taxi fares, housing rents, petrol and diesel prices) and where prices were subject to regulatory controls (water and electricity companies, hospitals and schools, except for driving schools). The response rate on the remaining outlets was 81.5 percent.

⁵ For a list of outlets in the sample by district and a map of Lesotho, see Table A2 and Figure A1 in the Appendix.

Table 1 presents descriptive statistics on various characteristics of the retail outlets included in our sample. Most retail outlets are medium in size (45 per cent), employing between 5 and 20 employees in total. Small outlets employing less than 5 employees account for 39 per cent of the retail outlets, and 14 per cent are large (more than 20 employees). Just over 60 percent of the surveyed outlets are branches of retail chains.⁶ These branches tend to be relatively large with a median employment of 5 full-time and part-time workers compared to 3 for other outlets. Like in most developing economies with low levels of urbanization, a majority (58 percent) of retail outlets are located in rural areas.

Table 2 presents descriptive statistics on various measures commonly used in the literature of the degree of competition faced by retail outlets in our sample. These inferred competition measures include the following (each captured by a question in the survey questionnaire): (i) the number of competitors perceived by the outlet, (ii) whether an outlet reduced prices in response to the lowering of a competitor's price, (iii) whether an outlet regarded reductions in a close competitor's price as important or very important in influencing it to lower its price. (iv) whether an outlet rated the fear of a rise in its competitor's price as an important factor stopping it from raising its own price. From Table 2, most outlets are faced with at least one and less than five competitors (73 percent) and few outlets (5 percent) face competition from more than 10 competitors. Broadly, fewer outlets report being concerned about competitors while setting prices.

⁶A chain is a group of retail or services outlets dealing in the same products. These outlets share a brand and central management and usually have a standardized business method and practice.

3.2 Micro price data

We also utilize historical product price data for these outlets from January 2011 through December 2012, provided by the Bureau of Statistics, Lesotho. Each individual price record (termed price quote) for a product has information on the date (month and year) of the transaction, the retail outlet's name, district, product description (including brand in many cases) and its unit code, and the price at which it is sold by the outlet. Since we are provided with outlet names, we are able to merge the micro price data with the corresponding outlet's survey responses. We are hence able to trace the pricing history of individual products within each retail outlet over the period 2011-2012.⁷ Nchake *et al.* (2015) provide further details on the price data.

We only consider products in an outlet's main product group since our survey questions on competition pertain to the outlet's main product group. However, we lose additional 26 outlets from our sample because we do not have frequency of price-change information on the main product group for these outlets. The final sample in the price data consists of 133 products sold in 224 retail outlets⁸.

Table 3 presents a breakdown of price records by major product group. The data in the table cover a sample of 7,458 price quotes. Over 80 percent of price quotes are made up of food products, followed by household furniture and equipment at 6.2 per cent, clothing and footwear at 5.4 per cent and alcoholic beverages at 2.2 per cent. Other product groups each make up less than one percent.

⁷ A limitation of the data is that it is not possible to identify price changes in response to temporary promotions and seasonal sales.

⁸ For the full list of products, see Table A1 in the Appendix.

4. Price-setting behavior

Differences in price-setting behavior across outlets reflect different strategies that outlets use in pricing their products. In this section, we first explore the main price-setting rules adopted by retail outlets. We then examine how competition in the market and various outlet characteristics (location, size, ownership) affect the choice of price-setting rule.

The questionnaire addresses the outlet's price-setting rule by directly requesting them to indicate whether they set the price of products in their main product group as a mark-up over costs or based on their main competitor's price. We refer to the 'mark-up over costs' price-setting rule as the 'mark-up pricing' rule and the 'set prices based on main competitor's price' price-setting rule as the 'main competitor's price' rule. While the question pertains to the main product group that generates the highest turnover of the outlet, on average, this constitutes 79.5 per cent of the total value of sales of each outlet in our data. Therefore, we argue that the price-setting rule applied to the main product group is broadly representative of the outlet's pricing behavior in general.

The data reveal that 93.5 per cent of the retail outlets in our sample apply a 'mark-up pricing' rule when setting prices. Only 6.5 per cent of outlets in our sample set prices according to their 'main competitor's price'. Following Alvarez *et al.* (2006), Alvarez and Hernando (2007a) and Greensdale and Parker (2010) who use mark-up pricing as an indicator of imperfectly competitive markets, these results suggest a high degree of market power in the Lesotho retail market compared to other economies. For example, the share of firms using mark-up pricing relative to competitor pricing is substantially higher in Lesotho compared to countries in the Euro area (Alvarez *et al.*, 2006; Alvarez and Hernando, 2007a) and the United Kingdom (Greensdale and Parker, 2010). This also holds when comparing Lesotho to other emerging economies such as Turkey (Şahinöz and Saraçoğlu, 2008) and Romania

(Copaciu *et al.*, 2010). In what follows, we try to isolate some of the outlet characteristics associated with differences in price-setting behavior.

Table 4 summarizes price-setting strategies of outlets according to characteristics of the outlet, such as size, ownership, and location. We find some evidence that price-setting behavior differs according to outlet characteristics. Retail outlets that are part of chain stores are more likely to set prices according to the ‘main competitor’s price’ compared to other outlets. Medium-sized outlets are also more likely to set prices according to the ‘main competitor’s price’ compared to large and small outlets. There is no significant difference between outlets that are located in shopping malls or outside malls, or in rural and urban areas.

The degree of competition is also widely found in other empirical research to be an important determinant of a firm’s price-setting rule (Álvarez and Hernando, 2007b; Fabiani *et al.* 2006; Copaciu *et al.*, 2010). We now explore if similar relationships are evident for Lesotho. With this goal in mind, we look at pricing strategies of retail outlets according to the various indicators of competition in our survey.

Table 5 summarizes these relationships. We find a negative relationship between the share of outlets following a ‘mark-up pricing’ rule (and hence, a positive relationship between the share of outlets following a ‘main competitor’s price’ rule) and the degree of competition. Less than 6 per cent of outlets facing fewer than 5 competitors use the ‘main competitor’s price’ rule, compared to 25 per cent for those facing more than 15 competitors. This pattern persists when using the other, more indirect measures of competition. Fewer outlets use the ‘main competitor’s price’ rule when the intensity of competition, as captured by our survey questions, is lower.

Hence, descriptive evidence in our data reveals that the degree of competition appears to be strongly related to price-setting rules adopted by retail outlets. The more competitive

the environment is, the more likely that an outlet sets its prices according to its ‘main competitor’s price’. We note here that it is difficult to interpret this relationship to imply that a high degree of market competition encourages firms to set prices competitively. Setting prices according to the ‘main competitor’s price’ need not necessarily mean competitive price-setting behavior. It could denote strategic interaction, or collusive behavior in an oligopolistic market. Nevertheless, evidence of this relationship in our data corroborates similar findings in other countries such as in the Euro area (Fabiani *et al.*, 2006).

5. Price-rigidity and competition

We now draw on our integrated micro price-survey database to analyze the relationship between perceived competition and price-rigidity among retail outlets in Lesotho. We measure price-rigidity for each product sold by an outlet as the average frequency of price changes over the period 2011-2012 (henceforth, the frequency of price changes).⁹ Table 6 presents the frequency of price changes by the degree of competition faced by outlets, utilizing the measures of competition in Table 5. A simple analysis of patterns in the data shows a non-monotonic relationship between the frequency of price changes and perceived competition for all measures of competition in the survey. For example, the frequency of price changes in outlets facing more than 15 competitors (24.7 per cent) is higher than in outlets facing between 11 and 15 competitors (21.9 per cent) but less than in outlets facing between one and five competitors (25.9 per cent).

These trends are consistent with the idea outlined in our conceptual framework, where increasing co-ordination costs of collusion in markets with few competitors induce a negative relationship between the frequency of price changes and competition, which switches into a

⁹ We calculate this as the number of months between January 2011 and December 2012 in which the outlet changed its price divided by the total number of months.

positive relationship when the number of competitors is high and collusion breaks down. In the next section, we test this relationship more rigorously using a regression analysis.

5.1 Regression analysis of the relationship between the frequency of price changes and competition

For our regression analysis, we employ the number of competitors reported by the retail outlet in our survey as our measure of perceived competition. We argue that this is the best measure of competition available to us from our survey, since it is more refined and less subjective than a simple binary outcome (or a categorical outcome) of how important a competitor's price response is in the pricing decision. Using the number of competitors as reported by the outlet as our measure of competition allows us to tease out a potentially non-monotonic relationship. To reiterate, the advantage of our database is that it combines detailed product-level price data for each outlet with in-depth information on various characteristics of that outlet. In analyzing the frequency of price changes, we are therefore able to control for product heterogeneity far more precisely than in other survey-based studies, in addition to controlling for outlet characteristics.

We first posit a linear relationship between competition and price-rigidity that is commonly estimated in the literature (see Alvarez and Hernando, 2007b). Drawing from equation (2.3), we regress the frequency of price changes over the period 2011-2012 on the reported number of competitors (*Number of competitors*). To control for cost and demand shocks at the outlet level, we follow Álvarez and Hernando (2007b) and include dummy variables that equal one if outlets assessed as important or very important the role of labour costs (*Labour costs*) and demand (*demand*) in driving price changes. Further, we include dummy variables that equal one if the outlet is located in an urban area (*Urban*), in a mall (*Mall location*) and if it is part of a chain (*Chain*). We also include dummies for outlet size (measured by total employment), and ownership of storage facilities (*Storage*) as this might

determine the outlet's ability to hold inventory. Finally, we include product fixed effects to control for product-specific time-invariant shocks to demand or supply related factors, like raw-material prices.

The dependent variable (*frequency of price changes*) is at the outlet-product-level, averaged over the period January 2011 through December 2012. Our key independent variable of interest (*Number of Competitors*) varies by outlet, and is obtained from our survey data collected in 2013. After excluding outlets which have missing information on key control variables, the regression analysis is based on a sample of 213 retail outlets.

5.2 Results

Results are presented in Table 7. In the first column, we estimate the baseline regression without controls or fixed effects. In the second column, we control for outlet-specific characteristics. Large and medium retail outlets are found to change prices more often and, as expected, retail outlets with storage facilities have a lower frequency of price changes. Finally, in column 3, we include a set of district and product fixed effects to control for time-invariant, unobserved heterogeneity at the district- and product-level. However, across all three columns, we find no systematic relationship between the frequency of price changes and perceived competition by retail outlets.

Next, in Table 8, we explore a potentially non-monotonic relationship between the frequency of price changes and competition by including a squared term of the number of competitors reported by the outlet. Like in Table 7, in column 1, we look at pure correlations. We introduce control variables in Column 2 and product and district fixed effects in Column 3. From column 2, we now find a significant non-monotonic relationship between the frequency of price changes and the number of competitors reported by the outlet that is robust to the inclusion of outlet characteristics. While the coefficient on competition is statistically significant but negative, the coefficient on the squared term is positive and significant.

This suggests that at low levels of competition, a rise in the number of competing outlets reduces the frequency of price changes within outlets, but that when the number of competitors is large, more competitors are associated with an increase in the frequency of price changes. The frequency of price changes for outlets with one competitor, for example, is 28 per cent and it declines to 27 per cent as the number of competitors increases to 5 but increases to 28 per cent as the number of competitors increases to 10 and to 33 per cent at 20 competitors. In column 3, we are unable to estimate the coefficient on competition precisely, though the sign remains negative.

Overall, we find evidence of a non-monotonic relationship, which is consistent with a model of increasing costs of coordinating price changes under tacit collusion with few competitors and a breakdown of collusion at higher levels of competition. Our argument is that as the number of outlets increases initially, coordination costs associated with price changes outweigh any gains from adjusting prices to demand shocks, until collusion is ultimately unsustainable and prices adjust to shocks. Our result thus emphasizes the fact that the relationship between price rigidity and competition may be quite nuanced, especially in markets characterized by strong information asymmetries or barriers to information flows.

5.3 Asymmetry in the frequency of price changes

Next, we explore the non-monotonic relationship between perceived competition and the frequency of price increases and decreases. While theory suggests symmetrical effects in price changes, empirical evidence shows that price increases and decreases respond asymmetrically to cost and demand shocks (Peltzman 2000; Blinder *et al.*, 1998; Klenow and Kryvtsov, 2008; Klenow and Malin, 2011 and; Nchake *et al.*, 2015). We test if asymmetric effects are also present in the relationship between price rigidity and competition.

Results presented in Table 9 show evidence of asymmetry in the relationship between competition and the frequency of price increases and price decreases. We find that the non-monotonic relationship between competition and the frequency of price changes is stronger for price decreases. At low levels of competition, at one competitor for instance, the frequency of price decreases is 7 percent and of price increases, 21 percent. A rise in the number of competing outlets to 10 reduces the frequency of price decreases to 6 percent but does not change the frequency of price increases. At a higher level of competition (20 competitors), the frequencies of price decreases and price increases rise to 7 percent and 27 percent respectively. One explanation for this asymmetry may be that co-ordination costs that arise from having to design future punishments for deviations, that essentially drive the non-monotonicity, might be more significant for price decreases than price increases.

5.4 Robustness checks

The conceptual framework we posit in this paper is most relevant for homogenous products. This is because the more differentiated the product, the more likely a shock experienced by a retail outlet will be product-specific and specific to the outlet, inducing outlets to respond by changing prices. The advantage of our data is that we have sufficient information on products to enable us to clearly distinguish between homogeneous and differentiated products. This allows us to ascertain if our results pertain primarily to homogenous products. To evaluate this, we use a sub-sample of 88 homogeneous products that are similar in their product description and unit of measurement. These include, for example, 750 ml of cooking oil, 500 g of rice, 500 ml of bottled water, 1 kg of beef or 1 kg of apples. We compare this sample to a sub-sample of 45 differentiated products.

In column 1 of Table 10, we present results for equation (2.3) for homogenous products and in column 2, for differentiated products. We present results for the frequency of

price increases and the frequency of price decreases for homogenous and differentiated products in columns 3 and 4 and columns 5 and 6 respectively. Consistent with our conceptual framework, we find that the non-monotonic relationship between the frequency of price changes and competition is statistically significant for homogeneous products and not for differentiated products.

The results so far are estimated using OLS. To deal with functional form and concerns of inference when using bounded data on the dependent variable, such as the frequency of price changes, we test the robustness of our results to the quasi-maximum likelihood (QML) approach of Papke and Wooldridge (1996) to estimate models with fractional dependent variables. In Table 11, we present results for estimation equation (2.3) using the QML approach, by expressing the dependent variable as a bounded nonlinear function of the explanatory variables using a logistic cumulative distribution function. This method has been widely used to account for possible bias when the dependent variable is fractional. The coefficients are then estimated using a Bernoulli quasi-maximum likelihood estimator. We find that our results are robust to this alternate estimation technique, with the non-monotonicity reflected.

6. Conclusion

This paper extends the microeconomic evidence on price-setting using micro price data and outlet survey data for Lesotho, a small, low-income, landlocked economy in Southern Africa. The empirical analysis draws on a unique dataset that combines survey data on outlets with detailed historical information on their product prices to analyze the relationship between price-setting behavior and perceived competition.

Our results provide some important insights into the nature of retail markets. We find that the market structure for consumer goods in Lesotho is characterised by a high degree of imperfect competition. A high proportion of outlets apply mark-ups over costs when setting prices, while very few outlets set prices according to the price of their main competitor. The latter tend to operate in environments perceived to be more competitive, and are more likely to be located in urban areas. We find a non-monotonic relationship between the frequency of price changes and perceived competition, suggesting that the relationship between price rigidity and market-structure is more nuanced than was previously posited.

Our study makes two important contributions. First, to our knowledge, it is the first study to explore the non-monotonic relationship between price rigidity and competition in the non-financial sector, providing a potential resolution to the lack of consensus in the literature exploring the relationship between price rigidity and competition. Second, it looks at market structure and price-setting in a developing country, where markets are characterized by asymmetric information and greater barriers to information flows. We believe that by delving into the nature of the relationship between competition and price rigidity, our study has implications for macroeconomic and competition policy, and underscores the scope for interaction between the two.

Table 1: Descriptive statistics by outlet characteristics, share total responses

Variable	Share of total responses (percent)
<i>Outlet size</i>	
Small (<5 employees)	39.8
Medium (5-20 employees)	45.6
Large (>20 employees)	14.6
<i>Outlet type</i>	
Chain	61.7
Not a chain	38.3
<i>Location</i>	
Within a shopping centre/mall	26.5
In a private location	64.0
Taxi rank/street or open space	9.5
Rural	58.8
Urban	41.2

Source: Outlet survey data, authors' calculations

Note: The sample comprises of 250 retail outlets.

Table 2: Descriptive statistics by degree of competition to the outlet, share total responses

Variable	Share of total responses (percent)
<i>Competition</i>	
none	11.4
Less than 5	73.7
Between 6 and 10	9.7
Between 11 and 15	4.1
More than 15	1.1
<i>Did you reduce price in response to reduction in price by competitor?</i>	
No	68.3
Yes	31.8
<i>How important is reduction in close competitor's price in terms of influencing you to lower price?</i>	
Unimportant	43
Minor importance	11.9
Important	22
Very important	23.2
<i>What stops you from increasing price - fear competitor's price will remain fixed?</i>	
Unimportant	40.6
Minor importance	10.7
Important	17.6
Very important	31.1

Source: Outlet survey data, authors' calculations

Note: The sample comprises of 250 retail outlets.

Table 3: Price records by major group, Jan 2011 through December 2012

	Price quotes		Product items	
	Number	Percent	Number	Percent
Food	6,331	84.9	69	51.9
Non-alcoholic beverages	17	0.2	8	6.0
Alcoholic beverages	163	2.2	3	2.3
Tobacco and narcotics	2	0.0	1	0.8
Clothing and footwear	404	5.4	11	8.3
Fuel	18	0.2	5	3.8
Household furniture and equipment	459	6.2	25	18.8
Household operations	17	0.2	4	3.0
Transport equipment	36	0.5	2	1.5
Personal care	11	0.2	5	3.8
Total	7,458	100	133	100

Source: BOS historical price data, Lesotho.

Notes: 1) The sample comprises of 133 products. 2) Price data are from January 2011 through December 2012. 3) Product groups are based on a modification of the Classification of Individual Consumption by Purpose (COICOP, United Nations, <http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=5>).

Table 4: Price-setting strategies by outlet characteristics (per cent)

	Mark-up over costs	Main competitor's price	Total	Observations Number	Observation Share (%)
<i>Outlet type**</i>					
Chain	91.6	8.4	100	131	53.0
Non-chain	98.3	1.7	100	116	47.0
<i>Size*</i>					
Small (<5 employees)	97.7	2.3	100	131	53.3
Medium (6-20 employees)	90.2	9.8	100	92	37.4
Large (>20 employees)	95.7	4.4	100	23	9.3
<i>Location</i>					
Within a shopping center/Mall	92.3	7.7	100	65	26.7
Other	95.5	4.5	100	178	73.3
<i>Rural/urban</i>					
Rural	96	4	100	124	50.8
Urban	93.3	6.7	100	120	49.2

Source: Outlet survey data, authors' calculations

Notes: 1) The sample comprises of 250 outlets. 2) Pearson Chi square tests of independence of outlet characteristics and price-setting rules were conducted for each category of outlet characteristics. 3) * and ** denote rejection of the null hypothesis of independence at the 95 per cent and 99 per cent confidence level.

Table 5: Price-setting strategies by degree of competition to the outlet (per cent)

	Mark-up over costs %	Main competitor's price %	Total %	Observations Number	Observation Share (%)
<i>Number of competitors*</i>					
none	100	0	100	22	8.9
Less than 5	94.7	5.3	100	189	76.2
Between 6 and 10	95.7	4.4	100	23	9.3
Between 11 and 15	90.0	10.0	100	10	4.0
More than 15	75.0	25.0	100	4	1.6
<i>Did you reduce price in response to reduction in price by competitor? **</i>					
No	97.5	2.5	100	162	73.3
Yes	86.4	13.6	100	59	26.7
<i>How important is reduction in close competitor's price in terms of influencing you to lower price?*</i>					
Unimportant	99.1	0.9	100	116	0.5
Minor importance	96.4	3.6	100	28	11.6
Important	91.3	8.7	100	46	19.1
Very important	90.2	9.8	100	51	21.2
<i>What stops you from increasing price - fear competitor's price will remain fixed? **</i>					
Unimportant	99.0	1.0	100	102	41.1
Minor importance	96.7	3.3	100	30	12.1
Important	95.6	4.4	100	45	18.1
Very important	87.3	12.7	100	71	28.6

Source: Outlet survey data, authors' calculations

Notes: 1) The sample comprises of 250 retail outlets. 2) Pearson Chi square tests of independence of outlet characteristics and price-setting rules were conducted for each indicator of competition. 3) * and ** denote rejection of the null hypothesis of independence at the 95 per cent and 99 per cent confidence level.

Table 6: The mean frequency of price changes and competition

VARIABLES	Frequency of price changes
<i>Competition</i>	
none	26.3
Less than 5	25.9
Between 6 and 10	24.0
Between 11 and 15	21.9
More than 15	24.7
<i>Did you reduce price in response to reduction in price by competitor?</i>	
No	25.3
Yes	24.7
<i>How important is reduction in close competitor's price in terms of influencing you to lower price</i>	
Unimportant	26.3
Minor importance	23.1
Important	25.6
Very important	25.3
<i>What stops you from increasing price - fear competitor's price will remain fixed</i>	
Unimportant	26.4
Minor importance	23.4
Important	22.2
Very important	27.1

Source: Integrated survey and BOS historical price data, authors' calculations

Notes: 1) The sample comprises of 224 outlets and 133 products. 2) Price data are from January 2011 through December 2012.

Table 7: Linear regression of the frequency of price changes on perceived competition

VARIABLES	(1)	(2)	(3)
Number of competitors	-0.0032 (0.002)	-0.0038 (0.003)	0.0013 (0.002)
Firm size: Medium		0.0249* (0.013)	-0.0045 (0.009)
Firm size: Large		0.0645*** (0.022)	0.0172 (0.017)
Labor costs		-0.0178 (0.013)	-0.0118 (0.009)
Demand		-0.0068 (0.012)	-0.0173** (0.009)
Chain		0.0033 (0.012)	0.0062 (0.009)
Storage		-0.0295** (0.015)	-0.0141 (0.009)
Mall location		0.0138 (0.017)	-0.0032 (0.012)
Urban		-0.0278** (0.014)	-0.0018 (0.010)
Constant	0.2670*** (0.009)	0.2898*** (0.017)	0.2722*** (0.019)
Observations	7,112	7,112	7,112
Adjusted R-squared	0.00	0.01	0.45
Clusters	213	213	213
<i>Fixed Effects</i>			
Product	N	N	Y
District	N	N	Y

Notes: 1) Regressions use the integrated survey and BOS historical price data. 2) The monthly average frequency of price changes are for the period January 2011 to December 2012 and independent variables are from the survey conducted in 2013. 3) Small outlets (5 employees or less) are the omitted category in the outlet size variable. Medium outlets employ 6 to 20 employees, while large outlets employ above 20. 4) Robust standard errors clustered at the outlet level in parentheses. 5) *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Linear regression of the frequency of price changes on perceived competition – Exploring the non-monotonicity

VARIABLES	(1)	(2)	(3)
Number of competitors	-0.0088** (0.004)	-0.0130*** (0.004)	-0.0041 (0.003)
Sqr of Number of competitors	0.0004 (0.000)	0.0006** (0.000)	0.0003** (0.000)
Firm size: Medium		0.0286** (0.013)	-0.0043 (0.009)
Firm size: Large		0.0705*** (0.021)	0.0206 (0.016)
Labor costs		-0.0165 (0.012)	-0.0111 (0.009)
Demand		-0.0098 (0.012)	-0.0202** (0.009)
Chain		0.0048 (0.012)	0.0071 (0.009)
Storage		-0.0339** (0.015)	-0.0167* (0.009)
Mall location		0.0170 (0.016)	-0.0014 (0.012)
Urban		-0.0316** (0.013)	-0.0029 (0.010)
Constant	0.2776*** (0.010)	0.3098*** (0.017)	0.2875*** (0.020)
Observations	7,112	7,112	7,112
Adjusted R-squared	0.00	0.02	0.46
Clusters	213	213	213
<i>Fixed Effects</i>			
Product	N	N	Y
District	N	N	Y

Notes: 1) Regressions use the integrated survey and BOS historical price data. 2) The monthly average frequency of price changes are for the period January 2011 to December 2012 and independent variables are from the survey conducted in 2013. 3) Small outlets (5 employees or less) are the omitted category in the outlet size variable. Medium outlets employ 6 to 20 employees, while large outlets employ above 20. 4) Robust standard errors clustered at the outlet level in parentheses. 5) *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Frequency of price increases and decreases

VARIABLES	(1) Frequency plus	(2) Frequency minus
Number of competitors	-0.0013 (0.002)	-0.0025** (0.001)
Sqr of Number of competitors	0.0002** (0.000)	0.0001** (0.000)
Firm size: Medium	-0.0053 (0.008)	-0.0001 (0.004)
Firm size: Large	0.0125 (0.012)	0.0096 (0.006)
Labor costs	-0.0095 (0.007)	-0.0047 (0.004)
Demand	-0.0095 (0.007)	-0.0053* (0.003)
Chain	0.0042 (0.007)	0.0038 (0.004)
Storage	-0.0171** (0.008)	-0.0001 (0.003)
Mall location	-0.0045 (0.009)	0.0066 (0.005)
Urban	-0.0047 (0.007)	0.0014 (0.004)
Constant	0.2108*** (0.017)	0.0699*** (0.007)
Observations	7,112	7,112
Adjusted R-squared	0.42	0.19
Clusters	213	213
<i>Fixed Effects</i>		
Product	Y	Y
District	Y	Y

Notes: 1) Regressions use the integrated survey and BOS historical price data. 2) The monthly average frequency of price changes are for the period January 2011 to December 2012 and independent variables are from the survey conducted in 2013. 3) Small outlets (5 employees or less) are the omitted category in the outlet size variable. Medium outlets employ 6 to 20 employees, while large outlets employ above 20. 4) *Labor costs* and *Demand* are dummies that equal one if the outlet reports these as important or very important in driving price increases in column (1) and price decreases in column (2). 5) Robust standard errors clustered at the outlet level in parentheses. 6) *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Robustness check: homogenous and differentiated products

VARIABLES	(1) Frequency: Homogenous	(2) Frequency: Differentiated	(3) Fplus: Homogenous	(4) Fplus: Differentiated	(5) Fminus: Homogenous	(6) Fminus: Differentiated
Number of competitors	-0.0060** (0.003)	0.0002 (0.003)	-0.0011 (0.002)	-0.0024 (0.003)	-0.0036*** (0.001)	0.0014 (0.002)
Sqr of Number of competitors	0.0005*** (0.000)	-0.0001 (0.000)	0.0003** (0.000)	0.0001 (0.000)	0.0002*** (0.000)	-0.0001 (0.000)
Firm size: Medium	-0.0077 (0.010)	0.0113 (0.013)	-0.0070 (0.009)	0.0051 (0.011)	-0.0008 (0.004)	0.0024 (0.006)
Firm size: Large	0.0125 (0.019)	0.0486*** (0.018)	0.0084 (0.015)	0.0240* (0.013)	0.0077 (0.007)	0.0195** (0.008)
Labor costs	-0.0094 (0.010)	-0.0156 (0.011)	-0.0096 (0.008)	-0.0077 (0.009)	-0.0026 (0.005)	-0.0153*** (0.005)
Demand	-0.0267*** (0.010)	-0.0106 (0.012)	-0.0067 (0.008)	-0.0252** (0.011)	-0.0059 (0.004)	-0.0085* (0.005)
Chain	0.0092 (0.010)	-0.0087 (0.011)	0.0061 (0.008)	-0.0073 (0.010)	0.0041 (0.004)	0.0020 (0.006)
Storage	-0.0205** (0.010)	-0.0090 (0.013)	-0.0220** (0.009)	-0.0041 (0.010)	0.0004 (0.004)	-0.0021 (0.006)
Mall location	0.0030 (0.014)	-0.0027 (0.014)	-0.0003 (0.011)	-0.0066 (0.012)	0.0068 (0.006)	0.0022 (0.006)
Urban	-0.0065 (0.011)	0.0117 (0.013)	-0.0084 (0.008)	0.0137 (0.012)	0.0028 (0.004)	0.0001 (0.007)
Constant	0.2976*** (0.021)	0.0227 (0.035)	0.2107*** (0.017)	0.0293 (0.027)	0.0730*** (0.008)	0.0074 (0.014)
Observations	5,828	1,284	5,828	1,284	5,828	1,284
Adjusted R-squared	0.44	0.29	0.41	0.32	0.21	0.15
Clusters	176	167	176	167	176	167
<i>Fixed Effects</i>						
Product	Y	Y	Y	Y	Y	Y
District	Y	Y	Y	Y	Y	Y

Notes: 1) Regressions use the integrated survey and BOS historical price data. 2) The monthly average frequency of price changes are for the period January 2011 to December 2012 and independent variables are from the survey conducted in 2013. 3) Small outlets (5 employees or less) are the omitted category in the outlet size variable. Medium outlets employ 6 to 20 employees, while large outlets employ above 20. 4) Labor costs and Demand are dummy variables that equal one if the outlet reports these as important or very important in driving price changes in columns (1) and (2), price increases in columns (3) and (4) and price decreases in columns (5) and (6). 5) Robust standard errors clustered at the outlet level in parentheses. 6) *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Robustness checks: an alternate estimation technique

VARIABLES	(1) QMLE - main products
Number of competitors	-0.025* (0.015)
Sqr of Number of competitors	0.002** (0.001)
Firm size: Medium	-0.029 (0.054)
Firm size: Large	0.120 (0.095)
Labor costs	-0.064 (0.054)
Demand	-0.122** (0.052)
Chain	0.048 (0.051)
Storage	-0.095* (0.053)
Mall location	0.001 (0.070)
Urban	-0.027 (0.057)
Constant	-0.876*** (0.113)
Observations	7,112
Clusters	213
<i>Fixed Effects</i>	
Product	Y
District	Y

Notes: 1) The regressions use the integrated survey and BOS historical price data. 2) The monthly average frequency of price changes are for the period January 2011 to December 2012 and an independent variable is from the survey conducted in 2013. 3) Small outlets (5 employees or less) are the omitted category in the outlet size variable. Medium outlets employ 6 to 20 employees, while large outlets employ above 20. 4) Robust standard errors clustered at the outlet level in parentheses. 5) *** p<0.01, ** p<0.05, * p<0.1.

Appendix

Table A1: List of Products in the Sample

Product number	Product description	Product number	Product description
1	Mattress, ¾ bed	67	Low fat cow milk in carton box, 1litre*
2	Maluti beer, 330ml*	68	Macaroni, 500 g (Fattis and Monis)*
3	Toilet paper per roll , 500 single ply	69	Mahleu, 500ml*
4	A bag of firewood	70	Malt,1 kg (Mtombo)*
5	Aluminum kettle	71	Mayonnaise, 750ml*
6	Apples per kg*	72	Men's elegant dress shoes; outer material
7	Aqua fresh tooth paste, 100ml*	73	Microwave; cooking power-800watts; control
8	Axe	74	Minced beef, per kg*
9	Bananas, per kg*	75	Mutton chops, per kg*
10	Beef sausages, per kg (Frankfurt/Vienna)*	76	Nan, 400 g*
11	Beef stock, 12 cubes*	77	Newden candles, 450 g (pkt of six)*
12	Beef, per kg*	78	Fruit Juice, 1L (Not 100%)*
13	Beetroot, per kg*	79	Oil filter for Toyota Corolla*
14	Blanket (mink)	80	Olive oil, 1litre*
15	Blue label, 200g*	81	One egg*
16	Boy's school shoes, black	82	One packet of ten matches*
17	Boys shirts; short sleeve; cotton 100%;	83	Onion, per kg*
18	Bread flour, 12.5 kg*	84	Oranges, per kg*
19	Brown bread, loaf*	85	Other leaf vegetables, per bundle*
20	Brown sugar, 1 kg*	86	Other meals
21	Butter, 250g*	87	Palmolive, 125 g*
22	Cabbage, per kg*	88	Paracetamol, 500mg*
23	Cake flour, 2.5 kg*	89	Paraffin heater
24	Canned beans, 410 g (Koo)*	90	Paraffin, per liter*
25	Canned fish in tomato sauce, 420 g*	91	Peaches, per kg*
26	Carrots, per kg*	92	Peanut butter in plastic bottle, 500g*
27	Chest of drawers; pressed wood, veneer	93	Peanuts, 55g*
28	Chewing Gum	94	Pears, per kg*
29	Chilli sauce, 200ml*	95	Pop up toaster; capacity 2 slices; power
30	Cigarettes P. Stuyvesant, pkt of 20*	96	Pork chops, per kg*
31	Clean trousers	97	Potato chips, 30g*
32	Coal, one bag of 50kg*	98	Potatoes, per kg*
33	Coca-Cola, 330 ml can*	99	Processed cheese- international brands
34	Cocoa with milk powder, 250g*	100	Propane gas; BP domestic gas, 9kg*
35	Colour TV, (51) 54 cm; flat screen; original	101	Pumpkins, per kg*

36	Comforters	102	Rama, 250g*
37	Concentrated drinks; Oros 750ml*	103	Refrigerator, electric, 180 liters,
38	Cornflakes, 500g*	104	Rice, 500 g (Tastic)*
39	Cream, 250ml*	105	Rooibos tea bags, 200 g*
40	Cremona, 250g*	106	Samp, 1 kg (Induna)*
41	Curtain material per meter; printed design; polyester 100%	107	Sanitary towel (Pads), pack of 10 (Stayfree)*
42	Custard	108	Scotch cart
43	Dining table with chairs; material of legs & top-solid wood; varnished	109	Seshoeshoe material, per meter*
44	Drinking glass in cardboard box, 6 units	110	Sheep offal, per kg*
45	DSTV set	111	Simple tiles in cartoon box
46	DVD player, original brands (e.g Sony)	112	Sorghum meal, 1 kg*
47	Easy bake flour, 12.5 kg*	113	Sour milk, 500g*
48	Electric iron; type-steam iron; power-80	114	Sparkling White Wine, 750ml*
49	Engine oil, 500 ml (petrol engine)*	115	Spinach, per bundle*
50	Frozen chicken, per kg*	116	Split dried peas, 500g*
51	Frozen fish	117	Steak and chop,40g*
52	Full cream cow milk in carton box, 500ml*	118	Still water, 500ml*
53	Gin, 750ml (Gordons)*	119	Stitched leather street sandals; small size
54	Ginger powder, 10g*	120	Sugar beans red speckled, 500g*
55	Green beans, per kg*	121	Sunflower cooking oil,750ml*
56	Headscarf; fiber type-polyester 100%	122	Surf, 1 kg*
57	Hi-fi set; radio cassette(double deck);original	123	Table salt, 1kg*
58	Hot plate (2plates) with selective heat	124	Tomato sauce, 375 ml*
59	Indoor house broom, plastic	125	Tomatoes, per kg*
60	Jacket; Cotton 35-65%, Linen 35-65%; sin	126	Toyota Corolla; power steering; 5Ds
61	Jungle oats, 500g*	127	Trotters jelly, 40g*
62	Ladies briefs; cotton 90%, spandex 10%;	128	TV aerial
63	Lawn mower/ Grass cutter	129	Vinegar
64	Light bulb; 60 watts	130	Wheelbarrow
65	Liver, per kg (cow)*	131	White Long sleeve
66	Lounge suite	132	Yeast, 10g*
		133	Yoghurt, 100ml*

Source: BOS historical price data

Notes: 1) * indicates a homogeneous product. 2) Paraffin in our sample is sold in retail outlets and not in petrol stations.

Table A2: List of retail outlets in the sample by district

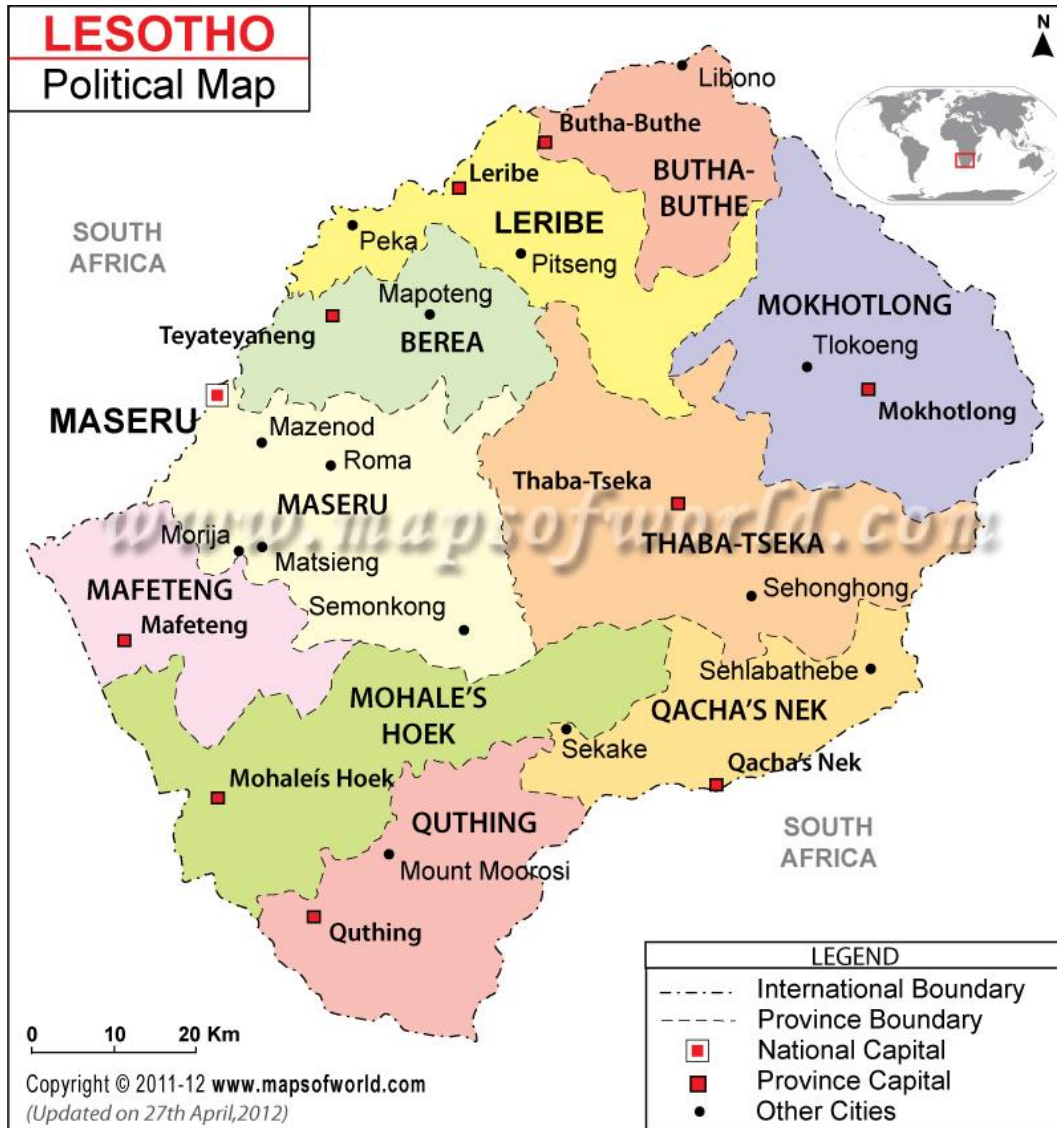
District	Number of outlets	Percent
Maseru	39	15.6
Butha-Buthe	18	7.2
Leribe	27	10.8
Berea	29	11.6
Mafeteng	16	6.4
Mohale's Hoek	23	9.2
Quthing	31	12.4
Qacha's Neck	24	9.6
Mokhotlong	17	6.8
Thaba-Tseka	26	10
Total	250	100

Source: Outlet survey data

Figure A1: Lesotho Map

Source: www.mapsofworld.com

Accessed July 21, 2015



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