Exchange Rate Pass-through in South Africa: Panel Evidence from Individual Goods and Services

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Abstract

This paper studies exchange rate pass-through in South Africa at the most disaggregated level possible. To accomplish this, two distinct panels of disaggregated data are employed. The first data set contains annual prices of 158 individual goods and services at the consumer level from 1990 to 2009. The second panel contains quarterly average import unit-values for twenty-six 8-digit import categories from ten of South Africa's top trading partners from 1998 Q1 to 2009 Q2. The study finds low pass-through to consumer prices (between 15 and 25 percent in the two years following an exchange rate change), slow convergence to long run purchasing power parity (6.4 years), and no apparent tendency for pass-through to have declined during the last twenty years. Relatively high estimates were found for import price pass-through from Brazil and the United States (75 percent), while Taiwan, Switzerland, India, Great Britain, and Germany were nearer the overall average of 60 percent. As with final consumer prices, there is little evidence of a decline in pass-through to import prices.

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I. Introduction

Exchange rate movements have important implications for the domestic macroeconomy, including the international transmission of business cycles and inflation, the adjustment of the current and financial accounts, and for the conduct of monetary policy. In addition, exchange rate volatility can potentially induce instability and increase uncertainty in each of these areas, thus making economic decision making more difficult for firms, consumers, and policymakers. Moreover, as economies become more globally integrated, these linkages potentially become more important. The key transmission mechanism in these relationships is via price changes; hence the relation between exchange rates and prices is central to macroeconomic research and economic policy.

Exchange rate pass-through is usually defined as the percentage response of domestic prices to exchange rate changes. This definition however contains a considerable amount of ambiguity. First, *which* prices are we considering? Where we measure the price change, e.g., at the dock into import prices, into intermediate prices, or to final goods prices is relevant because presumably the link between exchange rates and 'prices' becomes less immediate as we move from the dock to the consumer. This weakening in the response of consumer prices may reflect the bundling of local value added (marketing or distribution costs) into the final consumer price, or substitutions among final consumer goods – or inputs into their production, as well as monetary policy responses, etc.

An additional source of ambiguity with the simple definition of pass-through concerns the interval between exchange rate changes and price changes. That is, to be precise, we should specify *when* the response is measured, e.g., the next period, or after several years; hence both the stage one measures pass-through (CPI, or PPI, or import

prices), and the time frame, are relevant for measuring pass-through. Differences between short-run and long-run pass-through estimates may inform us about price stickiness or the perceived permanence of observed exchange rate changes.[1]

Two more difficulties that impede simple measurement are first, not all exchange rate changes have the same implications. For example, the exchange rate can change due to domestic inflation or to a 'shock' originating at home or abroad; thus appropriate care must be taken to control for the source of the exchange rate change when measuring exchange rate pass-through. And second, exchange rates and domestic prices (especially at the aggregate level) are jointly determined; thus more creative pass-through estimation strategies may be called for.

In addition to simultaneity biases present in aggregate investigations, the aggregate price indexes used, are aggregates which can change over time (even absent price changes) due to changes in the composition of the index. If this measurement error is correlated with the exchange rate, pass-through estimates will be biased. In this study, we attempt to mitigate these issues by focusing on well defined, specific goods and services. Hence, this paper studies exchange rate pass-through in South Africa at the most disaggregated level possible. To accomplish this, two distinct panels of disaggregated data are employed. The first data set contains annual prices of 158 individual goods and services at the consumer

[1] In the context of his model, Engel 2006, shows that the implications for pass-through are the same, whether an optimizing firm chooses its prices flexibly in response to changes in its costs or demand, or whether it must preset prices in advance in either the home (PCP) or importer's currency (LCP). That is, the firm will optimally choose to preset prices in its own currency (PCP) under the same conditions that the firm would choose to stabilize prices in its own currency under price flexibility. This implies that one cannot make inferences about price stickiness based on estimated pass-through. On the basis of their theoretical model and empirical evidence, Devereux and Yetman (2002) however conclude "sticky prices play an important role in cross-country variations in exchange rate pass-through".

level from 1990 to 2009. The second panel contains quarterly average import unit-values for twenty-six 8-digit import categories from ten of South Africa's top trading partners from 1998 Q1 to 2009 Q2. To facilitate comparison with existing studies, pass-through elasticities are estimated for both imports and for consumer prices. Here the estimates are comparable to existing estimates.

As an inflation targeter, South Africa is an interesting case study both due to the growing acceptance and implementation of inflation targeting regimes, and due to the hypothesized link between inflation targeting and the estimated declines in pass-through around the world.[2] Thus we check whether this 'conventional wisdom' holds for South Africa. Interestingly, we find that it does not. Finally, this study compliments existing research by examining whether pass-through is substantially different across South Africa's major import trading partners. Evidence of a decline in pass-through, or widely different pass-through across source countries would have important implications for monetary policy because pass-through affects both forecasts of inflation and the effects of changes in monetary policy on inflation. Hence, changes in the country composition of trade may have direct (and possibly unanticipated) implications for the conduct of monetary policy.

The next section summarizes some interesting findings from recent research. Section III discusses the econometric framework that we adopt, and Section IV discusses the data used. Section V presents the results and the final section concludes.

[2] South Africa's average inflation rate has declined from over 14 percent in the 1980s, to 9 percent in the 1990s (when it reportedly had an 'implicit' inflation target), to just over 6 percent since 2000, after formal inflation targeting was adopted. However, since inflation has generally been on the rise since 2004, there has been a lively debate about the credibility of its inflation targeting commitment. This controversy suggests caution should be exercised when drawing conclusions from this study, especially regarding links between inflation targeting and pass-through.

II. Some findings from recent research

Most studies of exchange rate pass-through have focused on aggregate import prices in industrialized countries, rather than into developing countries. In a recent systematic study of U.S. import prices, Marazzi et al (2005) document a dramatic and "sustained" decline in exchange rate pass-through from about 65 percent in the 1980s to around 12 percent in the decade ending in 2004. Interestingly, this decline in pass-through into the U.S. has been noted at least since Mann (1986). Otani, Shiratsuka, and Shirota (2003) find a decline in pass-through for imports into Japan, which they attribute to increased penetration by intra-firm imports and to a decline in global inflation.[3] Campa and Goldberg (2005) find a decline in the pass-through coefficient in the 1990s for OECD countries, which they attribute to a changing commodity composition of trade more than to a less inflationary environment. Their data set again consists solely of industrialized countries.

The implications for monetary policy of a decline in pass-through depend on the source of the decline. Mishkin (2008) notes that there is some evidence suggesting improved monetary policies – in particular, a strong commitment to an explicit nominal anchor in many countries, have contributed to their recorded declines. He also cites several additional possible explanations including: more pricing in the importer's currency, a greater share of distribution costs, which he argues are 'fairly insensitive to shocks driving the exchange rate of foreign costs", and more cross border production, which implies that

[3] Taylor (2000) proposed that a decline in pass-through of exchange rate changes into the CPI in the 1990s was due to a lower inflationary environment, and looked at US data. Gagnon and Ihrig (2004) extended this claim to a sample of 11 industrialized countries, finding that the standard deviation of inflation explains the coefficient better than does the average inflation rate.

costs are denominated in a basket of currencies; hence exchange rate movements may be partly offset by offsetting movements in costs. Mishkin concludes however by noting that a weaker relationship between exchange rates and nominal demand may make it easier for monetary policy to stabilize inflation and real activity.

Though the focus in Marrazi et al (2005) is on the United States, the study is particularly relevant because they evaluate in detail, several reasons for the estimated decline in pass-through. One hypothesis, observed by Parsley (1993) for Japan, and Campa and Goldberg (2005) for the U.S. is that the commodity composition of trade has changed; i.e., goods with lower pass-through are becoming more prevalent in trade. Marrazi et al (2005) also find this to be the case, but they argue that this can only explain part of the observed decline in U.S. pass-through. A second hypothesis they examine is the growing role of Chinese exports to the U.S. (also relevant for South Africa since China has now risen to the third largest supplier of imports, following the euro area, and the U.S.), which have grown from 5.8 percent of merchandise imports in 1994 to 13.4 percent in 2004. While this increase is impressive, it is still too small to directly account for the decline in pass-through; hence Marrazi et al (2005) hypothesize a self-limiting price effect working on other exporters to the U.S. market. That is, other exporters may feel pressure to limit pass-through for fear of losing market share to Chinese exporters. Marrazi et al (2005) find some confirmation for this hypothesis by documenting a high correlation in the decline in pass-through by import sector with the sector-by-sector increase in China's import penetration. In addition to growing imports from China, a third hypothesis is a shift in the source country of the import basket, e.g., from high-wage countries toward low-

wage countries. They find little evidence that this could account for the decline in U.S. import price pass-through.

The world-wide decline in inflation has been another often cited explanation for declining rates of pass-through (e.g., Taylor, 2000, and Gagnon and Ihrig, 2004). That is, since cross-country estimates of pass-through exhibit a positive correlation to inflation, declining global inflation is also associated with declining pass-through around the globe. Interestingly, there is no clear consensus over what the driving forces behind this convergence in inflation are, nor whether the trend will continue going forward. In particular, the financial crisis that began in 2007, and which has led to a variety of responses by the world's fiscal and monetary authorities, may lead to similarly diverse inflation experiences. Thus the question is whether inflation, and/or pass-through will continue to decline going forward.

Another potential 'compositional' (or technological) reason for a decline in estimated pass-through is a declining share of traded inputs into final goods. That is, as the share of local content rises, pass-through (in percentage terms) declines. To take an extreme example, suppose exchange rates do not affect costs of distribution services in the import market at all. If distribution services count for a growing fraction of the final good's price, the fraction of the final good's price that is responsive to exchange rates shrinks. Hence even 100 percent pass-through will have a muted impact on the final good's price. Recent estimates for non-traded input shares are indeed large, e.g., as much as 65 percent of the price of a Big Mac hamburger (Parsley and Wei, 2007). The evidence presented below casts some doubt on the presumption that this explanation is based on. In

particular, the evidence for South Africa is that (at least at the consumer level) goods have similar rates of pass-through as services.

Models of exchange rate pass-through in the 1980s emphasized the role of market segmentation – a model seemingly well suited to emerging countries where pass-through was typically estimated very high. Indeed, the conventional wisdom had long been that pass-through is relatively rapid and complete in small, and/or, less developed countries. For South Africa, Bhundia (2002) notes that "the South African Reserve Bank reports long run pass-through at 78 percent for import prices", i.e., import prices rise 7.8 percent, following a 10 percent depreciation in the (nominal) exchange rate". The process of economic integration witnessed since the 1990s however makes these models seem less compelling, hence it is also an open question whether import price pass-through has fallen for South Africa.

On the other hand, it has long been noted that pass-through was lower in United States and other rich countries, and there is some empirical documentation in the literature for this claim. For example, Choudhri and Hakura (2001) reported that for a sample of 12 emerging market economies during 1979-2000, their average one-year pass-through is 26% (with some individual pass-through degrees as high as 40%). This is much higher than the average one-year pass-through for a group of non-G3 industrial countries (12%) or G3 (only 7%).[4] In a cross-country study examining 76 countries over the period 1990-2001, Frankel, Parsley and Wei (2005) argue that slow pass-through was "imported" by lower-income countries in the 1990s. Several large devaluations occurred in East Asia, Latin America, and other emerging market countries between December 1994 (Mexico)

[4] Ho and McCauley (2003).

and December 2001 (Argentina), and yet local currency prices failed to rise in proportion to these devaluations.

In addition to Choudhri and Hakura (2001), there are several recent studies that include lower-income countries. Borensztein and De Gregorio (1999) and Goldfajn and Werlang (2000), study the low pass-through of recent large devaluations in developing countries.[5] Saiki (2004) includes two developing countries in her study of whether a switch in monetary regime to inflation-targeting is associated with a fall in the pass-through coefficient. Devereux and Yetman (2002) have 122 countries in their sample, and Barhoumi (2005) studies pass-through to import prices in 24 developing countries. But these are all studies of influences on aggregate price measures, the CPI in particular, not on import prices. Few studies concentrate on imports of specific goods into developing countries.[6]

III.A basic small-country framework

A simple textbook model of perfect competition, profit maximization by a foreign exporter with prices set in the exporter's currency (producer currency pricing), implies that price equals marginal cost, or, $P_i = C_i$, where, P_i is the price of the i^{th} good in the producer's currency. If the good is competitively traded internationally, the price in importing currency, P_i^*, is simply $P_i^* = C_i / S$, where S is the producer currency price of

[5] The BIS (2002, p. 92) is among those attributing the low pass-through to the CPI of recent large devaluations in developing countries to a decline in long-run inflation. But Burstein, Eichenbaum and Rebelo (2002) attribute the low observed pass-through in general price indices to a substitution of newly expensive import goods to local substitutes in the indices following large devaluations.
[6] Aw (1993) examines exports from Taiwan to four countries of footwear, but they are heavily affected by quotas. Parsley (2003) examines pass-through to Hong Kong import prices (unit values), and finds pass-through to be nearly complete within one year.

foreign exchange. With constant marginal cost, pass-through, i.e., the elasticity of importing currency price with respect to the exchange rate $\left(d \ln P^* / d \ln S\right)$, is equal to one (in absolute value). Thus, in the small country, perfect competition benchmark, local (import) currency import prices fully reflect exchange rate changes.

This same result holds in the case where the exporting firm set prices in its own currency (Producer Currency Pricing, or PCP), before the realization of an exchange rate change. At first glance, exchange rate pass-through will be complete. At the other extreme, however, if the firm chooses to preset price in local currency (LCP), exchange rate pass-through will equal zero. Thus, one might conclude that the degree of pass-through is not really an interesting question.

However, this position is too extreme. There are at least four cases where pass-through may lie between zero and 100 percent. First, as noted above the price indexes typically used to measure the price change actually refer to a price basket. Such baskets change over time – both the goods and services included, and in the origin of the goods in the basket. If the price index changes for either of these two reasons, there is ample scope for pass-through to take intermediate values between zero and 100 percent.[7] Hence, this provides another motivation for studying disaggregated price data. Second, mechanically, within the index some goods' prices may be set in producer's currency while other prices are set in the importer's currency, implying estimates of the degree of estimated pass-through are actually economy-wide averages of these practices. Third, also as noted above, imported goods may involve distribution services and other local content. This implies for

[7] Campa and Goldberg (2005) find that changes in the composition of trade over time can account for much, if not all of the widely discussed decline in pass-through among OECD economies.

example, that full pass-through at the dock will not be translated to full pass-through at the retail level. Fourth, in a dynamic setting, firms may alternate pricing policies (PCP & LCP) over time, thus implying that pass-through can take intermediate values. Unless one can rule out these possibilities, the degree of pass-through remains an interesting question.

Relaxing the perfect competition assumption implies that the first order condition must include a markup,

$$P_i^* = \lambda C_i / S, \qquad (1)$$

where the markup (λ) is a function of the elasticity of demand (ε), $\lambda = \varepsilon_i / (\varepsilon_i - 1)$. Thus, pass-through can be less than complete if the markup varies with exchange rates (Campa and Goldberg 2005), with import market demand conditions, or due to strategic interactions (see, e.g., Froot and Klemperer 1989). Note that the perfect competition case is also a special case of equation (1) when the demand elasticity is infinite; LCP is a special case where the markup varies perfectly with the exchange rate, and PCP occurs if markups are constant.

Though the models discussed so far are quite simple, it should be noted that a number theoretical models with e.g., different assumptions about price setting, or the structure of markets, yield similar empirical specifications (e.g., Yang, 2005, Engel 2006, Devereux and Yetman, 2002). That is, even though the framework specified above is simple, virtually all empirical estimates of pass-through are obtained from first-differenced, log linear specifications of equation 1, augmented with various controls for competitor prices, demand shifters, and lags (recent examples include, e.g., Marazzi et al,

2005, and Mumtaz, Oomen, and Wang, 2006)) using aggregate (e.g., import price index) data.[8]

In early studies, pass-through to the U.S. typically was found to be around sixty percent, implying that changes in markup thus accounted for the residual forty percent of the exchange rate change. However, pass-through estimates have fallen over time for the U.S. and other rich countries, and a consensus estimate is now around twenty percent (see Marazzi et al 2005, or Campa and Goldberg 2005).

There are several econometric issues to be confronted when estimating pass-through at the aggregate level which can either bias the results, or cloud interpretation of results. First, exchange rates and prices are both endogenous variables. In this case, by definition, the exchange rate will be correlated with the disturbance term and OLS estimates will be biased, possibly leading to instability in pass-through estimates (see, e.g., Parsley and Popper 1998). Second, as noted by Campa and Goldberg (2005), changes in the index can be responsible for changes in estimated pass-through. Knowing that pass-through is changing due to a changing basket of trade or due to changes in pricing behavior would almost certainly lead to different policy implications. Third, shifts in the traded/non-traded composition of the goods in the index can be responsible for changes in pass-through, as well as for biased estimates. The logic for biased estimates comes from recent research on measuring persistence of a time series, where the series is an index (see Imbs, et al 2005). The intuition is that the persistence of the aggregate (e.g., CPI) is a weighted average of the persistence of the individual constituents, where the weights are

[8] Expressed in first-differenced, natural log values the coefficients yield percentage changes of the dependent variable to a unit change in the independent variable.

proportional to the constituent variances. Thus, constituents with near unit-root behavior constitute most of the measured persistence (since in the limit, they have infinite variance), resulting in the upward bias.

In contrast, the focus in this study is on individual, final goods and services prices at the consumer level. This focus has a number of advantages. At an individual price level the assumption of exogeneity of exchange rate changes is more plausible. Second, barring changes in the production technology, there are no index changes to speak of at the level of an individual good; hence, we have a potentially cleaner measure of changes in pass-through. Similarly, since the data set includes prices of specific services, one of this study's unique contributions is to provide estimates pass-through for an important (and growing) category within the overall CPI. This is interesting as a direct test of the differences in pass-through between goods and services, as well as an indirect indication of how the growing share of non-traded inputs into production of final goods has affected pass-through estimates. Finally, the focus here is on prices and pass-through at the consumer level, which is presumably more relevant for ultimate inflationary consequences, for firms competing in final goods' markets, and from the perspective of consumers, than are import prices and pass-through at the import level.

IV. Data

(a) Description of the Disaggregated Consumer Price Data

The individual goods prices used in this study were compiled by the *Economist Intelligence Unit (EIU)*. The *EIU* data are collected as part of the *Worldwide Cost of Living Survey*, and are designed for use by human resource managers in the design of

compensation policies. The *EIU* description is at http://store.eiu.com/product/130000213.html. The data set contains more than 160 local currency retail prices of (mostly generic) goods and services collected from 140 cities around the world. Some goods are priced at two locations and both prices appear in the data set, bringing the total number of goods and services to more than 330. The data are reported annually, each December since 1990. For this study, we focus on 158 goods and services prices recorded for Johannesburg, South Africa.[9] The price data is relatively complete: of the potential 3160 observations in the data (=20 years x 158 prices) there are only 103 (3 percent) missing observations.

Table 1 lists all of the goods (indicated by "G") and services (S) included in this study. Of the total 158 prices, 46 are services, and 112 are goods. The goods/services breakdown is somewhat arbitrary – especially given the quite high estimates of the share of non-traded inputs in the price of traded goods. For example, Feenstra (1998) reports that Barbie dolls cost around ten dollars in the U.S., but the imported doll costs only one dollar; thus around 90 percent of the price of a Barbie doll in the U.S. is value added between the manufacturer and the consumer. Nonetheless, we report results for goods and services separately in the regression analysis.

All of the price series were checked for coding errors. First, price observations (in common currency) that differed from the cross-sectional mean by more than a factor of three were set to missing. Next, potential coding errors were screened by focusing on within-product price swings. Specifically, price changes within a given city of more than

[9] There is also data for Pretoria beginning in 2003, which we do not use due to the limited time span.

one hundred percent that were subsequently reversed in the next period (there were three) were also replaced by the average of the previous and next year's values. Finally we checked for outliers in our regressions by deleting the observations associated with the top 1 percent of the residuals.

In addition to the individual goods and services price data, world export price index data was taken from the International Financial Statistics (series 174..DZF). From the IFS the U.S and South African Consumer Price Indexes (series 19964...ZF and 11164…ZF) were also taken for use in computing South Africa's disequilibrium real exchange rate for use in subsequent error correction regressions. Two series were taken from the April 2009 World Economic Outlook (WEO) data base (www.imf.org/external/ns/cs.aspx?id=28). The first one was the G7 output gap, which was taken as a measure of aggregate demand conditions outside South Africa. The second series from WEO was South Africa's real gross domestic product.

(b) Description of the Unit Value Data

The source of the data is from a CD provided by Global Insight, which "cleans" raw data on the value and quantities of goods shipped, by good and by source country. The original data is collected by the Customs and Excise branch of the South African Revenue Service. Despite being cleaned, the data is a great deal more variable, and has more missing observations than that typically used in macroeconomic research. Hence, a number of additional filters were applied to the data before using it in the analysis. The data on the CD is monthly from January 1998 to June 2009.

To get a 'price' we construct unit values, i.e., value divided by quantity for each item included. Even for imports of identical goods, unit values can change due to changes in the price, or to changes in the way the goods are bundled. For example, a product can be shipped in bulk, or in cartons, which may be subdivided further into packets, etc. Presumably pricing would be different based on the quantity being purchased. We acknowledge this problem, and attempt to mitigate it by focusing on the most homogeneous and disaggregated (HS8-digit) commodity classifications possible. This focus hopefully minimizes changes in price due to changes in the basket being imported, as well as changes in the 'bundling' of the product.

We also wanted products that were typical imports; hence we require there to be a minimum of 120 monthly observations out of a possible 137 observations, and we required the good to be imported from a minimum of 4 trading partners.[10] Next we focused on the large variations in the data. All price swings of more than 100 percent (month-to-month) that were reversed in the subsequent month were set to missing. Next, all unit values that differed from the mean by more than three standard deviations were set to missing. Similarly, all observations where the difference between the maximum and minimum values was greater than 10000 percent (in absolute value) were set to missing. Next we linearly interpolated values where there were no more than two consecutive months missing. Finally, we took quarterly averages of the monthly values and performed all subsequent analysis at the quarterly frequency. We also repeated our statistical analysis after (a) dropping the largest and smallest 5 percent of the observations, (b) dropping one

[10] The four country minimum requirement was relaxed in an effort to focus on six arguably more homogenous imports of chemicals. Three of the six chemicals are imported from only three source countries.

country at a time (not reported), and (c) dropping one good at a time (not reported) as further checks on the robustness of the results. Despite these steps the unit value data is far from a balanced panel since not all products are imported from all source countries. Table 4 displays the ultimate data availability in terms of goods and source countries, as well as providing a listing of the product descriptions.

V. Empirical Results

(a) Pass-through to Consumer Prices

The first estimation reported below is equation (2a) which is a first-differenced log-linear specification based on equation 1, i.e.,

$$\Delta p_{it}^{*} = \sum_{j=0}^{1} \beta \Delta s_{t-j} + \gamma \Delta c_t + \delta \Delta rgdp_t + \varpi \Delta G7gap_t + good\ dummies\,, \tag{2a}$$

Where Δ is the first-difference operator, p_{it}^{*} is the natural log of the rand price of the good or service *i* at time t, c_{t-j} is the log of the world export price index – an indicator of costs of production, *rgdp* is log real gross domestic product – an indicator of changes domestic demand conditions, and the G7 output gap is indicated by *G7gap*. Since we pool the goods into a single regression, we include product dummies.

In specification 2b, we add lags of all right hand side variables, as well as including a lagged dependent variable

$$\begin{aligned}\Delta p_{it}^{*} = &\sum_{j=0}^{1} \beta_j \Delta s_{t-j} + \sum_{j=0}^{1} \gamma_j \Delta c_{t-j} + \sum_{j=0}^{1} \delta_j \Delta rgdp_{t-j} \\ &+ \sum_{j=0}^{1} \varpi_j \Delta G7gap_{t-j} + \lambda \Delta p_{it-1}^{*} + good\ dummies\end{aligned}\,, \tag{2b}$$

In these specifications, average pass-through is estimated by pooling all goods or services. Technically, we should weight the individual prices by their CPI weights to form a more comparable measure of 'average' pass-through. However, our results imply that this would have little effect on the results, given the small differences in pass-through between goods and services. Additionally, since most of the independent variables in each equation represent aggregate, i.e., country-level, effects, we augment the specifications with good-specific error correction mechanisms. This should mitigate concerns that our estimates are specific to the sample of goods and services that we examine.

We first estimate equation 2 without the lagged dependent variable. According to the first column of Table 2, exchange rate pass-through is nine percent in the first year and twenty-three percent (9+14) in the first two years, with a t-statistic of 5.04. Pass-through of world cost changes is roughly twice that, and more immediate, at 46 percent, and the coefficient is again highly statistically significant. The difference in these two types of pass-through (exchange rate, and cost) is more evidence that the law of one price does not hold; hence this restriction (i.e., the equality of the two coefficients) is not imposed in subsequent regressions. Increases in real income lead to lower pass-through, a pattern seen throughout the results. The effect is economically much smaller, but still highly statistically significant. Note that in the context of the data used here, this effect cannot be driven by sifts in trade – since the basket is the same, or from changes in the proportion of local content – again, because the basket is constant. Finally, the effect of the world business cycle (G7gap) seems to play little role in the change in the rand price of consumer goods.

In column 2, we add lags to the specification. In particular, we include the contemporaneous value and one lag of each independent variable plus one lag of the dependent variable. In this specification, pass-through declines (from 23 percent to 15 percent, with at t-statistic of 2.70) over the two year period. There is a marked improvement in the fit of the equation as evidenced by the much higher r-squared statics; these have risen to 10.6 percent overall, 53.7 percent for the between variation, and 12 percent for variation within goods. The coefficients and significance levels on the other independent variables are similar to those in column 1.

In columns 3 and 4 we repeat the analysis focusing on services. We note that this is a unique aspect of the current study. Based on theoretical grounds, our priors are that services have lower pass-through, since services involve higher shares of non-traded inputs. If the input is non-traded, the direct link between the exchange rate and price is severed. Interestingly, we find no support for these arguments in the data. That is, estimated pass-through is slightly larger (and still statistically significant) among our group of 46 services. The estimated coefficient on world export prices is smaller for services (and it loses its statistical significance), and the G7gap is now statistically significant. But interestingly, estimated pass-through is not much different between goods, and services; indeed if anything, pass-through for services is higher than that for goods.[11] Again, the main finding is a relatively low rate of pass-through at the consumer level, and, the similarity between pass-through to goods, and pass-through to services.

[11] Formal tests for equality of pass-through for goods and services could not be rejected at standard significance levels.

As discussed above, we next modify the specification in equation (2b) to include an error correction term to capture reversion to purchasing power parity (PPP). Subsequently we also allow the pass-through coefficient and the reversion to long-run PPP to change over time. Table 3 reports these results.

$$\Delta p_{it}^{*} = \sum_{j=0}^{1} \beta_j \Delta s_{t-j} + \sum_{j=0}^{1} \gamma_j \Delta c_{t-j} + \sum_{j=0}^{1} \delta_j \Delta rgdp_{t-j} + \sum_{j=0}^{1} \varpi_j \Delta G7gap_{t-j} + \lambda \Delta p_{it-1}^{*} + \theta ecm_{t-1} + good\ dummies \quad , \tag{2c}$$

The error correction term (*ecm*) is defined as the lagged residuals from a regression of South African consumer prices on prices in the U.S., the nominal rand/$ exchange rate, and a constant. To capture the long-run potential for cointegration, the regression was run using annual data from 1990-2008. Incorporating an error correction term thus allows for cointegration, but does not impose it. We do however, find that the error correction term's coefficient is consistently statistically significant, indicating there is a tendency to revert to long-run PPP.

As in Table 2, short run pass-through is highly statistically significant, but much smaller (11.2 percent) than the short run pass-through of cost changes (70.4 percent). The coefficient on real income is of a similar magnitude and statistical significance as in Table 2. The coefficient on the output gap in G7 countries is now statistically significant and positive, suggesting a positive correlation of domestic prices and demand conditions abroad.

The coefficient on the error correction term captures long-run reversion to purchasing power parity. Although the error correction term is highly statistically

significant, the estimate of -0.1019 suggests that convergence is quite slow. The half life is 6.4 years (ln(.5)/ln(1-.1019)), somewhat above the 'consensus' noted by Rogoff (1996), but interestingly, nearly identical to that estimated by Frankel, Parsley, Wei (2005). The failure of the law of one price is apparently due to slow adjustment far more than to a long-run pass-through coefficient that falls short of one. This evidence is consistent with sticky prices, or to a large wedge of local content embedded into the price of individual goods. Also note that since these data are (a) sampled at a point in time, and (b) disaggregated by product, recent theoretical arguments suggesting that slow convergence may be due to product-aggregation bias, or temporal-aggregation bias, apparently do not apply. That is the slow adjustment remains even absent these data biases.

Finally, columns 2 and 4 of Table 3 report the evidence on trends in both pass-through and in long run mean reversion. In particular, the specification includes trend interaction terms (with the exchange rate change and the error correction mechanism) to the specification, i.e.,

$$\begin{aligned}\Delta p_{it}^{*} = {} & \beta_1 \Delta s_t + \beta_2 \Delta s_t * trend + \gamma \Delta c_t + \delta \Delta rgdp_t \\ & + \varpi \Delta G7gap_t + \theta_1 ecm_{t-1} + \theta_2 ecm_{t-1} * trend + good\ dummies\end{aligned}, \qquad (2d)$$

Interestingly, there is little evidence of a trend in short run pass-through during the sample period. This is in contrast with much of the evidence found for other countries. Comparison of the coefficients in columns 1 and 2 suggests that short-run pass-through was slightly larger at the beginning of the sample, but the trend term is not statistically significant. Given South African inflation rates have not declined by as much as

elsewhere, this evidence is consistent with the research attributing declining pass-through to lower inflationary environments.

There is however, some evidence of a downward trend in the magnitude of the error correction term, consistent with the evidence in by Frankel, Parsley, Wei (2005). However, this evidence suggests that speed of reversion to long-run purchasing power parity has actually slowed from a half-life of about 4.5 years at the beginning of the sample to the 6.4 years today. There is little research to benchmark this result against, since most studies estimate the average mean reversion, and not changes in the rate.

(b) Pass-through to Imports

This section investigates pass-through to import prices relying on the framework developed in Knetter (1989) in his study of pricing to market in U.S. and German exports. It is useful to review some of the basic features of that analysis since it was the first to rely on a panel of disaggregated prices to estimate pass-through. Knetter considers an exporter selling to N foreign destinations. Maximizing profit subject to demand conditions in each foreign market subject to minimizing cost yields a set of first order conditions similar to equation (1):

$$P_{jt}^{*} = \lambda_{jt} C_t / S_{jt} , \qquad (3)$$

where *j* represents the destination country for the firm's exports of good *i*. For the moment we omit the goods' subscripts and consider a single product *i*. Knetter's estimation strategy uses multiple observations of the export price at each point in time to pin down marginal. In his case, the common price across all markets is equal to marginal cost, and the

difference from marginal cost is the local market markup. Since he utilizes multiple destination markets for each product, marginal costs are captured by the time fixed-effect in an OLS regression. That is, by utilizing the panel structure of the data and estimating a regression with a full complement of fixed effects – i.e., with fixed effects for country (markup), and time (marginal cost), Knetter argues that any residual correlation with the exchange rate (i.e., non-zero pass-through) implies a rejection of the simple constant markup, perfect completion model. Notice that this methodology obviates the need for finding proxies for marginal cost and factors affecting markups; they are completely subsumed in the fixed-effects. Note also that the panel structure of the estimation, and the inclusion of the full complement of fixed effects, obviates concerns about unit roots in the estimation.

Here, we adapt Knetter's methodology to import unit values of twenty-six of the most disaggregated import products into South Africa, from the ten largest suppliers. Here we have a three dimensional panel of: goods (26), countries (10), and time (46 quarters). Following Knetter, consider the following general empirical specification:

$$\ln p^{*}_{ijt} = \theta_t + \lambda_j + \gamma_i + \beta_j \ln s_{jt} + \nu_{ijt} \qquad (4)$$

According to equation (4) the rand price of import *i*, is determined by good, time, and source-country fixed effects, plus a random error. Augmenting the equation with country specific (log) exchange rates allows an estimate of the country-specific pass-through elasticities.

Table 5 presents the pass-through coefficient estimates and robust standard errors for each of the ten countries supplying exports to South Africa. Column (1) presents the

full panel results, while column (2) gauges the sensitivity of these results by dropping the top and bottom 5 percent of the residuals from the regression. Column (3) constrains all the country-specific coefficients ($\hat{\beta}_j$) to be equal (after dropping the two countries where zero pass-through could not be rejected), and column (4) again drops the top and bottom 5 percent of the residuals from that regression.

In Column 1 we see that the two countries with the highest import price pass-through to South Africa are Brazil and the United States, at about 75 percent. Following closely behind are Taiwan, Switzerland, India, Great Britain, and Germany, at around 60 percent, while pass-through from Japan has the lowest statistically significant value of only 38 percent. The overall fit of the regression equation is quite good.

The two countries where pass-through is not statistically different from zero are China and Sweden. For Japan one hypothesis is that their domestic deflationary environment might play a role, and for China perhaps its extremely rapid growth and exchange rate peg to the dollar might identify this country as a 'special' case. However, the low pass-through from Sweden is a puzzle. The low pass-through for China echoes results in Marrazi et al (2005) for the U.S.; however China's growing presence and low pass-through have not lowered pass-through from other source countries as observed by Marrazi et. al.

In column 2 the largest and smallest five percent of the residuals have been removed before re-estimating equation (4). The results are very similar, except that China becomes statistically significant at the 5% level (and still very low). Estimated pass-through from Sweden again remains statistically insignificant, despite the fact that the R-

squared statistics all improve. In column (3) we constrain the pass-through coefficient to be the same – despite it differing clearly across source country. The regression in column (3) also drops the two countries with statistically insignificant pass-through (China and Sweden) from the regression. According to the resulting coefficient estimate, "average" pass-through to import prices in South Africa since 1998 has been around 60 percent, somewhat lower than Bhundia's (2002) estimate of 78 percent; though the sample period here (1998-2009) is almost non-overlapping with Bhundia's. Finally, the regression in column (4) checks for evidence in a change in average pass-through during the sample. The coefficient on the exchange rate-trend interaction term is not statistically significant; hence we cannot reject the hypothesis that pass-through to import prices has not changed over the course of the sample.

VI. Conclusions

This study estimates pass-through into consumer goods and services and at the import level for South Africa. Estimates are derived from data at the lowest possible level of aggregation – thus mitigating some measurement problems and simultaneity biases present in studies at the aggregate level. The study finds low pass-through to consumer prices (between 15 and 25 percent in the two years following an exchange rate change), slow convergence to long run purchasing power parity (6.4 years), and no apparent tendency for pass-through to have declined during the last twenty years – contrary to evidence found for many large economies.

Import price pass-through is much higher, averaging around 60 percent for eight of the ten countries studied, and as with consumer goods and services, there was no evidence of a decline. There is also considerable diversity in the estimates. Relatively high

estimates were found for pass-through from Brazil and the United States (75 percent), while Taiwan, Switzerland, India, Great Britain, and Germany were nearer the overall average of 60 percent. Import pass-through from Japan recorded the lowest statistically significant estimate of pass-through at 38 percent, and the two countries where pass-through estimates were not statistically different from zero are China and Sweden. If trade with China continues to grow, pass-through may yet follow international patterns and register a decline.

Table 1: Goods and Services included

1	S	American /English school: annual tuition, ages 5-12 (avg.)	80	G	International weekly news magazine (Time) (avg.)
2	S	American/English school: extra costs, ages 5-12 (avg.)	81	G	Kodak colour film (36 exposures) (avg.)
3	S	American/English school: kindergarten annual fees (avg.)	82	G	Lamb: chops (1 kg) (supermarket)
4	S	Annual premium for car insurance (low)	83	G	Lamb: leg (1 kg) (supermarket)
5	G	Apples (1 kg) (supermarket)	84	G	Lamb: Stewing (1 kg) (supermarket)
6	G	Aspirins (100 tablets) (supermarket)	85	S	Laundry (one shirt) (standard high-street outlet)
7	S	Babysitter's rate per hour (avg.)	86	G	Laundry detergent (3 l) (supermarket)
8	G	Bacon (1 kg) (supermarket)	87	G	Lemons (1 kg) (supermarket)
9	G	Bananas (1 kg) (supermarket)	88	G	Lettuce (one) (supermarket)
10	G	Batteries (two, size D/LR20) (supermarket)	89	G	Light bulbs (two, 60 watts) (supermarket)
11	G	Beef: filet mignon (1 kg) (supermarket)	90	G	Lipstick (deluxe type) (chain store)
12	G	Beef: ground or minced (1 kg) (supermarket)	91	G	Liqueur, Cointreau (700 ml) (supermarket)
13	G	Beef: roast (1 kg) (supermarket)	92	G	Low priced car (900-1299 cc) (low)
14	G	Beef: steak, entrecote (1 kg) (supermarket)	93	S	Maid's monthly wages (full time) (avg.)
15	G	Beef: stewing, shoulder (1 kg) (supermarket)	94	S	Man's haircut (tips included) (avg.)
16	G	Beer, local brand (1 l) (supermarket)	95	G	Margarine, 500g (supermarket)
17	G	Beer, top quality (330 ml) (supermarket)	96	G	Men's business shirt, white (chain store)
18	G	Boy's dress trousers (chain store)	97	G	Men's business suit, two piece, medium weight (chain store)
19	G	Boy's jacket, smart (chain store)	98	G	Men's shoes, business wear (chain store)
20	S	Business trip, typical daily cost	99	G	Milk, pasteurised (1 l) (supermarket)
21	G	Butter, 500 g (supermarket)	100	G	Mineral water (1 l) (supermarket)
22	G	Carrots (1 kg) (supermarket)	101	S	Moderate hotel, single room, one night including breakfast (avg.)
23	G	Cheese, imported (500 g) (supermarket)	102	G	Mushrooms (1 kg) (supermarket)
24	G	Chicken: fresh (1 kg) (supermarket)	103	G	Olive oil (1 l) (supermarket)
25	G	Chicken: frozen (1 kg) (supermarket)	104	G	One drink at bar of first class hotel (avg.)
26	G	Child's jeans (chain store)	105	S	One good seat at cinema (avg.)
27	G	Child's shoes, dresswear (chain store)	106	S	One X-ray at doctor's office or hospital (avg.)
28	G	Child's shoes, sportswear (chain store)	107	G	Onions (1 kg) (supermarket)
29	G	Cigarettes, local brand (pack of 20) (supermarket)	108	G	Orange juice (1 l) (supermarket)
30	G	Cigarettes, Marlboro (pack of 20) (supermarket)	109	G	Oranges (1 kg) (supermarket)
31	G	Coca-Cola (1 l) (supermarket)	110	G	Paperback novel (at bookstore) (avg.)
32	G	Cocoa (250 g) (supermarket)	111	G	Peaches, canned (500 g) (supermarket)
33	G	Cognac, French VSOP (700 ml) (supermarket)	112	G	Peanut or corn oil (1 l) (supermarket)
34	G	Compact car (1300-1799 cc) (low)	113	G	Peas, canned (250 g) (supermarket)
35	G	Compact disc album (avg.)	114	G	Pipe tobacco (50 g) (avg.)
36	G	Cornflakes (375 g) (supermarket)	115	G	Pork: chops (1 kg) (supermarket)
37	S	Cost of a tune up (but no major repairs) (low)	116	G	Pork: loin (1 kg) (supermarket)
38	S	Cost of developing 36 colour pictures (avg.)	117	G	Potatoes (2 kg) (supermarket)
39	G	Cost of six tennis balls eg Dunlop, Wilson (avg.)	118	G	Razor blades (five pieces) (supermarket)
40	G	Daily local newspaper (avg.)	119	G	Regular unleaded petrol (1 l) (avg.)
41	G	Deluxe car (2500 cc upwards) (low)	120	S	Routine checkup at family doctor (avg.)
42	G	Dishwashing liquid (750 ml) (supermarket)	121	G	Scotch whisky, six years old (700 ml) (supermarket)
43	G	Drinking chocolate (500 g) (supermarket)	122	G	Shampoo & conditioner in one (400 ml) (supermarket)
44	S	Dry cleaning, man's suit (standard high-street outlet)	123	S	Simple meal for one person (avg.)
45	S	Dry cleaning, trousers (standard high-street outlet)	124	G	Sliced pineapples, canned (500 g) (supermarket)
46	S	Dry cleaning, woman's dress (standard high-street outlet)	125	G	Soap (100 g) (supermarket)
47	G	Eggs (12) (supermarket)	126	G	Socks, wool mixture (chain store)
48	G	Electric toaster (for two slices) (supermarket)	127	G	Spaghetti (1 kg) (supermarket)
49	S	Electricity, monthly bill for family of four (avg.)	128	G	Sugar, white (1 kg) (supermarket)
50	S	Entrance fee to a public swimming pool (avg.)	129	S	Taxi rate per additional kilometre (avg.)
51	G	Facial tissues (box of 100) (supermarket)	130	S	Taxi: airport to city centre (avg.)
52	G	Family car (1800-2499 cc) (low)	131	S	Taxi: initial meter charge (avg.)
53	G	Fast food snack: hamburger, fries and drink (avg.)	132	G	Tea bags (25 bags) (supermarket)
54	G	Flour, white (1 kg) (supermarket)	133	S	Telephone line, monthly rental (avg.)
55	S	Four best seats at cinema (avg.)	134	S	Telephone, charge per local call from home (3 mins) (avg.)
56	S	Four best seats at theatre or concert (avg.)	135	G	Television, colour (66 cm) (avg.)
57	S	French school: annual tuition, ages 5-12 (avg.)	136	S	Three-course dinner at top restaurant for four people (avg.)
58	S	French school: extra costs, ages 5-12 (avg.)	137	G	Toilet tissue (two rolls) (supermarket)
59	S	French school: kindergarten annual fees (avg.)	138	G	Tomatoes (1 kg) (supermarket)
60	G	Fresh fish (1 kg) (supermarket)	139	G	Tomatoes, canned (250 g) (supermarket)
61	G	Frozen fish fingers (1 kg) (supermarket)	140	G	Tonic water (200 ml) (supermarket)
62	G	Frying pan (Teflon or good equivalent) (supermarket)	141	G	Toothpaste with fluoride (120 g) (supermarket)
63	S	German school: annual tuition, ages 5-12 (avg.)	142	G	Two-course meal for two people (avg.)
64	S	German school: extra costs, ages 5-12 (avg.)	143	S	Unfurnished residential apartment: 2 bedrooms (moderate)
65	S	German school: kindergarten annual fees (avg.)	144	G	Vermouth, Martini & Rossi (1 l) (supermarket)
66	G	Gin, Gilbey's or equivalent (700 ml) (supermarket)	145	S	Visit to dentist (one X-ray and one filling) (avg.)
67	G	Girl's dress (chain store)	146	S	Water, monthly bill for family of four (avg.)
68	S	Green fees on a public golf course (avg.)	147	G	White bread, 1 kg (supermarket)
69	G	Ground coffee (500 g) (supermarket)	148	G	White rice, 1 kg (supermarket)
70	G	Ham: whole (1 kg) (supermarket)	149	G	Wine, common table (750 ml) (supermarket)
71	G	Hand lotion (125 ml) (supermarket)	150	G	Wine, fine quality (750 ml) (supermarket)
72	G	Heating oil (100 l) (avg.)	151	G	Wine, superior quality (750 ml) (supermarket)
73	S	Hilton-type hotel, single room, one night including breakfast (avg.)	152	S	Woman's cut & blow dry (tips included) (avg.)
74	S	Hire car, weekly rate for lowest price classification (avg.)	153	G	Women's cardigan sweater (chain store)
75	S	Hire of tennis court for one hour (avg.)	154	G	Women's dress, ready to wear, daytime (chain store)
76	S	Hourly rate for domestic cleaning help (avg.)	155	G	Women's shoes, town (chain store)
77	G	Insect-killer spray (330 g) (supermarket)	156	G	Women's tights, panty hose (chain store)
78	G	Instant coffee (125 g) (supermarket)	157	S	Yearly road tax or registration fee (high)
79	G	International foreign daily newspaper (avg.)	158	G	Yoghurt, natural (150 g) (supermarket)

Table 2: Pass-through to Final Goods and Services

	Goods		*Services*	
Exchange rate$_t$	0.0901**	0.0426	0.1515**	0.1838**
	(0.036)	(0.034)	(0.069)	(0.081)
Exchange rate$_{t-1}$	0.1433***	0.1084***	0.1423**	0.1835*
	(0.021)	(0.031)	(0.064)	(0.108)
Sum	*0.2334****	*0.1509****	*0.2938****	*0.3673****
	(0.046)	*(0.056)*	*(0.119)*	*(0.177)*
World export prices$_t$	0.4561***	0.4793***	0.2357	0.2414
	(0.106)	(0.106)	(0.165)	(0.178)
World export prices$_{t-1}$		-0.1858		0.1542
		(0.160)		(0.334)
Real income$_t$	-0.0141***	-0.0123***	-0.0098	-0.0160**
	(0.003)	(0.003)	(0.003)	(0.007)
Real income$_{t-1}$		0.0059		0.0025
		(0.004)		(0.007)
G7 gap$_t$	0.0027	-0.0033	0.0146	0.0249
	(0.003)	(0.006)	(0.005)	(0.012)
G7 gap$_{t-1}$		-0.0046		-0.0159
		(0.007)		(0.0161)
Dependent variable$_{t-1}$		-0.2796***		-0.1188
		(0.145)		(0.024)
Fixed effects	yes	yes	yes	yes
No. goods/services	113	113	45	45
No. of observations	1997	1991	765	765
R^2: within	0.037	0.120	0.025	0.040
between	0.443	0.537	0.082	0.730
overall	0.036	0.107	0.024	0.035

***, **, * indicate significance at the 1, 5, and 10 percent levels respectively. Robust standard errors are shown in parenthesis, clustered by good or service.

Table 3: Trends in Pass-through to Final Goods and Services: Error Correction Specification

	Goods		*Services*	
Exchange rate$_t$	0.1120***	0.1655***	0.1048**	0.1182
	(0.026)	(0.038)	(0.048)	(0.073)
*Trend*Exchange rate*$_t$		0.0067		0.0027
		(0.005)		(0.012)
World export prices$_t$	0.7042***	0.7845***	0.5083**	0.5176*
	(0.153)	(0.165)	(0.240)	(0.278)
World export prices$_{t-1}$	-0.0251	-0.1076	0.1355	0.0999
	(0.027)	(0.071)	(0.083)	(0.208)
Real income$_t$	-0.0192***	-0.0205***	-0.0175**	-0.0158*
	(0.005)	(0.005)	(0.009)	(0.008)
Real income$_{t-1}$	0.0042	-0.0006	0.0063	0.0075
	(0.003)	(0.004)	(0.006)	(0.008)
G7 gap$_t$	0.0246***	0.0256***	0.0329***	0.0340***
	(0.006)	(0.006)	(0.009)	(0.010)
G7 gap$_{t-1}$	-0.0207**	-0.0363***	-0.0085	-0.0056
	(0.009)	(0.011)	(0.015)	(0.019)
Error correction term$_{t-1}$	-0.1019***	-0.1494***	-0.0777**	-0.0559
	(0.0213)	(0.028)	(0.032)	(0.058)
*Trend*Ecm*$_{t-1}$		0.0036***		-0.0015
		(0.001)		(0.003)
Fixed effects	yes	yes	yes	yes
No. goods/services	113	113	45	45
No. of observations	1997	1997	765	765
R^2: within	0.052	0.055	0.033	0.033
between	0.031	0.029	0.082	0.082
overall	0.051	0.054	0.031	0.032

***, **, * indicate significance at the 1, 5, and 10 percent levels respectively. Robust standard errors are shown in parenthesis, clustered by good or service.

Table 4: Import Goods and Source Countries

Panel A: Import commodities and number of countries exporting to South Africa

Good	HS8 Code	HS 8th level product description	# countries
1	28112200	silicon dioxide	4
2	28211000	iron oxides and hydroxides	4
3	29153990	esters of acetic acid :	3
4	29157000	palmitic acid, stearic acid, their salts and esters	3
5	29239000	Quaternary ammonium salts and hydroxides; lecithins and other phosphoaminolipids, whether or not chemically defined:	3
6	29362700	vitamin c and its derivatives	4
7	32151100	printing ink, black	5
8	33041000	lip make-up preparations	4
9	33042000	eye make-up preparations	4
10	39241000	tableware and kitchenware	6
11	40169100	floor coverings and mats	7
12	48191000	cartons, boxes and cases, of corrugated paper or paperboard	5
13	73181526	socket screws	8
14	73182200	other washers	10
15	73182300	rivets	6
16	73182400	cotters and cotter-pins	10
17	73202000	helical springs	6
18	83021000	hinges	9
19	84824000	needle roller bearings	6
20	84825000	other cylindrical roller bearings	4
21	85044000	static converters	6
22	85322200	aluminium electrolytic	6
23	85364120	electromagnetic and permanent magnet relays	8
24	85393290	other	4
25	85411000	diodes, (excluding photosensitive or light emitting diodes)	5
26	96081000	ball point pens	8

Panel B: number of goods, by country

	Country	# of products
1	Brazil	8
2	Switzerland	6
3	China	16
4	Germany	26
5	Great Britain	24
6	India	10
7	Japan	16
8	Sweden	8
9	Taiwan	12
10	United States	22

Table 5: Pass-Through to South African Imports

Exporter:	(1)	(2)	(3)	(4)
Brazil	0.7526	0.7131		
	(0.1567)***	(0.1654)***		
China	0.2327	0.2648		
	(0.1597)	(0.1283)**		
Germany	0.5816	0.5012		
	(0.1936)***	(0.1475)***		
Great Britain	0.6055	0.5619		
	(0.2121)***	(0.1608)***		
India	0.6211	0.8068		
	(0.3209)*	(0.2203)***		
Japan	0.3767	0.4365		
	(0.1741)**	(0.1303)***		
Sweden	0.0741	-0.0461		
	(0.2362)	(0.2037)		
Switzerland	0.6328	0.4694		
	(0.3303)*	(0.2128)**		
Taiwan	0.6418	0.5911		
	(0.1864)***	(0.1508)***		
United States	0.7357	0.6692		
	(0.1691)***	(0.1499)***		
$\beta_i=\beta$			0.5935	0.5704
			(0.1316)***	(0.1346)***
β_t				0.001
				(0.0007)
Observations	6668	6000	5600	5600
Good dummies	yes	yes	yes	yes
Country dummies	yes	yes	yes	yes
Time Dummies	yes	yes	yes	yes
R-squared within	0.17	0.25	0.18	0.19
R-squared between	0.90	0.94	0.90	0.90
R-squared overall	0.84	0.90	0.83	0.83

Robust standard errors in parentheses, clustered at the good level.

* significant at 10%; ** significant at 5%; *** significant at 1%

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