A Disaggregated Analysis of Product Price Integration in the Southern African Development Community

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Abstract

Empirical evidence on the extent to which product markets are integrated within Africa remains noticeably limited. In particular, very limited attention has been afforded to price-based analyses of product market integration on the continent, especially in the case of markets within the Southern African Development Community (SADC). This paper addresses the lack of price-based studies using highly disaggregated retail price data for 32 products collected at the district level in five SADC countries (Botswana, Malawi, South Africa, Tanzania, Zambia) and Uganda to assess the extent to which product prices are integrated within and between these countries. We find evidence that product prices are dispersed both within and between each of the six African countries. This is reflected in large and persistent absolute deviations from the law of one price (LOP). We also find that price dispersion is higher across markets between the sampled countries in comparison to across markets within individual countries. There is also evidence of considerable heterogeneity in price dispersion across the sampled products. The results from simple econometric estimates indicate that, on average, absolute price deviations between country pairs are smaller for countries adjacent to each other and for SADC countries that share common membership in the Southern African Customs Union, the Common Market for Eastern and Southern Africa or the East African Community. We find that, relative to the SADC group as a whole, product prices have become more integrated over time between country pairs that share membership in these regional trade and monetary groupings. However, across all six countries, the level of dispersion in product prices is found to have grown between 2001 and 2011. The findings have important implications for the ongoing debate on regional integration in Africa.

KEY WORDS: Product market integration, Price Dispersion, Retail Prices, Law of One Price, African Regional Integration, Southern African Development Community.

JEL Codes: F14, F15

1. Introduction

On the surface, significant progress has been made over the past two decades in advancing the broader vision of regional integration in the Southern African Development Community (SADC). This has been evident in notable reductions in tariffs on intra-SADC trade; a process that has accelerated in the past decade with the introduction of the SADC Protocol on Trade. Under the terms of the Protocol, which was designed to reduce or eliminate the factors that inhibit intra-regional trade, the twelve participating SADC Member States agreed on schedules to phase down tariff barriers over a twelve-year period beginning in 2000.

As the tariff phase down period initially envisaged through the SADC Protocol on Trade draws to a close, one way to gauge the effectiveness of the trade liberalisation process is to examine whether the tariff reductions have been accompanied by more integrated product markets in the region. Higher levels of product market integration can have important welfare implications by strengthening competition and altering the boundaries for which goods can be traded. From a consumer perspective, stronger competition stemming from more integrated markets means that consumers benefit from lower prices and access to a wider array of goods and services. At the same time, as product markets become more integrated firms are likely to face increasing incentives to improve their productivity and competitiveness, while also benefiting from a wider range of suppliers or distributors from which to source inputs into production. Furthermore, the presence of well-integrated markets is likely to afford firms access to a significantly larger market in which to sell their products and services. This is particularly relevant in the SADC context given the generally small size of individual country markets in the region. Finally, better-integrated markets may be more resilient to economic shocks and, thereby, contain the impact of adverse shocks on economic growth and employment.

One way to assess the extent to which product markets are integrated is to examine the volume of trade flows between markets. Existing studies analysing intra-African trade flows (as well as other quantity-based measured of integration) have typically concluded that African product markets are fragmented. In the case of SADC, the volume of intra-SADC trade remains relatively low and trade flows within the region are highly concentrated both in terms of product coverage (the majority of intra-SADC trade occurs in the form of trade in resource-based products) and the reality that intra-regional trade is dominated by trade between the Southern African Customs Union (SACU) countries. Despite this, levels of intra-SADC trade have been

rising gradually. Moreover, while intra-SADC trade flows remain comparatively small in absolute terms, the level of trade between SADC countries is actually relatively high when the geography of the region and the limited size of its individual markets are taken into account, suggesting that the SADC region is actually quite integrated (Behar & Edwards, 2011).

Importantly, however, diagnoses of the level of market integration based solely on the volume of trade flows between countries can be misleading since trade volumes may be an endogenous outcome of market integration, and are also influenced by unrelated factors such as government expenditure, exchange rates and donor funding (Edwards & Rankin, 2012). Fortunately, market integration can also be measured along a number of alternative dimensions, including the behaviour of relative prices or price levels (Knetter & Slaughter, 2001). Among these alternatives, the use of techniques that measure price differentials between countries is increasingly favoured in analyses of product market integration. Prices should provide a good indication of changes in product market integration, even in cases where trade does not occur, since the potential for arbitrage is the key driver in determining the extent to which prices diverge (Parsley & Wei, 2002). According to Bradford and Lawrence (2004), analysing price differentials is "the most plausible" method to capture the effects of 'invisible barriers' to trade and market integration.

In the empirical literature, the vast majority of price-based analyses of product market integration have focused on industrialised countries. In contrast, only limited attention has been given to this area in the context of developing countries. In particular, very few price-based analyses of product market integration in Africa have been undertaken, especially in the case of markets within the SADC region. This has been primarily due to data limitations – particularly related to a lack of high-frequency data on narrowly defined goods – which have precluded research on product price dispersion and product market integration across African countries.

This paper draws on newly available microeconomic data to addresses the lack of price-based studies of product market integration in Africa. Specifically, the paper uses highly disaggregated retail price data collected at the district level for a selection of five SADC countries (Botswana, Malawi, South Africa, Tanzania and Zambia) and Uganda to assess the extent to which product prices are integrated within and between these countries. By providing a descriptive analysis of product price integration in SADC using disaggregated data on actual retail product prices, the paper presents new empirical evidence on the extent to which product markets are integrated in

the region. Such an analysis is particularly pertinent in the African context, and more generally in developing regions, where transport costs and other market rigidities – stemming from factors such as poor infrastructure, regulatory barriers and inefficient border controls that hamper the flow of goods – may serve to segment markets. In this respect, it is reasonable to expect that price dispersion may be larger in Africa in comparison to other regions.

The empirical results indicate that product prices are dispersed both within and between each of the six African countries. This is reflected in large (relative to evidence in other empirical studies) and persistent absolute deviations from the law of one price (LOP). Corroborating the general findings in the international literature, the dispersion in product prices is found to be substantially greater between the different African countries when compared to price dispersion across districts within the same country.

There is also considerable heterogeneity in price dispersion across the sampled products. In general, price dispersion between countries is found to be higher for clothing and textiles and machinery, equipment and electronics products in comparison to food products and the other products group (which includes brandy, cigarettes, paraffin, lounge suite, newspaper and shoe polish). This is consistent with evidence in the empirical literature of larger deviations from the LOP among products that use more non-tradable inputs in production.

The results from simple econometric estimates presented in the paper indicate that, on average, absolute price deviations between country pairs are smaller for countries adjacent to each other and for SADC countries that share common membership in SACU, COMESA or the EAC. They also reveal that, relative to the SADC group as a whole, product prices have become more integrated over time between country pairs that share membership in these regional trade and monetary groupings. That said, across all six countries, the level of dispersion in product prices is found to have grown between 2001 and 2011.

The remainder of the paper is structured as follows. Section 2 outlines the basic theoretical concepts that underpin the analysis of product price integration presented in this paper. This is followed in Section 3 by a discussion of the key findings in the empirical literature on price dispersion and product market integration. Section 4 provides a detailed explanation of the main features of the price data used in the analysis of product price integration. Thereafter, the conceptual framework and empirical methodology that forms the basis of the descriptive analysis

is outlined in Section 5. Section 6 presents the results from the analysis of product price integration, and Section 7 concludes.

2. Theoretical Background

In theory, progress towards greater market integration should be reflected in lower price differentials for similar products across markets. This assertion is derived from the theoretical benchmark of the law of one price (LOP), which states that for any good *i*:

$$P_i = EP_i^* \quad (1)$$

where P_i is the domestic currency price, E is the home currency price of foreign currency and P_i^* is the foreign currency price.

In essence, the LOP implies that identical goods should sell for the same price (when measured in a common currency) in different countries. The equalization of prices across markets suggested by the LOP is underpinned by a zero-arbitrage-profits principle (Ghemawat, 2001). In the absence of barriers to arbitrage between markets, buyers faced with the option to purchase similar goods in different markets will purchase a good from the market in which it is priced the lowest, subject to the cost of transportation to their home market (Bradford & Lawrence, 2004). Thus, arbitrage forces should ensure that prices for similar goods converge across well-integrated markets, as the absence of such convergence would entice buyers to purchase equivalent goods at a lower price in a different market (Knetter & Slaughter, 2001; Rogers & Smith, 2001; Parsley & Wei, 2002; Engel et al., 2005; Bradford & Lawrence, 2004). In this context, market integration is expected to reduce the size of deviations from the LOP and mean that countries face more similar relative prices for traded goods (Knetter & Slaughter, 2001).

In practice, however, a variety of factors may lead to deviations from the LOP, reflected in dispersion in the prices of similar goods across locations. Price dispersion may arise due to the presence of direct barriers to arbitrage or as a result of market- or firm-specific characteristics. With respect to the former, distance between locations is one of the most widely cited barriers to arbitrage in the theoretical literature (Dumas, 1992; Engel & Rogers, 1996; Crucini et al., 2005a; Bergin and Glick, 2007). The gravity model of trade suggests that relative price volatility should increase with distance. Transportation costs, as well as costs associated with market discovery and network creation are all expected to rise as distance between markets increases (Anderson, Schaefer & Smith, 2013). In addition, markets that are more geographically dispersed are likely to

face less similar cost structures, which may be reflected in important differences in the relative prices of non-traded services and relative productivity, leading to greater dispersion in product prices (Engel & Rogers, 1996). On the other hand, demand shocks may be correlated geographically, resulting in lower price dispersion between markets situated in close proximity (Anderson, Schaefer & Smith, 2013).

Differences in market characteristics can also generate price differentials across locations. For instance, variation in income levels, language and cultural differences, or heterogeneity in the density of ethnic networks across markets may generate price dispersion. Furthermore, heterogeneity in demand conditions across markets may be reflected in differences in the size of good- and location-specific mark-ups over cost. Similarly, differing levels of competition in individual markets may result in the application of different profit margins by firms in each market, leading to dispersion in prices for otherwise identical goods.

Other market- or firm-specific factors may also drive a wedge between product prices in different markets. For instance, variation in factor prices across markets or firms – such as rental costs or differences in relative wages paid to labour – may result in product price differentials. Differing sales taxes or retail productivity gaps arising from differences in physical capital employed in retail sectors may have similar effects (Crucini & Yilmakaduz, 2013). Variation in costs of resale across markets (which are expected to decline relative to other costs in an economy as market integration increases) may create opportunities for firms to exploit. These factors may encourage firms to engage in price discrimination or to adopt pricing-to-market strategies and charge dissimilar prices for the same product in different markets.

Importantly, for a variety of reasons, the magnitude of barriers to arbitrage and the size of variation in market-specific characteristics may be magnified in the case of markets located in different countries in comparison to those situated within the same country. For instance, additional transaction costs generated by the presence of political boundaries may hinder arbitrage and drive a wedge between prices in different countries. These transaction costs may take the form of direct costs stemming from barriers to trade (such as tariffs or quotas), non-tariff barriers (such as bureaucratic red tape) and other trade restrictions (Rogoff, 1996; Engel & Rogers, 1996; Rogers & Smith, 2001; Borraz, 2006); or non-pecuniary transaction costs such as exchange rate risk (Anderson, Davies & Smith, 2012). Alternatively, the influence of national borders in inhibiting arbitrage and generating price dispersion may arise from domestic policies

that discriminate against foreign goods, either directly or inadvertently. In this sense, hidden barriers such as subsidies, lax antitrust enforcement, health and safety standards and regulations or cumbersome customs procedures may be present across countries.

There is also likely to be greater heterogeneity in tastes, language, culture or social networks across locations in different countries in comparison to locations within a country, which can serve to segment markets and contribute to price dispersion across countries (Rogers & Smith, 2001; Bradford & Lawrence, 2004; Borraz, 2006; Aker et al., 2010). Similarly, there may be higher levels of heterogeneity in price mark-ups or relative productivity shocks between cities located across national borders in comparison to more homogenous locations within a country, leading to greater cross-border price dispersion (Engel & Rogers, 1996).

It is also plausible to assume that levels of integration and homogeneity in labour markets or distribution networks will be higher within, as opposed to across, countries (Rogers & Smith, 2001; Borraz, 2006). Moreover, markets for non-traded services such as marketing may be more highly integrated within countries than across countries separated by a border. Differences in the share of non-traded inputs used in production can lead to variation in relative prices for otherwise similar products (Crucini et al., 2005b).

Finally, nominal exchange rate variability in cases where final goods prices are sticky in local currency terms and do not adjust optimally to nominal exchange rate fluctuations will generate movements in the good-level real exchange rate and cause cross-border prices of similar goods to fluctuate in line with the exchange rate, resulting in greater price dispersion across countries than within countries (Engel & Rogers, 1996; Rogers & Smith, 2001; Engel et al., 2005; Engel & Rogers, 2004; Borraz, 2006). Price stickiness is likely to be a function of the level of market segmentation and higher where markets are more separated (Engel & Rogers, 1996).

3. Empirical Literature

3.1 Aggregate purchasing power parity studies of price dispersion and market integration

Increasing focus has been placed in the empirical literature on the use of price-based metrics to measure goods market integration. Much of the early focus involved studies using price indices to test for aggregate purchasing power parity (PPP), either in absolute or relative terms. A

number of these studies find that, in the long-run, real exchange rates tend towards PPP; and that there is significant variation in product prices around their long-run PPP means, with evidence of large and volatile short-run deviations from PPP (Frenkel, 1981; Krugman, 1987; Wei & Parsley, 1995; Rogoff, 1996; Asplund & Friberg, 2001). On balance, the price-based evidence stemming from these studies suggests that consumer goods prices remain dispersed internationally and have not converged to the extent expected given the level of globalization in the world economy (Rogoff, 1996; Rogers & Smith, 2001). Furthermore, the evidence suggests that where convergence in prices has occurred, it has happened at a slow pace.

In seeking to explain the observed volatility and persistence of PPP deviations, a large body of empirical studies have utilised CPI data to estimate and explain cross-border price differentials. While these studies typically find that distance between locations affects the variability of prices, they also tend to find that distance alone cannot account for the observed price differentials across markets (see for instance Engel & Rogers, 1996; Rogers & Smith, 2001). Beyond the role of distance, a central finding in many studies comparing differences in price dispersion between markets located within the same country with dispersion in prices between markets separated by an international border is that international price dispersion significantly exceeds intra-national dispersion in prices. Focusing primarily on industrialised countries, this has been demonstrated empirically through greater variability in relative prices between locations in different countries in comparison to across locations in the same country, even after accounting for the distance between markets and other location-specific factors (Engel, 1993; Rogers & Jenkins, 1995; Engel & Rogers, 1996; Engel & Rogers, 2000; Rogers & Smith, 2001).

The initial focus on aggregate price levels in the empirical literature was primarily due to a lack of disaggregated data on actual product prices. Importantly, however, studies that rely on price indexes to analyse price dispersion suffer from a number of shortcomings. At a fundamental level, price indexes can only be used to compare rates of inflation across locations and not to examine differences in price levels (Engel et al., 2005).[1] Moreover, given that CPI data typically provides prices of sub-indexes of fairly broad categories of goods, which may not be standardized across countries, evidence of dispersion in relative prices between countries based on price index data may reflect variation in the product and quality composition of the indices, rather than actual price differences for common products (Burstein & Jaimovich, 2012).

[1] In studies based on price index data, volatility in relative prices (measured as the standard deviation of the log of relative prices between two markets or locations) is most commonly used to measure price dispersion. Greater volatility in relative prices across locations is indicative of markets that are not well integrated.

Additionally, the use of price indexes can induce aggregation bias and overstate cross-country dispersion in relative prices by collapsing within-country volatility in relative prices and preserving the variation arising from cross-country differences (Evans, 2001; Broda & Weinstein, 2008; Chahrour & Stevens, 2012). Finally, when price index data is used, it is not possible to conclude whether observed changes in deviations in relative prices signify price convergence or divergence across countries unless PPP holds in the base year (Rogoff, 1996; Knetter & Slaughter, 2001; Edwards & Rankin, 2012).

3.2 Empirical evidence on the LOP across markets within and between countries

In contrast to price index data, the use of disaggregated product-level price data in studies of price dispersion confers a number of advantages. Goldberg and Knetter (1997) stress that it is necessary to use product-level price data to properly understand LOP deviations. Fundamentally, the use of disaggregated data on actual product prices allows for a comparison of differences in the price *levels* of homogenous goods across locations. This makes it possible to measure price dispersion in terms of absolute deviations from the LOP. It also means that it is possible to account for potential heterogeneity across products in empirical analyses of price dispersion.

Recognising the limitations of price index data in comparison to disaggregated price data, there has been a clear shift in the empirical literature towards studies that use microeconomic data on actual product prices to analyse cross-border price dispersion. Several studies covering a large number of countries have shown that global price dispersion has been uneven over time (Knetter & Slaughter, 2001; Bergin & Glick, 2007). For instance, in analysing price dispersion across a sample of 70 countries Bergin and Glick (2007) find that global price dispersion has followed a U-shaped pattern over the period between 1990 and 2005. Knetter and Slaughter (2001) observe that dispersion in relative prices across markets may differ based on whether markets are located in developed or developing economies. Specifically, the authors find that relative prices tend to be more similar across markets in developed economies, while there is evidence of both convergence and divergence in relative prices across their sample of developing economies.

There is widespread evidence documenting failures in the LOP in studies that use disaggregated product price data (see for instance Isard, 1977; Richardson, 1978; Giovanni, 1988; Froot, Kim and Rogoff, 1995; Parsley & Wei, 2002; Engel et al., 2003; Crucini et al., 2005b; Bergin & Glick, 2007; Crucini & Telmer, 2012; Cavallo, Neiman & Rigobon, 2013). This is reflected in findings

of wide dispersion in product-level real exchange rates within and between countries, and large and persistent deviations in product prices across locations. Engel et al. (2005), for instance, find a 7% difference in price levels across cities in the United States and Canada using actual product price data. They find that the observed price differences are evident in the case of both tradable and non-tradable goods.[2]

Crucini et al. (2005a), use microeconomic data on retail prices for 220 individual goods and services across 122 cities located in 79 countries and find that even after accounting for distance (as a proxy for trade costs) there is large variability in relative prices across goods markets. For their part, Cavallo, Neiman and Rigobon (2013) use online prices for identical traded goods and find large deviations from the LOP between countries outside of currency unions, even in cases where the nominal exchange rate is pegged. Furthermore, in a large cross-country study that draws on retail price data for 200 goods and services across 142 cities internationally (covering all continents except Antarctica), Anderson, Davies and Smith (2012) estimate a mean absolute price differential (over all goods and location pairs) of 0.56. Even when OECD countries are considered in isolation, the authors estimate mean price dispersion to be 0.44. By comparison, their estimates of mean price dispersion are notably smaller (at roughly 0.30) when measured over city pairs located in the same country.

The finding that dispersion in product prices is greater between markets located in different countries than across markets *within* the same country is replicated consistently in the empirical literature. Echoing the consensus in studies using CPI data, this is found to hold in studies based on disaggregated price data, which document evidence of larger price deviations across locations between countries (see for instance Engel et al., 2003; Crucini et al., 2005a; Gopinath et al., 2010; Crucini, 2013). Furthermore, Burstein and Jaimovich (2012) find that when measured in a common currency, changes in product prices are more correlated within countries than between countries. Similarly, some studies have found evidence of much greater volatility in product-level real exchange rates when compared to volatility in nominal exchange rates, which is suggestive of the segmentation of markets internationally (Broda & Weinstein, 2008; Burstein & Jaimovich, 2012; Gopinath et al., 2010).

[2] Price dispersion also seems to be present in the case of ex-factory prices. Using producer price data for goods across Organisation for Economic Cooperation and Development (OECD) countries, Bradford and Lawrence (2004) find considerable differences in producer prices across national markets, even in the presence of low tariffs. In adjacent countries in Europe and North America, the authors find that producer prices for comparable goods tend to differ by as much as 20%; while in the case of countries located on different continents, the price differential can range between 30% and 50%.

A growing number of studies have sought to identify the sources of dispersion in retail prices across markets using disaggregated price data. Most studies find that traditional trade costs (mostly proxied by distance) contribute to dispersion in product-level retail prices across markets (Bradford & Lawrence, 2004; Edwards & Rankin, 2012; Zachariadis & Inanc, 2012; Anderson, Schaefer & Smith, 2013; Crucini & Yilmazkuday, 2013; Kano, Kano & Takechi, 2010). However, several studies have found that the size of the distance effect is small and not economically significant (see for instance Engel et al., 2005; Bergin & Glick, 2007; Broda & Weinstein, 2008; Inanc & Zachariadis, 2009). However, the results documenting an economically small distance effect have been questioned in some recent studies, which argue, and demonstrate, that by not properly accounting for the spatial relationship between production and consumption these estimates are likely to be biased downwards; and, thereby, underestimate the role that transportation costs play as a determinant of price dispersion and LOP deviations across markets (Anderson, Schaefer & Smith, 2008; Kano, Kano & Takechi, 2010).[3]

Many empirical studies using disaggregated price data have also found that national borders contribute to price dispersion (Bradford and Lawrence, 2004; Crucini et al., 2005a; Bergin & Glick, 2007; Parsley & Wei, 2007; Crucini & Shintani, 2008; Crucini, Shintani & Tsuruga, 2008; Aker et al., 2010; Gopinath et al., 2010; Crucini & Yilmazkuday, 2013). It is generally accepted that borders can impose additional costs or barriers to trade that generate cross-border product price differentials and may segment markets.

At the product level, the extent of price dispersion across markets may depend on the nature of the product in question. Specifically, the production composition of goods and their tradability may influence price dispersion. For instance, Crucini et al. (2005b) demonstrate empirically that the size of LOP deviations is larger for less tradable goods and for goods that use more non-tradable inputs in production. The authors find that price dispersion is around 10% higher among non-tradable goods. They also find that cross-country dispersion in prices is higher for services and for goods such as alcohol and tobacco which are typically subjected to additional taxes.

[3] Anderson, Schaefer and Smith (2008), for example, argue that bilateral measures of price dispersion are only instructive in estimating distance-related trade costs if they properly account for the spatial relationship between production and consumption.

At the same time, other factors may serve to reduce cross-border product price dispersion. Anderson, Davies and Smith (2012), for instance, find that price dispersion is lower between international locations that share information-sharing ethnic networks. Focusing on more tangible factors, some studies using disaggregated price data have found that common membership in trade and monetary agreements may reduce product price dispersion across locations in different countries (see for instance Parsley & Wei, 2002; Engel & Rogers, 2004; Goldberg & Verboven, 2005; Bergin & Glick, 2007; Rogers, 2007; Cavallo, Neiman & Rigobon, 2013). Parsley and Wei (2002) show empirically that institutionalized currency arrangements – such as common participation in a currency union or a currency board – are associated with reduced price dispersion across international cities. More recently, using daily online retail prices for products sold by four major international retailers, Cavallo, Neiman and Rigobon (2013) find that the LOP holds within currency unions across a diverse range of products (which contrasts starkly with their finding of large deviations from the LOP outside of currency unions). In terms of trade groupings and arrangements, Bergin and Glick (2007) observe that price dispersion declines when countries participate in a regional trade agreement.

3.3 Price dispersion and product market integration in Africa

What is evident from a review of the empirical literature is the relative lack of studies on price integration in Africa. A number of previous studies on price integration on the continent have tested for the presence of long-run relative PPP using aggregate data (Holmes, 2000; Nagayasu, 2002; Bahmani-Oskooee and Gelan, 2006; Chang et al., 2006). Despite producing mixed results, these studies generally find support for increased price integration within Sub-Saharan Africa (Edwards & Rankin, 2012).

To date, however, very little research has been undertaken to investigate product market integration in Africa using disaggregated product price data. One exception is a study by Aker et al. (2010), who use disaggregated monthly price data for two commodities (millet and cowpea) to assess product market integration across the border between Niger and Nigeria. The authors find increased price dispersion in markets for millet and cowpea across the international border between these two countries.

Another recent and important study that has made an initial contribution towards extending the literature to Africa is Edwards and Rankin (2012). The authors assess product market integration

using disaggregated retail prices for more than 200 products across 13 African cities; first using absolute and relative measures of price dispersion, before undertaking an econometric analysis to identify domestic, regional and global factors that have contributed to product market integration in Africa. The authors find evidence of increased product market integration on the continent. Specifically, they find that over the past two decades product price dispersion fell at the retail level amongst their sample of African cities, although much of the decline was concentrated in North Africa during the early 1990s. The authors' econometric estimations reveal that trade costs – proxied by distance and most favoured nation tariffs – are the dominant sources of price dispersion; while also indicating that external forces in the form of global trends in price dispersion are important determinants of relative price variability.

While these studies have made an important initial contribution in extending the literature on product market integration to Africa, at this juncture very little is known about product price dispersion both within and between countries on the continent. In addition, there remains a lack of knowledge on the impact of mechanisms designed to enhance regional integration – such as regional trade and monetary agreements – on product price integration in Africa. Addressing the paucity of empirical studies on product market integration in Africa, and the SADC region in particular, this paper extends the literature through a descriptive analysis of product market integration using highly disaggregated data on actual product prices. In doing so, the main contribution of the paper is to provide empirical evidence on whether the key stylised facts in the burgeoning literature on price dispersion and market integration (as outlined above) hold in the African context.

Furthermore, the use of disaggregated retail price data in this paper presents a number of advantages over previous studies of product market integration, both in Africa and elsewhere, that are based on price index data. In this respect, by drawing on disaggregated data on actual product prices in five SADC countries and Uganda, it is possible to provide an empirical analysis of absolute deviations from the LOP, and which is able to account for possible heterogeneity across products when assessing product market integration in Africa. As a result, the paper provides a tighter and more nuanced descriptive analysis of product market integration in comparison to previous studies that are based on aggregate price index data. In this way, the paper expands the available evidence on product market integration in Africa, and the SADC region in particular. This, in turn, makes an important contribution to the debate on regional integration on the continent.

4. Data Description

To measure dispersion in product prices across the SADC region, this paper utilises highly disaggregated retail price data collected at the district level in Botswana, Malawi, South Africa, Tanzania, Zambia and Uganda (the latter is included as a control). In the case of each country, the data represents the underlying product price data that is used in the computation of the country's CPI. The raw data provides monthly observations for prices of a range of narrowly defined products, with the prices reported as average prices in individual districts. Importantly, for each country, the raw prices include value added tax (VAT) and, in the case of certain products, excise taxes as well. To aid comparability across countries, the prices used in the empirical analysis are recalculated net of VAT.[4] However, in the case of a small number of products (such as cigarettes and brandy) the excise taxes remain where applicable.

The fact that the disaggregated data exploited in this paper represents retail prices (rather than producer or wholesale prices) is advantageous. According to Hillberry and Hummels (2003), analyses of price dispersion that rely on business-to-business data may underestimate price differences within countries. In contrast, retail price data allows for tighter predictions on absolute and relative price movements in the case of consumer products (Edwards & Rankin, 2012).

Furthermore, the organisation of the data along narrowly defined product descriptions means that it is possible to compare prices for highly similar products across countries. To obtain a dataset of comparable products across all six countries that are as close to homogenous as possible, a comprehensive system of new product and unit codes was developed, which was then used to map unique product and unit codes to each of the original product and unit combinations in the individual country raw price datasets. The mapped datasets were then merged, and the resulting combined cross-country dataset was collapsed to include only observations for common products and units across all countries.

The final dataset constructed through this process, which was used in the empirical analysis of price dispersion presented in this paper, includes monthly price observations for 32 narrowly

[4] There is some variation in VAT rates across and within countries across the sample period. Across countries, VAT rates ranged from 10% in Botswana and 14% in South Africa to highs of 17.5% in Zambia, 18% in Uganda and 20% in Malawi and Tanzania in particular sub-periods.

defined products spanning the period from December 2001 to August 2012 (see Table A in the Appendix for a full list of the individual products and their units of measurement). Table 1 outlines the time, product and district coverage of the sample by country. Importantly, there is significant heterogeneity in the time span of the data across countries, as well as in the number of districts for which price data is available in each of the six countries. For instance, the Zambian product price data spans nearly 11 full years, while data is only available for significantly shorter periods in the cases of Botswana and Tanzania. Across all six countries, the overlapping time period in the combined dataset extends from September 2006 to December 2009. In turn, the district coverage ranges from 46 districts in Botswana and 42 in Zambia to 15 in Malawi and 8 in Uganda (the Tanzanian data is only available at the national level).[5]

Table 1: Time, district and product coverage, by country

Country	Timeframe	Number of Districts	Number of Products
Botswana	September 2006 – December 2009	46	32
Malawi	January 2002 – December 2011	15	32
South Africa	December 2001 – December 2010	25	29
Tanzania	June 2004 – September 2010	national	27
Uganda	July 2005 – August 2012	8	21
Zambia	January 2001 – November 2011	42	32

Notes: The Tanzanian data represents national average prices by product. Price data is missing in the Tanzanian dataset for the months of August and September 2006.

The 32 products included in the cross-country dataset cover a diverse range of product categories. In broad terms, these include foods; clothing and textiles; machinery, equipment and electronics; other products; and services. More specifically, the full range of product categories includes fruits (3 products); vegetables (4 products); fats and oils (1 product); cereal products (1 product); alcoholic beverages (1 product); tobacco products (1 product); girl's clothes (1 product); women's clothes (1 product); women's underwear (1 product); boy's clothes (1 product); men's clothes (3 products); linen and household fabrics (2 products); photography equipment (1 product); audio-visual equipment (2 products); household appliances (3 products); furniture (1 product); household consumables (1 product); household utilities, fuel and power (1 product); print media (1 product) and personal and healthcare services (2 services). One important advantage of the diverse coverage of products in the data is that it allows for an investigation of whether price dispersion in the SADC region differs according to product type.

[5] Importantly, the potential influence of the variation in district coverage across countries is mitigated through the use of country average prices (calculated annually across all districts) in the price dispersion calculations (see Section 5).

In addition to the diverse product coverage in the data, the country coverage presents another advantage that can be exploited in the cross-country analysis. The membership of the six countries included in the dataset in multilateral trade arrangements spans a number of different regional trade groupings: SADC, SACU, the Common Market for Eastern and Southern Africa (COMESA), and the East African Community (EAC). At least two of the six countries are members of each of these regional trade groupings. Furthermore, there are a number of examples of overlapping membership in which countries are members of more than one trade grouping. For instance, Botswana and South Africa are members of both SADC and SACU; Malawi and Zambia are members of both SADC and COMESA; Tanzania is a member of both SADC and the EAC; and Uganda is a member of both COMESA and the EAC (see Table B in the Appendix). The variation in country membership across regional trade groupings presents an opportunity to unpack the implications of common membership in various regional trade arrangements for product price integration across countries.

These advantageous features of the data aside, it is important to take cognisance of two limitations. At a fundamental level, despite the efforts made to devise a comprehensive cross-country product coding and mapping system from which to derive a common set of matched products across all five SADC countries and Uganda, the final set of products, while highly similar across countries, may still not be perfectly homogenous. In many cases, the original product descriptions provided in the raw country price data are devoid of detail on brand or other product-specific characteristics. As a result, potentially important product-level differences in quality or brand name may remain across countries (or even across districts within countries), and could contribute to dispersion in prices across locations for otherwise highly similar products. While this is mitigated to a certain extent through the product matching process, there remains some concern regarding whether the cross-country empirical analysis is based on a comparison of perfectly like-for-like products.

To address this concern, the bulk of the empirical analyses of price dispersion within and between countries are based on calculations of the average price deviations across all products. In addition, in the case of a number of products included in the sample (for example, the various fruits and vegetables or paraffin), it is reasonable to assume that there are less likely to be major differences in quality or brand name across locations. Taking cognisance of the aforementioned issues related to potential product heterogeneity, the empirical approach adopted in this paper

includes an analysis of price dispersion at the level of individual products. Finally, the robustness of the regression results presented later is also tested using sub-sets of products in specific groups (food; clothing and textiles; machinery, equipment and electronics; and other products).

Another noteworthy shortcoming in the raw country data for Tanzania is that the unit of measurement for individual products is not provided. As a result, depending on the nature of the product in question, observed price differentials between the Tanzanian products and those in other countries may arise purely due to differences in the units of denomination (which are common across all other countries) rather than from transaction and trade costs or other relevant factors. Recognising this problem, the Tanzanian product prices are excluded from the calculations of the mean SADC product prices (see Section 5).

5. Conceptual Framework and Empirical Methodology

The primary objective of this paper is to provide a descriptive, price-based assessment of product market integration in the SADC region. Conceptually, this is achieved by empirically measuring the dispersion in product prices within and between the SADC countries included in the sample. To do so, this paper exploits the disaggregated nature of the retail product price data in the cross-country dataset to measure dispersion in the *absolute* price levels of products within and between Botswana, Malawi, South Africa, Tanzania, Uganda and Zambia. More specifically, to examine the degree to which prices differ in absolute levels, the paper measures deviations from the LOP both within and between the six countries. As noted in Knetter and Slaughter (2001: 22), the "absolute version of the LOP provides one natural benchmark for assessing the integration of markets", with a greater degree of integration between markets expected to be reflected in smaller deviations from the LOP.

The absolute price level reflects the relative cost of an identical product between two locations at a particular point in time. Empirically, the relative price of product *i* between districts *j* and *k* at time *t* can be calculated as the difference in the log prices of product *i* between the two districts:

$$RP_{i,jk,t} = p_{i,j,t} - p_{i,k,t} \qquad (2)$$

If the absolute version of the LOP holds, the value of $RP_{i,jk,t}$ in equation (2), which represents the magnitude of the price differential for product *i* between the two districts, should be equal to

zero. In turn, deviations from the LOP (in other words, a difference in the common currency price of product *i*) will be reflected in an absolute value of $RP_{i,jk,t}$ that differs from zero.

The simple relative price measure in equation (2) forms the conceptual basis for the subsequent analysis of price dispersion within and between countries. Focusing initially on price dispersion *within* countries, the within-country relative price of product *i* in district *j* in country *c* at time *t*,[6] $RPW_{i,j,c,t}$, is represented as the deviation in the price of product *i* in district *j* from the country mean price for that product at a particular point in time:

$$RPW_{i,j,c,t} = p_{i,j,c,t} - \bar{p}_{i,c,t} = p_{i,j,c,t} - \frac{\sum_{j=1}^{Jc} p_{i,j,t}}{J_c} \quad (3)$$

where $p_{i,j,c,t}$ is the log price of product *i* in district *j* in country *c* at time *t*; and $\bar{p}_{i,c,t}$ is the mean log price of product *i* across all districts in country *c*, J_c. For each product, country and time combination, the average within country price dispersion is then computed as the mean of the absolute values of the individual within country relative price deviations for product *i* across all districts within country *c* at time *t*:

$$MADW_{i,c,t} = \frac{\sum_{j=1}^{Jc} |RPW_{i,j,c,t}|}{J_c} = \frac{\sum_{j=1}^{Jc} |p_{i,j,c,t} - \bar{p}_{i,c,t}|}{J_c} \quad (4)$$

A similar approach is used to measure price dispersion between countries. For each product, country and time combination, the between country relative price, $RPB_{i,c,t}$, is measured as:

$$RPB_{i,c,t} = \bar{p}_{i,c,t} - \bar{p}^*_{i,t} = \frac{\sum_{j=1}^{Jc} p_{i,j,c,t}}{J_c} - \frac{\sum_{c=1}^{C} \bar{p}_{i,c,t}}{C} \quad (5)$$

where $\bar{p}^*_{i,t}$ is the average log price of product *i* across all SADC countries (excluding Tanzania). The mean absolute price deviation for product *i* across all countries at time *t*, $MADB_{i,t}$, is then calculated as the mean of the absolute values of the individual between country relative price deviations across all countries C:

$$MADB_{i,t} = \frac{\sum_{c=1}^{C} |RPB_{i,c,t}|}{C} = \frac{\sum_{c=1}^{C} |\bar{p}_{i,c,t} - \bar{p}^*_{i,t}|}{C} = \frac{\sum_{c=1}^{C} \left| \left(\frac{\sum_{j=1}^{Jc} p_{i,j,c,t}}{J_c} \right) - \left(\frac{\sum_{c=1}^{C} \bar{p}_{i,c,t}}{C} \right) \right|}{C} \quad (6)$$

The formulae in equations (3) through (6) form the basis for the descriptive analysis of product price integration in the SADC presented in the following Section. Using these basic measures of

[6] All price deviations are calculated as time-averaged (averaged over all months) annual price deviations.

product price deviations across markets (either within or between countries), a number of different aspects of price dispersion in the region are investigated.

6. Analysis and Results

To provide a preliminary perspective on country level variation in prices for individual products, Table A in the Appendix compares the average prices (converted into US$) in each country in 2008 for all products included in the matched sample.[7] In the case of certain products (for example, the colour television, ladies dress, lounge suite, men's suit, radio cassette recorder and refrigerator) there is significant variation in common currency prices across countries. Aside from potential differences in prices induced by unobserved cross-country variation in product quality or brand, a variety of other factors may contribute to the observed price differentials, including differences in transaction costs between countries, variation in the levels of competition in individual country markets, disparities in factor prices and differences in the relative prices of non-traded services and relative productivity between the six countries.

Regardless of the source of variation in cross-country product prices, the preliminary perspective provided in Table A suggests that product prices are dispersed across the six countries, and that the size of the dispersion varies depending on the product in question. While it is important not to draw any serious conclusions from a simple cross-sectional comparison of price levels, it is nevertheless an interesting point of departure. The descriptive analysis and results presented in the following sub-section provide a more formal empirical perspective of country and product-level dispersion in prices within and between countries. It then moves to a cursory assessment of the importance of shared borders and common membership in regional trade groupings for product price integration. Finally, results are presented from an analysis of the degree of absolute price convergence over time within the sample of African countries.

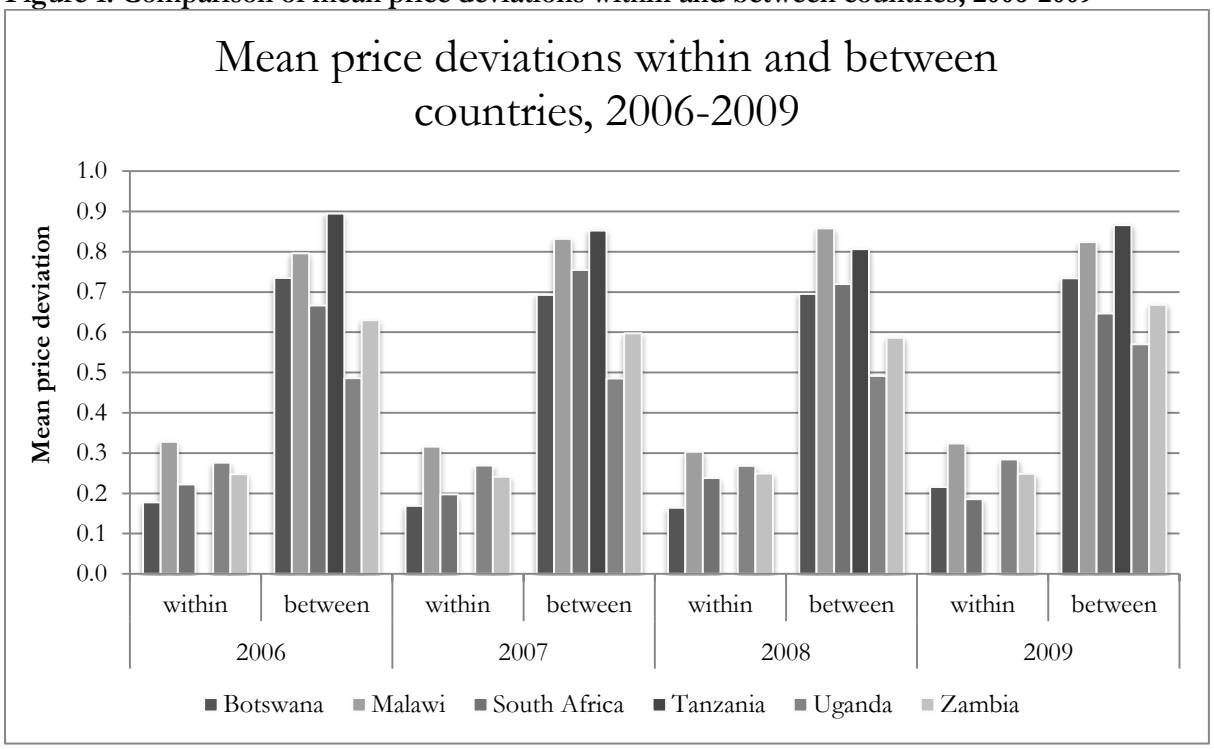
6.1 Country-level comparison of price dispersion within and between SADC countries

To provide an initial, cross-country perspective on variation in product prices within and between countries and over time, a country level comparison of average price dispersion across all products within and between countries is presented in Figure 1. In the case of price dispersion

[7] The year 2008 is chosen as it provides the most recent time period for which the largest possible sample of common products across all countries is available.

within each country, this involves computing the average of the within country absolute price deviation, $MADW_{i,c,t}$, across all products: $E_i[MADW_{i,c,t}]$. In turn, the between country measure for each country is calculated as the average of the absolute value of the $RPB_{i,c,t}$ across all products: $E_i[|\bar{p}_{i,c,t} - \bar{p}^*_{i,t}|]$. For each country, these two measures are examined in order to compare the level of integration across districts within that country to the level of integration between that country and all other SADC countries at a particular point in time. For ease of comparison, the within and between country price deviations presented in Figure 1 are restricted to the 2006-2009 period, in which data is available for all six countries.

Figure 1: Comparison of mean price deviations within and between countries, 2006-2009



Notes: The sample is restricted to the 2006-2009 period in which data is available for all countries. The dataset includes only one district in Tanzania. Hence, within country dispersion in prices across districts in Tanzania is zero, and is omitted. Owing to the lack of data on the units of measurement, the Tanzanian prices are omitted from the calculations of the mean SADC price used to compute the between country price dispersion measure.

A number of interesting points can be drawn from Figure 1. Focusing initially on within country variation, the average values of the within country absolute price deviations differ across the six countries. In 2009, average price dispersion across districts within each country was lowest in South Africa (at 0.19) and highest in Malawi (at 0.32). Across all countries – excluding Tanzania (where the product price data is only available at the national level) – the mean of the within country price dispersion measures was 0.25 in 2009. Across all SADC countries (again excluding Tanzania) this value was marginally lower at 0.24 in 2009. These values are quite similar to those

obtained by Anderson, Davies and Smith (2012) who, using a disaggregated dataset spanning almost 200 products and services across 142 cities internationally, find mean price dispersion over city pairs within the same country to be around 0.30.

The average values of the within country absolute price deviations in each country have remained fairly stable over time. This suggests that internally, product prices within each of the SADC countries have not, on average, become more integrated over time. The average price deviations across all products in Zambia and Uganda were unchanged when the values for 2006 and 2009 are compared; while there were marginal declines in within country variation in average prices in Malawi (from 0.33 to 0.32) and South Africa (from 0.22 to 0.19) over the four-year period. For the same period, the average size of the deviation in product prices across districts within Botswana actually increased (from 0.18 to 0.22). These findings are upheld when looking over the full sample period from 2001 to 2011.

Turning to the average between country price deviations, for each country and in all years (both for the full sample period and over the restricted 2006-2009 period), average dispersion in prices between countries is substantially higher than across districts *within* countries. This finding is consistent with the large body of literature that documents greater dispersion in product prices between markets located in different countries in comparison to price differentials across markets within the same country. For the five SADC countries in 2009, the magnitude of deviations in the mean country prices from the SADC mean price ranged from 0.65 in South Africa and 0.67 in Zambia to 0.73 in Botswana, 0.82 in Malawi and as high as 0.87 in Tanzania (the large deviations from the mean SADC price in Tanzania may be due, in part, to possible differences in the unit denominations of individual products).

These findings are in line with the general evidence in the literature of widespread deviations from the LOP. However, the price dispersion estimates are comparatively high when measured against similar estimates in the empirical literature. Anderson, Davies and Smith (2012) estimate a mean absolute price differential (over all goods and location pairs) of 0.56 (and 0.44 when OECD country pairs are considered in isolation). Engel et al. (2005) estimate a 7% difference in price levels across cities in the United States and Canada using actual product price data. Focusing on Africa, Edwards and Rankin (2012) estimate the absolute value of average log price deviations from the LOP (relative to the average log Sub-Saharan Africa price) to be 0.29 and

0.08 in Lusaka and 0.18 and 0.12 in Pretoria over the periods between 2001-2004 and 2005-2008, respectively.

The magnitude of the between country price deviation measures has remained similar over time. For the restricted 2006-2009 period, the size of deviations in the country mean price from the SADC mean price was unchanged in Botswana in 2006 and 2009; while the value of this measure increased marginally in Malawi (from 0.80 in 2006 to 0.82 in 2009) and Zambia (from 0.63 in 2006 to 0.67 in 2009). By comparison, deviations from the SADC mean price in Uganda (the control country) increased from 0.49 in 2006 to 0.57 in 2009. The opposite is true in the cases of South Africa and Tanzania, which both saw marginal declines in the size of deviations from the mean SADC price between 2006 and 2009.

The general observation that the size of between country price deviations has remained relatively stable over time holds for the full sample period from 2001 to 2011 as well. The evidence of large and persistent LOP deviations would seem to suggest that the product prices in the SADC region have not become more integrated over the sample period. These initial observations are particularly significant given that the sample period coincides with the period of significant liberalization of intra-SADC trade facilitated through the introduction of the SADC Protocol on Trade in 2000 (and the reality that the phased approach to the liberalization of tariffs under the Protocol meant that, for the majority of countries, the tariff reductions were accelerated in the restricted 2006-2009 sample period).

6.2 Comparison of price dispersion across products

The price deviation measures presented above are computed using average prices across all products included in the sample. While instructive in providing an aggregate, country-level picture of price dispersion within and between the six countries, they may, nevertheless, mask important differences in price dispersion across products. For instance, in theory LOP deviations should be larger for less tradable goods and for goods that use more non-tradable inputs in production (Engel, 1999; Crucini et al., 2005b). Mindful of this, product-specific price deviation measures within and between countries for each product *i* are also computed. First, to compare within country, product-level dispersion in prices, the mean across all countries C of the individual within country relative price deviations for product *i* across all districts within country *c* at time *t* is computed as:

$$\overline{MADW}_{i,t} = \frac{\sum_{c=1}^{C} MADW_{i,c,t}}{C} \quad (7)$$

This yields one observation, $\overline{MADW}_{i,t}$, at time *t* for each of the 32 matched products included in the sample. In turn, product-level dispersion in prices between countries is measured as the mean absolute price deviation for product *i* across all countries at time *t*, $MADB_{i,t}$, as in equation (6). This allows for a comparison of average price dispersion within and between countries at the level of individual products.

The product-specific values of the cross-country within and between country price dispersion measures are presented in Table 2. In general, the broad findings of the country-level comparison across all products (presented in Section 6.1) are replicated when the sampled products are considered individually. Specifically, for the majority of products and in almost all years, price dispersion within countries is notably lower than dispersion in prices between countries (measured as deviations from the SADC mean price). Furthermore, on balance the magnitude of both within country and between country price dispersion has remained fairly stable over time, both for the full sample period from 2001-2011 and in the case of the restricted 2006-2009 period.

That said, the figures presented in Table 2 indicate that there is considerable heterogeneity in price dispersion across products, even across the smaller sub-sets of products that are common to a particular group. Looking across all products and focusing initially on within country price dispersion in 2009, average variation in prices within countries was lowest for newspapers (at 0.03%) and highest in the case of a consultation with a private doctor (at 0.57). In the group of food products in 2009, within country variation in prices ranged from a mean value across all countries of 0.14 for margarine to 0.35 for rice. In the case of clothing and textiles, average within country dispersion was as low as 0.17 for a bath towel and as high as 0.48 for a men's suit in 2009. The equivalent range within the machinery, equipment and electronics group went from 0.10 for a roll of colour film to 0.28 for a 21 inch colour television and 0.29 in the case of an electric kettle. Within country price dispersion for products in the other products group was generally quite low in 2009, with the exception of a lounge suite (at 0.47). In contrast, even within countries, average price dispersion for non-tradable services (consultation with a private doctor and a men's haircut) was comparatively high.

Table 2: Comparison of product-level price dispersion within and between countries, 2006-2009

	2006		2007		2008		2009	
Product	**within**	**between**	**within**	**between**	**within**	**between**	**within**	**between**
Food								
bananas	0.28	0.57	0.23	0.56	0.29	0.60	0.30	0.57
cabbage	0.23	0.69	0.18	0.66	0.17	0.66	0.20	0.68
margarine	0.17	0.18	0.15	0.20	0.13	0.21	0.14	0.19
onions	0.21	0.37	0.16	0.32	0.21	0.37	0.23	0.48
oranges	0.30	0.70	0.27	0.64	0.27	0.61	0.30	0.61
pineapples	0.22	0.57	0.20	0.47	0.19	0.40	0.21	0.47
potatoes	0.21	0.55	0.22	0.54	0.24	0.57	0.23	0.62
rice	0.25	0.42	0.26	0.46	0.26	0.50	0.35	0.51
tomatoes	0.18	0.53	0.16	0.49	0.17	0.53	0.20	0.61
Clothing and Textiles								
bath towel	0.18	0.35	0.18	0.35	0.14	0.37	0.17	0.47
blanket	0.35	0.69	0.40	0.68	0.49	0.59	0.29	0.59
boy's shirt	0.25	0.40	0.23	0.42	0.23	0.42	0.27	0.45
brassiere	0.41	0.69	0.36	0.74	0.36	0.62	0.40	0.72
girl's dress	0.30	0.51	0.31	0.51	0.31	0.49	0.25	0.58
ladies dress	0.40	0.99	0.36	0.99	0.38	1.00	0.37	1.25
men's shirt	0.33	0.86	0.30	0.89	0.27	0.91	0.27	0.96
men's suit	0.50	1.88	0.44	1.90	0.38	1.98	0.48	2.55
men's trousers	0.30	1.00	0.25	1.01	0.27	1.00	0.28	1.04
Machinery, equipment and electronics								
colour film (36 exposure)	0.16	0.33	0.13	0.26	0.09	0.23	0.10	0.24
colour television (21 inch)	0.21	1.32	0.23	1.32	0.22	1.31	0.28	1.32
electric iron	0.19	1.33	0.19	1.35	0.20	1.39	0.20	1.38
electric kettle	0.33	0.69	0.36	0.69	0.34	0.69	0.29	0.70
radio cassette recorder	0.35	1.29	0.41	1.25	0.30	1.24	0.27	1.19
refrigerator	0.17	1.45	0.19	1.46	0.24	1.46	0.27	1.45
Other products								
brandy	0.09	0.18	0.13	0.23	0.09	0.21	0.11	0.28
cigarettes	0.06	0.47	0.06	0.45	0.11	0.48	0.10	0.46
lounge suite	0.33	0.37	0.34	0.40	0.39	0.27	0.47	0.31
newspaper	0.01	0.58	0.01	0.56	0.02	0.50	0.03	0.46
paraffin	0.15	0.38	0.06	0.43	0.15	0.48	0.14	0.32
shoe polish	0.06	0.09	0.07	0.06	0.05	0.06	0.05	0.11
Services								
consultation fee for private doctor	0.48	1.11	0.49	1.11	0.50	1.08	0.57	1.06
men's haircut	0.24	0.86	0.24	0.87	0.25	0.78	0.28	0.37

Turning to the between country measures, the earlier finding of large and persistent LOP deviations at the country-level is echoed in the cross-country price dispersion measures for individual products. Across all products in 2009, the across-country average values of between country price deviations from the SADC mean product price were lowest for shoe polish (0.11) and margarine (0.19) and highest for a men's suit (2.55). Consistent with the theoretical literature, and empirical evidence provided in studies such as Crucini et al. (2005b), the computed price deviations are comparatively high for the services included in the sample.

In the case of a number of products – namely a ladies dress, men's trousers, colour television, electric iron, radio cassette recorder and refrigerator – the between country price deviations exceed 1.00 for 2009. Notably, these products all fall within the clothing and textiles and machinery, equipment and electronics groups. Across all product groups, the mean values of between country price deviations are lowest for the other products (0.32) and food (0.53) groups, and notably higher for the clothing and textiles (0.96) and machinery, equipment and electronics (1.05) groups. Compared to most of the products in the other products category, as well as the food products, the products in the clothing and textiles and machinery, equipment and electronics groups are likely to likely to require considerably more non-tradable inputs in production. In this respect, the relatively higher levels of price dispersion observed for products in these categories is consistent with the empirical evidence in studies such Crucini et al. (2005b), which find larger LOP deviations among products that use more non-tradable inputs in production.

A visual perspective of product-specific trends in price dispersion between countries over time is given by the kernel density estimates for specific product groups presented in Figure A in the Appendix. The figure presents kernel density estimates of distributions of product-by-product deviations in the mean price of product *i* in country *c* from the mean SADC price (excluding Tanzania) for product *i* in each year between 2006 and 2009 (thus plotting one observation for each product in each country). In the food group, there is some evidence of retail price convergence over time, with the product-by-product deviations from the mean SADC price shifting and becoming more centred over the four-year period. The picture is much less clear in the case of the other product groups. In general, the patterns of the kernel density estimates for these product groups reflect wide dispersion in deviations from the SADC mean product price; and average deviations from the SADC mean price that differ substantially from zero. Thus, aside from the food products group, the kernel density estimates provide no clear evidence of retail price convergence over time for the 2006-2009 period.

A more nuanced picture of trends in product-level price deviations over time can be drawn from the figures in Table 2. Again, the trends are indicative of considerable heterogeneity across products. Average between country price deviations increased (albeit mostly by relatively small amounts) for just over half (17) of the 32 products in the sample between 2006 and 2009; while these deviations declined in the case of 12 products over the same period (and were unchanged for 3 products between 2006 and 2009). Interestingly, between country price deviations declined

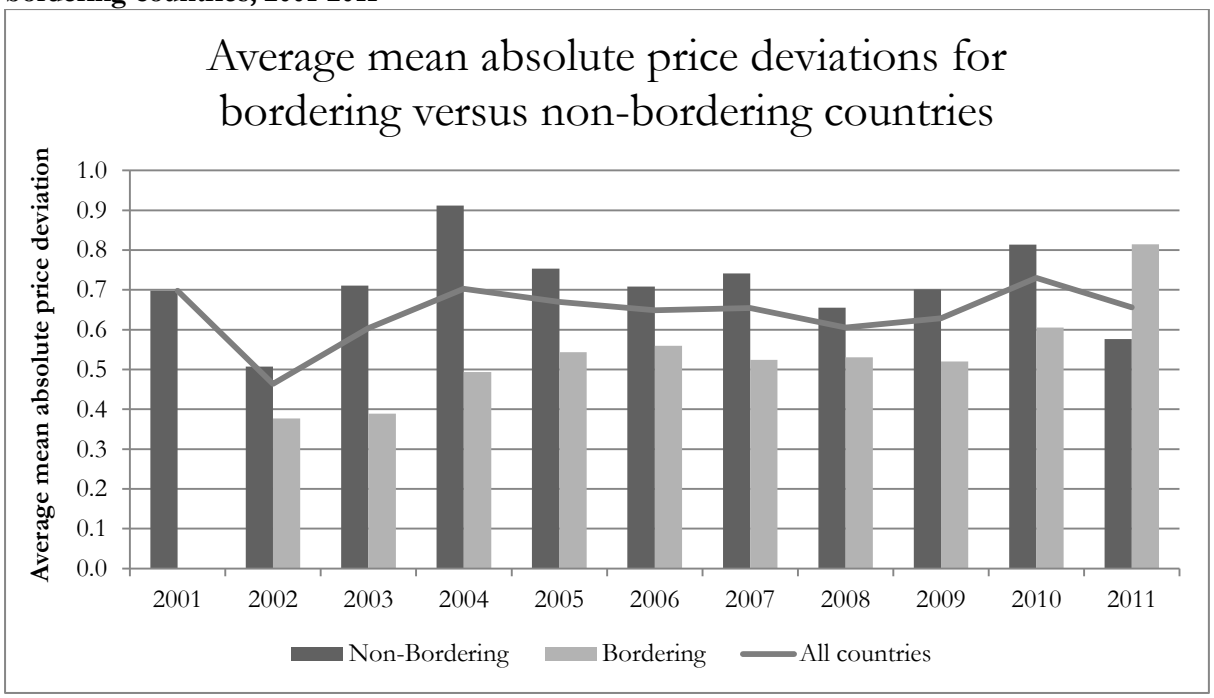
for just one product (blanket) in the clothing and textiles sub-group between 2006 and 2009, while the results were much more mixed within the remaining product groups.

6.3 The importance of a shared border and common membership in regional trade groupings for product price integration

The stylized facts in the theoretical and empirical literature on price dispersion and product market integration indicate that traditional trade costs (typically proxied by distance) contribute to dispersion in product-level retail prices across markets. This implies that adjacent countries, and those separated by smaller distances, are likely to experience less dispersion in product prices over more geographically disparate countries. There is also a body of evidence in the empirical literature to suggest that common membership in regional trade and monetary agreements may reduce product price dispersion across locations in different countries. Taken together, these stylized facts suggest that bordering countries and countries that are both party to specific regional trade and monetary agreements within the SADC region may be subject to lower cross-country dispersion in product prices.

This section presents a number of simple empirical estimates to test whether these key stylized features in the empirical literature hold in the African context. In order to do so, a dataset is constructed containing product price deviations for all combinations of bilateral country pairs involving the six countries (amounting to a total of 15 country pair combinations). To provide an initial perspective, the average of the mean absolute price deviations (across all products) for specific groups of bilateral country pairs is computed for each year. Figure 2 compares this measure for bilateral pairs of bordering and non-bordering countries, as well as against the average across all bilateral country pairs, for the period from 2001-2011. In turn, Table 3 presents a comparison of the average of the mean absolute price deviations for bilateral country pairs that share common membership in specific regional trade and monetary agreements involving SADC countries against those that do not share membership in the respective groupings.

Figure 2: Comparison of average mean absolute price deviations – bordering versus non-bordering countries, 2001-2011



Note: The data for 2001 includes only product prices for Zambia and South Africa; and the data for 2011 includes only prices for Malawi, Uganda and Zambia.

Figure 2 shows that, on average (across all products), price deviations between bordering countries are lower in comparison to countries that are not adjacent to each other. Similarly, the results presented in Table 3 indicate that price dispersion (averaged over all products) is lower between countries that share common membership in any one of the SACU, COMESA or EAC formations. However, the same does not hold in all years in the case of countries that are members of both SADC and COMESA.

Table 3: Comparisons of average mean absolute price deviations – membership in regional trade agreements, 2001-2011

	SACU		COMESA		EAC		SADC & COMESA	
	Not both SACU	Both SACU	Not both COMESA	Both COMESA	Not both EAC	Both EAC	Not both SADC & COMESA	Both SADC & COMESA
2001	0.70	-	0.70	-	0.70	-	0.70	-
2002	0.46	-	0.51	0.38	0.46	-	0.51	0.38
2003	0.60	-	0.71	0.39	0.60	-	0.71	0.39
2004	0.70	-	0.75	0.49	0.70	-	0.75	0.49
2005	0.67	-	0.76	0.45	0.69	0.48	0.68	0.58
2006	0.67	0.37	0.67	0.55	0.66	0.51	0.64	0.74
2007	0.68	0.34	0.69	0.51	0.66	0.52	0.65	0.66
2008	0.63	0.31	0.61	0.59	0.61	0.50	0.60	0.74
2009	0.64	0.47	0.65	0.53	0.64	0.44	0.63	0.65
2010	0.73	-	0.79	0.59	0.76	0.45	0.73	0.71
2011	0.66	-	-	0.66	0.66	-	0.58	0.81

These relationships are tested more formally through simple econometric estimates to isolate the influences of proximity and common regional trade and monetary agreements on price deviations between countries. Maintaining the focus on absolute price dispersion, the average of the mean absolute price deviation across all products for bilateral country pair (*jk*), $MADB_{jk,t}$, is selected as the dependent variable. The basic model is specified as:

$$MADB_{jk,t} = \alpha + \beta_1 \ln(dist_{jk}) + \beta_2 bordering_{jk} + \beta_3 SACU_{jk} + \beta_4 COMESA_{jk} + \beta_5 EAC_{jk} + \beta_6 \ln(ypc_{k,t}) + \beta_7 \ln(pop_{k,t}) + \varepsilon_{jk,t} \quad (8)$$

where $dist_{jk}$ is the log of the bilateral distance between the respective capital cities for country pair (*jk*); $bordering_{jk}$ is a dummy variable equal to one if the two countries in country pair (*jk*) are adjacent bordering countries; $SACU_{jk}$, $COMESA_{jk}$ and EAC_{jk} are dummy variables equal to one if the two countries in country pair (*jk*) share common membership in SACU, COMESA or the EAC, respectively; $ypc_{k,t}$ is the log of GDP per capita in country *k* at time *t*; and $pop_{k,t}$ is the log of the total population of country *k* at time *t*. Based on the stylised facts in the theoretical and empirical literature, price deviations are expected to be lower in countries located closer to each other, that are adjacent to each other, and that share common membership in a regional trade or monetary agreement.

The GDP per capita variable is included to account for the potential impact that the distribution of income may have on the consumption of quality differentiated products within narrowly defined product categories. Countries with higher mean income distributions are likely to consume higher priced goods (Choi, Hummels & Xiang, 2008). In turn, the population variable is included to capture the possible effect of market size on prices; product prices may be comparatively lower in larger markets (Melitz & Ottaviano, 2005). As a further control, the regressions are estimated separately with and without the inclusion of time fixed effects. The relationship is estimated over the period from 2001 to 2011.

The estimation results are presented in Table 4. Due to a high level of correlation between the distance and bordering variables, these variables are included in the regressions separately, with the regressions including only the bordering variable presented in columns (1) to (4) and those including only the distance variable presented in columns (5) through (8). In general, the results in Table 4 conform to expectations and corroborate both the earlier findings and the stylized facts in the literature. Average absolute price deviations between country pairs are smaller for

countries adjacent to each other and for countries that share common membership in either the SACU, COMESA or EAC formations. In the regressions including the bordering variable (but not those with the distance variable), GDP per capita and population size are also important determinants of price dispersion between country pairs – with higher per capita GDP or a larger population in one country associated with greater dispersion in prices.

The distance variable is only significant when included in the regressions on its own. In these cases, the positive coefficients indicate that price dispersion between country pairs increases the further apart the two countries are from each other. This is in line with existing evidence in the empirical literature, and supports the theoretical argument that price dispersion increases with distance as transportation costs and barriers to arbitrage between markets rise. However, when the other variables are included in the regressions, the coefficient on the distance variable switches signs, and is no longer significantly different from zero.[8]

Table 4: Regressions with mean absolute price deviations across all products for bilateral country pairs as dependent variable

	Regressions with bordering variable				Regressions with distance variable			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bordering	-0.180***	-0.0876**	-0.185***	-0.0864**				
	(0.0408)	(0.0410)	(0.0418)	(0.0420)				
log distance					0.145***	-0.0309	0.141***	-0.0491
					(0.0370)	(0.0507)	(0.0386)	(0.0541)
SACU		-0.434***		-0.417***		-0.555***		-0.573***
		(0.0912)		(0.0938)		(0.128)		(0.135)
COMESA		-0.0964**		-0.110**		-0.111**		-0.132***
		(0.0407)		(0.0441)		(0.0442)		(0.0483)
EAC		-0.154*		-0.166*		-0.268***		-0.296***
		(0.0856)		(0.0877)		(0.0856)		(0.0897)
log GDP per capita		0.0441*		0.0404*		0.0207		0.0128
		(0.0234)		(0.0242)		(0.0252)		(0.0265)
log population		0.117***		0.118***		0.171***		0.180***
		(0.0404)		(0.0415)		(0.0449)		(0.0458)
constant	0.718***	-1.563**	0.720***	-1.547**	-0.398	-2.104***	-0.367	-2.061***
	(0.0257)	(0.608)	(0.0262)	(0.628)	(0.267)	(0.563)	(0.278)	(0.580)
Observations	96	96	96	96	96	96	96	96
R-squared	0.171	0.489	0.232	0.535	0.141	0.465	0.184	0.515
Year fixed effects	no	no	yes	yes	no	no	yes	yes

Notes: Standard errors are in parentheses. Significance at the 10 percent, 5 percent and 1 percent levels is denoted by *, ** and *** respectively. The SADC dummy is the omitted category.

[8] In the case of all variables, the sizes of the estimated coefficients change only marginally when time fixed effects are included and, importantly, the significance of the estimates remains unchanged.

As a further test, additional regressions are estimated for the various product groups introduced earlier (food; clothing and textiles; machinery, equipment and electronics; and other products). In each case the dependent variable is the average of the mean absolute price deviation across all products in the specific product group for bilateral country pair (*jk*). The results from these regressions are provided in Tables C, D, E and F in the Appendix.

In the case of all product groups, the estimation results are weaker than the results for the pooled sample containing average price deviations across all products; and in many cases the coefficients on the independent variables are sensitive to the model specification. For instance, for the food and clothing and textiles groups, the coefficients on the bordering dummies are not significant once the various dummies for membership in regional trade and monetary agreements and GDP per capita and population control variables are included in the regressions. In contrast, while the coefficient on the bordering variable is significant in all regressions for the machinery, equipment and electronics group, and for the regressions with time fixed effects in the case of the other products group, the sign on the coefficient is positive; suggesting that, on average, price dispersion across these products is higher between countries located adjacent to each other. Similarly, when the bordering variable is replaced with distance, the significance and sign of the estimated coefficients on the distance variable vary depending on the specification.

The results are somewhat more definitive with respect to the influence of membership in the various regional trade and monetary agreements on absolute price deviations between countries, and mostly corroborate the earlier finding that price dispersion is lower between countries that are members of these regional groupings. Price dispersion across all food products, as well as across all clothing and textiles products, is significantly lower between country pairs that are both members of SACU. However, the influence of common membership in SACU is less conclusive in the case of the machinery, equipment and electronics and other products groups, where the SACU dummy is only significant in certain specifications.

In contrast, for the machinery, equipment and electronics and other products groups, price dispersion is significantly lower between country pairs that are both members of COMESA. However, this is not the case for the food and clothing and textiles groups. Finally, in most of the regressions for specific product groups, price dispersion is lower between countries that are both members of the EAC (with the exception of the regressions without time fixed effects for

the food and other products groups, and the regressions with the bordering variable for the clothing and textiles group).

6.4 Price convergence over time

It is also instructive to investigate the degree of absolute price convergence over time within the sample of African countries examined in this paper. A decline in absolute price dispersion across the sample period would suggest that product prices (and hence product markets) are becoming more integrated in the region over time. Whether or not this has occurred is particularly interesting given that the time series used in this study coincides closely with the significant liberalization of tariffs on intra-SADC trade that has taken place since 2000. In this respect, evidence of absolute price convergence may provide a tentative indication of a relationship between the tariff phase downs implemented through the SADC Protocol on Trade and the integration of product markets in the region.

A pooled dataset of bilateral country pairs with variation in the mean absolute price deviations across individual products is used to investigate whether product prices have converged over the period between 2001 and 2011. This involves regressing the absolute value of the LOP deviation across products on a time trend. Additional regressions that include interactions between the time trend and dummies for the various regional trade and monetary agreements (SACU, COMESA and the EAC) are also estimated. The results from these regressions are presented in Table 5. The regressions in columns (1) and (3) are estimated with country fixed effects to account for time-invariant country effects that may influence price dispersion between country pairs. In turn, the regressions in columns (2) and (4) are estimated with both country and product fixed effects.

The positive and significant coefficients on the time trend variable in Table 5 indicate that absolute price dispersion between countries *increased* over the 2001-2011 period. The initial evidence of growing divergence in product prices suggests that product prices have not become more integrated over the sample period, thereby providing no evidence in favour of increased product market integration in the region. However, the estimated coefficients on the interaction terms present a different and more nuanced picture. The negative and significant coefficients on each of the interactions between the time trend and the SACU, COMESA and EAC dummies (the latter is significant only when country and product fixed effects are included) indicate that,

relative to the SADC group as a whole, product prices between country pairs within each of these regional trade and monetary groupings have become more integrated over time.

Table 5: Trend in the absolute value of price dispersion between bilateral country pairs, full 2001-2011 sample

	(1)	(2)	(3)	(4)
year	0.0171***	0.0156***	0.0198***	0.0186***
	(0.00505)	(0.00451)	(0.00501)	(0.00446)
year*SACU			-0.000149***	-0.000127***
			(2.93e-05)	(2.60e-05)
year*COMESA			-0.000109***	-0.000115***
			(1.82e-05)	(1.62e-05)
year*EAC			-3.82e-05	-6.15e-05**
			(3.16e-05)	(2.82e-05)
Observations	2,437	2,437	2,437	2,437
R-squared	0.035	0.247	0.059	0.271
Country fixed effects	yes	yes	yes	yes
Product fixed effects	no	yes	no	yes

Notes: Standard errors are in parentheses. Significance at the 10 percent, 5 percent and 1 percent levels is denoted by *, ** and *** respectively.

To augment the analysis, the regressions in Table 5 are repeated, restricting the sample to the period between 2006 and 2009 that includes product price deviations for all 15 possible bilateral country pair combinations. The results for the regressions using the restricted sample are presented in Table G in the Appendix. In contrast to the results using the full sample, the signs on the estimated coefficients for the time trend are negative when the sample is restricted to the 2006-2009 period. However, the estimates are not statistically significant, suggesting that product prices between countries have not become more integrated over the shorter period. Nevertheless, as in the case of the full sample period, the negative and significant coefficients on the interaction terms corroborate the earlier finding that product prices have become more integrated between country pairs within the SACU, COMESA and EAC groupings, even over the shorter time period.

In summary, the evidence on retail price convergence over time is mixed, with the general increase in price dispersion across all SADC countries contrasting with evidence of price convergence among countries that are members of the individual trade and monetary agreements in the region. In comparative work on Africa, Edwards and Rankin (2012) find evidence of convergence over time in both absolute and relative prices within their sample of Sub-Saharan African and North African countries. However, the authors note that much of the convergence

occurred during the 1990s and was concentrated in North African cities; with the degree of absolute price convergence lower within Sub-Saharan Africa.

7. Conclusion

This paper uses highly disaggregated retail price data collected at the district level in six African countries to provide a descriptive analysis of the extent to which product prices are integrated within and between countries in the region. In doing so, the paper extends the literature on product market integration to Africa, and the SADC region in particular; thereby addressing the lack of knowledge about product price dispersion both within and between countries on the continent. The approach of the paper is centred on an investigation of whether key features in the burgeoning literature on price dispersion and product market integration hold in the African context.

In line with the balance of evidence in the international literature, the paper finds large and persistent deviations from the LOP, both within and between, each of the six African countries. On average over all products, there is dispersion in product prices across districts within each country, with the level of dispersion lowest within South Africa and highest in Malawi. It is also shown that the average values of within country absolute price deviations have remained fairly stable over time, suggesting that, internally, product prices within each of the countries have not, on average, become more integrated.

In line with the international literature, dispersion in product prices is found to be substantially greater between markets located in different African countries in comparison to price differentials across markets within the same country. Product price deviations from the SADC mean price are, on average, lowest in the case of South Africa and highest in Malawi and Tanzania. In general, the price dispersion estimates for the six countries are comparatively high when measured against similar estimates in the empirical literature.

These broad findings are replicated when the sampled products are considered individually. Nevertheless, considerable heterogeneity in price dispersion is found across products. In general, price dispersion between countries is shown to be higher for products in the clothing and textiles and machinery, equipment and electronics groups. This is consistent with findings in the

empirical literature of larger deviations from the LOP among products that use more non-tradable inputs in production.

The paper also explored the relationships between cross-country price dispersion, the proximity of countries to each other, and whether or not they share membership in various regional trade and monetary agreements. The results from simple econometric estimates indicate that, on average, absolute price deviations between country pairs are smaller for countries adjacent to each other and for SADC countries that share common membership in SACU, COMESA or the EAC. Furthermore, relative to the SADC group as a whole, there is evidence that product prices have become more integrated over time between country pairs that share membership in these regional trade and monetary groupings. Taken together, these findings are consistent with evidence in the international literature that suggests that common membership in regional trade and monetary agreements may reduce product price dispersion across locations in different countries.

The findings outlined here present a nuanced picture of product price integration in the region. In general, product prices remain dispersed, a reality reflected in large and persistent deviations from the LOP between countries. Furthermore, when all six countries are considered together, there is no clear evidence to suggest that product prices have become more integrated over the sample period. That said, the empirical results do indicate that, relative to SADC as a whole, there has been some movement towards greater integration of product prices within the SACU, COMESA and EAC formations.

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Appendix

Table A: Average price in US$ by product and country (across all districts), 2008

		Average product price (in US$)					
Product	**Unit**	**Botswana**	**Malawi**	**South Africa**	**Tanzania**	**Uganda**	**Zambia**
bananas	1 kg	0.70	0.19	1.51	0.30	0.37	0.75
bath towel	each	4.34	4.71	5.06	3.08	-	5.73
blanket	each	17.38	11.61	16.73	5.64	-	7.26
boy's shirt	each	2.70	1.61	6.11	3.54	-	4.79
brandy	750 ml	10.68	8.99	7.32	-	-	5.45
brassiere	each	3.77	1.37	5.75	1.38	1.38	1.92
cabbage	1 kg	0.68	0.15	0.79	0.31	0.20	0.37
cigarettes	20	2.38	0.64	1.99	0.72	1.02	1.64
colour film (36 exposure)	each	3.44	1.73	-	-	-	2.52
colour television (21 inch)	each	184.62	221.97	151.01	182.19	-	241.37
consultation fee for private doctor	1 service	14.85	2.70	-	0.80	2.57	3.59
electric iron	each	11.84	21.54	32.67	12.69	15.46	21.25
electric kettle	each	12.99	22.92	15.86	-	20.13	17.68
girl's dress	each	5.30	1.23	9.27	7.46	-	7.60
ladies dress	each	13.03	3.24	16.69	2.24	15.73	14.56
lounge suite	3 piece	705.18	662.81	917.82	-	-	473.31
margarine	250 g	0.99	1.08	0.98	1.67	0.97	1.41
men's haircut	1 service	1.67	0.35	6.20	0.45	0.93	0.65
men's shirt	each	5.82	3.15	7.75	6.75	7.65	10.45
men's suit	each	84.98	25.31	73.61	28.44	91.74	104.83
men's trousers	pair	9.54	4.41	12.96	7.13	9.16	6.99
newspaper	each	0.43	0.47	-	0.31	0.49	0.80
onions	1 kg	0.97	0.38	0.86	0.57	0.81	1.30
oranges	1 kg	0.63	0.16	0.86	0.50	0.39	0.95
paraffin	1 litre	1.01	0.87	2.10	3.90	1.06	1.16
pineapples	1 kg	0.77	0.37	0.75	0.45	0.32	0.78
potatoes	1 kg	0.81	0.20	1.05	0.39	0.36	0.89
radio cassette recorder	each	24.95	54.87	-	28.61	-	96.81
refrigerator	each	403.33	471.59	387.73	288.90	-	293.50
rice	1 kg	1.58	0.40	1.38	0.62	3.18	1.34
shoe polish	50 ml	0.79	0.81	0.67	-	-	0.78
tomatoes	1 kg	1.13	0.23	1.28	0.54	0.50	0.82

Notes: Product price for each country calculated as the mean price across all districts and all months. Data on the unit denomination for Tanzanian products is unavailable.

Table B: Country membership in regional trade groupings

	SADC	SACU	COMESA	EAC
Botswana	x	x		
Malawi	x		x	
South Africa	x	x		
Tanzania	x			x
Uganda			x	x
Zambia	x		x	

Table C: Food product sub-group regressions with mean absolute price deviations between bilateral country pairs as dependent variable

	Regressions with bordering variable				Regressions with distance variable			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bordering	-0.213***	-0.101	-0.219***	-0.0944				
	(0.0657)	(0.0744)	(0.0654)	(0.0754)				
log distance					0.115*	-0.0951	0.0982	-0.189**
					(0.0605)	(0.0903)	(0.0614)	(0.0937)
SACU		-0.538***		-0.528***		-0.787***		-0.948***
		(0.166)		(0.168)		(0.228)		(0.234)
COMESA		0.103		0.0680		0.0685		-0.000651
		(0.0738)		(0.0791)		(0.0788)		(0.0837)
EAC		-0.240		-0.296*		-0.418***		-0.550***
		(0.155)		(0.157)		(0.152)		(0.155)
log GDP per capita		0.0817*		0.0634		0.0416		0.00167
		(0.0425)		(0.0434)		(0.0449)		(0.0460)
log population		0.129*		0.121		0.220***		0.253***
		(0.0734)		(0.0744)		(0.0800)		(0.0794)
constant	0.747***	-2.039*	0.750***	-1.774	-0.163	-2.638**	-0.0431	-2.208**
	(0.0414)	(1.104)	(0.0410)	(1.127)	(0.436)	(1.003)	(0.443)	(1.004)
Observations	96	96	96	96	96	96	96	96
R-squared	0.100	0.295	0.212	0.373	0.037	0.289	0.134	0.391
Year fixed effects	no	no	yes	yes	no	no	yes	yes

Notes: Standard errors are in parentheses. Significance at the 10 percent, 5 percent and 1 percent levels is denoted by *, ** and *** respectively. The SADC dummy is the omitted category.

Table D: Clothing and textiles product sub-group regressions with mean absolute price deviations between bilateral country pairs as dependent variable

	Regressions with bordering variable				Regressions with distance variable			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bordering	-0.213***	-0.101	-0.221***	-0.123				
	(0.0657)	(0.0744)	(0.0679)	(0.0786)				
log distance					0.115*	-0.0951	0.0698	-0.269***
					(0.0605)	(0.0903)	(0.0640)	(0.0961)
SACU		-0.538***		-0.367**		-0.787***		-0.957***
		(0.166)		(0.175)		(0.228)		(0.240)
COMESA		0.103		-0.0446		0.0685		-0.142
		(0.0738)		(0.0825)		(0.0788)		(0.0858)
EAC		-0.240		-0.109		-0.418***		-0.458***
		(0.155)		(0.164)		(0.152)		(0.159)
log GDP per capita		0.0817*		0.0457		0.0416		-0.0400
		(0.0425)		(0.0452)		(0.0449)		(0.0471)
log population		0.129*		0.190**		0.220***		0.373***
		(0.0734)		(0.0776)		(0.0800)		(0.0814)
constant	0.747***	-2.039*	0.834***	-2.710**	-0.163	-2.638**	0.244	-3.256***
	(0.0414)	(1.104)	(0.0426)	(1.175)	(0.436)	(1.003)	(0.462)	(1.030)
Observations	96	96	96	96	96	96	96	96
R-squared	0.100	0.295	0.187	0.345	0.037	0.289	0.097	0.386
Year fixed effects	no	no	yes	yes	no	no	yes	yes

Notes: Standard errors are in parentheses. Significance at the 10 percent, 5 percent and 1 percent levels is denoted by *, ** and *** respectively. The SADC dummy is the omitted category.

Table E: Machinery, equipment and electonics product sub-group regressions with mean absolute price deviations between bilateral country pairs as dependent variable

	Regressions with bordering variable				Regressions with distance variable			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bordering	0.0658**	0.119***	0.0767***	0.139***				
	(0.0297)	(0.0341)	(0.0259)	(0.0287)				
log distance					-0.00656	-0.0656	-0.00716	-0.0691*
					(0.0271)	(0.0434)	(0.0244)	(0.0404)
SACU		-0.111		-0.124*		-0.145		-0.148
		(0.0758)		(0.0640)		(0.110)		(0.101)
COMESA		-0.118***		-0.107***		-0.130***		-0.121***
		(0.0338)		(0.0301)		(0.0378)		(0.0361)
EAC		-0.232***		-0.248***		-0.159**		-0.162**
		(0.0712)		(0.0599)		(0.0732)		(0.0670)
log GDP per capita		-0.0196		-0.0182		-0.0115		-0.00862
		(0.0195)		(0.0165)		(0.0216)		(0.0198)
log population		0.00196		0.0218		-0.0173		-0.00645
		(0.0336)		(0.0283)		(0.0384)		(0.0342)
constant	0.299***	0.430	0.294***	0.0750	0.372*	1.218**	0.376**	1.038**
	(0.0187)	(0.506)	(0.0163)	(0.428)	(0.195)	(0.482)	(0.176)	(0.433)
Observations	96	96	96	96	96	96	96	96
R-squared	0.050	0.235	0.361	0.531	0.001	0.152	0.295	0.414
Year fixed effects	no	no	yes	yes	no	no	yes	yes

Notes: Standard errors are in parentheses. Significance at the 10 percent, 5 percent and 1 percent levels is denoted by *, ** and *** respectively. The SADC dummy is the omitted category.

Table F: Other products sub-group regressions with mean absolute price deviations between bilateral country pairs as dependent variable

	Regressions with bordering variable				Regressions with distance variable			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
bordering	0.0141	0.0671	0.0767***	0.139***				
	(0.0581)	(0.0567)	(0.0259)	(0.0287)				
log distance					0.203***	0.221***	-0.00716	-0.0691*
					(0.0473)	(0.0650)	(0.0244)	(0.0404)
SACU		-0.612***		-0.124*		-0.156		-0.148
		(0.126)		(0.0640)		(0.165)		(0.101)
COMESA		-0.284***		-0.107***		-0.213***		-0.121***
		(0.0563)		(0.0301)		(0.0567)		(0.0361)
EAC		0.0571		-0.248***		0.297***		-0.162**
		(0.119)		(0.0599)		(0.110)		(0.0670)
log GDP per capita		0.0838**		-0.0182		0.145***		-0.00862
		(0.0324)		(0.0165)		(0.0323)		(0.0198)
log population		-0.000340		0.0218		-0.140**		-0.00645
		(0.0560)		(0.0283)		(0.0576)		(0.0342)
constant	0.553***	0.0425	0.294***	0.0750	-0.902***	0.363	0.376**	1.038**
	(0.0366)	(0.842)	(0.0163)	(0.428)	(0.341)	(0.722)	(0.176)	(0.433)
Observations	96	96	96	96	96	96	96	96
R-squared	0.001	0.417	0.361	0.531	0.164	0.476	0.295	0.414
Year fixed effects	no	no	yes	yes	no	no	yes	yes

Notes: Standard errors are in parentheses. Significance at the 10 percent, 5 percent and 1 percent levels is denoted by *, ** and *** respectively. The SADC dummy is the omitted category.

Table G: Trend in absolute value of price dispersion between bilateral country pairs, restricted 2006-2009 sample

	(1)	(2)	(3)	(4)
year	-0.0116	-0.00858	-0.0122	-0.00894
	(0.0126)	(0.0109)	(0.0124)	(0.0108)
year*SACU			-0.000150***	-0.000122***
			(2.89e-05)	(2.53e-05)
year*COMESA			-9.04e-05***	-0.000101***
			(2.59e-05)	(2.26e-05)
year*EAC			-3.54e-05	-6.16e-05*
			(3.95e-05)	(3.45e-05)
Observations	1,517	1,517	1,517	1,517
R-squared	0.030	0.283	0.055	0.304
Country fixed effects	yes	yes	yes	yes
Product fixed effects	no	yes	no	yes

Notes: Standard errors are in parentheses. Significance at the 10 percent, 5 percent and 1 percent levels is denoted by *, ** and *** respectively.

Figure A: Kernel density estimates of distributions of product-by-product price deviations by product group, 2006-2009