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Economic Policy Uncertainty and Exchange Market Pressure: Panel Evidence

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Controlling for macroeconomic indicators and trade openness, this study examined the impact of economic policy uncertainty on exchange market pressure for a panel of 25 countries from 2003Q2 to 2021Q3. The pooled mean group estimator, which allows for variation in short-run estimates and error variances but constrains long-run parameters to be the same, was employed to conduct the analysis. The overall panel was further split into developed, developing, and emerging economies panels to check if there was variation in the effect of economic policy uncertainty. Further, we split the entire sample into pre and post-GFC period to account for potential nonlinearity caused by the structural break (i.e., global financial crisis). Results indicate significant positive effect of economic policy uncertainty on EMP1. Economic policy uncertainty has larger impact on developing and emerging economies EMP1 than their developed counterparts entire sample period and all countries panel all sample periods. For EMP2 economic policy uncertainty has significant effect only for developing and emerging economies entire sample period. Furthermore, the effect of uncertainty in economic policy on EMP1 is larger in pre-GFC period than post-GFC period for all countries and developed economies panel. For developing and emerging economies, post-GFC is larger than pre-GFC period. All the remaining variables have mixed effect on either of the exchange market pressure indexes.

Keywords: Exchange market pressure; economic policy uncertainty; exchange rate volatility; gross domestic product; real exchange rate

JEL Classifications: E43, E58, F41

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1 Introduction

Failure of fundamentals-based macroeconomic models, such as purchasing power parity (PPP) and uncovered interest rate parity, to predict the exchange rate accurately has remained one of the most important puzzles in international economics. Although the predictive power of macroeconomic models of exchange rate determination has been confirmed in the long run (Beckmann and Czudaj, 2017) yet in short run it has remained uncertain (Chen and Chou, 2015; Meese and Rogoff, 1983) which could be due to transitory shocks such as economic uncertainty (Bartsch, 2019; and Abid, 2020). Uncertainty in the economy is unobservable and plays a key role in shaping the future expectations of economic agents. It is defined as people's inability to accurately predict the likelihood of an event occurring (Knight, 1921). Economic policy uncertainty is an important aspect of economic uncertainty and refers to the uncertainty surrounding government policies (Pastor and Veronesi, 2013).

Three factors have contributed to the surge in the empirical literature on the impact of economic policy uncertainty. These include the post 2008 rise in uncertainty and its contribution to the global financial crisis, quantification of uncertainty, and rise in computing power (Bloom, 2014). Economic policy uncertainty has both direct and indirect impacts on the exchange rate (Liming et al. 2020). Directly, economic policy uncertainty affects exchange rate evolution. Indirectly, economic policy uncertainty affects the exchange rate by affecting a country's macroeconomic conditions. Economic policy uncertainty has both aggregated and disaggregated effects (Baker et al. 2016). At the aggregate level, policy uncertainty is associated with a decrease in gross investment, industrial production, and employment growth. At the disaggregated level, economic policy uncertainty affects the stock market volatility, employment, and investment of firms with government spending dependency. Firms reduce their investments and wait for further information if the investment is irreversible (Bernanke, 1983; Bloom, 2014). However, economic policy uncertainty has a positive effect on research and development investment (Romer, 1990). Furthermore, economic policy uncertainty negatively affects trade flows (Novy and Taylor, 2020). Other effects of economic policy uncertainty include banks' liquidity hoarding, mortgage credit, non-performing loans and loan provision, inflation and inflation expectations, precautionary savings, cost of borrowing, stock market returns and stock market volatility (Berger et al. 2022; Kara and Yook, 2019; Ozili, 2022; Adeosun et al. 2022; Istrefi and Piloiu, 2014; Ostry and Ghosh, 1992; Ashraf and Shen, 2019; Batabyal and Killins, 2021; Liu and Zhang, 2015) among others.

There are three channels through which economic policy uncertainty affects the exchange rate. First, capital movement is sensitive to government policies. Hence, policy uncertainty significantly affects both inward and outward capital movements and, thereby,

the exchange rate. Second, policy uncertainty affects relative costs, and thereby exports and imports. Exports are major contributors to a country's foreign exchange reserves; hence changes in export proceeds due to policy uncertainty have a bearing on the exchange rate. Third, risk-averse investors demand a higher ambiguity premium to hold financial assets when the policy uncertainty rises (Gabor-Toth and Georgarakos, 2019; and Brenner and Izhakian, 2018). This makes domestic assets less attractive to domestic and foreign investors, and depreciates the exchange rate.

Despite the theoretical relationship, there is scant literature examining the impact of economic policy uncertainty on exchange rate fluctuations in levels (Abid, 2020; Chang et al. 2022; El-Abed et al. 2022; Kido, 2016; Kurasawa, 2016; and Murad, 2022 among others) and exchange rate volatility (Abid and Rault, 2021; Balcilar et al. 2016; among others). Exchange rate changes in levels and volatility have a negative impact on domestic macroeconomic indicators. If PPP holds, the effect of exchange rate changes is fully reflected in domestic price changes. Real exchange rate changes fully reflect nominal exchange rate changes when PPP does not hold. This impacts relative prices of exports and import which affects the country competitiveness and thereby export earnings (Gilal, 2011). A negative exchange rate shock results in loss of output and employment due to collapse of firms and financial institutions. According to Taylor (2000) nominal exchange rate changes determine domestic firms' price setting behavior in high-inflation countries. Nominal exchange rate changes in one country cause collapse of another country exchange rate regime (Eichengreen et al., 1996).

The effect of economic policy uncertainty is fully reflected in nominal exchange rate changes and/or exchange rate volatility when the central bank abstains from intervening in the foreign exchange market to stabilize the value of the domestic currency against foreign currency. However, central banks most often intervene in foreign exchange markets to avoid the undesirable effects of exchange rate changes and volatility. Hence, exchange rate changes or volatility do not reflect a complete picture of events in the foreign exchange market (Olanipekun et al. 2019b). The implication is that the use of exchange rate change and/or volatility to examine the impact of economic policy uncertainty completely ignores countries with fixed exchange rate regimes. This is because such countries, in order to maintain fixed parity, spend foreign exchange reserves to absorb economic policy uncertainty shocks. Hence, foreign exchange reserve changes instead of exchange rate changes and/or volatility fully reflect the effect of economic policy uncertainty shocks. In managed float, the central bank alleviates pressure on domestic currency by either changing interest rate or foreign exchange reserves or both. Hence, in managed float, the sum of exchange rate, interest rate, and foreign exchange reserve changes fully reflect the effect of economic policy uncertainty shock for these countries. Thus, the exchange market pressure (*EMP*) index, instead of exchange rate

fluctuations and/or volatility, is a more relevant variable for measuring the effect of economic policy uncertainty shock, as it includes both foreign exchange reserve changes and interest rate changes along with nominal exchange rate changes as its components.

The empirical literature examining the impact of economic policy uncertainty on *EMP* is scant. Olanipekun et al. (2019a)[1] and Olasehinde-Williams and Olanipekun (2020)[2] employ bootstrap panel Granger causality, common correlated effect mean group (*CCEMG*) and augmented mean group methods of estimation for examining the impact of domestic, United States (*US*), and global economic policy uncertainty on the *EMP* of a panel of countries. These estimation procedures are robust to cross-sectional dependency and slope heterogeneity. Liu (2022) employed time-varying parameter vector autoregression (TVP-VAR) method to investigate the impact of economic policy uncertainty on *EMP* in China. Kumeka et al., (2022 & 23) applied quantile regression method for examining the nexus between economic policy uncertainty and exchange market pressure for Nigeria and the three largest West African economies.[3] This approach enabled the authors to examine EPU-EMP relationship across different market conditions.

This study also examines the impact of economic policy uncertainty on *EMP* and makes four contributions to the relevant literature. First, the sample of panel countries includes all countries on which balanced economic policy uncertainty data is available. Second, contrary to earlier empirical literature that applies cross-section dependency and slope heterogeneity robust estimation methods; this study employs the pooled mean group (*PMG*) method of estimation to conduct the analysis. The *PMG* estimator allows variation in short-run coefficients and error variances across the group, but constrains the long-run estimates to be homogenous. Third, we separately consider the impact of economic policy uncertainty on *EMP* in advanced economies and developing and emerging markets *EMP*. Economic policy uncertainty is higher in developing and emerging economies than in their developed counterparts because the developing and emerging economies are less diversified, have volatile commodity prices and higher political uncertainty, natural disasters, and ineffective or less effective fiscal and monetary policies (Koren and Tenereyo, 2007; World Bank Development Report, 2013). The effect of economic policy uncertainty is more severe in developing countries than in developed countries because of credit constraints (Carriere-Swallow and Cespedes, 2013). Furthermore, the currencies of developing and emerging economies have remained more volatile post-fixed exchange rate regimes (Engel and West, 2005). This makes it necessary to separately examine the impact of economic policy uncertainty on developing and emerging market economies to

[1] Australia, Brazil, Canada, Chile, China, France, Germany, India, Ireland, Italy, Japan, Korea, Mexico, Netherlands, Russia, Singapore, Spain, Sweden, United Kingdom, and United States.

[2] Angola, Egypt, Ethiopia, Ghana, Kenya, Libya, Morocco, Nigeria and South Africa

[3] Cote D'Ivoire, Ghana and Nigeria

determine if its magnitude is higher than that of developed economies. Fourth, the entire sample period for all panels is further divided into pre and post-GFC to account for possible nonlinearity in EPU-EMP nexus caused by structural break (e.g., 2008 global financial crisis).

The rest of the paper proceeds as follows. In the following section, we review the empirical literature examining the impact of economic policy uncertainty on exchange rate returns and exchange rate volatility. This section also reviews the studies that show an increase in exchange rate returns and/or volatility under poor economic conditions. Section 3 discusses the data, sources, and variable construction, followed by a discussion of the construction of the *EMP* index of our choice in Section 4. The econometric methods employed in this study are given in Section 5, and they include the cross-sectional dependency (*CD*) test, panel unit root test, panel cointegration test, and *PMG* in sections 5.1, 5.2, 5.3, and 5.4, respectively. The results are provided in Section 6, and result discussion and conclusion are given in Section 7.

2 Literature Review

The exchange rate is a key financial variable that reflects the expected present value of current and future macroeconomic fundamentals given that expectations are formulated rationally (Engel and West, 2005). This means that agents' expectations of current and future macroeconomic fundamentals are the key drivers of exchange rate adjustments. Government policy actions play a key role in shaping the expectations of economic agents. Economic agents do not change their expectations when the relevant policymakers properly communicate information regarding their future policy actions. In this situation, the exchange rate remains the same. However, the failure of relevant authorities to properly communicate information to economic agents regarding their future policy actions generates policy uncertainty and leads to exchange rate adjustment or exchange rate volatility. Hence economic policy uncertainty is a major determinant of exchange rate adjustments and/or exchange rate volatility. Economic agents revise their expectations of future macroeconomic fundamentals when uncertainty in economic policy rises. This results in exchange rate fluctuations and volatility.

Two strands of literature examine the nexus between exchange rates and economic policy uncertainty. One strand focuses on the impact of economic policy uncertainty on exchange rate adjustment in level. Abid (2020), using the linear autoregressive distributed lag (*ARDL*) model, conclude that uncertainty in economic policy has a significant effect on emerging market economies' exchange rate fluctuations in the short run and long run. Macroeconomic data often exhibit structural breaks and nonlinearity over time (Lee and Lin, 2012) which linear models fail to capture (Naifar and Al Dohaiman, 2013) and have

low explanatory power compared to nonlinear models (Bildirici and Turkmen, 2015). Accounting for linear model weaknesses, Chang et al. (2022) identifies significant effect of economic policy uncertainty which varies across all quantiles for all the sample countries exchange rates. El-Abed et al. (2022) conclude asymmetric effect of domestic economic policy uncertainty on China and Japan exchange rates. Murad (2022) also finds significant long-run asymmetric impact of economic policy uncertainty on exchange rates of sample countries. However, there is heterogeneity in the impact of economic policy uncertainty. For developed economies, the domestic economic policy uncertainty effect is more dominant than the effect of foreign policy uncertainty. In developing countries, the effect of foreign economic policy uncertainty is more dominant. Nilavongse et al. (2020) attributes real exchange rate fluctuations to domestic economic policy uncertainty. Sohag et al. (2022), using the quantile approach, conclude the appreciation and depreciation of local currency against the US dollar under different quantiles of managed-float and most of the quantiles under free-float exchange rate systems. Li et al. (2020) attributes the widening of Chinese Yen and Chinese Yen in Hong Kong spread to a positive economic policy uncertainty shock. Dai et al. (2017) conclude a causal relationship between economic policy uncertainty and the exchange rate when economic policy uncertainty is high. Kido (2016) finds a negative correlation between US economic policy uncertainty and returns of high-yielding currencies, except for the Japanese Yen. Kurasawa (2016) also obtains positive and negative correlation between US and domestic economic policy uncertainty and US dollar–Japanese yen exchange rate. All the preceding studies investigate the role of the economic policy uncertainty in determining the exchange rate in level.

The second strand of literature examines the interaction between economic policy uncertainty and exchange rate volatility. The uncertainty in economic policy has larger impact on exchange rate volatility compare to exchange rate changes in levels (Park et al. 2019). This occurs because foreign exchange market participants perceive the effect of economic policy uncertainty shocks differently on exchange rate changes. This leads to heterogeneous trading in foreign exchange markets, which increases exchange rate volatility. Abid and Rault (2021) show that both domestic and foreign economic policy uncertainty increase exchange rate volatility. The effect of a shock to foreign uncertainty in economic policy on exchange rate volatility is larger than that of local economic policy uncertainty. Balcilar et al. (2016) finds causal effect of relative uncertainty on exchange rate returns in mean for some countries and in variance for others. Bush and Noria (2021) show a positive association between economic policy uncertainty and exchange rate volatility in Mexico. Chen et al. (2019) conclude that uncertainty in economic policy from different markets has a heterogeneous impact on exchange rate volatility in China.

Christou et al. (2018) finds usefulness of uncertainty in economic policy in predicting exchange rate returns and exchange rate volatility. The results also indicate asymmetry in economic policy uncertainty forecasting of exchange rate volatility. Kisswani and Elian (2021) examined the asymmetric impact of oil price, economic policy uncertainty, and geopolitical risk and concluded the asymmetric and symmetric impact of these variables, except geopolitical risk, on the sample countries' exchange rate volatility. According to Krol (2014) economic policy uncertainty increases exchange rate volatility in some of the sample countries. However, the impact of economic policy uncertainty has been larger than that of general economic policies. Liming et al. (2020) find asymmetry and heterogeneity in the impact of uncertainty in economic policy from different markets on China's exchange rate volatility due to their different economic structures. Zhou et al. (2010) concluded relative economic policy uncertainty impact on China's exchange rate volatility. All preceding studies, except Zhou et al. (2010), use monthly data to examine the impact of economic policy uncertainty on exchange rate volatility for different countries. Zhou et al. (2010), on the other hand, uses daily exchange rate data and monthly data on relative economic policy uncertainty. Bartsch (2019) concludes stronger effect of economic policy uncertainty on exchange rate volatility when daily data is used.

Additionally, some empirical studies indicate an increase in the spillover effect of economic policy uncertainty on exchange rate changes and/or volatility during a recession. This occurs because policymakers during recessions are tempted to experiment with new policies to stir the economy in the right direction, which further generates policy uncertainty (Pastor and Veronesi, 2012). Krol (2014) finds that both domestic and US economic policy uncertainties raises the exchange rate volatility for industrial economies during a recession. For emerging economies, only domestic economic policy uncertainty increases exchange rate volatility in bad economic conditions. Kido (2016) shows a rise in the time-varying correlation between US economic policy uncertainty and some real effective exchange rates during US recessions. Kurasawa (2016) concludes that recessionary conditions in Japanese economy mainly drive the correlation between US economic policy uncertainty and the Japanese yen and US dollar exchange rate. Bush and Noria (2021) also concludes a rise in the effect of domestic economic policy uncertainty on the exchange rate volatility during a recession. According to Al-Yahyaee et al. (2020), the linkage between economic policy uncertainty and exchange rates intensified during the 2008-09 global financial crisis. This study further extends this literature by examining the impact of economic policy uncertainty on *EMP* instead of exchange rate fluctuations and exchange rate volatility.

3 Data

Quarterly data from 2003Q1 to 2021Q3 were utilized to examine the impact of economic policy uncertainty on *EMP* of a panel of 25 countries. The availability of data on all countries for all variables determined the choice of the sample period. This resulted in a balanced panel dataset, as recommended by Hansen (1999) for estimating panel data regression models. Also, Hansen (1999) requirement to use balance panel data set for estimating panel data regression model led us to drop fixed exchange rate regime from the analysis. The data on all variables except economic policy uncertainty is taken from the International Monetary Fund (*IMF*) International Financial Statistics and Federal Reserve Economic Data (*FRED*) from the Federal Reserve Bank of St. Louis. Baker et al. (2016) are sources of data on economic policy uncertainty and are obtained from https://www.policyuncertainty.com/. Quarterly data on economic policy uncertainty is constructed by averaging monthly data on the index. Unlike event-based economic policy uncertainty and uncertainty surrounding government elections, Baker et al. (2016) is a continuous variable that enables researchers to continuously track policy risk. The data on trade openness were constructed by scaling the sum of exports and imports with the gross domestic product. The real exchange rate data were constructed by adjusting the foreign price to domestic price ratio with the nominal exchange rate.

4 Exchange market pressure index (*EMP*)

Eichengreen et al. (1996) is our preferred approach for examining the impact of economic policy uncertainty on exchange market pressure for a panel of 25 countries. It is the weighted sum of exchange rate changes, relative interest rates, and relative foreign

Table 1. List of Countries

Advanced economies
Australia, Belgium, Canada, Denmark, France, Germany, Greece, Hong Kong SAR, Ireland, Italy, Japan, New Zealand, Singapore, South Korea, Spain, Sweden and the United Kingdom.
Emerging and developing countries
Brazil, Chile, China, Colombia, India, Mexico, Poland and Russia.

Notes: There are 25 countries in the quarterly balanced panel dataset from 2003Q2 to 2022Q3. SAR refers to separately administered region. The division of countries between developed economies and emerging and developing economies is from the IMF *World Economic Outlook* [https://www.imf.org/en/Publications/WEO/weo-database/2023/April/groups-and-aggregates#ae

exchange reserve changes. This approach is adopted due to failure of fundamental based macroeconomic models to predict the exchange rate accurately and is as follows:

$$emp_{it} = [(\alpha_i \Delta s_{it} + (\beta_i \Delta(i_{it} - i_{it}^*) \text{ -}(\gamma_i \Delta(f_{it} - f_{it}^*)] \quad (1)$$

Here, the subscripts i and t represent the cross section and time period, respectively.Δs_{it}, $\Delta(i_{it} - i_t^*)$ and $\Delta(f_{it} - f_{it}^*)$ represent exchange rate changes, relative interest rate and foreign exchange reserve changes respectively. Δ denotes the first difference operator. Lower-case letters represent log transformations of the data. A foreign counterpart of the domestic variable is represented by asterisk (*). The nominal exchange rate (s_{it}) is defined as the number of units of domestic currency required to purchase one unit of a foreign currency. Hence, a rise in s_{it} is associated with depreciation of domestic currency against the foreign currency. The parameters α_i , β_i and γ_i represents weights assigned to each component of *EMP*1 and are calculated by estimating the inverse of volatilities, which assign a low weight to a more volatile component. An increase in the nominal exchange rate changes, interest rate differential changes and a reduction in relative foreign exchange reserves changes are consistent with depreciating pressure on the domestic currency in the foreign exchange market. Girton and Roper's (1977) *EMP*2 index is also used in the empirical analysis for checking robustness of the results.

5 Econometric Methods

5.1 Cross Sectional Dependence (*CD*) Test

It is important to test the cross-section dependency of disturbances before estimating panel data models. It is assumed that the large panel data model disturbances are cross-sectionally independent which may not hold in highly globalized economies due to common shocks and unobserved components, spatial dependence, and idiosyncratic pairwise dependence (Pesaran, 2004; Baltagi, 2005). Also unobserved common factors and externalities may also cause cross-sectional dependency among panel data model residuals (Bildirici, 2014). Violation of this assumption results in inefficient estimated parameters and distorts the size of panel unit root tests. Pesaran (2004) developed a *CD* test to test the cross-sectional dependency of panel data model disturbances. It assumes a non-asymmetric distribution of the error process and is applicable to models such as stationary dynamics and unit root heterogeneous panels. The test is performed as follows:

$$\text{CD} = \left[\frac{TN(N-1)}{2}\right]^{1/2} \bar{\rho} \tag{2}$$

where

$$\bar{\rho} = \left[\frac{2}{N(N-1)}\right] \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \widehat{\rho_{ij}} \tag{3}$$

Here, N = panel size, T = sample size, and $\widehat{\rho_{ij}}$ = residuals' pair-wise cross-sectional correlation obtained from Augmented Dickey-Fuller (*ADF*) regression (Olanipekun et al. 2019b). The null and alternative hypotheses tested are as follows:

$$H_0: \rho_{ij} = \rho_{ji} = cor(u_{it}, u_{jt}) = 0 \text{ for } i \neq j \tag{4}$$

$$H_1: \rho_{ij} = \rho_{ji} = cor(u_{it}, u_{jt}) \neq 0 \text{ for } i \neq j \tag{5}$$

Non-zero correlations among disturbances imply cross-sectional dependence of panel data model disturbances (Hsiao et al. 2007).

5.2 Panel Unit Root Tests

We apply Pesaran's (2007) cross-sectionally augmented Im, Pesaran and Shin (*CIPS* (2003) unit root test to check integrating order of the variables. Contrary to Levin et al. (2002), which allows intercept heterogeneity, Im et al. (2003) permit heterogeneity in both intercept and slope parameters. The test is robust to cross-section dependency and slope heterogeneity, and provides consistent and reliable estimates. This is expressed as follows:

$$CIPS = \frac{1}{N} \sum_{i=1}^{N} t_i(N, T) \tag{6}$$

where $t_i(N, T)$ is the *i*th cross-sectional cross-sectionally augmented Dickey–Fuller (*CADF*) test statistic. It averages the *CADF* test statistic for the entire panel and tests the null hypothesis of the unit root against the alternative of no unit root.

5.3 Panel Cointegration Test

Pedroni's (1999) test is applied for testing the cointegrating relationships among the variables. Contrary to other residual-based cointegrating tests, Pedroni (1999) allows heterogeneity in both short-run and long-run estimated parameters across groups (Barbieri, 2008). Thus, Pedroni's (1999) test statistics accounts for heterogeneity in both short-run and long-run estimates, as it is unrealistic to assume homogeneity of the cointegrating vectors among individuals (Bangake and Eggoh, 2012). Compare to other residual based cointegration tests, Pedroni (1999) test has more explanatory power when

the time dimension of the data set gets larger. Also Pedroni (1999) seems to be the best choice to investigate cointegrating relationship among the variables when cross-section units are assumed heterogenous. The test proposes seven test statistics to test the presence of cointegrating relationships among the variables. Four of these tests pool the data within the dimension and are called panel cointegration tests. Both numerator and denominator are summed over *N* dimension for constructing these tests. The remaining three test statistics are based on pooling between the dimensions and are called group-mean cointegration tests. The numerator is first summed over *N* dimension before being divided by the denominator for obtaining these test statistics. Both test statistics, test the null hypothesis of no co-integrating relationship. However, they differ in terms of the specifications of the alternative hypothesis. The alternative hypothesis specified within the dimension-based test statistics is $\rho_i = \rho < 1$. For tests based on between dimensions, the alternative hypothesis is specified as $\rho_i < 1$. Kao (1999) test is also applied to check the robustness of Pedroni (1999) test results.

5.4 Pool Mean Group (*PMG*)

Nonstationary panel data econometric methods have been increasingly used in multicountry macroeconomic studies due to their greater precision and efficiency than those of individual country studies. Traditional panel data models are of two types: averaging and pooling (Byrne and Davis, 2005). The average models averages the group estimates in the panel method and is also called the mean group estimator. It allows heterogeneity of parameters and does not consider the fact that certain parameters may be equal across the cross-sections. The second method usually consists of fixed and random effects models. They pool the data and assume homogeneity of slope coefficients and error variances, which could lead to inconsistent and inefficient long-run estimates if the time period is long. Pesaran et al. (1999) proposed an intermediate method called *PMG*. It allows heterogeneity in short-run adjustment coefficients and error variance but constrains long-run estimates to be equal across the cross-section. Thus, *PMG* includes aspects of both the averaging and pooling methods of the panel data estimation. It allows heterogeneity in short-run adjustment coefficients and error variances but constrains the long-run estimates to be the same across the cross-section (Bangake and Eggoh, 2012). Thus, pooled long-run estimates and averaged short-run estimated coefficients are obtained, which indicate mean reversion. Hence, the *PMG* is an *ARDL* model for periods $t = 1, 2, \ldots T,$ and groups $i = 1, 2, \ldots N$ with y as the dependent variable, and can be written as:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij}\, y_{it-j} + \sum_{j=0}^{q} \gamma'_{ij}\, x_{it-j} + \mu_i + \varepsilon_{it} \quad (7)$$

where x_{it} is a vector of independent variables that includes consumer price index, domestic credit, economic policy uncertainty, gross domestic product, real exchange rate and trade openness. μ_i shows the fixed effects, λ_{ij} represents the coefficients of the lagged dependent variable, y_{it} represents the dependent variable (exchange market pressure), γ_{ij} is the (k × 1) vector of coefficients.

Equation 7 in reparameterized form can be written as:

$$\Delta y_{it} = \phi_i y_{it-1} + \beta'_i x_{it-1} + \sum_{j=1}^{p-1} \lambda'_{ij}\, \Delta y_{it-j} + \sum_{j=1}^{q-1} \gamma' \Delta x_{it-j}\, \mu_i + \epsilon_{it} \quad (8)$$

Residuals in the above equation are assumed to be independently distributed across *i* and *t* with a zero mean and variance greater than zero ($\sigma^2 > 0$). The roots of the above equation are assumed to lie outside the unit circle to ensure that $\phi_i < 0$ and thus the long-run relationship exists between y_{it} and x_{it} and is defined as:

$$y_{it} = -\left(\beta'_i \big/ \phi_i\right) x_{it} + \eta_{it}$$

$\theta = \theta_i = -(\beta'_i \big/ \phi_i)$ is a long-run homogenous coefficient constrained to be the same across the cross-sections. The *PMG* applies the Maximum Likelihood Method to estimate long- run and short-run coefficients. The parameters estimated from the pool mean group estimator are independent of the integrating order of the variables.

6 Results

Tables 2 to 4 presents results of the *CD* test for all countries, developed and developing and emerging economies panel for the entire sample period and the pre and the post global financial crisis period. The outcome of the test suggests that the null hypothesis of no cross-section dependency can be rejected for all panels for all sample periods except all countries pre-GFC period. For all countries pre-GFC period, the null hypothesis of no cross-section dependence cannot be rejected for all the variables except epu_{it}, gdp_{it} and q_{it}. For developed economies, null of no cross-section dependence can be rejected for all variables for all sample periods. For developing and emerging economies, the null hypothesis can be rejected for all the variables except for emp_{2it}, for the pre-GFC period and for emp_{1it} and emp_{2it} for the post-GFC period.

Table 2 All Countries Cross Section Dependence Test

Variable	Entire Sample	Pre GFC	Post GFC
cpi_{it}	140.33[0.00]	-0.89[0.38]	103.47[0.00]
dc_{it}	67.47[0.00]	-1.19[0.23]	15.19[0.00]
$emp1_{it}$	51.13[0.00]	-0.59[0.56]	42.05[0.00]
$emp2_{it}$	16.37[0.00]	-0.07[0.95]	15.56[0.00]
epu_{it}	77.31[0.00]	-1.99[0.05]	38.96[0.00]
gdp_{it}	63.79[0.00]	1.98[0.05]	11.69[0.00]
q_{it}	66.55[0.00]	-1.93[0.06]	35.89[0.00]
to_{it}	72.18[0.00]	-1.13[0.26]	21.43[0.00]

Note: Probability values are given in brackets. *cpi* = consumer price index; *dc* = domestic credit to GDP ratio; *emp* =exchange market pressure; *epu*= economic policy uncertainty; *gdp* = gross domestic product; *q* = real exchange rate; *to* = trade openness.

Table 3 Developed Economies Cross Section Dependence Test

Variable	Entire Sample	Pre GFC	Post GFC
cpi_{it}	92.69[0.00]	-41.28[0.00]	69.74[0.00]
dc_{it}	36.17[0.00]	10.94[0.00]	3.65[0.00]
$emp1_{it}$	32.25[0.00]	16.44[0.00]	28.95[0.00]
$emp2_{it}$	17.53[0.00]	3.97[0.00]	14.28[0.00]
epu_{it}	58.90[0.00]	21.12[0.00]	28.78[0.00]
gdp_{it}	51.94[0.00]	13.25[0.00]	8.27[0.00]
q_{it}	46.87[0.00]	6.02[0.00]	16.98[0.00]
to_{it}	56.82[0.00]	6.54[0.00]	13.12[0.00]

Note: Probability values are given in brackets

CIPS panel unit root test is applied to test for integrating order of the variables due to the presence of cross-section dependency in the data. The test is robust to cross-section dependency and slope heterogeneity and is applied in intercept and trend specifications.

Tables 5 to 7 contain outcome of the *CIPS* test in level for all panels for all sample periods. Outcome of the test shows that for all countries, the null of panel containing unit root can be rejected for all variables except inflation for the entire sample period. For the pre-GFC period, cpi_{it},dc_{it}, gdp_{it}, q_{it} and to_{it} are level nonstationary. The remaining variables are stationary in level. For the post-GFC period, all variables except cpi_{it},gdp_{it}, and q_{it} are level stationary.

Table 4 Developing and Emerging Economies Cross Section Dependence Test

Variable	Entire Sample	Pre GFC	Post GFC
cpi_{it}	44.53[0.00]	21.01[0.00]	27.06[0.00]
dc_{it}	29.89[0.00]	5.74[0.00]	3.31[0.00]
$emp1_{it}$	25.91[0.00]	6.04[0.00]	0.8[0.42]
$emp2_{it}$	4.38[0.00]	0.49[0.62]	-1.61[0.11]
epu_{it}	18.46[0.00]	4.84[0.00]	8.55[0.00]
gdp_{it}	10.32[0.00]	23.65[0.00]	-4.72[0.00]
q_{it}	21.74[0.00]	20.61[0.00]	1.71[0.09]
to_{it}	15.18[0.00]	14.57[0.00]	2.27[0.02]

Note: Probability values are given in brackets

Table 5 CIPS Panel Unit Root Test (All Countries)

Variable	Entire Sample	Pre GFC	Post GFC
cpi_{it}	0.76[0.78]	0.98[0.84]	1.34[0.91]
dc_{it}	-2.20[0.02]	0.92[0.82]	-2.09[0.02]
$emp1_{it}$	-26.27[0.00]	-10.58[0.00]	-23.01[0.00]
$emp2_{it}$	-35.38[0.00]	-11.37[0.00]	-27.16[0.00]
epu_{it}	-14.42[0.00]	-5.94[0.00]	-9.52[0.00]
gdp_{it}	-4.27[0.00]	-1.28[0.10]	1.97[0.98]
q_{it}	-3.66[0.00]	0.97[0.83]	1.89[0.97]
to_{it}	-4.59[0.00]	0.08[0.53]	-2.12[0.02]

Note: Probability values are given in brackets

Table 6 CIPS Panel Unit Root Test (Developed Economies)

Variable	Entire Sample	Pre GFC	Post GFC
cpi_{it}	1.15[0.87]	-37.54[0.00]	3.70[0.99]
dc_{it}	-1.53[0.06]	-48.06[0.00]	-1.65[0.05]
$emp1_{it}$	-27.67[0.00]	-6.05[0.00]	-95.35[0.00]
$emp2_{it}$	-30.85[0.00]	-8.79[0.00]	-22.75[0.00]
epu_{it}	-11.91[0.00]	-4.44[0.00]	-7.49[0.00]
gdp_{it}	-4.33[0.00]	-32.58[0.00]	4.35[1.00]
q_{it}	-4.28[0.00]	-52.42[0.00]	4.13[1.00]
to_{it}	-4.62[0.00]	-95.57[0.00]	-0.79[0.21]

Estimates of the *CIPS* test for a panel of developed economies for all sample periods are given in table 6 above. It is apparent from the table that except cpi_{it}, all variables are level stationary for the entire sample period.

All variables are level stationary in pre-GFC period. The post GFC results indicate level stationarity of all the variables except cpi_{it}, gdp_{it}, q_{it} and to_{it}.

Table 7 shows *CIPS* panel unit root test results for a panel of developing and emerging economies. Outcome of the table indicate level nonstationarity of cpi_{it}, gdp_{it}, q_{it} and to_{it} for the entire sample period. The remaining variables are stationary in level. The pre-GFC period results indicate level stationarity of all the variables except cpi_{it} and dc_{it}. In the post-GFC period, cpi_{it}, dc_{it}, gdp_{it}, q_{it} and to_{it} are level nonstationary. All the remaining variables are level stationary.

After confirming the integrating order of the variables, Pedroni (1999) and Kao (1999) tests are applied to test the presence of cointegrating relationships among the variables. Pedroni (1999) test was performed in intercept and trend specifications. Kao (1999) test on the other hand was applied only in intercept specification. Tables 8 to 13 contain the outcome of the Pedroni and the Kao tests for both *EMP*1 and *EMP*2 for all the panels for all the sample periods.

Table 8 indicate that null of no cointegrating relationship can be rejected for the entire sample for all countries *EMP*1 based on the outcome of Pedroni (1999) 3 test statistics.

Table 7 CIPS Panel Unit Root Test (Developing and Emerging Economies)

Variable	Entire Sample	Pre GFC	Post GFC
cpi_{it}	-0.25[0.40]	1.98[0.98]	3.96[1.00]
dc_{it}	-1.66[0.05]	0.44[0.67]	2.27[0.99]
$emp1_{it}$	-16.89[0.00]	-2.52[0.00]	-11.92[0.00]
$emp2_{it}$	-20.49[0.00]	-6.52[0.00]	-10.81[0.00]
epu_{it}	-8.13[0.00]	-3.67[0.00]	-4.69[0.00]
gdp_{it}	-1.24[0.11]	-2.51[0.01]	-2.38[0.99]
q_{it}	-0.22[0.41]	-2.41[0.00]	4.11[1.00]
to_{it}	-1.39[0.08]	-2.25[0.01]	-0.71[0.24]

Note: Probability values are given in brackets

However, Kao (1999) test outcome does not support the presence of long run relationship among the variables for the entire sample period.

The table further indicates that null of no cointegrating relationship can be rejected for the pre and the post-GFC on the basis of 6 and 2 test statistics of Pedroni (1999). Kao (1999) test estimates further support these findings and reject null of no cointegrating relationship among the variables for both the sample periods.

Table 9 below shows the outcome of the Pedroni and the Kao cointegration test for *EMP*2 for all countries and for all sample periods. The results indicate the rejection of null of no cointegration among the variables on the basis of outcome of 5 Pedroni test statistics for the entire sample. However, the Kao test does not support the presence of long run relationship among the variables for the entire sample period. For the pre and the post GFC period, the null of no cointegrating relationship for *EMP*2 can be rejected based on the estimates of 5 and 2 Pedroni (1999) test statistics. The estimates of the Kao tests further support these findings for both the subsamples.

Table 8 All Countries Pedroni and Kao Panel Cointegration Test (*EMP*1)

Pedroni Test			
Test	**Entire Sample**	**Pre GFC**	**Post GFC**
H_a: Common Auto Regressive Coefficients (Within Dimensions)			
	Statistic	Statistic	Statistic
Panel *v*-Statistic	3.47[0.00]	-3.23[0.99]	-1.74[0.04]
Panel *rho*-statistic	-11.19[0.00]	5.42[1.00]	-6.53[0.00]
Panel PP-Statistic	-14.75[0.00]	-6.25[0.00]	-17.23[0.00]
Panel ADF-Statistic	1.87[0.00]	-5.25[0.00]	-15.29[0.00]
Weighted			
Panel *v*-Statistic	0.70[0.24]	-3.41[0.99]	0.07[0.47]
Panel *rho*-statistic	-2.12[0.02]	4.71[1.00]	1.39[0.08]
Panel PP-Statistic	-5.44[0.00]	-2.14[0.02]	-8.13[0.00]
Panel ADF-Statistic	1.11[0.87]	-1.42[0.10]	-5.82[0.00]
H_a: Individual Auto Regressive Coefficients (Between Dimensions)			
Group *rho*-statistic	-2.30[0.01]	6.10[1.00]	-0.35[0.36]
Group PP-Statistic	-5.82[0.00]	-4.31[0.00]	-7.80[0.00]
Group ADF-Statistic	-2.05[0.98]	-2.25[0.01]	-4.30[0.00]
Kao test			
ADF	3.03[0.00]	0.42[0.34]	1.03[0.15]

Table 9 All Countries Pedroni and Kao Panel Cointegration Test (*EMP*2)

Pedroni Test			
Test	**Entire Sample**	Pre GFC	Post GFC
H_a: Common Auto Regressive Coefficients (Within Dimensions)			
	Statistic	**Statistic**	**Statistic**
Panel *v*-Statistic	2.67[0.00]	-4.27[1.00]	2.67[0.00]
Panel *rho*-statistic	-9.41[0.00]	4.18[1.00]	-6.77[0.00]
Panel PP-Statistic	-13.12[0.00]	-8.32[0.00]	-17.40[0.00]
Panel ADF-Statistic	2.37[0.99]	-8.78[0.00]	-15.23[0.00]
Weighted			
Panel v-Statistic	0.29[0.38]	-3.39[0.99]	-0.01[0.50]
Panel rho-statistic	-1.35[0.09]	4.74[1.00]	-1.70[0.04]
Panel PP-Statistic	-4.61[0.00]	-2.04[0.02]	-8.30[0.00]
Panel ADF-Statistic	1.92[0.97]	-2.20[0.01]	-5.42[0.00]
H_a: Individual Auto Regressive Coefficients (Between Dimensions)			
Group rho-statistic	-1.78[0.04]	6.39[1.00]	-0.68[0.25]
Group PP-Statistic	-4.96[0.00]	-3.27[0.00]	-8.27[0.00]
Group ADF-Statistic	1.68[0.95]	-1.99[0.02]	-5.90[0.00]
Kao test			
ADF	3.25[0.00]	0.66[0.26]	0.88[0.19]

Table 10 and 11 contain the outcome of Pedroni (1999) and Kao (1999) test for *EMP*1 and *EMP*2 for developed economies for all the sample periods. Results confirm the rejection of null of no cointegrating relationship among the variables for *EMP*1 for all sample periods based on the estimates of 6, 5 and 3 Pedroni (1999) test statistics. Kao (1999) test statistics further confirm these findings and support the presence of long run relationships among the variables for *EMP*1 for all the sample periods.

The outcome of Pedroni (1999) and Kao (1999) for EMP2 is given in table 11 for developed economies all sample periods. The results indicate that null of no cointegrating relationship among the variables can be rejected on the basis of estimates of 6, 8 and 3 Pedroni (1999) test statistics for the entire and the pre and the post-GFC periods. The Kao (1999) test also supports these finding and reject the null of no cointegrating relationship among the variables for all the sample periods.

Table 10 Developed Economies Pedroni and Kao Panel Cointegration Test (*EMP*1)

Pedroni Test			
Test	**Entire Sample**	**Pre GFC**	**Post GFC**
H_a: Common Auto Regressive Coefficients (Within Dimensions)			
	Statistic	Statistic	Statistic
Panel v-Statistic	2.63[0.00]	-0.09[0.54]	1.33[0.09]
Panel rho-statistic	-7.31[0.00]	4.55[1.00]	-5.73[0.00]
Panel PP-Statistic	-10.18[0.00]	-7.11[0.00]	-14.74[0.00]
Panel ADF-Statistic	1.88[0.97]	-4.45[0.00]	-14.37[0.00]
Weighted			
Panel v-Statistic	0.37[0.35]	-3.90[1.00]	-0.85[0.80]
Panel rho-statistic	-0.19[0.42]	3.94[1.00]	-0.43[0.33]
Panel PP-Statistic	-2.61[0.00]	-5.49[0.00]	-5.81[0.00]
Panel ADF-Statistic	2.33[0.99]	-3.21[0.00]	-5.31[0.00]
H_a: Individual Auto Regressive Coefficients (Between Dimensions)			
Group rho-statistic	0.45[0.33]	6.05[1.00]	0.51[0.70]
Group PP-Statistic	-2.79[0.00]	-5.59[0.00]	-5.18[0.00]
Group ADF-Statistic	2.22[0.98]	-2.12[0.02]	-4.36[0.00]
Kao test			
ADF	-0.28[0.39]	-0.08[0.47]	0.14[0.45]

Table 12 and 13 contain the outcome of Pedroni (1999) and Kao (1999) test for developing and emerging economies for both *EMP*1 and *EMP*2 for all sample periods. Results indicate that the null of no cointegration can be rejected for the entire sample period for *EMP*1, based on the estimates of 5 Pedroni (1999) test statistics. For the pre and the post GFC, the null hypothesis can be rejected based on the estimates of the Pedroni 7 and 5 test statistics. The Kao test estimates further confirm the presence of long run relationship among the variables for all the sample periods.

For *EMP*2, the null of no cointegrating relationship can be rejected for developing and emerging economies based on the estimates of Pedroni (1999) 5, 9 and 4 test statistics for the entire, the pre and the post-GFC period. The estimates of Kao (1999) test also reject the null hypothesis for the entire sample period and pre-GFC period. However, for the post GFC period, null hypothesis of no long run relationship among the variables cannot be rejected.

Table 11 Developed Economies Pedroni and Kao Panel Cointegration Test (*EMP*2)

Pedroni Test			
Test	**Entire Sample**	Pre GFC	Post GFC
H_a: Common Auto Regressive Coefficients (Within Dimensions)			
	Statistic	**Statistic**	**Statistic**
Panel v-Statistic	2.14[0.02]	-0.05[0.52]	3.32[0.00]
Panel rho-statistic	-7.86[0.00]	5.19[1.00]	-5.94[0.00]
Panel PP-Statistic	-10.83[0.00]	-4.85[0.00]	-14.84[0.00]
Panel ADF-Statistic	1.46[0.93]	-3.03[0.00]	-14.45[0.00]
Weighted			
Panel v-Statistic	-0.06[0.52]	-4.01[1.00]	-0.24[0.59]
Panel rho-statistic	0.03[0.51]	3.74[0.99]	-0.41[0.34]
Panel PP-Statistic	-2.27[0.01]	-3.12[0.02]	-5.17[0.00]
Panel ADF-Statistic	2.31[0.99]	-0.33[0.37]	-4.48[0.00]
H_a: Individual Auto Regressive Coefficients (Between Dimensions)			
Group rho-statistic	-0.39[0.35]	6.25[1.00]	0.23[0.59]
Group PP-Statistic	-2.64[0.00]	-0.65[0.26]	-5.37[0.00]
Group ADF-Statistic	1.74[0.96]	0.54[0.71]	-4.73[0.00]
Kao test			
ADF	-0.14[0.44]	-0.42[0.34]	-0.004[0.50]

Table 14 to 19 contains the outcome of pool mean group estimates of *EMP*1 and *EMP*2 for all countries for all the sample periods. Table 14 contains results of *EMP*1 for all countries for all sample periods. Economic policy uncertainty estimate is insignificant for the entire sample period. However, for pre GFC and post GFC economic policy uncertainty estimate is significant and positive. Other variables having relevancy in explaining *EMP*1 are cpi_{it}, gdp_{it} and to_{it} for the entire sample period. cpi_{it} and to_{it} for the pre-GFC period and cpi_{it}, dc_{it}, gdp_{it}, q_{it} and to_{it} for the post-GFC period. The cointegrating equation estimates are significant and negative ranging from -0.73 for the entire sample period to -0.89 and -0.6 for pre and post-GFC period.

Table 15 indicates insignificant effect of economic policy uncertainty on *EMP*2 for all sample periods. Other variables having relevancy in explaining *EMP2* are cpi_{it}, $gdp_{it}$and to_{it} for the entire sample period, $gdp_{it}$and to_{it} for the pre GFC period, and gdp_{it}, q_{it} and to_{it} for the post-GFC period. The estimates of the cointegrating equation are significant negative and range from –0.92 for the entire sample period to -1.01 and -0.939 for pre and post GFC period respectively.

Table 12 Developing and Emerging Economies Pedroni and Kao Panel Cointegration Test (*EMP*1)

Pedroni Test			
Test	**Entire Sample**	**Pre GFC**	**Post GFC**
H_a: Common Auto Regressive Coefficients (Within Dimensions)			
	Statistic	Statistic	Statistic
Panel v-Statistic	0.69[0.24]	-0.31[0.62]	-2.85[0.99]
Panel rho-statistic	-5.53[0.00]	2.20[0.99]	-2.57[0.00]
Panel PP-Statistic	-8.21[0.00]	-4.64[0.00]	-6.16[0.00]
Panel ADF-Statistic	1.40[0.92]	-3.76[0.00]	2.24[0.98]
Weighted			
Panel v-Statistic	1.03[0.15]	-1.70[0.95]	-1.11[0.87]
Panel rho-statistic	-2.38[0.01]	2.47[0.99]	-2.63[0.00]
Panel PP-Statistic	-4.27[0.00]	-2.03[0.02]	-6.61[0.00]
Panel ADF-Statistic	-0.41[0.34]	-1.26[0.10]	-0.16[0.44]
H_a: Individual Auto Regressive Coefficients (Between Dimensions)			
Group rho-statistic	-1.84[0.03]	3.45[0.99]	-3.90[0.00]
Group PP-Statistic	-3.94[0.00]	-3.46[0.00]	-9.46[0.00]
Group ADF-Statistic	0.58[0.72]	-1.28[0.10]	0.59[0.72]
Kao test			
ADF	-0.04[0.49]	-0.74[0.23]	-4.96[0.00]

Table 13 Developing and Emerging Economies Pedroni and Kao Panel Cointegration Test (*EMP*2)

Pedroni Test			
Test	**Entire Sample**	Pre GFC	Post GFC
H_a: Common Auto Regressive Coefficients (Within Dimensions)			
	Statistic	**Statistic**	**Statistic**
Panel v-Statistic	0.70[0.24]	0.45[0.33]	1.74[0.96]
Panel rho-statistic	-5.94[0.00]	2.70[0.99]	-2.99[0.00]
Panel PP-Statistic	-8.76[0.00]	-2.01[0.02]	-6.65[0.00]
Panel ADF-Statistic	-1.36[0.91]	-1.99[0.02]	-1.89[0.97]
Weighted			
Panel v-Statistic	0.96[0.17]	-1.43[0.92]	-0.17[0.57]
Panel rho-statistic	-2.26[0.01]	2.68[0.99]	-2.73[0.00]
Panel PP-Statistic	-4.18[0.00]	-0.36[0.36]	-6.74[0.00]

Panel ADF-Statistic	-0.37[0.36]	0.65[0.74]	-2.03[0.02]
H_a: Individual Auto Regressive Coefficients (Between Dimensions)			
Group rho-statistic	-1.90[0.03]	3.76[0.99]	-3.93[0.00]
Group PP-Statistic	-3.95[0.00]	-1.18[0.12]	-8.90[0.00]
Group ADF-Statistic	0.57[0.72]	0.45[0.67]	-0.93[0.18]
Kao test			
ADF	0.34[0.37]	-1.16[0.12]	-3.19[0.00]

Table 14 All Countries Pool Mean Group Estimates (*EMP*1)

Variable	Entire Sample	Pre GFC	Post GFC
cpi_{it}	1.95**	9.79**	3.36**
dc_{it}	-0.01	0.01	-0.20*
epu_{it}	0.20	1.09**	0.92*
gdp_{it}	2.85*	0.36	6.79*
q_{it}	1.08	0.33	5.32*
to_{it}	0.95**	0.56**	2.90*
$Cointeq$:	-0.73*	-0.89*	-0.60*

Table 15 All Countries Pool Mean Group Estimates (*EMP*2)

Variable	Entire Sample	Pre GFC	Post GFC
cpi_{it}	-0.04*	-0.068	0.011
dc_{it}	0.001	0.001	-0.001
epu_{it}	0.005	0.005	0.003
gdp_{it}	-0.03*	-0.013**	-0.046*
q_{it}	-0.001	0.006	-0.059*
to_{it}	-0.009***	-0.007**	-0.028*
$Cointeq$:	-0.92*	-1.010*	-0.939*

Note: below *, **, and *** denote one, five and ten percent significance level, respectively.

Tables 16 and 17 contain the outcome of pool mean group estimates for the developed economies panel for both the market pressures for all the sample periods. Table 16 shows significant positive effect of economic policy uncertainty on *EMP*1 for all sample periods. Other variables having significant effect on *EMP*1 for developed economies are cpi_{it} for the entire sample period,cpi_{it},dc_{it}, gdp_{it} and q_{it} for the pre-GFC period, dc_{it}, gdp_{it}, q_{it} and to_{it} for the post-GFC period. The estimates of the cointegrating equation are significant negative for all the sample periods.

Table 16 Developed Economies Pool Mean Group (*EMP*1)

Variable	Entire Sample	Pre GFC	Post GFC
cpi_{it}	3.12***	25.52**	-3.86
dc_{it}	-0.01	0.35*	-0.48*
epu_{it}	1.21*	3.67*	1.97*
gdp_{it}	-0.99	8.79**	27.16*
q_{it}	0.26	25.77*	19.65*
to_{it}	-0.50	-1.27	-1.25*
$Cointeq$:	-1.12*	-0.91*	-0.45*

Table 17 Developed Economies Pool Mean Group Estimates (*EMP*2)

Variable	Entire Sample	Pre GFC	Post GFC
cpi_{it}	-0.09**	0.34**	-0.22*
dc_{it}	0.001***	-0.003**	0.001
epu_{it}	0.001	-0.01	0.003
gdp_{it}	-0.02	-0.001	0.09*
q_{it}	-0.06**	0.015	0.04*
to_{it}	-0.01***	-0.02*	-0.02*
$Cointeq$:	-0.96*	-1.07*	-1.09*

Table 17 shows the outcome of *PMG* estimates for *EMP*2 for developed economies panel for all the sample periods. It shows that epu_{it} has insignificant impact on *EMP*2 for all the sample periods. Other variables having significant effect on *EMP*2 are cpi_{it}, dc_{it}, q_{it} and to_{it} for the entire sample period, cpi_{it}, dc_{it} and to_{it} for the pre-GFC period and cpi_{it},gdp_{it}, q_{it} and to_{it} for the post-GFC period. The cointegrating equation estimates are significant and negative for all the sample periods which further confirm the presence of long run relationship among the variables.

PMG estimates of both the market pressures for the developing and emerging economies for all the sample periods are given in table 18 and 19. Results from table 18 indicate that epu_{it} has significant positive effect on *EMP*1 for all sample periods. Other variables having significant effect on *EMP*1 are dc_{it}, gdp_{it} and to_{it} for the entire and the pre-GFC period and dc_{it}, q_{it} and to_{it} for the post-GFC period. The cointegrating equation estimates are negative and significant which confirms the presence of long run relationship among the variables.

Table 18 Developing & Emerging Economies Pool Mean Group Estimates (*EMP*1)

Variable	Entire Sample	Pre GFC	Post GFC
cpi_{it}	-0.63	7.58	-2.26
dc_{it}	-0.13**	-2.41*	-0.69*
epu_{it}	1.38*	1.15*	1.73**
gdp_{it}	2.21**	33.61*	0.40
q_{it}	-0.18	18.79	1.92***
to_{it}	1.72**	55.58*	7.88*
$Cointeq$:	-0.82*	-0.71**	-0.73*

Table 19 Developing & Emerging Economies Pool Mean Group Estimates (*EMP*2)

Variable	Entire Sample	Pre GFC	Post GFC
cpi_{it}	-0.02	0.33**	0.05**
dc_{it}	0.003**	-0.027*	-0.01*
epu_{it}	0.01**	-0.01	0.012
gdp_{it}	-0.04*	0.21*	-0.06*
q_{it}	-0.04***	0.87*	-0.08*
to_{it}	0.003	-0.24*	0.06*
$Cointeq$:	-0.78*	-0.78*	-0.66*

Note: *, **, and *** denote one, five and ten percent significance level, respectively.

For *EMP*2, the estimate of epu_{it} is only significant for the entire sample period. However, magnitude of epu_{it} is almost zero. For the remaining two sample periods, epu_{it} has insignificant effect which is consistent with our findings for all the countries and the developed economies panel. Other variables having significant effect on *EMP*2 are dc_{it}, gdp_{it} and q_{it} for the entire sample period, and cpi_{it}, dc_{it}, gdp_{it}, q_{it} and to_{it} for the pre and the post-GFC periods. The negative and significant estimates of cointegrating equation for all sample periods further confirm the presence of long run relationship among the variables.

7 Results Discussion and Conclusion

Earlier empirical literature examining the impact of economic policy uncertainty has mainly focused on exchange rate changes and exchange rate volatility. However, exchange rate changes and/or volatility may not fully reflect the effect of economic policy uncertainty when the central bank intervenes in the foreign exchange market to stabilize

the value of the domestic currency against the foreign currency. In such a situation, exchange market pressure, instead of exchange rate returns and/or volatility, fully reflects the effect of economic policy uncertainty. In this study, we examined the impact of economic policy uncertainty on a panel of 25 countries' exchange market pressure. We further divided the entire panel into a panel of developed countries and developed and emerging economies to see if there is a variation in the effect of economic policy uncertainty across the panel. Further the entire sample period for all panels was further divided into the pre and the post global financial crisis to account for possible nonlinearity that might have been caused by structural breaks (e.g., 2008 global financial crisis).

The estimates of Pedroni (1999) and Kao (1999) test confirms the presence of long run relationship for both *EMP*1 and *EMP*2 for all panels for all sample periods. The pool mean group estimates show that economic policy uncertainty has significant positive effect on all panels *EMP*1 for all sample periods except all the countries entire sample period. However, for all countries and developed economies, uncertainty in economic policy has larger effect on *EMP*1 for the pre-GFC period than the post-GFC period which could be due to the relevant authorities' the post-GFC intervention to alleviate uncertainty in the economy. For the developing and emerging economies, post-GFC period effect of uncertainty in economic policy is smaller than pre-GFC period which may reflect absence of relevant authorities' intervention to alleviate uncertainty in the economy. Furthermore, uncertainty in economic policy has larger effect for developing and emerging economies *EMP*1 for all sample periods for all countries and only for the entire sample period for developed economies panel. This confirms the theoretical prediction that economic policy uncertainty has larger effect for developing and emerging economies because they have less diversified economies, volatile commodity prices, higher political uncertainty, natural disaster, ineffective or less effective fiscal and monetary policies and credit constraints. However, the effect of economic policy uncertainty for the developing and emerging economies the pre and the post-GFC *EMP*1 is smaller compare to the developed economies.

The effect of economic policy uncertainty on *EMP*2 is insignificant for all panels for all periods except for the developing and emerging economies entire sample period. *EMP*2 does not include interest rate changes as its component and its components are equally weighted which may explain insignificant effect of policy uncertainty in economy on it.

The effect of inflation on *EMP*1 is positive for the all countries all sample periods. For the developed economies, it is positive only for the entire sample period and the pre-GFC period. For the developing and emerging economies, the estimate of inflation is insignificant. Thus inflation has positive impact for our preferred exchange market pressure index (*EMP*1). There is mixed evidence regarding the effect of inflation on

*EMP*2. The inflation has significant negative impact on *EMP*2 for all countries entire sample period, negative for the entire and the post-GFC and positive for the pre-GFC period for the developed economies. For the developing and emerging economies, inflation has significant positive effect only for subsamples. The positive estimate of inflation for our preferred market pressure index (*EMP*1) confirms the relevant theory that supports positive association between inflation and exchange market pressure. An increase in domestic prices makes the country goods less competitive in the international markets thus negatively affects the export proceeds and put pressure on the domestic currency to depreciate against the foreign currency.

Domestic credit has negative impact on *EMP*1 for all countries post-GFC period, positive and negative for pre and post GFC period for developed economies and negative for developing and emerging economies all sample periods. For *EMP*2, the domestic credit effect is positive and negative for developed economies entire and pre-GFC period. For developing and emerging economies, domestic credit estimate is negative for the pre and post-GFC period and positive for the entire sample period. The positive and negative impact of the changes in domestic credit on the market pressures is consistent with the literature. The increase in domestic credit reduces interest rate and creates inflationary pressure in the economy and thereby puts pressure on the domestic currency to depreciate. The negative impact of the domestic credit on the market pressure occurs due to increased economic activity resulting from drop in the interest rate.

There is mixed evidence regarding the effect of real gross domestic product on exchange market pressure. The gross domestic product has positive impact on *EMP*1 of all the countries for the entire sample period and the post-GFC period. For the developed economies, it is positive only for the pre and the post-GFC period and for the developing and emerging economies, positive for the entire sample period and the pre-GFC period. For *EMP*2, the gross domestic product has negative impact on all countries for all sample periods, positive for the developed economies the post-GFC period, and negative for the entire sample period and post-GFC period and positive for pre-GFC for developing and emerging economies. The drop in exchange market pressure due to increased economic activity is consistent with the literature which says that an increase in economic activity raises investor confidence and thereby increases the demand for the domestic currency in the foreign exchange market. The positive impact of gross domestic product on exchange market pressure works through increased imports. Generally, residents of the country demand more goods and services that include imports when their income rises which generates pressure on the domestic currency to depreciate in foreign exchange market.

Same like the gross domestic product, the real exchange rate has also both positive and negative impact on the foreign exchange market pressures. The real exchange rate has

significant positive impact on *EMP*1 for all countries post-GFC period, pre and post-GFC for the developed economies and post-GFC for developing and emerging economies panel. Thus the real exchange rate is positive for our preferred market pressure index (*EMP*1). The real exchange rate has negative impact on *EMP*2 for all countries post-GFC period, negative and positive for the entire and the post-GFC period for developed economies and negative for the entire and post-GFC period and positive for the pre-GFC period for developing and emerging economies. The positive impact of the real exchange rate on our preferred market pressure (*EMP*1) is consistent with the literature which says that an overvalued exchange rate reduces domestic exporters' competitiveness in international market and causes the foreign exchange market pressure to rise (Gilal, 2011). However, the relevant literature does not support the real exchange rate negative impact of foreign exchange market pressure.

There is mixed evidence regarding the effect of the trade openness on both the market pressures. Results indicate positive impact of trade openness on *EMP*1 for all the countries and developing and emerging economies all sample periods. For the developed economies *EMP*1, the estimate of trade openness is significant negative only for post-GFC period. The trade openness has significant negative impact on all countries and developed economies *EMP*2 for all sample periods. For developing and emerging economies, trade openness has significant negative and positive impact for pre and post-GFC period *EMP*2. The positive estimate of trade openness for our preferred foreign exchange market pressure (*EMP*1) index indicate that a drop in the country's exports results in drop in capital inflows and thus put pressure on the domestic currency to depreciate. The optimistic view of the trade openness argues that the countries default probabilities are reduced due to strengthening of trade links and thus cause the domestic currency to appreciate. In our case, positive and negative effects of trade openness appear to be more dominant for *EMP*1 and *EMP*2 respectively. The estimates of cointegrating equation are significant and negative for both the market pressures for all the panels and for all sample periods. This confirms the presence of the long relationship among the variables.

Based on the results for our preferred foreign exchange market pressure index (*EMP*1), it can be concluded that the relevant authorities must intervene in the economy to alleviate uncertainty in the economy policy, raise the domestic credit and control increase in prices, real exchange rate and trade openness for alleviating pressure on the domestic currency to depreciate against the foreign currency. However, developed economies trade openness estimate is significant negative implying that these countries need to strengthen trade to reduce depreciating pressure on their currencies.

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