Exchange Rate Pass-Through in Pakistan

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Abstract

Exchange rate pass-through, which is the degree of reflection of exchange rate movements on domestic inflation, is a crucial phenomenon especially for the developing economies. In this paper we study the exchange rate pass-through for the Pakistani economy from 2008 to 2019. Using quarterly data for consumer prices and the Pakistani Rupee – USD exchange rate and a simple econometric framework, we estimate the pass-through coefficients to various subgroup and item indices within Pakistani household consumption basket. Our findings indicate that pass-through behavior is limited to only some items, motivating us to develop an exchange rate sensitive items index to allow for better forecasting performance on the side of policymakers.

Keywords: Exchange rate, ERPT, Pass-through, Pakistan, Inflation, Price level.

JEL Codes: C51, E31, E58.

1. Introduction

Exchange rate pass-through (ERPT) refers to the effect of a change in the foreign exchange rate on the concerned country's price levels. ERPT is of immense importance to the governments and the central banks, with respect to the challenges it poses on policymaking. A lower ERPT is desirable, since now exchange rates are mostly left to market forces. According to Choudhri and Hakura (2001), "a low exchange rate pass-through is thought to provide greater freedom for pursuing an independent monetary policy and to make it easier to implement inflation targeting" whereas a high ERPT will mean high volatility in the inflation rates. Many emerging markets of the world are aiming for free floating exchange rates (exchange rates which are left to the market forces of demand and supply) and inflation targeting. One such economy is Pakistan. According to Hussain (n.d.), "Pakistan has abandoned monetary aggregate targeting and is planning to adopt flexible inflation targeting by 2020". Therefore, checking for the ERPT is essential for a smooth monetary policy for Pakistan. In this paper, we look at the ERPT in Pakistan from 2008 to 2019.

According to the State Bank of Pakistan's Monetary Policy Framework, Pakistan follows a market-based exchange rate system since May 1999. However, the SBP at times intervenes in the

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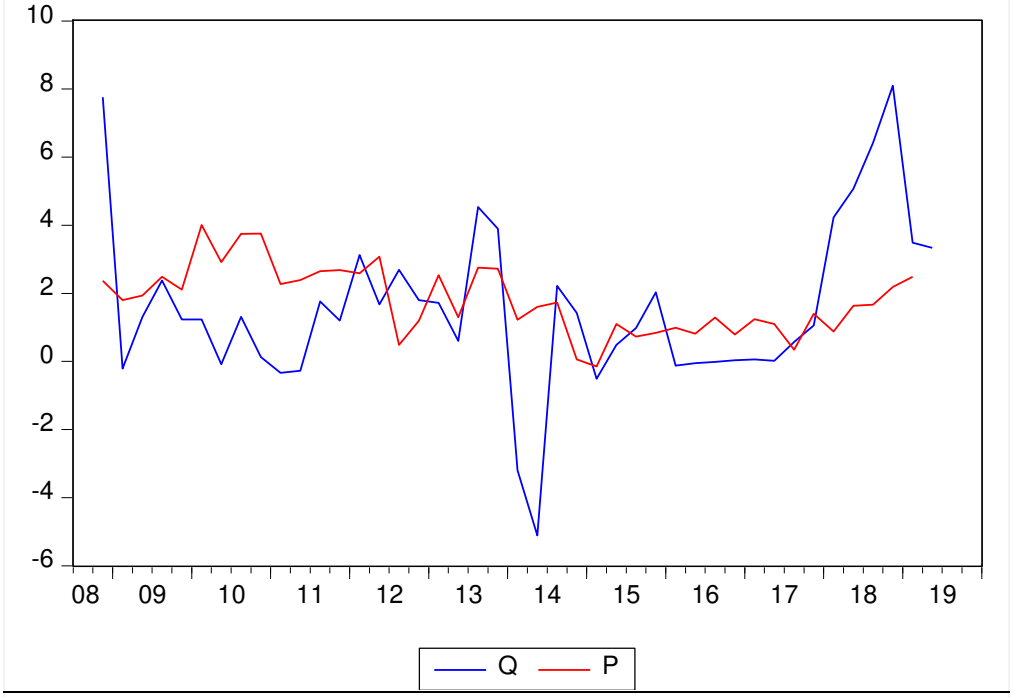
exchange rate market to ensure stability and smoothness, indicating a regime of "dirty float". Being an emerging economy, Pakistan has a vast sector for its imports which includes of not only finished products but also of many inputs for the manufacturing industries. According to the United Nations COMTRADE database on international trade, Pakistan's major imports include mineral fuel, oil and distillation products which constitute 24% of the imports. Any changes in the exchange rates are likely to affect the import prices which can make the end products expensive in the domestic market contributing towards inflation. Such a structure would cause a significant pass-through to the import prices. As mentioned in Goldberg and Knetter (1997), the pass through is described as the impact of a change in exchange rate onto the import prices. However, a considerable portion of the literature, like Kara et al. (2005), maintains that "the literature on emerging market economies treats ERPT as the impact of exchange rate on domestic prices, as well". Therefore, we focus on the domestic prices.

Calvo and Reinhart (2000) maintained that ERPT is high in developing and emerging economies. Leigh and Rossi (2002) concluded that the high ERPT was a main factor in the high inflationary pressure in Turkey. Kara et al. (2005) conclude that ERPT in Turkey was higher during the depreciation periods than it was in the appreciation periods. With respect to Pakistan, Asghar and Naveed (2015) concluded that the Pakistani nominal exchange rate and inflation have a negative relationship with each other. Whereas, Jaffri (2010) suggested that the ERPT to consumer price inflation in Pakistan was very low.

Figure 1. Rates of Inflation and Depreciation (2008-2019, quarterly)



Notes: CPI has been seasonally adjusted (Source of Data: SBP and PBS).

However, since Pakistan has a wide base of imports and a current balance of imports exceeding the exports, in such a country the ERPT can work in several ways. According to Savoie-Chabot and Khan (2015), imported goods become expensive due to a depreciation of the

country's exchange rate, and also since the inputs of certain goods are imported, they add to the costs of production which are then passed "to consumers via higher prices". Therefore, Pakistan comes into the realm of exchange rate pass through in both scenarios. Since Pakistan is aiming for inflation targeting, it is useful to check for the ERPT and the role it plays. One of the productive ways to do so is by "checking the sub-components of aggregate price indices" (Aron et al., 2014). In this paper, we plan to look at the headline along with the subgroups for pass-through. According to Menon's (1995) research, ERPT differed in extent amongst different countries and was usually higher in small economies. Similarly, Goldfajn and Werlang (2000) concluded that pass through is higher in emerging economies than what it is in developed economies. Moreover, Taylor (2000) argued that there was a decrease in inflation in many countries which also led to a fall in the pass through of exchange rate to prices. He maintains that a "lower pass through should not be taken as exogenous to the inflationary environment". For Pakistan's case, similar results can be expected.

Figure 1 shows the quarter-to-quarter CPI inflation rate (denoted P) and the percentage change in the value (denoted Q) of the US dollar (USD) against the Pakistani rupee (PKR) from 2008Q3 to 2019Q2. It can be seen that recently Pakistan is seen moving to a period of depreciation of the Rupee and an increasing trend in the inflation.

In the next section, we describe our methodology. In Section 3, we present our empirical estimates. Section 4 is devoted to discussion and the concluding remarks.

2. Methodology

a. Data

We took data of Pakistan's Consumer Prices Index starting from July 2008 till June 2019 from the Pakistan Bureau of Statistics and Pakistani Rupee – USD exchange rate data from the State Bank of Pakistan on a monthly basis starting from July 2008 till June 2019 from the SBP.

We had price indices for all commodities which were divided into 12 major subgroups, namely Food and non-Alcoholic Beverages, Alcoholic Beverages and Tobacco, Clothing and Footwear, Housing and fuels, Household equipment and Maintenance, Health, Transport, Communication, Education, Recreation and Culture, Restaurants and Hotels, Miscellaneous Goods and Services. Except for seasonal adjustment, either using Census X12 or Tramo-Seats, we have not implemented any preliminary adjustments on the data set. In the rest of the paper, unless otherwise specified explicitly, only the seasonally adjusted versions of the price indices entered our specifications at a quarterly frequency, running from 2008Q3 to 2019Q2.

b. Modeling Approach

In order to understand the nature of ERPT in Pakistan, we followed an exploratory approach using Ordinary Least Squares regressions of the form:

$$p_t = \alpha + \beta_1 p_{t-1} + \beta_2 p_{t-2} + \beta_3 p_{t-3} + \gamma_0 q_t + \gamma_1 q_{t-1} + \gamma_2 q_{t-2} + \gamma_3 q_{t-3} + \theta z + \epsilon_t \quad (1)$$

where p_t is the quarter-on-quarter inflation rate at time t for the price index under consideration and $q_t$is the quarter-to-quarter depreciation rate of the Pakistani Rupee against the US dollar. As no periodicity in data is expected, we have limited the maximum number of lagged terms to three for each variable. ϵ_t is the statistical error term subject to usual assumptions. In addition, a simple vector autoregressive form has been employed, as presented in the last subsection. The ERPT in the short-run, based on Equation (1), is defined as the sum of $\hat{\gamma}_0$, $\hat{\gamma}_1$, $\hat{\gamma}_2$, and $\hat{\gamma}_3$.

Our preference toward the modest OLS specification of Equation (1) stems from the observation that Pakistani ERPT behaviour was not in line with our preliminary expectations. As presented subsequently, pass-through to headline CPI was limited, despite the anecdotally known sensitivities of the economy to changes in the currency's value. Equation (1), once powered with a stepwise approach to attain parsimony, then, allowed us to measure and compare ERPT across a number of price indices.

Following the tradition, extreme behavior in price movements have been controlled via impulse dummy variables, having the value of 1 at the period of extreme behavior and a value of 0 otherwise. These dummy variables are indicated in our tables wherever applicable.

In what follows, we present our estimates of the pass-through coefficients. In that, the following estimations were performed:

(i) Single equation estimation of ERPT for headline CPI and for the main subgroups of CPI
(ii) Single equation estimation of ERPT for the item indices under CPI
(iii) Single equation estimation of ERPT for the exchange rate sensitive items index that we constructed
(iv) VAR estimation of ERPT for the exchange rate sensitive items index

3. Estimates

a. ERPT to Headline CPI Inflation and Main Subgroups

For the first model, we check the headline inflation along with the subgroups. Based on our preliminary analyses (not reported here), two regressions were done for each. The first has been intended to check for the autoregressive behavior in inflation only, so including the p_{t-j} terms alone. In the second one, we also included the pass-through terms, i.e. q_{t-j}. As mentioned earlier, in order to get results which were not based on seasonality and political factors (such as changes in policies leading to changes in price levels or crises), the data for each component being tested was seasonally adjusted and certain dummy variables were also added to control for sudden jumps in the data.

The results of these specifications can be seen in Table 1. As can be seen in the table, when only the autoregressive terms were checked, we can see a connection between the prices. However, once we put in the variables for the pass-through, we see that in some of the components the autoregressive dynamic disappears, leaving the current inflation only having a relationship with the exchange rate depreciation in the previous quarters. This seemed a bit

counter-intuitive, suggesting that the sellers were setting the prices only keeping in mind the exchange rates they saw in the previous quarters.

In one of the subgroups, namely Clothing and Footwear, a negative pass-through can also be seen which again seems counter-intuitive suggesting that as the Rupee will depreciate (that is the USD increasing in value), the rate of change of prices will drop. Rupee depreciation is likely to make imports more expensive hence causing expensive inputs and so prices should not be decreasing. Observation of such 'anomalies', indeed, urged us to perform a brute force sequence of regressions, of the same form as in Equation (1), for all component items of the CPI basket one at a time.

Table 1. ERPT for the Headline Consumer Price Inflation and Main Subgroups

	$p_t = \alpha + \beta_1 p_{t-1} + \beta_2 p_{t-2} + \beta_3 p_{t-3} + \gamma_0 q_t + \gamma_1 q_{t-1} + \gamma_2 q_{t-2} + \gamma_3 q_{t-3} + \theta z + \epsilon_t$		
Subgroup	**Dummy Used** (z)	**Autoregressive model** $\gamma_0 = \gamma_1 = \gamma_2 = \gamma_3 = 0$	**Pass-through model** *(No a priori restrictions)*
Headline CPI	2012Q1	Dummy is significant $\hat{\beta}_1$ = 0.339 (0.0312)	$\hat{\beta}_3$ =0.232(0.0806) $\hat{\gamma}_1$ =0.146 (0.0434), $\hat{\gamma}_3$ =0.097(0.0062),
Food and Non-alcoholic Beverages	2012Q1	Dummy is significant No autoregression	Dummy is significant $\hat{\gamma}_3$ =0.168 (0.0152)
Transport	None	$\hat{\beta}_1$ = 0.327 (0.0296)	$\hat{\gamma}_0$ =0.451 (0.0310), $\hat{\gamma}_3$ =0.373 (0.0966)
Health	D12	Dummy is significant $\hat{\beta}_1$ = 5.834 (0.000)	Same results as in autoregressive model. No pass-through.
Alcohol and Tobacco	D11	Dummy is significant $\hat{\beta}_1$ = 0.223 (0.0167)	Dummy is significant $\hat{\beta}_1$ =0.208 (0.0272) $\hat{\gamma}_3$ =0.203 (0.1442)
Clothing and Footwear	D1 and D2	Dummies are significant $\hat{\beta}_1$ = 0.480 (0.0020) $\hat{\beta}_2$ = 0.387 (0.0027)	Dummies are significant $\hat{\beta}_1$ = 0.477 (0.002), $\hat{\beta}_2$ = 0.413(0.0012) $\hat{\gamma}_1$ =-0.072 (0.0384)
Water, Housing, Gas, Electricity and other fuels	D10	Dummy is significant No autoregression	Dummy is significant $\hat{\beta}_2$ =0.217 (0.0843) $\hat{\gamma}_1$ =0.216 (0.0026)
Household, Furniture and Maintenance	D3	Dummy is significant $\hat{\beta}_1$ = 0.550 (0.0000)	Same results as in autoregressive model. No pass-through.
Communication	D4 and D5	Dummies are significant	Same results as in autoregressive model. No pass-through.
Recreation	D6 and D7	Dummies are significant $\hat{\beta}_1$ = 0.304 (0.0015) $\hat{\beta}_2$ =0.269 (0.0043)	Same results as in autoregressive model. No pass-through.
Education	D8 and D9	Dummies are significant No autoregression	Same results as in autoregressive model. No pass-through.
Restaurants and Hotels	2013Q4	Dummy is significant $\hat{\beta}_1$ = 0.182 (0.2025)	Same results as in autoregressive model. No pass-through.
Miscellaneous	2012Q4	Dummy is significant $\hat{\beta}_1$ = 0.263 (0.0784)	Same results as in autoregressive model. No pass-through.

Notes: p-values are given in parentheses.

b. ERPT to Inflation Items Under CPI

In our next sequence of specifications, we dive deep down to check the pass-through of each component of the subgroups, in an attempt to get a clearer picture of what was causing an abnormality in our previous results. Following the same data processing stages, we first obtained

a mechanical sequence of ERPT estimates, using a stepwise elimination strategy for the insignificant explanatory variables. Then, we undertook a one-by-one checking procedure to pinpoint abnormally high or negative pass-through measurements, which are often caused by erratic movement of the inflation series under consideration. For these instances, the estimations were repeated after designating and including appropriate dummy variables. Appendix provides the complete list of estimates, where the marker "_co" indicates a re-estimation with dummy control.

After all the corrections made, the commodities which still showed problematic results included potatoes, pulses mash, pulse moong, pulse masoor, sugar, kerosene oil, transport, gur, motor vehicle, wheat, wheat flour, cooking oil, beans, wheat product and education. Here, transport is a subgroup which includes motor vehicles, motor fuel, vehicle accessories and more such related commodities. These commodities form a significant place in Pakistan's imports and hence the pass-through here can be owed to the high number of imports. Similarly, kerosene oil too forms a huge chunk of Pakistan's imports and so the same can be said about it too. However, being an agrarian country, the rest of the commodities are mostly produced within the country and so a high pass-through in them and a negative pass-through in education seem to be an abnormality. For the education sector, since a large part of it is owned privately and targets the middle to high class of society, a depreciation in the dollar can cause them to increase the fees since they may believe that the upper strata of the society may now be able to afford to spend more. A depreciation of the USD for them would mean a higher affordability of the high class of society.

c. ERPT to Exchange Rate Sensitive Items Index

Our last single equation specification considers the relationship between inflation and exchange rate depreciation by taking into account only the items prone to changes in the exchange rate. These items were chosen according to the results of item-level estimates of pass-through, and were those which had a positive ERPT before controlling for shocks. Using these items an index was created with their respective weights on a quarterly basis. This was then used to measure ERPT going back up to three lags again (Table 2).

Table 2. ERPT for the Exchange Rate Sensitive CPI Aggregate

$\hat{\alpha}$	0.1582 (0.7124)
$\hat{\beta}_3$	0.3231 (0.0304)
$\hat{\gamma}_0$	0.2738 (0.5520)
$\hat{\gamma}_3$	0.3522 (0.0179)

Notes: The equation was estimated via OLS using stepwise elimination of insignificant explanatory variables. p-values are given in parentheses.

As Table 2 suggests, the ERPT turned out to be of around 62% and the pricing is related to the present exchange rate as well as the one which was 3 quarters ago.

d. VAR Analysis of ERPT to Exchange Rate Sensitive Items Index

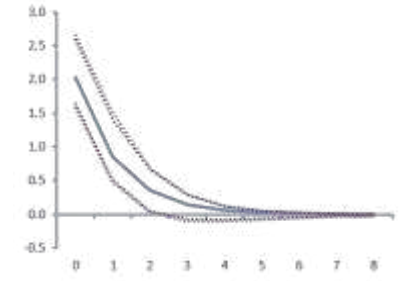
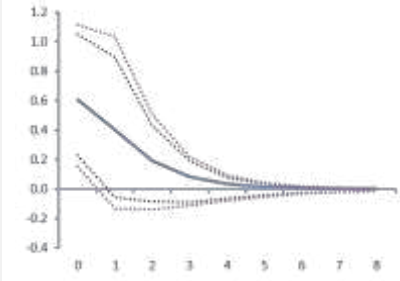
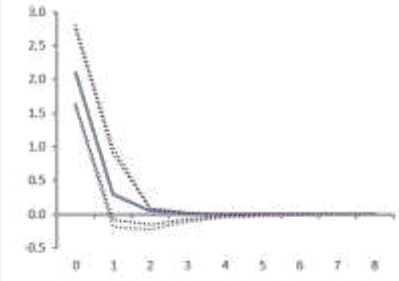
Our final step was to conduct a VAR analysis of the items which were sensitive to the exchange rate. The percentage changes on the index showing the sensitive items was used along with the exchange rate. VAR was estimated using the JMulti software. At the beginning, we consider the Schwarz Information Criterion which gives us the optimal lag order as 1 for our model. We then computed the VAR using Equation 2.

$$\begin{pmatrix} q_t \\ ps_t \end{pmatrix} = \begin{pmatrix} a_{10} \\ a_{20} \end{pmatrix} + \begin{pmatrix} a_{11} & 0 \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} q_{t-1} \\ ps_{t-1} \end{pmatrix} + \begin{pmatrix} \epsilon_q \\ \epsilon_{ps} \end{pmatrix} \quad (2)$$

Here the q_t stands for the exchange rate depreciation, the ps_t represents the inflation of the items sensitive to the exchange rate. The 2x2 matrix with the a_{ij} represents the coefficients for the lagged terms and the 2x1 vector show the coefficients for the constant terms. Since Pakistani inflation has almost no role in the determination of the exchange rate, the value for a_{12} was set to be 0, as shown in Equation 2. The model was, then, estimated via Ordinary Least Squares.

In order to get a better idea about the dynamic model, an Impulse Response Function was then created using the same items and VAR equation. We checked the orthogonal impulse responses for 12 periods using a 90% and 95% Hall percentile confidence interval with 1000 bootstrap replications. The results can be seen in Figure 2. The results show a promising outcome with a significant ERPT. As can be seen, the response of the ps_t when one standard deviation shock is given to the q_t is statistically significant in the earlier periods. We see the response of ps_t to the impulse in the q_t in the very earlier stages is sizable and significant, then it gradually dies out, while also becoming statistically insignificant. Therefore, we can confirm here that there is enough evidence to support presence of the ERPT. Within the figure, we can also see how the variables respond to a one standard deviation shock given to them. Here too, we see statistically significant responses which die out gradually.

Figure 2. Impulse Response Functions

Depreciation → Depreciation	Depreciation → Inflation	Inflation → Inflation
		

Notes: The central blue line shows the IRF values. The black and pink lines show the 90% and 95% error bands of IRFs, respectively. The error bands are the Studentized Hall Bootstrap Confidence Intervals and they were computed in JMulTi.

4. Discussion and Concluding Remarks

Exchange rate pass-through is of immense importance to an economy trying to manage smooth prices within it. Since exchange rates are now left to market forces, in order to predict

inflation and make some policy changes it is important to know about the exchange rate pass-through. The lower the ERPT will be, the better it might be for the economy as it will not depend on the shocks to the exchange rates for its price levels. As can be seen in Figure 1, recently Pakistan is seen to be going towards an inflationary pressure and also a depreciation of the Rupee. Hence, there might be a connection between the two. However, the early stages of our research showed otherwise. Although we saw evidence of pass-through, the figures came out to be a bit counter-intuitive. Even after controlling for shocks in prices, although some of the pass through reduced, most of the ERPT figures still remained more than 25% and some went as high up to a 175%, which seems amusingly high for exchange rate pass-through. However, after controlling for shocks, most of the items had pass through coming from the current period exchange rate. Products such as, kerosene oil, motor fuel and motor vehicles having a high pass through were perceivable as they or their production materials form a large part of Pakistan's imports and so any fluctuations in the exchange rate can affect their consumer prices greatly. According to an article published by The Tribune in 2018, the auto industry in Pakistan passed the costs arising due to the depreciation of the rupee on to its consumers. However, other products such as wheat and potatoes had unexplainably high pass through.

To further strengthen the analysis, we then checked the relationship between inflation and the items which showed a high positive pass through under the results of the item-level estimates. As a result, we saw a pass through which came from the current and the three quarters older exchange rate. This result was similar to what we found in our first estimate about headline inflation and subgroups and also what we saw after controlling for shocks for individual items. It seems that in Pakistan's case, the current exchange rate, along with the one which was present 3 quarters ago play an important role in the pass through. Where a connection with the current period exchange rate makes sense, it is quite difficult to explain a relationship with the rate which happened around 8 to 9 months ago. Perhaps it may be that the items responsible for such a pass through are those which are subsidized by the government. The VAR analysis, along with the IRF, also showed how there was a presence of ERPT in the items which were sensitive to the pass through, and that it was statistically significant for the earlier periods after the impulse.

All in all, it is now reasonable and evident to conclude that the Pakistani economy does have an ERPT, although minimal in headline but quite evident in certain items. It is both essential and useful to know about these items and also know about the level of impact which fluctuations in exchange rate can cause. Such knowledge can be useful for policy implications, as the impact of a future change in the exchange rate can be foresighted and the extent to which it will have an impact can also be ball-parked.

References

Aron, J., K. Creamer, J. Muellbauer, and N. Rankin. "Exchange rate pass through to consumer prices in South Africa: Evidence from micro-data." *Journal of Development Studies* 50.1 (2014): 165-185.

Asghar, N. and T.A. Naveed, 2015. "Pass-through of world oil prices to inflation: A time series analysis of Pakistan." *Pakistan Economic and Social Review* (2015): 269-284.

Calvo, G.A., and C.M. Reinhart, 2000. Fixing for your life. No. w8006. *National Bureau of Economic Research*, 2000.

Choudhri, E.U. and Dalia Hakura. *Exchange rate pass-through to domestic prices: does the inflationary environment matter?* No. 2001-2194. International Monetary Fund, 2001.

Efron, B. and R.J. Tibshirani, (1993). An Introduction to the Bootstrap, Chapman & Hall, New York.

Goldberg, P. and M. Knetter, "Goods Prices and Exchange Rates: What Have We Learned?" *Journal of Economic Literature*, 35 (1997): 1243-1272.

Goldfajn, I. and S.R. da C. Werlang. "The pass-through from depreciation to inflation: a panel study." *Werlang, Sergio R., The Pass-Through from Depreciation to Inflation: A Panel Study (July 2000). Banco Central de Brasil Working Paper* 5 (2000).

Hall, P. (1992). The Bootstrap and Edgeworth Expansion, Springer, New York.

Hussain, B. "Auto industry to pass impact of rupee fall to consumers." *The Express Tribune* (July 2018). Date accessed: 01/09/2020, tribune.com.pk/story/1759764/2-auto-industry-pass-impact-rupee-fall-consumers/

Hussain, F. "Flexible Inflation Targeting and Relevance of Monetary Aggregates for Inflation in Pakistan."

Jaffri, A.A., 2010. "Exchange rate pass-through to consumer prices in Pakistan: Does misalignment matter?" *The Pakistan Development Review (2010):* 19-35.

Kara, H., H. Kucuk-Tuger, U. Ozlale, B. Tuger, D. Yavuz and E.M. Yucel. "Exchange rate pass-through in Turkey: Has it changed and to what extent?" *Central Bank of the Republic of Turkey Working Paper*, No. 0504. 2005.

Kara, H., H. Kucuk-Tuger, U. Ozlale, B. Tuger and E.M. Yucel. "Exchange Rate Regimes and Pass-Through: Evidence from the Turkish Economy", *Contemporary Economic Policy* 25(2):206-225, 2007.

Lütkepohl, H. and M. Kratzig, Applied Time Series Econometrics, Cambridge University Press, Cambridge, 2004.

Leigh, D., and M. Rossi. ''Exchange Rate Pass-Through in Turkey'' *IMF Working Paper* No. 02/204, 2002.

Menon, J. "Exchange Rate Pass-Through", *Journal of Economic Surveys, Vol. 9, No. 2* (1995): 197-23.

PBS, Pakistan Bureau of Statistics, *Statistical Indicators.*

Savoie-Chabot, L. and M. Khan. "Exchange rate pass-through to consumer prices: Theory and recent evidence", *Bank of Canada Discussion Paper*, No. 2015-9, 2015.

SBP, State Bank of Pakistan, Monetary Policy Framework, *Monetary Policy.*

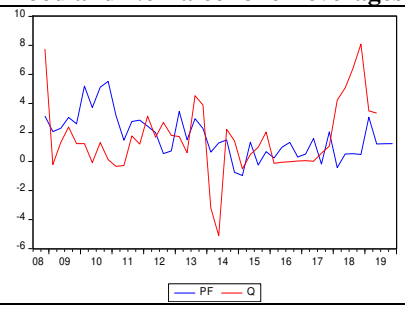
Taylor, J.B. "Low inflation, pass-through, and the pricing power of firms." *European Economic Review* 44.7 (2000): 1389-1408.

UN, United Nations, UN Comtrade, *Trade Statistics.*

Appendix

Figure A1. Rates of Inflation in Main Group Prices and Depreciation Over Time

Food and Non-alcoholic Beverages



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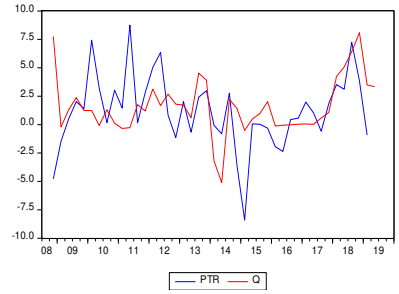
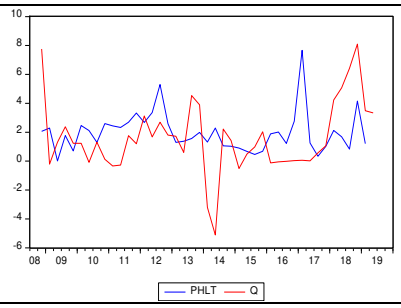
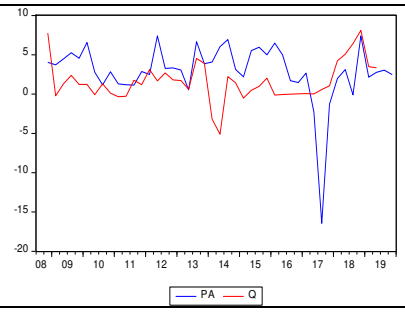


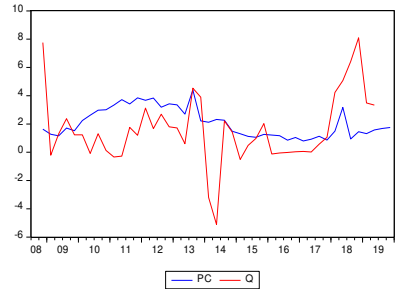
Health



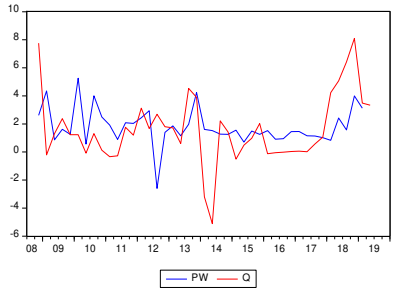
Alcohol and Tobacco



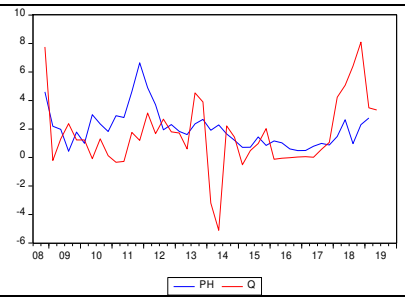
Clothing and Footwear



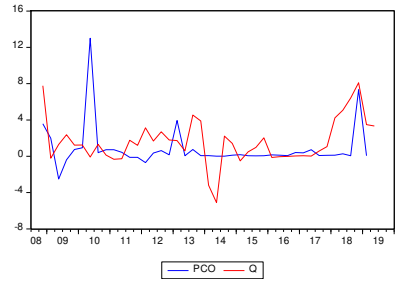
Water, Housing, Gas, Electricity and other fuels



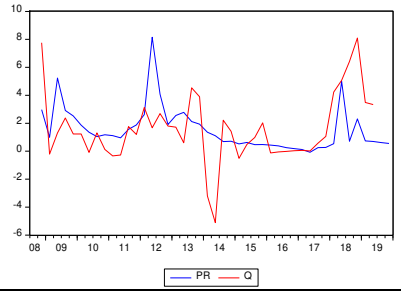
Household, Furniture and Maintenance



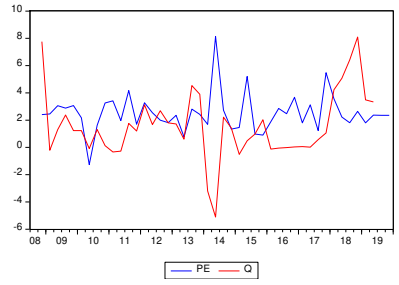
Communication



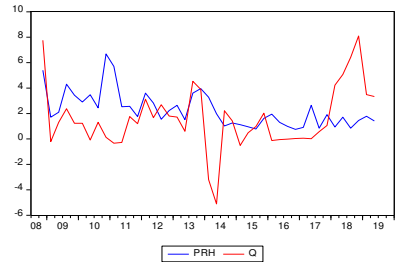
Recreation



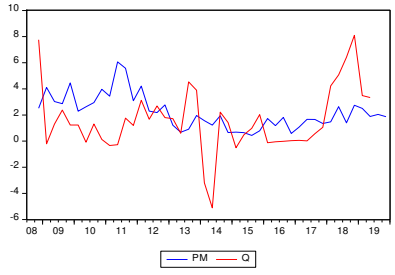
Education



Restaurants and Hotels



Miscellaneous



Notes: The group prices have been seasonally adjusted (Source of Data: SBP and PBS).

Table A1. ERPT Estimates for All CPI Items

Item	C	P(-1)	P(-2)	P(-3)	Q	Q(-1)	Q(-2)	Q(-3)	n	R2	F stat	ERPT
PP0406 Gas	-0.5079 (2.7301)				1.9766 (0.9395)*				43	0.10	4.4262 (0.0416)	1.9766
PP0406_CO												0.0000
PP0127_SA Potatoes	0.6925 (2.9039)				-2.1717 (0.9997)*			3.6438 (1.0236)**	40	0.29	7.5157 (0.0018)	1.4721
PP0127_SA_CO								1.7575				1.7575
PP0703 Motor fuel	-0.2103 (1.0378)				0.6946 (0.3573)			0.6852 (0.3658)	40	0.19	4.4776 (0.0181)	1.3798
PP0703_CO					0.2463							0.2463
PP0123 Pulse mash	-0.9514 (1.1015)	0.6495 (0.1101)**						1.23 (0.4127)**	40	0.55	22.4781 (0.0000)	1.2300
PP0123_CO		0.5138						0.7354				0.7354
PP0131_SA Sugar	-0.6612 (1.4505)			0.3659 (0.1380)*			0.9795 (0.4936)		41	0.20	4.828 (0.0135)	0.9795
PP0131_SA_CO				0.266		0.6175		0.9406				1.5581
PP0407 Kerosene oil	0.1365 (1.0425)	0.2996 (0.1481)						0.9145 (0.3832)*	40	0.20	4.6524 (0.0158)	0.9145
PP0407_CO					0.3571							0.3571
PP0700 Transport	0.333 (0.5741)				0.4522 (0.1976)*			0.3808 (0.2024)	40	0.23	5.377 (0.0089)	0.8330
PP0700_CO				0.1779	0.4827							0.4827
PP0122 Pulse Moong	-0.2887 (0.9829)	0.8391 (0.0947)**				0.828 (0.3267)*			42	0.67	39.7581 (0.0000)	0.8280
PP0122_CO		0.801				0.8109						0.8109
PP0132_SA Gur	-0.0989 (0.7389)	0.3527 (0.1216)**						0.7385 (0.2990)*	40	0.37	11.0481 (0.0002)	0.7385
PP0701 Motor vehicle	1.2309 (0.2474)**		-0.4555 (0.0821)**	-0.125 (0.0727)	0.3756 (0.0798)**		0.2173 (0.0806)*		40	0.64	15.584 (0.0000)	0.5929
PP0701_CO			-0.2854	-0.1448	0.3567		0.1693					0.5260
PP0405 Electricity	1.1188 (0.6872)					0.5462 (0.2374)*			42	0.12	5.2936 (0.0267)	0.5462
PP0405_CO			0.1031									0.0000
PP0101_SA Wheat	0.3544 (0.5841)						0.5009 (0.2029)*		41	0.14	6.095 (0.0180)	0.5009
PP0101_SA_CO			0.2905		0.5528							0.5528
PP0102_SA Wheat flour	-0.0128 (0.5126)		0.3701 (0.1357)**		0.4925 (0.1662)**				43	0.27	7.5819 (0.0016)	0.4925

Notes: The equation was estimated via OLS using stepwise elimination of insignificant explanatory variables. Standard errors for all coefficients and p-values for the F stat are given in parentheses.

Table A1. ERPT Estimates for All CPI Items (continued)

Item	C	P(-1)	P(-2)	P(-3)	Q	Q(-1)	Q(-2)	Q(-3)	n	R2	F stat	ERPT
PP0102_SA_CO			0.3335		0.4839							0.4839
PP0117 Cooking oil	0.0832 (0.5607)	0.4646 (0.1277)**						0.4351 (0.2100)*	40	0.30	7.9729 (0.0013)	0.4351
PP0903 Newspapers	0.9859 (0.4841)*				0.4239 (0.1666)*				43	0.14	6.4734 (0.0148)	0.4239
PP0903_CO												0.0000
PP0706_SA Transport services	0.2893 (0.4493)	0.285 (0.1392)*			0.4078 (0.1526)*				43	0.27	7.4463 (0.0018)	0.4078
PP0706_SA_CO		0.2735										0.0000
PP0126 Beans	0.5707 (0.5123)		0.4477 (0.1399)**			0.3994 (0.1562)*			41	0.28	7.5476 (0.0017)	0.3994
PP0126_CO						0.2818						0.2818
PP0103 Wheat product	-0.0065 (0.4977)			0.3148 (0.1304)*		0.3703 (0.1709)*			40	0.20	4.5267 (0.0174)	0.3703
PP0103_CO				0.2561		0.3125						0.3125
PP0105 Rice	0.3087 (0.5227)	0.3597 (0.1489)*		0.2256 (0.1181)				0.3672 (0.1849)	40	0.36	6.6506 (0.0011)	0.3672
PP0105_CO												0.0000
PP0309 Footware	0.637 (0.4355)				0.2765 (0.1499)				43	0.08	3.4032 (0.0723)	0.2765
PP0309_CO					0.1632							0.1632
PP0121_SA Pulse masoor	-0.486 (0.4425)	0.6231 (0.1166)**				0.2634 (0.1528)			42	0.45	15.7118 (0.0000)	0.2634
PP1400_SA	0.2465 (0.3229)	0.3339 (0.1388)*		0.3264 (0.1438)*	0.1166 (0.0695)			0.1415 (0.0709)	40	0.46	7.5494 (0.0002)	0.2581
PP1202 Cosmetics	1.6003 (0.3017)**				0.2366 (0.1038)*				43	0.11	5.1916 (0.0280)	0.2366
PP1300_SA	0.2614 (0.3148)	0.3519 (0.1388)*		0.3242 (0.1441)*	0.1084 (0.0649)			0.1277 (0.0662)	40	0.48	7.9727 (0.0001)	0.2361
PP0400 Housing, water, elec,gas and other fuels	1.4321 (0.2191)**					0.2134 (0.0757)**			42	0.17	7.9486 (0.0074)	0.2134
PP0100_SA Food and non-alcoholic beverages	0.2156 (0.2894)	0.4002 (0.1530)*	0.3279 (0.1531)*					0.2036 (0.0791)*	40	0.54	14.2909 (0.0000)	0.2036
PP0000_SA CPI	0.2294 (0.2824)	0.3804 (0.1347)**		0.3511 (0.1385)*	0.091 (0.0530)			0.0978 (0.0543)	40	0.54	10.0811 (0.0000)	0.1888
PP0904_SA Stationary	0.8293 (0.2843)**			0.3882 (0.1159)**	0.1496 (0.0627)*				42	0.29	7.8778 (0.0013)	0.1496
PP0301_SA Cotton cloth	0.9868 (0.3277)**	0.5487 (0.1072)**			-0.1446 (0.0732)			0.272 (0.0759)**	40	0.50	12.0868 (0.0000)	0.1274

Notes: The equation was estimated via OLS using stepwise elimination of insignificant explanatory variables. Standard errors for all coefficients and p-values for the F stat are given in parentheses.

Table A1. ERPT Estimates for All CPI Items (continued)

Item	C	P(-1)	P(-2)	P(-3)	Q	Q(-1)	Q(-2)	Q(-3)	n	R2	F stat	ERPT
PP0503_SA Household equipment	1.0403 (0.1777)**	0.3223 (0.1047)**		-0.292 (0.0696)**			0.0813 (0.0468)		41	0.45	10.0132 (0.0001)	0.0813
PP0104 Besan	0.919 (1.0604)	0.5346 (0.1336)**							42	0.29	16.0003 (0.0003)	0.0000
PP0106 Cereals	1.0602 (0.2634)**	0.3462 (0.0983)**							42	0.24	12.4103 (0.0011)	0.0000
PP0107_SA Bakery and confectionary	0.3804 (0.2312)	0.4368 (0.1311)**		0.2768 (0.1258)*					42	0.51	20.0589 (0.0000)	0.0000
PP0108 Nimco	0.1786 (0.2571)	0.5227 (0.1192)**		0.3113 (0.1086)**					40	0.62	30.5872 (0.0000)	0.0000
PP0109 Meat	0.384 (0.3266)	0.4828 (0.1482)**	0.3753 (0.1477)*						41	0.65	35.9308 (0.0000)	0.0000
PP0110_SA Chicken	1.3742 (0.8936)	-0.4829 (0.1310)**		0.3992 (0.1466)**					42	0.33	9.5707 (0.0004)	0.0000
PP0111_SA Fish	0.6463 (0.3492)			0.5858 (0.1195)**					42	0.38	24.0319 (0.0000)	0.0000
PP0112_SA Milk fresh	0.0679 (0.1292)	0.9384 (0.0469)**							44	0.91	400.8283 (0.0000)	0.0000
PP0113_SA Milk product	0.1659 (0.1695)	0.8939 (0.0625)**							44	0.83	204.7245 (0.0000)	0.0000
PP0114_SA Milk Powder	0.5847 (0.2988)	0.6949 (0.1101)**							44	0.49	39.8618 (0.0000)	0.0000
PP0115_SA Eggs	2.0169 (0.9383)*	-0.379 (0.1447)*							44	0.14	6.8612 (0.0122)	0.0000
PP0116_SA Mustard oil	0.2225 (0.2001)	0.7727 (0.0885)**							44	0.64	76.2024 (0.0000)	0.0000
PP0118 Vegetable ghee	0.6319 (0.4643)	0.5467 (0.1070)**							42	0.39	26.0972 (0.0000)	0.0000
PP0119_SA Dry fruits	0.9483 (0.4000)*	0.2937 (0.1216)*		0.2198 (0.1167)					42	0.27	7.1268 (0.0023)	0.0000
PP0120_SA Fresh fruits	1.7112 (0.6491)*	0.2688 (0.1537)							44	0.07	3.0582 (0.0876)	0.0000
PP0124 Pulse gram	1.14 (1.2628)	0.4927 (0.1369)**							42	0.24	12.9472 (0.0009)	0.0000
PP0125 Gram whole	0.7436 (0.8040)	0.5394 (0.1340)**							42	0.29	16.1985 (0.0002)	0.0000
PP0128_SA Onions	5.8833 (4.0018)		-0.2953 (0.1540)						43	0.08	3.6785 (0.0621)	0.0000
PP0129 Tomatoes	24.6892 (7.0026)**	-0.5312 (0.1597)**	-0.5544 (0.1567)**	-0.3456 (0.1655)*					40	0.33	5.8418 (0.0023)	0.0000
PP0130_SA Fresh vegetables	2.7443 (0.9782)**								45	0.00	NA NA	0.0000
PP0133 Honey	1.4991 (0.5350)**	0.4698 (0.1253)**							42	0.26	14.0509 (0.0006)	0.0000
PP0134 Sweet	0.488 (0.4215)	0.5294 (0.1330)**		0.2357 (0.1323)					40	0.42	13.5568 (0.0000)	0.0000
PP0135_SA Beverages	0.754 (0.3025)*	0.5727 (0.1271)**							44	0.33	20.2943 (0.0001)	0.0000
PP0136 Jam, tomato ketchup, pickle	0.5135 (0.3116)	0.3472 (0.1446)*	0.3413 (0.1290)*						41	0.40	12.6079 (0.0001)	0.0000
PP0137 condiments	0.905 (0.3539)*	0.4673 (0.1221)**							42	0.27	14.6395 (0.0004)	0.0000
PP0138_SA Spices	0.9747 (0.7080)	0.5394 (0.1300)**							44	0.29	17.2216 (0.0002)	0.0000

Notes: The equation was estimated via OLS using stepwise elimination of insignificant explanatory variables. Standard errors for all coefficients and p-values for the F stat are given in parentheses.

Table A1. ERPT Estimates for All CPI Items (continued)

Item	C	P(-1)	P(-2)	P(-3)	Q	Q(-1)	Q(-2)	Q(-3)	n	R2	F stat	ERPT
PP0139 Tea	1.9869 (0.7154)**	0.4618 (0.1318)**		-0.3484 (0.1287)*					40	0.36	10.465 (0.0003)	0.0000
PP0200_SA Alcoholic drinks tobacco	1.7692 (0.6620)*	0.4054 (0.1413)**							44	0.16	8.2312 (0.0064)	0.0000
PP0201_SA Cigarette	1.9892 (0.7159)**	0.3212 (0.1461)*							44	0.10	4.8313 (0.0335)	0.0000
PP0202_SA Betel leaves, nuts	5.5748 (3.7785)								45	0.00	NA NA	0.0000
PP0300_SA Clothing and footwear	0.2658 (0.2088)	0.5075 (0.1470)**	0.3698 (0.1473)*						43	0.70	47.4906 (0.0000)	0.0000
PP0302_SA Woolen cloth	0.4428 (0.3189)	0.5208 (0.1525)**	0.2617 (0.1517)						43	0.54	23.4734 (0.0000)	0.0000
PP0303_SA Ready-made garments	0.3598 (0.2185)	0.8226 (0.0856)**							44	0.69	92.3853 (0.0000)	0.0000
PP0304_SA Woolen ready-made garments	0.757 (0.4045)	0.2945 (0.1332)*		0.4261 (0.1264)**					42	0.40	12.8337 (0.0001)	0.0000
PP0305 Hosiery	0.6862 (0.3818)	0.4223 (0.1444)**		0.273 (0.1416)					40	0.37	10.7098 (0.0002)	0.0000
PP0306 Dupatta	0.5112 (0.2832)	0.7757 (0.0997)**							42	0.60	60.4967 (0.0000)	0.0000
PP0307_SA Cleaning, Laundering	0.4323 (0.3236)	0.5249 (0.1414)**		0.272 (0.1413)					42	0.52	21.0658 (0.0000)	0.0000
PP0401_SA House rent	1.7109 (0.0879)**								45	0.00	NA NA	0.0000
PP0402 Construction items	0.889 (0.2825)**	0.4729 (0.1077)**							42	0.33	19.2637 (0.0001)	0.0000
PP0403_SA Construction wage rate	1.5346 (0.3483)**		0.2707 (0.1521)						43	0.07	3.1689 (0.0825)	0.0000
PP0404 Water supply	1.8629 (0.3652)**			-0.3005 (0.1563)					40	0.09	3.6975 (0.0620)	0.0000
PP0408_SA Fire wood whole	0.3224 (0.2547)	0.8392 (0.0786)**							44	0.73	114.1201 (0.0000)	0.0000
PP0500 Furnishes Household equipment and maintenance	0.6172 (0.2599)*	0.6694 (0.1076)**							42	0.49	38.7216 (0.0000)	0.0000
PP0501 Furniture	0.7543 (0.2810)*	0.6248 (0.1233)**							42	0.39	25.6782 (0.0000)	0.0000
PP0502_SA Household textile	0.766 (0.3754)*	0.3258 (0.1510)*	0.2786 (0.1499)						43	0.28	7.6799 (0.0015)	0.0000
PP0504 Utensils	0.783 (0.3158)*	0.6399 (0.1211)**							42	0.41	27.9319 (0.0000)	0.0000
PP0505 Plastic products	0.4056 (0.2618)	0.4431 (0.1512)**	0.3353 (0.1530)*						41	0.52	20.7805 (0.0000)	0.0000
PP0506 Washing soap, detergent	0.5705 (0.3053)	0.5564 (0.1614)**	0.3175 (0.1379)*	-0.1975 (0.1108)					40	0.49	11.4576 (0.0000)	0.0000
PP0507 Sewing needle and dry cell	1.8734 (0.2685)**								43	0.00	NA NA	0.0000
PP0508 Household servant	1.2642 (0.4729)*	0.5119 (0.1333)**							42	0.27	14.7422 (0.0004)	0.0000

Notes: The equation was estimated via OLS using stepwise elimination of insignificant explanatory variables. Standard errors for all coefficients and p-values for the F stat are given in parentheses.

Table A1. ERPT Estimates for All CPI Items (continued)

Item	C	P(-1)	P(-2)	P(-3)	Q	Q(-1)	Q(-2)	Q(-3)	n	R2	F stat	ERPT
PP0509 Marriage hall charges	0.8706 (0.3356)*	0.5866 (0.1241)**							42	0.36	22.3573 (0.0000)	0.0000
PP0600_SA Health	1.9445 (0.1914)**								45	0.00	NA NA	0.0000
PP0601 Drug medicine	1.666 (0.3336)**								43	0.00	NA NA	0.0000
PP0602_SA Medical equipment	0.8105 (0.3701)*	0.6574 (0.1145)**							44	0.44	32.9583 (0.0000)	0.0000
PP0603 Doctor(MBBS) clinic fee	1.6071 (0.4573)**	0.3517 (0.1449)*							42	0.13	5.8933 (0.0198)	0.0000
PP0604_SA Medical test	0.7933 (0.2539)**	0.5504 (0.1273)**							44	0.31	18.6896 (0.0001)	0.0000
PP0702 Motor vehicle accessories	0.6147 (0.3032)*	0.5159 (0.1004)**							42	0.40	26.4183 (0.0000)	0.0000
PP0704 Mechanic service	1.1202 (0.3510)**	0.4156 (0.1435)**							42	0.17	8.387 (0.0061)	0.0000
PP0800 Communication	0.8251 (0.3628)*								43	0.00	NA NA	0.0000
PP0801 Postal services	2.0078 (0.6136)**								43	0.00	NA NA	0.0000
PP0802 Communication and apparatus	0.7874 (0.3762)*								43	0.00	NA NA	0.0000
PP0900_SA Recreation and Culture	0.9108 (0.3208)**	0.4587 (0.1364)**							44	0.21	11.3126 (0.0017)	0.0000
PP0901_SA Recreation and culture	0.3649 (0.1366)*	0.4814 (0.1359)**							44	0.23	12.5516 (0.0010)	0.0000
PP0902_SA Text books	1.8541 (0.7795)*	0.2545 (0.1494)							44	0.06	2.9034 (0.0958)	0.0000
PP1100 Restaurant and Hotels	1.1611 (0.3479)**	0.4613 (0.1292)**							42	0.24	12.7555 (0.0009)	0.0000
PP1101 Ready-made food	1.1611 (0.3479)**	0.4613 (0.1292)**							42	0.24	12.7555 (0.0009)	0.0000
PP1200_SA Misc goods services	0.4404 (0.3081)	0.4419 (0.1432)**		0.3347 (0.1351)*					42	0.52	21.1086 (0.0000)	0.0000
PP1201 Personal care	0.5478 (0.2910)	0.2662 (0.1454)	0.399 (0.1303)**						41	0.41	13.2008 (0.0000)	0.0000
PP1203 Blades	0.7234 (0.3216)*	0.5762 (0.1303)**							42	0.33	19.5679 (0.0001)	0.0000
PP1204 Personal equipment	1.0939 (0.6951)	0.2763 (0.1478)		0.3255 (0.1476)*					40	0.21	4.8923 (0.0130)	0.0000
PP0308_SA Tailoring	0.5904 (0.3624)	0.4731 (0.1411)**	0.3283 (0.1438)*			-0.0868 (0.0446)			42	0.56	16.4402 (0.0000)	-0.0868
PP0308_SA_CO												0.0000
PP1000_SA Education	2.7601 (0.2689)**					-0.2096 (0.0929)*			42	0.11	5.0879 (0.0296)	-0.2096
PP1000_SA_CO							-0.1245					-0.1245
PP1001_SA Education	2.7601 (0.2689)**					-0.2096 (0.0929)*			42	0.11	5.0879 (0.0296)	-0.2096
PP1001_SA_CO							-0.1245					-0.1245
PP0705_SA Motor vehicle tax	2.7814 (1.1445)*				0.9393 (0.4540)*	-1.3944 (0.4204)**			42	0.23	5.7071 (0.0067)	-0.4551
PP0705_SA_CO			0.0883									0.0000

Notes: The equation was estimated via OLS using stepwise elimination of insignificant explanatory variables. Standard errors for all coefficients and p-values for the F stat are given in parentheses.