Consumption and Exchange Rate Uncertainty: Evidence from Selected Asian Countries

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Abstract

We set out to assess the effects of exchange rate uncertainty on real consumption in selected Asian countries. Consumption influences business cycles, which in turn shape short-run monetary policy decisions. Hence, understanding factors driving consumption is appealing to policymakers. In the extant literature, few studies have analysed the effects of uncertainty on consumption. The available ones generally focus on the long-run effects, in spite of the fact that the short-run persistence and adjustments to equilibrium are equally relevant. Our study takes this limitation seriously by distinguishing the short- and long-run effects of exchange rate uncertainty on consumption. Using a flexible dynamic panel data technique that allows long-run effects to be homogeneous and the short-run effects to be heterogeneous, we find that uncertainty impedes consumption in the long run. In the short run, however, the effects are immaterial. This evidence remains robust to the measure of uncertainty, asymmetric uncertainty, the role of consumer prices, and the global financial crisis of 2008. By decomposing uncertainty into its temporary and permanent components, we find that the latter have a stronger effect on consumption in the long run than the former. Although both components demand policy attention, the evidence suggests that policymakers should be more concerned with permanent uncertainty.

Keywords: Real Consumption; Exchange Rate Uncertainty; Asian Countries.
JEL Codes: E31; F31; C23.

1. Introduction

Consumption and saving decisions are critical components of short- and long-run economic analysis owing to several factors but the following two stand out. Firstly, because consumption affects business cycles, it influences short-run monetary policy decisions. Secondly, saving decisions affect the level of capital stock, wages, interest rates and the standard of living in the long run, and therefore affect fiscal and monetary policies (Carroll, 2006; Iyke and Ho, 2017). Since consumption and saving decisions are critical factors shaping both fiscal and monetary policies, a large number of studies have focused on the factors influencing consumption and saving. From the consumption literature, real income and interest rates regularly appear as fundamental determinants of consumption (Bahmani-Oskooee et al., 2015). Exchange rates are also gaining prominence as a determinant of consumption in recent studies because countries are becoming more open (Iyke and Ho, 2017). Alexander (1952) was one of the earliest to connect exchange rates to consumption. He contended that exchange rates influence consumption by their pass-through effects on inflation. That is, exchange rate uncertainty is associated with inflation uncertainty, thereby affecting consumption decisions (Alexander, 1952).

Providing support for this contention, Carroll (1997), while investigating the optimal behaviour of consumers with standard attitudes toward risk facing income uncertainty, found that it could be optimal for average household consumption behaviour to mimic the average household income for most part of the life cycle, conditional on the household's income and its degree of impatience. Moreover, Obstfeld and Rogoff (1998) noted that exchange rate uncertainty impedes real consumption through direct and indirect channels. In terms of the direct channel, they explained that firms and households react adversely to uncertainty generally, which in turn influences their consumption decisions. Equally, uncertainty impedes production, income, trade, and consequently affects consumption. In terms of the indirect channel, they argued that firms could attempt to hedge the risks related with exchange rate uncertainty by pushing up prices of their goods and services, which may in turn hurt real consumption. On the empirical front, few studies have examined the effects of exchange rate uncertainty on domestic consumption. Bahmani-Oskooee and Hajilee (2010), for example, found currency depreciation to be associated with low unskilled labour wages in some countries, and to boost skilled labour wages in others. Similarly, Bahmani-Oskooee et al. (2015) found that while exchange rate uncertainty has short-run effects on consumption in all countries in their sample, the short-run effects translate to long-run effects only in six countries.

In this paper, we revisit the effects of exchange rate uncertainty on consumption using a selected sample of Asian countries. Specifically, we combined the traditional Asian Tigers: South Korea, Taiwan, Hong Kong and Singapore, the new Asian Tigers: Thailand, Indonesia, Malaysia and China, and the first industrialised Asian country, Japan, to achieve this objective. One limitation of the existing studies is that they mostly focus on estimating long-run effects. The short-run transitional dynamics are usually ignored. To further the literature, we attempt to estimate both short- and long-run effects of exchange rate uncertainty on consumption using a distributed lag approach developed by Pesaran et al. (1999). This approach entails pooling countries together and verifying whether cross-equation restriction of a common equilibrium relationship exists among variables by applying the Pooled Mean Group (PMG) estimator. In the current context, our aim is to establish whether cross-equation restriction of a common equilibrium relationship exists between uncertainty and consumption. The approach is particularly desirable because it allows the policymaker to capture persistence in consumption decisions by way of imposing specific lag structure, model policy changes, accommodate imperfections in the exchange rate market, and model peculiar cross-sectional and time-series heterogeneities in the data (Loayza and Ranciere, 2006; Frank, 2009; Kim and Lin, 2010). Furthermore, since the approach can be employed regardless of whether the variables are integrated or not, we are able to overcome pretesting bias associated with tests for unit roots. Generally, most studies have eliminated the noise or business cycle effects associated with panel data by averaging when examining the effects of some variables on others. However, as noted by Loayza and Ranciere (2006), such a technique risks losing critical information including purging cross-sectional parameter heterogeneity and dynamic effects. The distributed lag approach overcomes such issues.

As a baseline, we estimated a distributed lag real consumption model that include real income, interest rates and exchange rate uncertainty using the PMG estimator. Because we are interested in both the short- and long-run estimates, we followed Loayza and Ranciere (2006) and Kim and Lin (2010) by imposing a common lag order across countries. Since the data is annual, we imposed a maximum of one lag across countries to avoid over-specification (Frank, 2009). Inappropriate choice of estimators could influence the parameter estimates. Therefore, we also estimated the consumption specification using the mean group (MG) and the dynamic fixed-effects (DFE) estimators as well in order to complement the PMG estimates.[1] We then used the Hausman test to select the best estimator. It turns out that the PMG estimator yielded the best results. By measuring exchange rate uncertainty as the annualised conditional variance of a generalised autoregressive conditional heteroskedastic GARCH(1,1) model, we found that uncertainty has negative effects on consumption in the long run. Although, these effects exist in the short run, they are insignificant. This evidence is unaffected using the annualised standard deviation of monthly exchange rates as the measure of uncertainty. Consumer prices influence consumption decisions. Hence, ignoring them in our model indicates potential misspecification issues. To overcome this problem, we re-estimated the consumption function by including consumer prices as one of the predictors. We found that, conditional on consumer prices, the effect of uncertainty on consumption in the long run has reduced, suggesting that the appropriate size of the effects of uncertainty on consumption becomes clearer if relevant information is captured in the model.

In reality, consumers may react to unanticipated and anticipated changes in the real exchange rate differently (see Baum *et al.*, 2001). As noted by Byrne and Davis (2005), a negative shock to exchange rates could induce higher uncertainty owing to the heightened expectations of a speculative attack linked to it. Thus, the GARCH(1,1) and the moving-window standard deviation measures of uncertainty may fail to contain these asymmetries. To provide a robust relationship between consumption and exchange rate uncertainty, we employed Nelson's (1991) exponential GARCH (EGARCH) model. We found that, controlling for asymmetries, uncertainty has a negative effect on consumption in the long run – although, the effect was reduced in absolute terms. The short-run effect, while still negative, is immaterial. We took the analysis further in two ways. First, we controlled for the global financial crisis (GFC) of 2008, an extreme event which has influenced both consumption and exchange rate uncertainty significantly and contemporaneously. We found that, once the effects of the GFC are purged, the error-correction term becomes more significant in the model, suggesting that the GFC is a force driving the variables apart in the short run. Similarly, we found that, when compared with the baseline results, the long-run effect of exchange rate uncertainty on consumption is smaller after purging the GFC from the sample. Second, we estimated the component of exchange rate uncertainty that appears to drive the negative uncertainty-consumption nexus. By decomposing exchange rate uncertainty into its temporary and permanent components using the Engle and Lee (1999) component GARCH (CGARCH) model, we found that, while both temporary and permanent uncertainty appear to hurt consumption in the long run, permanent uncertainty tends to have a stronger effect. This is in line with the growing literature arguing that the economy responds differently to temporary and permanent uncertainty (e.g. Kim, 1993; Chadha and Sarno, 2002; Moore and Schaller, 2002; Byrne and Davis, 2004).

Our empirical analysis contributes to the literature that studies consumption and its determinants (Friedman, 1957; Blinder, 1975; Raut and Virmani, 1989; Cocco et al., 2005; Carroll, 2006). Consumption decisions are known to influence business cycles. In essence, our analysis contributes to the business cycle literature (e.g. Wunder, 2012; Mian et al., 2013; Kapeller and Schütz, 2015). We explored exchange rate uncertainty and its influence on consumption. Hence, our empirical analysis adds to the uncertainty literature in general, and the literature focusing on exchange rate fluctuations and their effects on the economy in particular, such as those of Alexander (1952), Hooper and Kohlhagen (1978), Carroll and Kimball (1996), Betts and Kehoe (2006), Kandil et al. (2007), Schnabl (2008), and Tille, (2008). Since we attempted to distinguish short-run effects from long-run effects, our empirical

[1] Details of these estimators are provided in the methodology section.

approach is linked to the recent studies filling this gap in the literature including Byrne and Davis (2005), Catao and Solomou (2005), Loayza and Ranciere (2006), Frank (2009), Kim and Lin (2010), and Chudik et al. (2017).

The rest of the paper proceeds as follows. Section 2 presents the methodology and the data. Section 3 discusses the empirical results. Section 4 concludes.

2. Methodology

2.1. Specifications

Based on the theoretical literature, exchange rate uncertainty may influence inflation which in turn affects real consumption (Alexander, 1952). Therefore, we defined the consumption function as a function of exchange rate uncertainty. Several theoretical studies have identified real income and interest rates as critical drivers of real consumption (e.g. Friedman, 1957; Ando and Modigliani, 1963; Hall, 1978; Campbell and Mankiw, 1991). We followed these studies and modelled real consumption as a function of real income and interest rates as well. The baseline consumption model for the selected Asian countries takes the following form:

$$lnC_{it} = \alpha_0 + \alpha_1 lnY_{it} + \alpha_2 r_{it} + \alpha_3 VOL_{it} + \epsilon_{it} \quad (1)$$

where C, Y, r, and VOL denote real consumption, real income, the nominal interest rate, and real exchange rate uncertainty respectively; ln denotes the natural logarithm operator; α's denote the parameters of the model; ϵ is the *iid* error term; i and t are the cross-sectional and time subscripts respectively.

In theory, rising income levels are supposed to be associated with rising consumption levels. (Friedman, 1957; Campbell and Mankiw, 1991). Therefore, we expect the estimated value of α_1 to be positive. Similarly, a fall in the interest rate is expected to induce an intertemporal substitution of consumption for savings; the reverse is true (Hall, 1988). The estimated value of α_2 should be negative. In contrast to these variables, exchange rate uncertainty may impede or promote real consumption contingent on the reaction of consumers following an exchange rate uncertainty-induced inflation uncertainty (Obstfeld and Rogoff, 1998; Bahmani-Oskooee et al., 2015). This means that the estimated value of α_3 could be negative or positive.

The consumption model in Eq. (1) fails to capture the short-run behaviour of the variables. In other words, the policymakers cannot evaluate the short-run effects of uncertainty and the other factors on consumption. They can only recover the long-run effects. In order to recover the short-run dynamics, we reformulated Eq. (1) as an error-correction consumption model as follows:

$$\Delta y_{it} = \phi_i(y_{it-1} - \theta_i' X_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{it-j} + \sum_{j=0}^{q-1} \delta_{ij}'^* \Delta X_{it-j} + \mu_i + \varepsilon_{it} \quad (2)$$

which is a suitable reparameterisation of the following distributed lag model:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} \, \Delta y_{it-j} + \sum_{j=0}^{q} \delta'_{ij} \, X_{it-j} + \mu_i + \varepsilon_{it} \qquad (3)$$

where, for notational convenience, y and X replaced consumption and the explanatory variables respectively; μ and ε are the individual fixed-effects and the *iid* error term respectively; λ_{ij} and δ_{ij} are scalars and coefficient vectors respectively. The additional definitions are: $\phi_i = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right)$; $\theta_i = \sum_{j=0}^{q} \delta_{ij} / (1 - \sum_k \lambda_{ik})$; $\lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im}, j = 1, 2, \ldots, p-1$; $\delta^*_{ij} = -\sum_{m=j+1}^{q} \delta_{im}, j = 1, 2, \ldots, q-1$. ϕ_i is the error-correction term, which shows how fast the variables move back to equilibrium when they move apart in the short-run. Therefore, the variables are said to be cointegrated or move closely in the long run if the estimated value of ϕ_i is negative and statistically significant. θ'_i is the cointegrating vector, explaining the number of long-run relationships in the model.

The error-correction model Eq. (2) does not only allow policymakers to differentiate the short-run effects from the long-run effects of exchange rate uncertainty on consumption, it allows them to (i) model the persistence and the adjustment to equilibrium paths of consumption and exchange rate uncertainty; (ii) capture the contemporaneous feedback causal flow from consumption to exchange rate uncertainty; (iii) and to model cross-sectional heterogeneities in the consumption-uncertainty nexus by allowing the parameters in Eq. (2) to vary (Catao and Solomou, 2005; Catao and Terrones, 2005; Frank, 2009; Kim and Lin, 2010; Chudik et al., 2017).

Three popular estimators have been proposed to estimate the error-correctional model, Eq. (2), in the literature. First, if we assume that the parameters are heterogeneous across countries or individuals, then the model can be estimated using the mean group (MG) estimator proposed by Pesaran and Smith (1995). In that case, the parameters are estimated for each country and then averaged to obtain the group estimates. Second, if we assume that only the intercept parameters are heterogeneous, then the model can be estimated using the dynamic fixed-effects (DFE) estimator. Third, if we allow the intercept, short-run coefficients, and the error terms to vary across countries but restrict the long-run coefficients to be homogeneous, then the model can be estimated using the pooled mean group (PMG) estimator proposed by Pesaran, Shin, and Smith (1999). This estimator essentially combines the pooling advantages of the DFE estimator and the averaging advantages of the MG estimator, and thus serves as the intermediate estimator between the two extreme cases. Due to its flexibility, the PMG estimator has been shown to perform better than both the MG and DFE estimators (Pesaran et al., 1999). This is because, if the slope coefficients are heterogeneous, the DFE estimator yields inconsistent results; the MG estimator also produces inconsistent results if the long-run coefficients are homogeneous. The PMG estimator offers a compromise and is therefore preferred in empirical analysis.

Pesaran et al. (1999) have demonstrated that the suitability of the PMG estimator can be tested against both the DFE and MG estimators using the standard Hausman test. Hence, in this paper, we used the PMG estimator to report our main results and compare its performance to the DFE and MG estimators. The PMG estimator is particularly relevant to our study because it permits us to model the potential common cross-sectional long-run relationship between consumption and exchange rate uncertainty, while capturing the potential short-run heterogeneous adjustments of the markets to equilibrium across countries (Loayza and Ranciere, 2006; Kim and Lin, 2010).

2.2. Data

We collected data on real consumption, real income, interest rates, consumer prices, and exchange rates for the empirical analysis. The countries included in our sample are Hong Kong, Singapore, Thailand, Malaysia, Indonesia, China, Japan, and Taiwan. In other words, the sample combines the traditional Asian Tigers: South Korea, Taiwan, Hong Kong and Singapore, the new Asian Tigers: Thailand, Indonesia, Malaysia and China, and the first industrialised Asian country, Japan. The high-income levels of some of these countries (Japan, Korea, Singapore, and Taiwan) and the fast-rising income levels in others (Thailand, Indonesia, Malaysia and China) indicate that real consumption could be rising as well. There is evidence suggesting that these countries have experienced dramatic rise in the middle class relative to other world regions since 1990 (Asian Development Bank, 2010). Additionally, these countries have readily available data for the variables considered in our study. Other studies consider them as well (e.g., Sharma and Thuraisamy, 2013). The real effective exchange rate (REER) data for Hong Kong, Singapore, Thailand, and Malaysia are only available from January 1991. Similarly, data on the remaining variables end at 2014. Therefore, the sample is restricted to the period 1991 to 2014. Table A.1 in the appendix shows the variables employed in the study and their sources. In order to analyse the effects of exchange rate uncertainty on consumption, we calculated various measures of uncertainty. The baseline measure of exchange rate uncertainty, VOL, is derived as the annualised conditional variance of a generalised autoregressive conditional heteroskedastic, GARCH(1,1), model of the natural logarithm of the REER (lnREER). For robustness, we obtained a different measure of uncertainty, SDV, by using a 12-month moving-window standard deviation of lnREER. To capture asymmetries in the exchange rate uncertainty, EVOL, we obtained an annualised conditional variance of an exponential GARCH(1,1) model of lnREER. Finally, we analysed the effects of temporary (TEMP) and permanent (PERM) uncertainty by obtaining these measures from annualised conditional variances of a component GARCH(1,1) model of lnREER. These approaches for calculating the uncertainty have been used in various studies (e.g., Asteriou and Price, 2005; Byrne and Davis, 2005; Kim and Lin, 2010; Iyke and Ho, 2017). Technical details of these approaches are presented in the appendix for the interested reader. The next section presents the empirical findings.

3. Empirical Results

3.1. Consumption and Uncertainty

We begin our empirical analysis by computing our baseline measure of exchange rate uncertainty. As mentioned earlier, this is obtained using the annualised conditional variance of a GARCH(1,1) model of lnREER. The kernel density plot of this measure, VOL, for each country is shown in Figure A.1 in the appendix. The plots show that on average, VOL is skewed to the right meaning that extreme uncertainty is uncommon in these countries. Table 1 shows the mean uncertainty and the corresponding real consumption in each country. The table shows that the highest mean uncertainty is experienced in Indonesia followed by China, and the lowest being Taiwan and Singapore. Mean real consumption is highest in China, followed by Japan Indonesia and South Korea. The lowest mean real consumption is recorded in Hong Kong and Singapore. Table 2 shows the correlations among the variables for the period 1991–2014. From Table 2, it is immediately obvious that the measures of real exchange rate uncertainty and real consumption are negatively correlated. Also, the correlation between pairs of uncertainty measures is positive and very high.

Table 1: Mean Exchange Rate Uncertainty and Real Consumption.

Country	Mean VOL	Mean SDV	Mean Consumption	Observation
Hong Kong	0.0023(7)	0.0837(7)	189971.9111(8)	24
Singapore	0.0009(9)	0.0482(9)	104271.9132(9)	24
South Korea	0.0128(3)	0.1128(3)	787790.9323(4)	24
Thailand	0.0105(4)	0.0974(5)	471732.9583(6)	24
Malaysia	0.0099(5)	0.1114(4)	235428.4525(7)	24
Indonesia	0.0617(1)	0.1754(1)	971676.6745(3)	24
China	0.0129(2)	0.1273(2)	3810423.5(1)	24
Japan	0.0073(6)	0.0859(6)	3209786.833(2)	24
Taiwan	0.0022(8)	0.0651(8)	531336.0378(5)	24

Source: Computed using lnREER data from Bruegel.org and consumption data from Penn World Table (PWT) 9.0.

Table 2: Correlation Matrix of the Variables 1991–2014.

	lnC	lnY	r	VOL	SDV	EVOL	TEMP	PERM	lnP
lnC	1.0000								
lnY	0.9840	1.0000							
r	-0.0970	-0.1459	1.0000						
VOL	-0.0462	-0.0365	0.4384	1.0000					
SDV	-0.1386	-0.0778	0.4156	0.6244	1.0000				
EVOL	-0.0374	-0.0318	0.4371	0.9847	0.6227	1.0000			
TEMP	-0.0545	-0.0337	0.0818	0.8322	0.4419	0.8456	1.0000		
PERM	-0.0551	-0.0345	0.0902	0.8306	0.4402	0.8441	0.9991	1.0000	
lnP	-0.4239	-0.4923	-0.2004	-0.0469	0.0003	-0.0563	-0.0241	-0.0290	1.0000

Source: Computed using data described in Table A.1. lnC, lnY, i, and lnP are real consumption, real income, interest rate, and consumer price index, respectively. VOL, SDV, EVOL, TEMP, and PERM are the measures of exchange rate uncertainty.

What are the effects of exchange rate uncertainty on consumption? Table 3 shows the baseline results alongside the specification tests required to answer this question. Because the data is annual, we restrict the maximum lag in the model to one in order to avoid over-specification. Besides, Kim and Lin (2010) and Loayza and Ranciere (2006) argued that if our interest is in the long-run parameters, we should select the optimal lags using consistent information criteria on a country-by-country basis, and a common lag order across countries if our interest is also to analyse the short-run effects. In this study, our interest lies in both the short- and the long-run coefficients. Therefore, it makes sense to impose a common lag order. We report the results based on the PMG, MG, and DFE estimators and determined the best specification using the Hausman test.

In all three cases, the coefficient of error-correction term is negative, significant and considerably lower than unity in absolute terms. This suggests that there exists a stable long-run relationship among the variables included in the model. In other words, the variables tend to move together in the long run if they drift apart in the short run. The Hausman test establishes whether the PMG estimator performs better than the MG and DFE estimators in our current specifications. From Table 3 it is clear that the PMG estimator performs better. Therefore, we focus on the results obtained using this estimator. The long-run results suggest that exchange rate uncertainty hurts real consumption. In the short run, the effect of exchange rate uncertainty on consumption is negative but insignificant. Notice that the short-run results are not restricted to be the same across countries due to different market frictions and adjustment mechanisms across these countries. Instead, what we report are the average effects of coefficients across these countries. Hence, the short-run effect of the uncertainty on consumption should be understood to mean the average effect.

Regarding the other variables, from Table 3 it can be seen that real income enhances consumption. That is, increases in real income leads to increases in real consumption in the long run. Although, interest rates are negatively related to real consumption in the long run, the relationship appears insignificant. The short-run results show the same pattern. Real income has a positive effect on real consumption, while interest rates have negative and insignificant effect on it.

Table 3: Consumption and Exchange Rate Uncertainty.

Variable	PMG	MG	DFE
Long-run Results			
lnY	0.8289	0.0812	0.4308
	(0.0000)	(0.0630)	(0.0180)
r	-0.0014	-0.0607	-0.0332
	(0.6930)	(0.1210)	(0.4600)
VOL	-1.7168	-2.4913	-0.9473
	(0.0030)	(0.9650)	(0.0563)
Short-run Results			
ECT	-0.0676	-0.1963	-0.0348
	(0.0810)	(0.0000)	(0.0030)
ΔlnY	0.2675	0.2091	0.3963
	(0.0030)	(0.0680)	(0.0000)
Δr	-0.0022	-0.0012	-0.0021
	(0.3590)	(0.6190)	0.0730)
ΔVOL	-5.7550	-1.2754	-0.0190
	(0.1930)	(0.1550)	(0.3090)
Constant	0.1710	0.6309	0.2905
	(0.0230)	(0.0400)	(0.0180)
Hausman Test ($\chi2$)		3.0800	0.0100
p-value		(0.3794)	(0.9990)

Notes: p-values are in the parenthesis; Δ is the first difference operator; ECT is the error correction term.

Are these results potentially influenced by the measure of exchange rate uncertainty? To respond to this question, we obtained a different measure of uncertainty by using a 12-month moving-window standard deviation of natural logarithm of the real effective exchange rate. Our empirical strategy follows from Table 3. The results obtained using the alternative measure of uncertainty, SDV, are reported in Table 4. The error-correction term clearly suggests that there is convergence. Hence, the long-run relationship among the variables is dynamically stable, since the coefficients of ECT are negative, significant, and lie within the unit circle. The PMG estimator clearly performs better than the MG and DFE estimators as shown by the Hausman test. Concentrating on the results obtained using the PMG estimator, it is evident that uncertainty tends to reduce the level of real consumption in the long-run. Unlike the baseline results above, the short-run results in Table 4 indicate that uncertainty relates positively but insignificantly to consumption in the short run. Since the short-run impact of uncertainty in both cases is insignificant, we can infer that uncertainty hurts consumption in the long-run regardless of the measure of uncertainty. What is evident is that, when measured by VOL, the effect of exchange rate uncertainty on consumption is orders of magnitude higher than when measured by SDV. Hence, if the policymaker is particularly interested in the size of the effect, the measure of uncertainty must be carefully chosen.

Table 4: Consumption and Uncertainty using Alternative Measure of Uncertainty.

Variable	PMG	MG	DFE
Long-run			
lnY	0.4648	0.0855	0.4713
	(0.0000)	(0.0040)	(0.1000)
r	-0.0159	-0.0626	0.0179
	(0.0220)	(0.1750)	(0.6220)
SDV	-1.2652	-1.0336	-1.3611
	(0.0360)	(0.0613)	(0.0080)
Short-run			
ECT	-0.0414	-0.2104	-0.0295
	(0.0514)	(0.0000)	(0.0010)
ΔlnY	0.3796	0.2150	0.3371
	(0.0010)	(0.0530)	(0.0000)
Δr	-0.0041	-0.0030	-0.0033
	(0.1290)	(0.2610)	(0.0120)
ΔSDV	0.0078	0.0323	0.0529
	(0.8220)	(0.3650)	(0.0110)
Constant	0.3260	0.7805	0.2355
	(0.1110)	(0.0090)	(0.0240)
Hausman Test (χ2)		3.9800	0.0100
p-value		(0.3280)	(0.9998)

Notes: p-values are in the parenthesis; Δ is the first difference operator; ECT is the error correction term.

The reason why the short-run effects are not significant may be attributed to the heterogeneities in the adjustment mechanisms across countries. The market conditions in these countries are unlikely to be same. Hence, it may be possible that in the short run, while uncertainty may impede consumption in some countries, it may be irrelevant or even induce consumption in others. So that, taking all the countries together, the opposing effects of uncertainty on consumption may be nullified. Bahmani-Oskooee et al. (2015), for example, reported both positive and negative short-run effects of uncertainty on consumption in their time series investigation – thus, supporting this contention. The long-run results, however, appear relevant because we expect the markets in these countries to settle in the long run. The possible steady-state property of these markets means that the true relationship between uncertainty and consumption would manifest in the long run. This intuition appropriately reflects the long-run homogeneity assumption observed when applying the PMG estimator.

3.2. The Role of Inflation

Apart from real income and interest rates, consumer prices are critical factors in consumption decisions. Theoretically speaking, high consumer prices are expected to be associated with low consumption, other factors remaining unchanged. That is, at a given level of income, consumers would be unable to buy the same quantity of goods and services they could when prices are lower. Apart from the same quantity of money being unable to acquire the same basket of goods and services following an increase in consumer prices, the value of representative consumers' wealth is negatively affected (e.g., Kessel, 1956; Mundell, 1963). Following this intuition, the empirical results documented above may be suffering from omitted variable bias. In other words, the signs and sizes of the coefficients reported in Tables 3 and 4 could change altogether if we included consumer prices. To address this weakness, we re-estimated our baseline model by including consumer prices. The corresponding estimates are shown in Table 5.

The error-correction term is negative and statistically significant indicating that the long-run association among the variables is valid. Besides, the coefficient of the error-correction term lies within a unit circle, therefore the long-run relationship is dynamically stable. The long-run results suggest that consumer prices are important in the model and should be included. The results also show that consumer prices related with consumption negatively in the long run but this relationship disappears in the short run. We can further infer that the effect of uncertainty on consumption in the long run has reduced once we accounted for consumer prices. This indicates that the appropriate size of the effect of uncertainty on consumption can only be reported if we control for other relevant information.

Table 5: The Role of Inflation in the Consumption-Uncertainty Relationship.

Variable	PMG Estimates Baseline	PMG Estimates Inflation
Long-run		
lnY	0.8289	0.8380
	(0.0000)	(0.0000)
r	-0.0014	-0.0032
	(0.6930)	(0.3900)
VOL	-1.7168	-1.6865
	(0.0030)	(0.0000)
lnP		-0.1704
		(0.0250)
Short-run		
ECT	-0.0676	-0.0936
	(0.0810)	(0.0430)
ΔlnY	0.2675	0.2261
	(0.0030)	(0.0240)
Δr	-0.0022	-0.0003
	(0.3590)	(0.9140)
ΔVOL	-5.7550	-8.8008
	(0.1930)	(0.1730)
ΔlnP		-0.1204
		0.4490
Constant	0.1710	0.2875
	(0.0230)	(0.0150)

Notes: p-values are in the parenthesis; Δ is the first difference operator; ECT is the error correction term; PMG denotes results obtained using the PMG estimator.

3.3. The Effects of Asymmetries in Exchange Rate Uncertainty

Economic agents may react to unanticipated changes in the real exchange rate differently. In this sense, the overall economy may react differently to unexpected depreciations and appreciations (see also Baum et al., 2001). Byrne and Davis (2005) noted that a negative shock to exchange rates could lead to higher uncertainty because it may be associated with heightened expectations of a speculative attack. This indicates that a simple GARCH(1,1) model of uncertainty may not capture this obvious asymmetric uncertainty. Hence, the effects of uncertainty on consumption reported above may not reflect the approximate size. Nelson (1991) proposed the exponential GARCH (EGARCH) model to circumvent this problem. The advantage of this approach is that it captures the asymmetries related to the positive and negative shocks in the conditional variance. We computed an annualised conditional variance of EGARCH(1,1) model of lnREER to examine the role of asymmetric uncertainty on real consumption.[2] The results using this asymmetric measure of uncertainty, EVOL, are reported in Table 6. From these results we can see that, once the asymmetries are taken into account, the effect of exchange rate uncertainty on consumption in the long run has reduced in absolute terms. The short-run results indicate that uncertainty has immaterial effects on consumption as documented earlier. The other variables have the same effects on consumption as reported earlier, in terms of direction. A conclusion may be that capturing the asymmetries in exchange rate uncertainty is consequential for the size of the effects on real consumption.

Table 6: The Effects of Asymmetric Uncertainty on Consumption.

Variable	PMG Estimates Baseline	PMG Estimates Asymmetric Uncertainty
Long-run Results		
lnY	0.8289	0.8339
	(0.0000)	(0.0000)
r	-0.0014	0.0020
	(0.6930)	(0.5800)
VOL	-1.7168	
	(0.0030)	
EVOL		-1.2533
		(0.0050)
Short-run		
ECT	-0.0676	-0.0660
	(0.0810)	(0.0830)
ΔlnY	0.2675	0.2623
	(0.0030)	(0.0060)
Δr	-0.0022	-0.0022
	(0.3590)	(0.4250)
ΔVOL	-5.7550	
	(0.1930)	
ΔEVOL		-7.1943
		(0.1790)

[2] The technical details are left in the appendix for the interested reader.

Constant	0.1710	0.1640
	(0.0230)	(0.0220)

Notes: p-values are in the parenthesis; Δ is the first difference operator; ECT is the error correction term; PMG denotes results obtained using the PMG estimator.

3.4. The Effects of the Global Financial Crisis

The global financial crisis (GFC) in 2008 is reported to have strongly affected several Asian markets and the strength of their dependence on other markets around the world (Fidrmuc and Korhonen, 2010; Glick and Hutchison, 2013; Wang, 2014). Since this was an extreme event, including 2008 in our estimations could have distorted the overall picture of the effects of exchange rate uncertainty on real consumption. Therefore, we pushed the empirical analysis further by purging 2008 from our sample before computing the coefficient estimates. In doing so, we were able to gauge the average effects of uncertainty, excluding an extreme event – thus, presenting clean estimates. For comparison purposes, we also reported the results including the GFC in 2008 (i.e. the baseline PMG results in Table 3).

Table 7 shows these results. From the results, we could see that, once the effects of the GFC are purged, the error-correction term becomes more significant in the model, suggesting that the GFC is a force driving the variables apart in the short-run. The coefficient of the error-correction term is negative and lies within a unit circle, implying convergence to long-run equilibrium. When compared with the baseline results, the long-run effect of exchange rate uncertainty on consumption is smaller after purging the GFC from the sample. Moreover, as in the case of the baseline results, the effect of exchange rate uncertainty on consumption is negative but insignificant after controlling for the GFC. This suggests that the GFC was not driving our short-run estimates. In terms of the other variables, it is evident that increases in real income lead to increases in real consumption in the long run. In contrast, interest rates and consumer prices are negatively related to consumption in the long run. In the short-run, real income has a positive effect on real consumption, while interest rates and consumer prices have negative but insignificant effects on it. Overall, the conclusions drawn earlier are unaffected when we purged the effects of the GFC from the sample.

Table 7: Purging the Effects of the Global Financial Crisis.

Variable	PMG Estimates Baseline	PMG Estimates Financial Crisis	PMG Estimates Crisis with Inflation
Long-run Results			
lnY	0.8289	0.8133	0.8259
	(0.0000)	(0.0000)	(0.0000)
r	-0.0014	-0.0003	-0.0008
	(0.6930)	(0.7915)	(0.8730)
VOL	-1.7168	-1.1680	-1.3673
	(0.0030)	(0.0026)	(0.0000)
lnP			-0.1447
			(0.0170)
Short-run Results			
ECT	-0.0676	-0.0645	-0.0879
	(0.0810)	(0.0624)	(0.0290)
ΔlnY	0.2675	0.2709	0.2429
	(0.0030)	(0.0040)	(0.0120)
Δr	-0.0022	-0.0020	-0.0001

	(0.3590)	(0.4040)	(0.9550)
ΔVOL	-5.7550	-6.2687	-8.3187
	(0.1930)	(0.1890)	(0.1780)
ΔlnP			-0.1655
			(0.3350)
Constant	0.1710	0.1794	0.2751
	(0.0230)	(0.0380)	(0.0090)

Notes: p-values are in the parenthesis; Δ is the first difference operator; ECT is the error correction term; PMG denotes results obtained using the PMG estimator.

3.5. What Component of Uncertainty Matters?

It is clear from the above discussion that exchange rate uncertainty influences real consumption, especially in the long run. In particular, exchange rate uncertainty tends to reduce real consumption in the long run. Naturally, the policymaker would want to understand what component of uncertainty influences real consumption so that policies can be devised to moderate the effect. There is a growing literature arguing that the economy responds differently to temporary and permanent uncertainty (Chadha and Sarno, 2002; Moore and Schaller, 2002; Byrne and Davis, 2004, 2005). Hence, in this section, we aim to find out what component of uncertainty matters for real consumption in these countries. To do this, we followed Kim (1993) and Byrne and Davis (2005) and utilised the CGARCH approach proposed by Engle and Lee (1999) to decompose uncertainty into its permanent and temporary components.[3]

Table 8 shows the results obtained using these components of uncertainty. Both temporary and permanent uncertainty appear to hurt consumption in the long run, just as the overall uncertainty measure suggests. However, looking closely at the results, we see that much of the effect comes from the permanent component. The coefficient associated with the permanent component is an order of magnitude larger than that of the temporary component. That aside, the permanent component appears to be highly significant, in statistical terms, when compared with the temporary component. However, not much can be inferred from the short-run coefficients of permanent and temporary uncertainty, since both are statistically insignificant. That the permanent component of exchange rate uncertainty matters in consumption decisions is in line with common sense. To the extent that consumers would take into account short-term fluctuations in the exchange rate when deciding their consumption plans, rationally we should expect them to worry more if such fluctuations are prolonged or persistent. Exchange markets are generally inefficient as are markets in general. Temporary uncertainty is, therefore a consequence of market inefficiency and the average consumer is much aware of this. Permanent uncertainty, in contrast, is a result of markets failing to self-correct temporary fluctuations. In effect, we should expect permanent uncertainty to influence consumption decisions more. Moreover, consumers, unlike investors, tend to have persistent consumption habits that are unlikely to change due to short-term uncertainty. It appears that our results reflect this general knowledge.

This evidence is in contrast with the investment literature, whereby permanent uncertainty has little influence on investment decisions because firms, unlike consumers, have the required capital to invest in understanding the sources of the permanent changes in exchange rates (Baum et al., 2001). And, therefore, they take advantage of the permanent uncertainty to invest more in interest-bearing assets, while temporary uncertainty tends to matter since it may be

[3] The technical details are presented in the appendix for the interested reader.

less predictable. In other words, the effects of uncertainty on investment decisions, as argued by Moore and Schaller (2002), depend on the evolution of beliefs under learning.

Table 8: Temporary and Permanent Uncertainty on Consumption.

Variable	PMG Estimates Baseline Results	PMG Estimates Temporary Uncertainty	PMG Estimates Permanent Uncertainty
Long-run			
LnY	0.8289	0.8217	0.8211
	(0.0000)	(0.0000)	(0.0000)
r	-0.0014	-0.0011	-0.0009
	(0.6930)	(0.7600)	(0.8010)
VOL	-1.7168		
	(0.0030)		
TEMP		-0.3778	
		(0.0972)	
PERM			-1.0846
			(0.0225)
Short-run			
ECT	-0.0676	-0.0610	-0.0567
	(0.0810)	(0.0246)	(0.02110)
ΔlnY	0.2675	0.3248	0.3254
	(0.0030)	(0.0010)	(0.0020)
Δr	-0.0022	-0.0039	-0.0039
	(0.3590)	(0.1780)	(0.1920)
ΔVOL	-5.7550		
	(0.1930)		
ΔTEMP		0.2046	
		(0.3980)	
ΔPERM			-0.2191
			(0.8650)
Constant	0.1710	0.1540	0.1453
	(0.0230)	(0.0450)	(0.0740)

Notes: p-values are in the parenthesis; Δ is the first difference operator; ECT is the error correction term; PMG denotes results obtained using the PMG estimator.

4. Conclusion

Real consumption is an important component of real aggregate expenditure. Therefore, consumption decisions shape critical economic indicators including business cycles, economic growth, general prices, employment, and income, and thus influence economic policy decisions. In light of this, a proportionate body of studies have focused on identifying the factors driving consumption from a micro to an aggregate level. Among the most established factors are real income and interest rates. Several countries have moved from a fixed exchange rate regime post-Bretton Woods era. As a result, exchange rates have become more volatile due to the uncertain information arriving at the exchange rate markets at a higher frequency. Although the idea that exchange rate volatility or uncertainty and consumption are linked dates far back to Alexander (1952), who argued that exchange rate uncertainty may induce inflation uncertainty which may in turn influence consumption decisions, only recently have researchers started to give serious attention to this issue. Nevertheless, few studies have analysed the effects of uncertainty on consumption. Even so, the available ones generally focus on the long-run effects in spite of the fact that the short-run persistence and adjustments to equilibrium are equally relevant. In this paper, we take this limitation seriously by distinguishing the short- and long-run effects of exchange rate uncertainty on consumption for a select group of Asian countries during the period 1994 to 2014. Using a flexible dynamic panel data technique that allows long-run effects to be homogeneous and the short-run effects to be heterogeneous, we find that uncertainty impedes consumption in the long run. In the short run, however, the effects are immaterial. This evidence remains robust to the measure of uncertainty, asymmetric uncertainty, the role of consumer prices, and the global financial crisis of 2008. By decomposing uncertainty into its temporary and permanent components, we find that the latter has a stronger effect on consumption in the long run than the former. Although both components demand policy attention, the evidence suggests that policymakers should be more concerned with permanent uncertainty.

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APPENDIX

Technical Appendix: Calculating the Measures of Exchange Rate Uncertainty

The GARCH-based measures of exchange rate uncertainty are calculated as follows. Supposing that the logarithm of the exchange rate follows a simple mean equation of the form:

$$lnREER_t = f(lnREER_{t-1}; \gamma) + \varepsilon_t \qquad (1)$$

where $lnREER_t$ is the natural logarithm of the real effective exchange rate (REER) at time *t*, $f(.)$ is the functional form of REER assumed to be linear in parameters, $lnREER_{t-1}$ is the one-period lag of the natural logarithm of REER, and γ is a vector of coefficients to be estimated. ε_t is the error term with mean zero and a conditional variance of a known form σ_t^2. Strictly speaking, σ_t^2 is the measure of exchange rate uncertainty. A GARCH(1,1) model would take the form:

$$\sigma_t^2 = \overline{\omega} + \alpha_1(\varepsilon_{t-1}^2 - \overline{\omega}) + \beta_1(\sigma_{t-1}^2 - \overline{\omega}) \qquad (2)$$

where $\overline{\omega}$, α_1, and β_1 parameters to be estimated. Hence, the GARCH(1,1) model is expected to reverse to a constant mean, $\overline{\omega}$.

A simple extension of the GARCH(1,1) model whereby we allow a reversion to a time-varying mean q_t instead of a constant $\overline{\omega}$ yields the CGARCH(1,1) model of the form:

$$\sigma_t^2 - q_t = \overline{\omega} + \alpha_1(\varepsilon_{t-1}^2 - \overline{\omega}) + \beta_1(\sigma_{t-1}^2 - \overline{\omega}) \qquad (3)$$

$$q_t = \alpha_0 + \rho(q_{t-1} - \alpha_0) + \varphi(\varepsilon_{t-1}^2 - \sigma_{t-1}^2) \qquad (4)$$

where $\sigma_t^2 - q_t$ captures the temporary exchange rate uncertainty, while q_t captures the permanent exchange rate uncertainty; α_0, ρ and φ are parameters to be estimated. The temporary uncertainty converges to zero whenever $0 < \alpha_1 + \beta_1 < 1$. Similarly, the permanent uncertainty converges to $\alpha_0/(1-\rho)$ whenever $0 < \rho < 1$. It has been shown that permanent uncertainty has a longer memory than temporary uncertainty, meaning that $0 < \alpha_1 + \beta_1 < \rho < 1$. The estimated uncertainty is strictly non-negative, implying that α_0, α_1, β_1 must be positive and $\beta_1 > \varphi > 0$.

Asymmetric information can be captured in the uncertainty, σ_t^2, by modelling this variable as an exponential GARCH(1,1) model of the form:

$$ln\sigma_t^2 = \omega + \alpha ln\varepsilon_{t-1}^2 + \beta \left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| + \delta \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \quad (5)$$

where ω, α, β, and δ are parameters to be estimated. It is evident that the model shows the relationship between past shocks and the natural logarithm of the conditional variance, σ_t^2, whereby positive shocks have an effect of $\beta + \delta$ and negative shocks $\beta - \delta$. Clearly, the asymmetry is introduced into the model by $\delta \neq 0$.

In terms of our application, since the obtained uncertainty measures from these models are in monthly terms, we annualised them as follows:

$$Annualised\ Monthly\ Uncertainty\ at\ Year\ t\ =\ Average\ Uncertainty\ at\ Year\ t\ x\ 12$$

Finally, for the 12-month moving-window standard deviation of lnREER, SDV, we calculated it as the annualised standard deviation of the monthly lnREER as follows:

$$SDV\ at\ Year\ t\ =\ Standard\ Deviation\ \ of\ lnREER\ at\ Year\ t\ x\ \sqrt{12}$$

The interested reader may further consult Bollerslev (1986), Nelson (1991), and Engle and Lee (1999) for the theory; and Asteriou and Price (2005), Byrne and Davis (2005), Kim and Lin (2010), and Iyke and Ho (2017) for recent applications.

Data Appendix

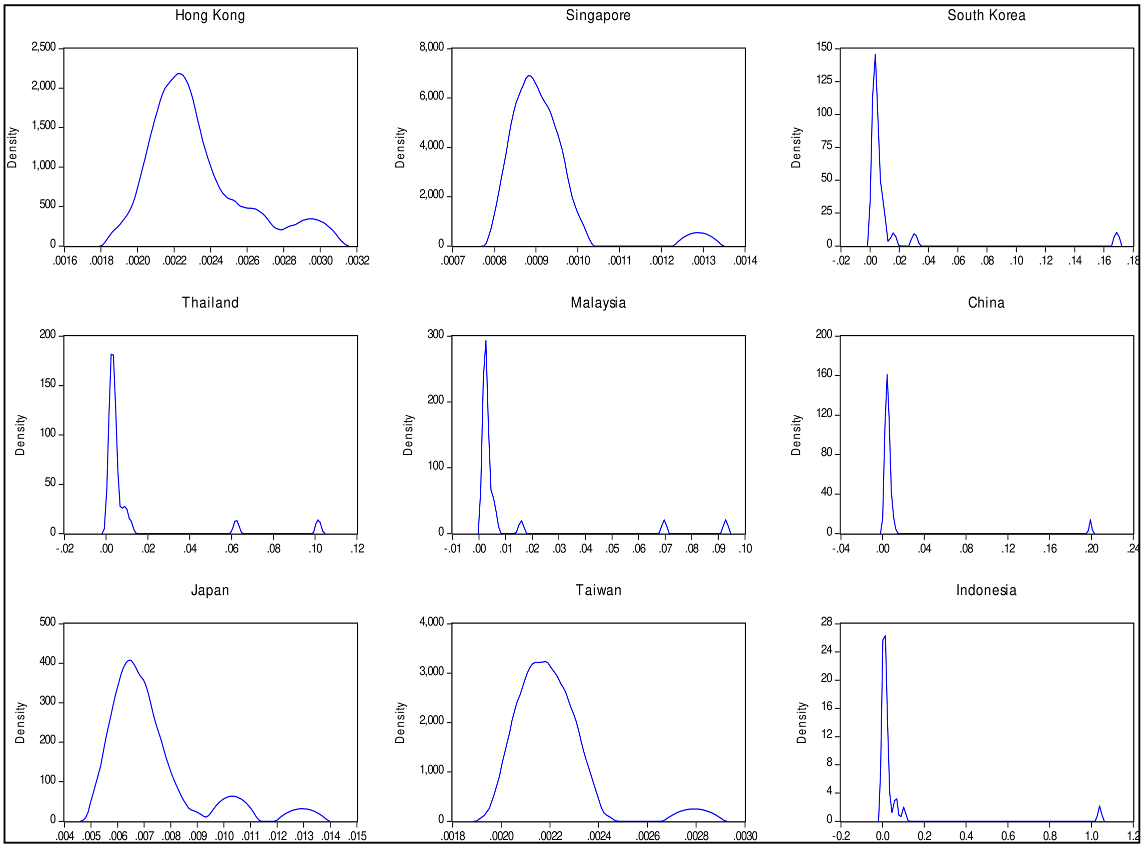
Table A.1: Variables, Data Sources, Frequency, and Span.

Variable	Name	Source	Frequency	Span
C	Real consumption (US$ million)	PWT 9.0	Annual	1991-2014
Y	Real income (US$ million)	PWT 9.0	Annual	1991-2014
r	Nominal interest rate	WDI, Central Bank of the Republic of China (Taiwan)[a]	Annual	1991-2014
SDV	Annualised standard deviation	Computed	Annual	1991-2014
VOL	GARCH uncertainty	Computed	Annual	1991-2014
EVOL	EGARCH uncertainty	Computed	Annual	1991-2014
TEMP	Temporary uncertainty	Computed	Annual	1991-2014
PERM	Permanent uncertainty	Computed	Annual	1991-2014

P	Consumer price index	WDI	Annual	1991-2014
REER	Real effective exchange rate	Bruegel.org	Monthly	1991:01-2014:12

Notes: WDI denotes World Development Indicators compiled by the World Bank; a = Central Bank of the Republic of China (Taiwan). Available at http://www.cbc.gov.tw/ct.asp?xItem=30010&CtNode=517&mp=2,

Figure A.1: Kernel Densities of the Baseline Measure of Exchange Rate Uncertainty.



Source: Computed using lnREER data from Bruegel.org.