Quantitative competition analysis: Stationarity tests in geographic market definition

WILLEM H. BOSHOFF

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WILLEM H. BOSHOFF
DEPARTMENT OF ECONOMICS
UNIVERSITY OF STELLENBOSCH
PRIVATE BAG X1, 7602
MATIELAND, SOUTH AFRICA
E-MAIL: WIMPIE2@SUN.AC.ZA

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WILLEM H. BOSHOFF

ABSTRACT

The paper focuses on the delineation of geographic markets in competition analysis, investigating the use of both quantitative and qualitative evaluation in the market definition exercise. To this end, the first part is devoted to a conceptual framework for market definition (adopted from Haldrup (2003)). Thereafter, a variety of price tests are explored that can be applied within the quantitative part of the framework. Similar to Forni (2004), the paper emphasizes the use of stationarity tests (that is, tests for the existence of unit roots) – illustrating their application to a recent competition investigation in South Africa.

Keywords: Market definition; Delineation; Quantitative; Stationarity tests; Prices; Geographic; SSNIP; Hypothetical monopolist; Competition; Unit root; Price ratio; Antitrust
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1. INTRODUCTION

In the recent investigation of the proposed merger between Sasol and Engen, the relevant geographic market was crucial to the market power arguments of the different parties involved. In fact, the geographic market definition accepted by the South African competition authorities led to their rejecting the merger. Geographic market definition has also been contentious in abuse of dominance investigations, such as the case of Patensie Sitrus Beherend (a former citrus co-operative in the Sondags River Valley) (Competition Commission, 2002).

This paper focuses on the delineation of geographic markets in competition analysis, investigating the use of both quantitative techniques (as proposed by Forni (2004)) and qualitative evaluation in the market definition exercise. Although the product market definition is also included in the earlier part of the discussion, the empirical application focuses on geographic markets[1].

A systematic geographic market definition exercise requires a clear rationale and a conceptual framework. This framework is developed in the next section; a following section elaborates on the quantitative procedures (specifically, tests of price co-movement). Lastly, an empirical demonstration is attempted, based on a recent investigation into alleged abuse of dominance in the South African milk industry at the producer/processor level.

2. CONCEPTUAL FRAMEWORK FOR GEOGRAPHIC MARKET DEFINITION

Competition analysis is geared towards the assessment of market power, regardless of whether the concern is one of horizontal integration, vertical integration or alleged abuse of dominance. However, the measurement of market power usually requires a clear delineation of a relevant market in both product and geographic terms. While the literature has proposed methods for the direct measurement of market power (that is, without defining a relevant market), competition authorities in South Africa and Europe continue to rely on market definition to assess the extent of market power[2]. Consequently, the market definition exercise remains important in achieving the ultimate goal of measuring market power[3].

The focus on market power in competition economics implies that a market for competition policy purposes differs from a general economic market. In competition economics a market constitutes that set of products and that geographic area that can *potentially* be monopolized by the firm under investigation (Geroski (1998: 681); Massey (2000: 324)). This market, in turn, is used to investigate market power, i.e. the firm's *actual* capacity to monopolize. This involves identifying (i) all firms selling potential substitutes for the products of the firm under investigation and (ii) all firms offering these potential substitute products in other geographic areas and reasonably capable of potentially providing the product in regions where the firm under investigation is operating. The focus, as Motta (2005: 102) notes, is on identifying those firms whose operations *constrain* anti-competitive behaviour by the firm under investigation. Products and geographic areas that meet these criteria are included in the product and geographic market respectively.

This notion of the antitrust[4] market is accepted by competition authorities in the United States, Europe[5] and South Africa and is embodied in the so-called SSNIP (small but significant non-transitory increase in price) test used to delineate product and geographic markets in these jurisdictions. The SSNIP test (also known as the hypothetical monopolist test) for market definition is described in the Horizontal Merger Guidelines of the US

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[1] However, recent work by Haldrup and Møllgaard (2005) questions the "sequential" approach to market definition and argues in favour of the simultaneous definition of the product and the geographic market.

[2] This is partly due to lack of sufficient data in most competition cases and partly due to the need to verify results obtained from direct methods against the results of the more traditional methods relying on the definition of a relevant market (Motta, 2005: 101).

[3] Theron (2001) discusses the Structure-Conduct-Performance paradigm used as a guiding framework by South African competition authorities and notes that "[t]he purpose of market delineation is to permit calculation of market shares, which are then used to evaluate market power issues…" (Theron, 2001: 622).

[4] "Antitrust" is the American term for competition-related issues.

[5] However, Copenhagen Economics (a Danish economics consultancy) suggests that the European Commission (EC) has not consistently adhered to the SSNIP framework in the context of geographic market definition – a situation that the EC has apparently sought to remedy (Copenhagen Economics, 2003).

Department of Justice and the Federal Trade Commission (1992: 3):

"A market is defined as a product or group of products and a geographic area in which it is produced or sold such that a hypothetical profit-maximising firm, not subject to price regulation, that was the only present and future producer or seller of those products in that area likely would impose at least a 'small but significant non-transitory' increase in price, assuming the terms of sale of all other products are held constant. A relevant market is a group of products and a geographic area that is no bigger than necessary to satisfy this test".

The SSNIP test represents a thought experiment in which the competition analyst defines the relevant geographic market by considering whether the firm under investigation is capable of maintaining a small price increase of 5%-10% for a twelve-month period (for example) without a reduction in profits. It starts with only the geographic area in which the firm under investigation is operating. If the firm's profits are ultimately adversely affected by the price increase, the geographic market is too narrow. Consequently, a broader geographic market can be defined by including that region from which competition is most likely following the price increase. The thought experiment is repeated and other regions are added until a broad enough geographic market has been defined in which the firm under investigation could raise prices on a profitable and sustainable basis. A similar exercise can be carried out for the delineation of the product market.

(a) Operational versions of the SSNIP test

Given its nature as a philosophical exercise, the SSNIP test must be rendered operational for empirical application. The fundamental problem in converting the SSNIP test to an operational version lies with interpreting this thought experiment incorrectly as a technical statement specifying threshold elasticities for market delineation. Bishop and Walker (1998: 70) argue that the "precise language in which the test is described" may lead competition analysts to infer, incorrectly, that markets should be defined by the size of cross price elasticities alone[6]. Instead, they argue that the SSNIP test is intended to broadly convey the central importance of competitive constraints (from the demand and supply side) in defining competition markets. Therefore, competition analysts should consider a diverse set of evidence when delineating geographic (or product) markets.

In a study on geographic market definition for the European Commission, Copenhagen Economics (2003: 66) has suggested the following framework that integrates different pieces of evidence into a consistent "story":

(i) Initially, descriptive and anecdotal evidence can be used to identify barriers to either demand-side or supply-side substitution. Such evidence may include transport costs, product flows[7] and other qualitative information (Copenhagen Economics (2003: 66); McCarthy and Thomas (2003: 8-9)). Based on the evidence, the competition analyst then defines a hypothetical geographic market.

(ii) Where data availability permits, the accuracy of the initial conclusions should be verified empirically. This may include the estimation of a demand system (to calculate elasticities) or an evaluation of price co-movement (see Massey (2000); Haldrup (2003); Forni (2004)). The latter is of particular importance where data is limited to prices. In such cases, Hosken and Taylor (2004) note that price tests may be useful for market delineation – provided that the tests are part of a larger body of evidence (such as the evidence presented in (i)).

This paper generally focuses on quantitative procedures in market definition (that is, part (ii) of the above framework) and specifically on the use of tests of price co-movement (given that data constraints usually necessitate their use). Therefore, prior to attempting an empirical application of the above framework, the following section considers various forms of price tests.

3. TESTS OF PRICE COMOVEMENT

In hypothesis testing, the choice of a specific test is guided by the question at hand. In this case, the question is whether the geographic market defined in the first part of the preceding framework is appropriate. As noted, data constraints in many situations force the competition analyst to rely primarily on price data. But can price

[6] This does not at all preclude the estimation and use of elasticities, but instead casts the net wider to test the consistency of the evidence from the elasticities against other pieces of economic evidence.

[7] In South Africa, the Competition Commission (2002) has applied the so-called Elzinga-Hogarty test to identify geographic markets in several competition cases. The test is based on the proportion of consumption imported to a region and the proportion of production exported from that region. If any of these proportions exceed arbitrary thresholds, the geographic market definition is considered too narrow – as suppliers from outside the region offer effective competitive constraints on the behaviour of suppliers in the region.

data (or statistical features thereof) be used to verify a geographic market definition?

Stigler and Sherwin (1985) proposed tests of price co-movement for market definition, based on the argument that prices within a single market should converge, allowing for some variability due to transport costs (Stigler and Sherwin, 1985). Haldrup (2003) argues further that the requirement is not that prices in two regions should be equal if the two regions are to constitute a single market. Therefore, the requirement is not one of *absolute* price convergence. Instead, *relative* convergence is required – where price adjustments in one area *affect* price adjustments in the other area.

Critics of the price co-movement approach point out that market definition using tests of price convergence is not consistent with the concept of an antitrust market. Massey (2000: 317-318) points out that while price tests establish whether price series in different locations are "linked", these tests do not verify whether firms have the capacity to raise prices. Consequently, Massey (2000) argues that price elasticities are the only appropriate measures for the purpose of market definition.

Two comments are appropriate here. Firstly, while the elasticity approach may offer superior guidance in defining the geographic market (and may be preferred by US competition authorities (see Hosken and Taylor (2004: 465)), it is not without its own problems. In particular, Forni (2004) offers a detailed analysis of the so-called "cellophane fallacy" encountered when using price elasticities in non-merger competition investigations. Typically, the price elasticity of demand is less than unity for lower prices and greater than unity for higher prices. But at which price should the elasticity be evaluated? Usually current market prices are used. However, in a market where firms possess pricing power, the prevailing price will be above the competitive price. Consequently, the correspondingly higher elasticity (as compared to the competitive situation) will indicate incorrectly that the firm does not have market power. Analysts foreseeing the problem may opt to use a lower price, but such an action leads to circular reasoning. When the purpose of the analysis is to evaluate possible abuse of market power by a firm, the very goal of defining the market is to ultimately *assess* such market power. Hence, any assumption that the prevailing price is too high indicates that the analyst holds a prior view of market power, before it has been confirmed. The name "cellophane fallacy" is derived from the famous US case in which Du Pont, a manufacturer of cellophane, argued, on the basis of a high price elasticity for cellophane, that the material competed with aluminium foil and other packaging in a single market (see Forni (2004: 445-446) and Bishop and Walker (1998: 49)). In addition, and certainly of practical importance, data constraints may prevent the reliable estimation of elasticities.

Secondly, Hosken and Taylor (2004), Genesove (2004) and Massey (2000) argue that geographic market definition based on price co-movement, under very general conditions, could be misleading and that it "requires the economist to have substantial institutional knowledge of the markets studied" (Hosken and Taylor, 2004: 466). Along similar lines, McCarthy and Thomas (2003: 15) point to cases where two regions exhibit significant price co-movement, but supply constraints prevent producers in one region from competing with producers in the other region. Alternatively, they also argue that areas for which price co-movement is not substantial may very well constitute a single market, if one of the regions holds excess production capacity. However, the framework presented earlier addresses these concerns by incorporating several pieces of evidence to ensure a *consistent* set of arguments. More generally, all statistical tests involve the risk of incorrect inferences, but the framework presented here tries to minimize the risk by requiring the results of particular statistical tests to be supported by other qualitative evidence or even, where feasible, alternative statistical tests.

Several time series techniques are available to investigate how the behaviour of a price series in one location affects the behaviour of a price series in another area. Table 1 presents a taxonomy of these techniques:

Table 1: Taxonomy of price tests

Both price series required to have same order of integration		**Price series can have different orders of integration**
Final series I(0) (stationary)	**Final series I(1), I(2), etc.**	
Correlation analysis	Co-integration analysis	Stationarity test of the price ratio

Correlation analysis is frequently used to compare the behaviour of price series in different geographic locations. However, where the original price series are both unit root processes, transforming the series to stationary

versions entails a significant loss of information. In addition to the statistical critique, the literature contains several economic objections – of which two is worth noting here. Firstly, even if the original price series are both stationary, correlation analysis offers no objective benchmark against which the competition analyst may judge whether the price co-movement is significant in an economic sense (Bishop and Walker (1998: 238), Forni (2004: 450)). Secondly, contemporaneous correlation coefficients ignore the possible existence of lagged relationships between two price series (Forni, 2004: 450). Given the statistical and economic criticisms of price correlation tests, co-integration studies have received attention in the market definition literature. While tests of co-integration address the problems cited above, their merit lies in how closely these dynamic tests match the fundamental motivation for using price tests in general, namely to investigate *price convergence* in different geographic areas.

In these analyses, evidence of co-integration is usually considered sufficient proof of price convergence. However, Forni (2004) proposes that it is more prudent to test whether the co-integrating vector of two price series is the vector (1; -1), as this would indicate whether the two regions form a perfectly integrated market. Haldrup (2003), however, notes that a (1; -1) co-integrating vector is not a necessity in defining competition markets, although he points out that such a relationship does have an intuitive interpretation in terms of the price differential. Therefore, testing such a restriction may be useful – especially given that such a restriction test allows the competition economist to circumvent an actual co-integration analysis. Forni (2004) shows that testing for a co-integrating vector of (1; -1) is equivalent to testing whether the log of the ratio of the two price series is stationary (an easier approach which also saves time). Hence, the competition analyst can establish whether the co-integrating vector is (1; -1) by calculating the log of the ratio of the two price series and then applying a conventional unit root test to evaluate stationarity. Apart from its simplicity, Forni (2004) also notes that stationarity tests on the log price ratio are invariant with respect to the use of nominal or real price data.

In their discussion of Forni's proposal of a stationarity test for market definition, Hosken and Taylor (2004) point out that stationarity tests may be misleading when applied to product markets trading in differentiated goods. This is not necessarily applicable to geographic markets, although it is conceivable that a large price movement for a particular good in one small geographic area may not have a material effect on the price of the same good in a very large adjacent area. However, Hosken and Taylor (2004: 469) also highlight the more serious problem of the stationarity outcome being misleading in two situations:

(i) Where a single shock is common to both series[8]. Forni (2004) also suggests that, prior to inferring market singleness from an outcome of stationarity, the series' exposure to common input costs and shocks should be analysed. Although not settling the issue, the framework introduced earlier arguably reduces the possibility of incorrect inferences, given that results from price tests should be consistent with other pieces of qualitative and quantitative evidence.

(ii) Where the original price series are themselves both stationary.

In sum, tests of price co-movement have been criticized in the literature, but continue to be employed by competition analysts due to their simplicity and the data constraints that prohibit more advanced analysis, such as estimation of elasticities. The arguments of the preceding paragraphs are summarized in Table 2, which shows the outcomes of price stationarity tests and their proposed interpretation.

Table 2: Interpretation of stationarity test on the log ratio of prices in two geographic regions

Overall conclusion	Decision
Non-stationary	Separate geographic markets
Stationary	Single geographic market only if: (i) price series of at least one area is non-stationary (ii) price series not subject to common shocks according to other evidence

The following section present an empirical application of the framework for geographic market definition, including price stationarity tests, in a recent South African competition investigation.

4. EMPIRICAL APPLICATION

[8] The problem of common shocks also applies to the correlation statistic. McDermott and Scott (2000) discuss similar problems with the correlation measure traditionally used in business cycle studies.

A proper assessment of the market power held by a particular firm is premised on a correct market definition. In line with US and European measures, the South African Competition Act states that a firm under investigation is assumed dominant if it holds in excess of 45% of the relevant market – and that there is no defence for dominance. Whether such a stringent approach is the correct one is debatable, though it is clear that the delineation of the market is a crucial step (see Theron, 2001: 620-622).

The following paragraphs discuss the application of the market definition framework to an investigation into alleged anti-competitive conduct by a South African dairy processor. The product market was not contentious and was defined as the upstream market for fresh milk between dairy processors and dairy farmers. The following paragraphs discuss evidence[9] considered in the delineation of the geographic market, using the framework presented earlier.

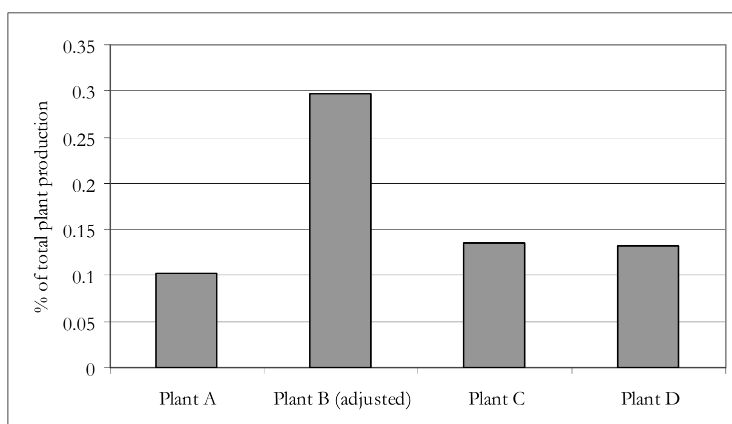
(a) Descriptive evidence on geographic substitutability

The dairy processor owns several processing plants in the southern regions of South Africa. The question, for the purposes of geographic market definition, is whether trade is possible (or, perhaps, even normal) between dairy farmers and dairy processors located in adjacent regions. As noted earlier, it is important that a correct assessment is made, as too narrow a market will overstate the market power of the dairy processor in some of the southern regions[10].

The lack of representative data is arguably the greatest challenge in conducting empirical competition analysis. In this case, no aggregate data on milk flows between different geographic regions are available. However, transfer volumes of fresh milk between four different plants of the dairy processor are available. The size of these milk transfer figures may indicate whether transport costs can be considered a potential barrier to substitutability – offering initial indications of whether the relevant geographic market is defined broadly enough.

Figure 1 shows that, on average, the volumes of milk imported to four different processing plants in the south are negligible for the period 2004-2005. For example, imports to Plant A, the plant which has the highest proportion of milk imports relative to total production, lies at only **0.3%** of total plant production. However, average volumes could be misleading. The average figure for Plant B is calculated by excluding the months of June and July 2004 during which large milk transfers were made from Plant A to Plant B – accounting for 24% and 13% respectively of total production at Plant B for these months. Therefore, while it is safe to conclude that large-scale transfers are not common, occasionally large flows indicate that transport costs may not be prohibitively large so as to prevent milk transfers from taking place between the different southern regions.

Figure 1: Imports from other regions as percentage of production at different plants



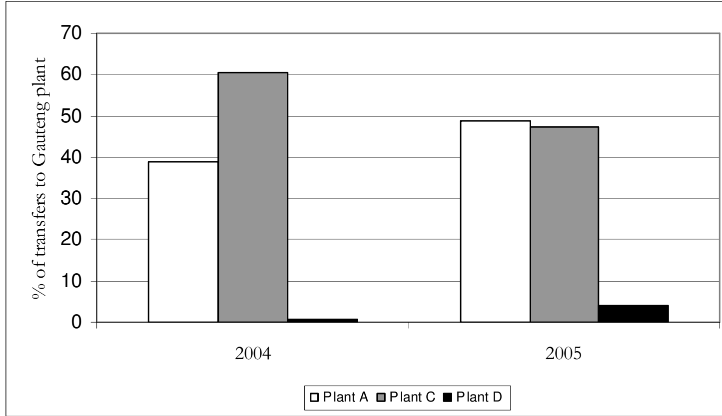
More importantly, the transfer story is quite different for the single northern plant, which the dairy processor owns in addition to its plants in the south. The dairy producer discontinued buying milk in the northern region in June 2003, due to what it considered excessive prices demanded by milk farmers. Subsequently, milk used at the northern plant has been imported from the different southern regions. Figure 2 illustrates the composition of

[9] The confidential nature of the investigation prevents full disclosure of the issues.
[10] There is a bias here, as this firm has an incentive to argue in favour of a broad geographic market.

the southern milk transfers to the northern plant for 2004 and 2005. Plant A and Plant C (who are furthest from the northern plant) have been the main sources for the milk used at the northern plant, indicating that long-distance transport costs are not prohibitively high.

In sum, the consistent milk transfers from the southern regions to the northern plant as well as the possibility of occasional large transfers between the southern regions appear to support the notion of a geographic market that is larger than regional. To test the preliminary hypothesis of a larger geographic market, the price behaviour in different southern regions should be investigated.

Figure 2: Share of selected southern plants in milk transfers to the northern plant



(b) Issues in evaluating milk price ratios

A practical difficulty encountered in a study of milk price behaviour is a lack of representative milk prices, as different processors pay different prices to milk farmers – with such price data for the different competing processors not being freely available. However, SAMILCO, an industry body representing a large portion of dairy farmers in the southern regions, calculates an average monthly milk price for its three constituent regions: Western Cape[11], Southern Cape and Eastern Cape. As noted earlier, unit root tests may be carried out on the log of the ratio of milk prices in any two of these regions to establish whether the particular ratio contains a persistent trend. Mathematically, the log price ratio (r_t^{ij}) between region *i* and region *j* can be described as:

$$r_t^{ij} = \log \frac{P_{it}}{P_{jt}} = \log P_{it} - \log P_{jt} = p_{it} - p_{jt} \qquad (1)$$

where

P_{it} seasonally adjusted[12] milk price in region *i* at time *t*

P_{jt} seasonally adjusted milk price in region *j* at time *t*

$i\,;j$ = {*Western Cape, Southern Cape, Eastern Cape*}, where $i \neq j$

In this case, the log ratios (r_t^{ij}) can be calculated for the following pairs of regions:

(i) Western Cape and Southern Cape (hereafter called the W:S ratio).
(ii) Western Cape and Eastern Cape (W:E ratio).
(iii) Southern Cape and Eastern Cape (S:E ratio).

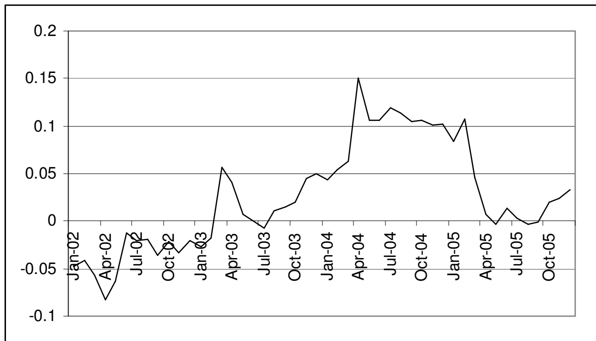
Persistence in any of these ratios will indicate that the particular ratio does not revert to a long-run equilibrium value. However, as Hosken and Taylor (2004) emphasize, the competition analyst should not lose sight of

[11] The Western Cape region does not refer to the Western Cape Province.

[12] Haldrup (2003: 16) notes that seasonal adjustment is particularly important for time series analysis in competition cases – where shorter, *higher frequency* time series are typically used. The US Census Bureau's seasonal adjustment procedure X12 is used. Fok et al (2006) illustrate that alternative procedures, such as the TRAMO/SEATS procedure, perform equally well. The results for this data set based on the alternative procedures support their argument.

institutional details that may alter the conclusion drawn based on these simple tests. This is important in the case of the W:S ratio, presented by Figure 3.

Figure 3: Log of milk price ratio between Western Cape and Southern Cape



At the start of 2004, dairy farmers in the Southern Cape argued that the price differential between the Western and Southern Cape exceeded the transport cost by a significant margin. The farmers subsequently threatened to transport milk from the Southern to the Western Cape region. In response, the processors started adjusting the Southern Cape milk price incrementally each month to address the farmers' concerns. These adjustments were followed by a formal agreement between a prominent processor and its Southern Cape SAMILCO members in December 2005, stipulating "the adjusted Western Cape regional … average milk price shall not exceed the adjusted regional … average milk price for the Southern Cape region plus the cost of transport of milk from the Southern Cape region to the Western Cape region." Arguably, such institutional changes will have altered the dynamics of competition between the Western and Southern Cape regions – creating a single geographic market. This implies that, in this case, the *past* behaviour of the W:S ratio may be misleading. Consequently, this ratio will not be evaluated further.

As the price adjustments have occurred throughout 2005, it is prudent to exclude 2005 when evaluating the stationarity of the W:E and S:E price ratios. This is clarified when plots of these ratios are considered, as presented in Figure 4 and 5. The W:E ratio declines substantially from mid-2004 onwards, while the S:E ratio grows substantially during 2005. Although this is not necessarily due to the agreement, the identification problem requires a conservative approach.

Figure 4: Log of milk price ratio between Western Cape and Eastern Cape

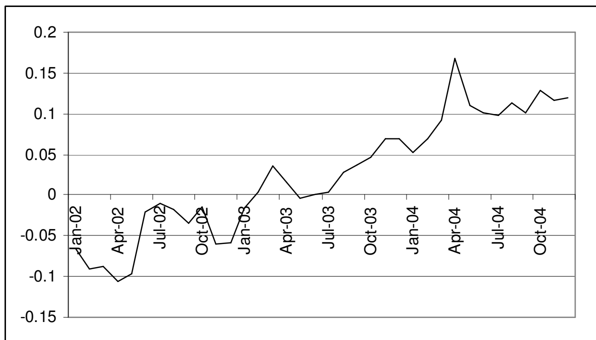
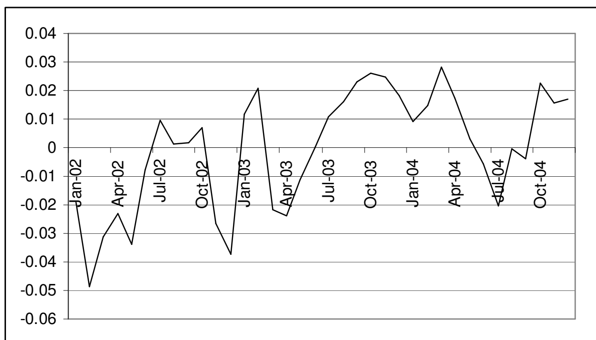


Figure 5: Log of milk price ratio between Southern Cape and Eastern Cape



While these ratios do not appear to be trend-stationary over time, it is difficult to deduce visually whether the ratios are difference-stationary (i.e. whether the ratios contain stochastic trends). Hence, a formal hypothesis test is needed.

(c) Stationarity tests on milk price ratios

Choosing a unit root test involves identifying a test with a low probability of error – i.e. a low probability of committing either a Type I or Type II error when testing the null hypothesis (that the price ratio contains a stochastic trend) against an alternative hypothesis. This amounts to identifying a hypothesis test enjoying good power properties (i.e. a test with a high probability of rejecting the null hypothesis when false). In addition, for a given sample, the actual size (Type I error) should not differ substantially from the nominal size initially selected (say 5% or 10%). As Hosken and Taylor (2004) point out in their critique of Forni (2004), conventional unit root tests such as the augmented Dickey-Fuller (ADF) and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) tests suffer from severe size distortions. This observation is representative of a general conclusion in the econometric literature that traditional tests for detecting stochastic trends face severe small sample problems. In fact, in their renowned book on the problems encountered in unit root testing, Maddala and Kim (1998: 92) argue that "[a]lthough often used, the DF [and] ADF … tests lack power against meaningful alternatives and should not be used any more".

The past decade has seen a plethora of attempts to address the size distortion in traditional unit root tests, including the introduction of modified information criteria to ensure optimal lag length selection. A very important strand of the literature also aims to estimate the "nuisance" parameters causing the size distortions. A set of tests that have been shown to have superior size and power properties are the modified versions of the Phillips-Perron (PP), Bhargava (B) and Elliott-Rothenberg-Stock (ERS) unit root tests proposed by Ng and Perron (2001). This paper does not discuss the technical detail of the Ng and Perron (2001) tests, but a fairly complete review is provided in Haldrup and Jansson (2006). Some applied econometric packages (such as Eviews 5) already provide functionality to run these tests.

This paper applies the different Ng and Perron (2001) tests – comparing the results to ensure a more robust conclusion. This is akin to the approach adopted by Forni (2004), but Maddala and Kim (1998: 126-128) argue that such "confirmatory data analysis" may be less helpful than it appears. In particular, they present evidence that the proportion of correct inferences is low for the conventional unit root tests where the true DGP is stationary. Table 3 presents the inferences from unit root tests where lag lengths are based on modified information criteria (as proposed by Ng and Perron (2001) and Perron and Ng (1996)):

Table 3: Outcomes of unit root tests (non-rejection reported at 10% significance level) for 2002-2004

Price ratio	MZ_a	MZ_t	MSB	MP_T
W : E				
1 lag	Reject***	Reject***	Reject***	Reject***
2 lags	Reject***	Reject***	Reject***	Reject***
3 lags	Reject***	Reject***	Reject***	Reject***
6 lags	Do not reject	Do not reject	Do not reject	Do not reject
S : E				
1 lag	Reject**	Reject**	Reject**	Reject**
2 lags	Do not reject	Do not reject	Do not reject	Do not reject
3 lags	Reject***	Reject***	Reject***	Reject***
6 lags	Reject***	Reject***	Reject***	Reject***

*** Significant at 1% level ** Significant at 5% level * Significant at 10% level

The results in Table 3 support the conclusion that the W:E log price ratio is stationary, given consistent rejection of the null hypothesis that the series contains a unit root. Although the test is not rejected from lag length of six onwards, these non-rejections are the result of a natural loss of power due to the sub-optimal lag choices (and not due to the specific structure of the test). Similarly, the S:E log price ratio also appears to be stationary. The peculiar non-rejection at a lag length of two is a sobering reminder that although these tests have improved power properties they are certainly not perfect. In particular, the size of the sample (thirty-six data points) probably contributes to the problem.

(d) Summary

The price tests provide substantial support for a larger market in the south. However, as argued earlier, common

shocks (and not competition dynamics) may be the source of the co-movement. Within the framework presented earlier, these price test results *combined* with other qualitative evidence on the SAMILCO agreement and on product flows support the identification of at most two markets in the south – one in the Western Cape / Southern Cape and one in the Eastern Cape. Nonetheless, either of these conclusions results in a market share for the company under investigation of below 45% – weakening the allegations of dominance and market power abuse against it.

5. CONCLUSION

This paper has argued that incorporating several forms of qualitative and quantitative evidence serves to reduce errors in the market definition exercise. In particular, the application of stationarity tests on price data shows that quantitative evaluation can be a powerful tool in competition analysis. While data challenges may prevent more involved quantitative approaches, simple price tests can help to justify the proposed market in competition investigations.

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