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THE EFFECT OF EXCHANGE RATE VOLATILITY ON IMPORT: EVIDENCE FROM EMERGING MARKETS

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Abstract

This study investigates the co-integration relationships among the import, exchange rate volatility, income, and real exchange rate for the emerging market economies during 2000 - 2020. Apart from the previous studies, we consider the cross-section dependency in emerging markets. For the co - integration analysis, Westerlund and Edgerton (2007) co-integration test was used to obtain effective results by allowing autocorrelation and varying variance in the co - integration equation. The findings of this study show that there is a co -integration relationship between the variables. The impact of volatility, income, and real exchange rate on imports are estimated using common correlated effects (CCE). The findings of the panel indicate that long-run imports are significantly impacted negatively whenever there is volatility in emerging markets. It is seen that tastes and preferences are directed towards imported goods, and an increase in income leads to an increase in imports. At the same time findings contradict theoretical projection and shows that an increase in the value of the currency exchange rate has a positive influence on the quantity of goods imported. This could be due to the fact that exports revenue in emerging market countries depend on imports.

Keywords ***:*** *Exchange rate volatility, Emerging market economies, Co-integration, CCE.*

JEL Classification ***:*** *F31, F14, C33.*

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DÖVİZ KURU OYNAKLIĞININ İTHALAT ÜZERİNDEKİ ETKİSİ: YÜKSELEN PİYASALARDAN KANITLAR

Öz

Bu çalışma, 2000 - 2020 yılları arasında yükselen piyasa ekonomileri için ithalat, döviz kuru oynaklığı, gelir ve reel döviz kuru arasındaki eş - bütünleşme ilişkisini incelemektedir. Bu çalışma önceki çalışmalardan farklı olarak, gelişmekte olan piyasalardaki yatay kesit bağımlılığını dikkate almaktadır. Eş – bütünleşme analizinde otokorelasyon ve değişen varyans durumunu dikkate alan Westelund ve Edgerton (2007) eş bütünleşme testi kullanılmıştır. Çalışmanın bulguları değişkenler arasında eş bütünleşme ilişkisi olduğunu göstermektedir. Oynaklık, gelir ve reel döviz kurunun ithalat üzerindeki etkisi, ortak ilişkili etkiler (CCE) yöntemi kullanılarak tahmin edilmektedir. Gelişmekte olan piyasalara ilişkin panel bulguları, uzun dönemde oynaklığın ithalat üzerinde istatistiksel olarak anlamlı, negatif bir etkiye sahip olduğunu göstermektedir. Zevk ve tercihlerin ithal mallara yöneldiği, gelir artışının ithalat artışına yol açtığı görülmektedir. Aynı zamanda bulgular teorik tahminle çelişmekte ve döviz kurunun değerindeki artışın ithal edilen mal miktarı üzerinde olumlu bir etkiye sahip olduğunu göstermektedir. Bunun nedeni gelişmekte olan ülkelerdeki ihracat gelirlerinin ithalata bağlı olmasından kaynaklanıyor olabilir.

Anahtar Kelimeler ***:*** *Döviz kuru oynaklığı, Gelişmekte olan piyasa ekonomileri, Eşbütünleşme, CCE*

JEL Sınıflandırması ***:*** *F31, F14, C33.*

INTRODUCTION

In 1973, with the collapse of the Bretton Woods fixed exchange rate regime, academics and policymakers have interested in the consequences of exchange rate volatility on international commerce. liberalization of capital flows, exchange rate speculation, changes in cross-border foreign exchange flows, and technological progress cause exchange rate volatility (Bahmani-Oskooee and Gelan, 2018). It is commonly argued that exchange rate fluctuations have negative impacts on the amount of international imports, since risk-averse importers and exporters are exposed to more risk and uncertainty over the returns from global commerce, limiting their demand and supply of traded commodities. Theoretically, this direct influence is unpredictable and dependent on variables such as the availability of hedging alternatives, the degree of risk aversion, the currency value of contracts, and the presence of other forms of company risk (Sauer and Bohara, 2001). There is no consensus on how exchange rate volatility impacts the direction and breadth of international commerce.

When the import rates in developed and developing countries are analyzed, it is seen that there is an increasing trend in both country groups. While imports in developed countries increased 1.8 times in twenty years, it is seen that imports increased 3.5 times in developing countries. In general, the import dependency of emerging nations makes them more susceptible to fluctuations in exchange rates. Since the majority of exported goods are dependent on imported inputs. At the same time, the fact that the financial markets are not well developed, the scarcity of contracts, and the adverse effect on trade in these countries will lead to a further increase in the uncertainty situation.

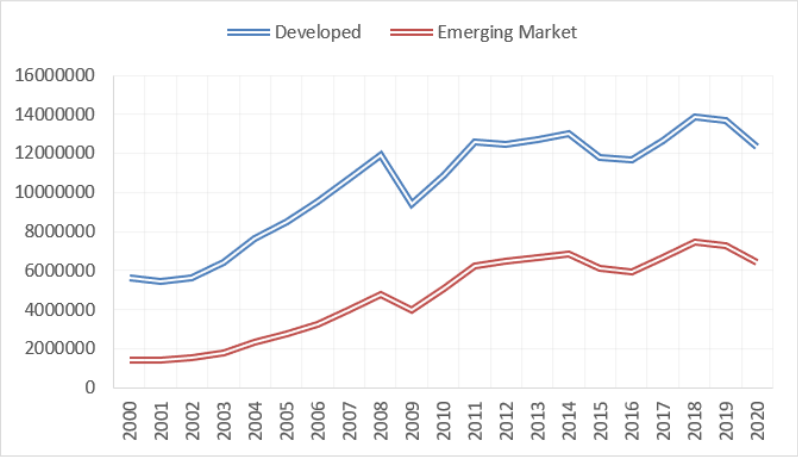

Figure 1. Imports Graph

The size of income and substitution effects helps to explain the relationship between trade and Exchange rate volatility. Clark (1973) and Hooper and Kohlhagen (1978) stated that changes in the exchange rate will initially be reflected in enterprises' earnings, and firms will lower their exports to reduce their risk exposure. So, if trading businesses are sufficiently risk-averse, higher volatility will decrease trade volume. This phenomenon can be explained by the "substitution effect." Hence, although the price of a tradable commodity is decided at the time of the transaction, payment is made upon delivery. In the interim, since the high volatility in exchange rates creates uncertainty regarding the quantity of profit to be made, risk-averse businesses may abandon trade. The "substitution effect" explains this negative impact of exchange rate volatility on imports. Yet, the replacement effect will not be the sole one encountered by the importing firm. Hence, the drop in demand for imported goods caused by the substitution effect resulting from excessive exchange rate volatility will raise the estimated marginal benefit from imported items. In this situation, the importing corporation may decide to expand imports. Due to the substitution effect, a positive association may develop between exchange rate volatility and the quantity of imports. The amount of the net effect will determine the effect of fluctuating exchange rates on imports.

Accordingly, this article makes two important contributions to the literature. First, we examine the impact of exchange rate volatility on emerging markets. Secondly, this study, unlike the others, considers the cross-section dependency. To our knowledge, this is the first empirical study to examine the co-integration relationship between imports and exchange rate volatility, taking into account the cross-sectional dependency in emerging markets.

The rest of the paper is organized as follows. Section 2 provides a brief literature review. Section 3 outlines the data, methodology, and findings. The last section presents the conclusions.

I. LITERATURE REVIEW

The transition from a fixed exchange rate system to a flexible exchange rate system causes volatility in exchange rates and encourages academics to investigate how exchange rates affect trade flows. Many theoretical and empirical research have investigated the effect of exchange rate volatility on trade. Despite important studies on the subject, no consensus has not yet been reached. The majority of the researches in the literature focus on the effects of exchange rates on exports, and only a few study examined the impact of exchange rate volatility on imports.

Many studies state that exchange rate volatility has a negative impact on imports. For example, Ethier (1973) states that under the assumption of risk avoidance, the reaction of companies to exchange rate volatility will be negative. Demers (1991) argues that the risk of exchange rate disrupts the price mechanism and affects companies' investment decisions in physical capital and causes a long -term decrease in trade. Arize (1998) argues, using an empirical methodology, that exchange rate volatility has a large negative effect on the imports of European countries. In another research, the IMF (2004) used a gravity model to investigate the link between exchange rate volatility and international commerce. The IMF analysis predicts that cross-border commerce would decline by seven percent if exchange rate volatility rises by one standard deviation.

Many research demonstrate that the effect of exchange rate volatility on imports is uncertain and varies depending on the country's features. Bahmani-Oskoee and Payesteh (1993), examined the import and exchange rate relationship in LDCs countries for the 1973:Q1-1190:Q4 period with the Johansen co-integration test and could not find a co-integrating relationship. Bahmani-Oskooeea and Gelan (2018) analyzed African countries by using ARDL management and the effects of exchange rate shocks on imports and exports were examined. The findings showed that while exchange rate shocks affect the trade of many economies negatively in the short run, the negative effects are limited to only a few countries in the long run. Bahmani-Oskooee and Arize (2019) and Bahmani-Oskooee and Gelan (2018) state that there is no long-term relationship between imports and volatility in LDCs countries. Developing countries are often more impacted by fluctuations in currency rates due to their reliance on imports. Because most of the exported products are related to imported inputs. At the same time, the fact that the financial markets are not well developed, the scarcity of contracts, and the adverse effect on trade in these countries will lead to a further increase in the uncertainty situation. Sauer and Bohara (2001) explored the influence of exchange rate volatility on trade. The study, which included both fixed and random models, covers both developed and developing countries and concludes that exchange rates have a negative effect on imports. According to Asteriou, Masatci, & Pılbeam, (2016), the impact of currency rate volatility on international commerce could depend on traders' risk preferences, futures markets, and the evolution of hedging tools. Furthermore, Braun and Larrain (2005) suggest that the negative impact of trade volatility increases a nation's reliance on external funding. The theoretical expectation is that volatility in developed markets does not impact overseas commerce or has a minor effect. Baum and Caglayan (2010) analyzed several developed markets. In this study, which also includes the impact of CPI, it was discovered that volatility boosted international trade more than the other factors. Hall, Hondroyiannis, Swamy, Tavlas, & Ulan (2010), examined developing countries and their emerging markets in the period 1980:Q1–2006:Q4. At the same time, since the production in developing markets is dependent on oil, the effect of oil prices is also considered in the study. The results of the GMM method showed that volatility does not affect foreign trade negatively in developed market economies, but negatively affects emerging economies. Tunc, Babuşçu, Hazar, & Solakoglu, (2020) discovered that volatility has a favorable influence on exports but a negative effect on imports for developed markets. Studies such as Byrne, Darby, & MacDonald, (2008), Zelekha and Bar-Eftar (2011), Bahmani-Oskooee and Hegerty (2008), and Grier and Smallwood (2013) contend that exchange rate volatility will have a detrimental effect on import.

Table 1. Selected Literature

Study	Country	Data	Methods	Findings
Bahmani-Oskooee and Payesteh(1993)	LDCs 1973Q1-1990Q4	Vol, M, REX, GDP	ARCH Johansen Co- integration	There is no long term relationship
Sauer and Bohara (2001)	Developing and Developed 1973–1993	Vol, M, REX, GDP, TOT	ARCH, OLS, FE – RA	Vol has negative impact
Byrne et al. (2008)	Developed 1989–2001	Vol, M, GDP, RP, PPP, OIL Vol.	GARCH, FE - RA	Vol has a significant negative impact.
Bahmani-Oskooee et al. (2008)	Developed 1973-2006	Vol, M, GDP, REX	GARCH ARDL	In the short run, Vol. affects some industries negatively.
Bahmani-Oskooee and Harvey (2011)	Developing and Developed 1971-2006	Vol, M, GDP, REX	GARCH, ARDL	REX Vol is more effective in the short run
Khan, Azim, & Syed (2014)	Developing and Developed 1970:Q1 – 2009:Q12	Vol, M, I, GDP, REX	GARCH, FE	Vol has negative impact
Asteriou et al. (2016)	MINT 1995M1-2012M12	Vol, M, RP, GDP	GARCH, ARDL, Granger Causality	Vol is not effective in the long run. In countries other than Turkey, causality was detected.
Alper (2017)	15 European Countries 2002M1-2013M12	Vol, M, GDP, REX	GARCH, Westerlund Panel Co-integration	M sectors are both negatively and positively affected.
Bahmani-Oskooeea and Aftab (2017)	Developing and Developed 2001M1-2015M12	Vol, M, GDP, REX	GARCH, Nonlinear ARDL	Supports short-run as well as long-run asymmetric effects in 1/3rd of the industries
Meniago and Eita (2017)	LDCs 1995-2012	Vol, M, GDP, REX	GARCH ARDL, NARDL	In the long run, Vol has a negative impact for five countries
Sharma and Pal (2018)	Developing and Developed 2009:Q1 - 2016:Q12	Vol, M, GDP	GARCH Panel Granger Causality PMG, MG, DFE	Vol has a negative impact. In the long run PMG, MG, and DFE estimations support the evidence
Bahmani-Oskooee and Gelan (2018)	LDC 1971:Q1 – 2015:Q4s	Vol, M, GDP, REX,	Panel ECM	Vol positive and negative impact

Abbreviations: Vol= Exchange Rate Volatility M = Import, , I=Inflation Rate, REX= Real Exchange Rate, Y = GDP, FDI= Foreign Direct Investment, TFE=Total final expenditure, ,RP= Relative Price, PPP= purchasing power parity, OIL= Petrol Price, MINT= Mexico, Indonesia, Nigeria, and Turkey, M2= Money Stock, PPI = producer price index, FE = Fixed Effect Model, RA= Random Effect Model

II. DATA, METHODOLOGY, AND FINDINGS

II.I. Data

This section of the study attempts to apply the theoretical model stated for the period of 2000-2020 to the 19 emerging markets[3]: Turkey, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, Indonesia, India, Mexico, Malaysia, Peru, Phillippines, Poland, Saudi Arabia, Kuwait, and Qatar were excluded from the analysis as they have outliers. United Arab Emirates, Taiwan, and Korea were not included in the analysis due to a lack of data. The reason why the data covers the period of 2000-2020 is that the imports of emerging market economies increased 3.5 times in this period. Following Bahmani-Oskooee and Hegerty (2008), the empirical model in this study is based on standard determinants of international trade theory: that is, import is a function of exchange rate volatility, exchange rate level, national income. The model can be written as

$$LnM_{it} = \alpha_0 + \beta lnVol_{it} + \gamma lnREX_{it} + \partial lnY_{it} + \varepsilon_{it} \qquad (1)$$

where α_0 is a constant, Vol_{it} is the real exchange rate volatility obtained using the GARCH (1,1) method, REX_{it} is the real exchange rate and Y_{it} is the gross domestic product. All relevant variables were obtained from the World Bank and used in logarithmic form.

II.II. Panel Cross-Sectional Dependency Test Results

Equation (1), derived from our theoretical model, shows a persistent relationship between import and its determinant. First, we conducted an empirical analysis to determine the relevance of cross-sectional relationships across the panel members. Disregarding the issue of cross-section dependence in panel data econometrics would lead to inconsistent estimates and misleading information. This is because cross-section dependence is a crucial issue (Grossman and Krueger, 1995). Before examining

[3] MSCI Emerging Market Economies classifies the countries.

the stationarity of all variables, this study examines cross-section dependency using Pesaran's scaled LM and CD tests (2021). The associated probability are detailed in Table 2. Breusch and Pagan (1980) devised the following statistic for the Lagrange multiplier test:

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{p}_{ij}^2 \qquad (2)$$

where $\hat{p_{ij}}$ is the expected correlation coefficient between the results of individual OLS calculations. Under the null hypothesis of no cross-sectional dependency, this test has a chi-square asymptotic distribution. However, with a larger N, this test is inapplicable (Nazlioglu et al., 2011). To overcome this difficulty, Lagrange multiplier statistics were established by Pesaran (2004).

$$Scaled\ LM = 1/N(N-1))^{1/2} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T\,\hat{p}_{ij}^2 - 1). \qquad (3)$$

In the cases of N and T, the scaled LM statistic possesses an asymptotic normal distribution. When T is less than N, considerable size distortion is observed. Pesaran (2021) suggested employing the following test of cross-sectional dependence when N > T:

$$CD = (2T/N(N-1))^{1/2} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{p}_{ij}^2 \qquad (4)$$

The CD test standard is normally distributed asymptotically under the null hypothesis that there is no cross-sectional dependence with N→ ∞ and T→ ∞. (Nazlioglu, Lebe, & Kayhan, 2011).

Correlations between section residuals are highly significant for all tests, as shown in Table 2. The null hypothesis is rejected by both tests. As a consequence, while evaluating co-integration in the model, we considered cross-section dependency into account.

Table 2. Cross – Sectional Dependecy and Homogeneity Test

Variable	*LM*	*Scaled LM*	*CD*
LnM	2861.289***	145.474***	51.987***
	(0.000)	(0.000)	(0.000)
LnVol	467.282***	16.021***	7.478***
	(0.000)	(0.000)	(0.000)
LnREX	1279.850***	59.959***	24.635***
	(0.000)	(0.000)	(0.000)
LnGDP	2879.131***	146.438***	52.655***
	(0.000)	(0.000)	(0.000)
Model	820.000***	35.138***	6.345***
	(0.000)	(0.000)	(0.000)

Note: The values in parentheses are the p values of the test statistics. LM is the cross-section dependency test of Breusch and Pagan (1980); and scaled LM and CD are the cross-section dependency tests of Pesaran (2004)

II.III. Panel Unitroot Test Results

Pesaran's (2007) second generation panel unit root tests were utilized in order to study the stationarity qualities of the variables. This was done due to the fact that the variables had a cross-section dependency. Table 3 shows the findings obtained from running the unit root test on the Im-Pesaran-Shin (CIPS) panel data. With panel data with cross-section dependency, the unit root is the CIPS test's alternative to the null hypothesis. According to the findings of the CIPS test, all variables integrated at the I(1) level.

Table 3. Tests for Unit Root

	Constant	Constant and Trend
Level	**CIPS**	**CIPS**
LnM	-1.86231	-2.225
LnVOL	-3.64348	-3.274
LnGDP	-3.24986	-2.703
LnREX	-1.93527	-3.573
First-difference		
LnM	-2.912***	-2.823***
LnVOL	-3.643***	-3.550***
LnGDP	-2.323***	-3.014***
LnREX	-3.787***	-4.078***

Notes: CIPS refers to Pesaran (2007), and the Maximum number of lags is set to 2 and the optimal number of lags is determined by the Akaike information criterion. *, **, *** statements indicate the rejection of the null hypothesis at 10%, 5%, and 1%, respectively.

II.IV. Panel Co-integration Analysis

The LM bootstrap panel co-integration analysis proposed by Westerlund and Edgerton was used to investigate the presence of a long-term equilibrium connection between the aforementioned variables, which allowed the dependence of cross-sectional units (2007). The null hypothesis for the test is the co-integration of *LnM* and its possible determinants. Table 4 shows the panel co-integration test results for the model, which provide strong validation for the inability to reject the null hypothesis of panel co-integration. We use additional co-integration tests to obtain reliable results. The most of available tests accept the co-integration relationship.

After the cointegration relationship has been constituted, the next step is to estimate the long-run parameters. The panel co-integration technique (CCE estimation procedure) proposed by Pesaran (2006) was approved as suitable in this setting. This is due to the fact that it allows for posibble cross-section dependencies caused by several omitted co-factors, as well as its resistance to slope heterogeneity and probable unit roots. Moreover, it allows for hypothetical cross-section dependencies caused by many unobserved co-factors (Durusu-Ciftci, Gokmenoglu, & Yetkiner, 2018). Here is an example of model estimate in CCE form:

$$LnY_{it} = \alpha_1 + \gamma_i X_{it} + i = 1,\ldots N; \quad t = 1,\ldots T. \quad \mu_1 \overline{Ln_{Yit}} + \mu_2 + \bar{\bar{X}}_t + \varepsilon_{it} \qquad (5)$$

where elasticity estimates of LnYit it are represented by $\mu 1$ and $\mu 2$ with regard to the cross-section averages of the dependent variable and observed regressors, respectively. Hence, *LnVol*, LnY, and LnREX are included inside X, and it is the error term. Inside of a panel framework, the individual coefficients (γ) I are estimated, and then the joint correlated effects mean group estimator is calculated. This estimator is the simple average of the individual CCE estimators.

Table 4. Results for Panel Co-integration Tests

		Constant		Constant & Trend	
Study	**Test**	**Statistic**	**p-value**	**Statistic**	**p-value**
Kao (1999)	Panel ADF	-7.116***	0.000		
Pedroni (1999, 2004)	Panel v-stat.	0.298	0.382	0.632	0.263
	Panel rho-stat.	2.151	0.984	2.189	0.985
	Panel PP-stat.	1.437	0.924	-0.397	0.345
	Panel ADF-stat.	1.134	0.871	-2.410***	0.008
	Group rho-stat.	2.341	0.990	2.882	0.998
	Group PP-stat.	-0.864	0.193	-4.244***	0.000
	Group ADF-stat.	-2.089	0.018	-5.385***	0.000
Westerlund (2007)	Group-tau	-37.397	0.000[a]	-5.110	0.000[a]
			0.233[b]		0.915[b]
	Group-alpha	3.694	1.000[a]	3.952	1.000[a]
			0.760[b]		0.890[b]
	Panel-tau	-5.447	0.000[a]	-5.404	0.000[a]
			0.160[b]		0.890[b]
	Panel-alpha	1.436	0.925[a]	3.004	0.999[a]
			0.473[b]		0.851[b]
Westerlund and Edgerton (2007)	LM	2.455	0.007[a]	4.147	0.000[a]
			0.766[b]		0.695[b]
Larsson et al. (2001)	None	679.7***	0.000	1032***	0.000
	At most one	330.4***	0.000	534.1***	0.000
	At most two	178.6***	0.000	243.7***	0.000
	At most three	104.9***	0.000	93.06***	0.000

Note: Maximum number of lags is set to 2 and the optimal number of lags is determined by the Akaike information criterion for Kao (1999) and Pedroni(1999, 2004) tests. To construct the panel statistics, the individual statistics are obtained based on the long-run variance estimator by using the Bartlett method with Newey-West automatic bandwidth selection for Kao (1999) and Pedroni (1999, 2004) tests and with int(4*(T/100)^(2/9)) bandwidth for Westerlund (2007) and Westerlund and Edgerton (2007) tests. DOLS estimations include int(4*(T/100)^(2/9)) leads and lags for Westerlund (2007). [a] denotes asymptotic p-value, and [b] denotes bootstrap p-value with 1,000 replications. The underlying VAR model includes 2 lags for Larsson, Lyhagen, & Löthgren (2001). ***(1%), **(5%), and *(10%).

The results of the CCE estimation procedures are shown in Table 5, and it show a significant negative coefficient for LnVol. Imports reduce by -0.01% for every 1% increase in volatility. Alper (2017) and Bahmani-Oskooee and Saha (2021), who discovered positive coefficients for exchange rate

volatility, found the opposite outcome. Additionally, CCE findings show that an increase in GDP will increase imports by 0.04% over the long term. Our findings deviate from the theoretical prediction and demonstrate that a rise in the exchange rate has a favorable impact on imports. This might be as a result of the dependence of these nations' exports on imports.

Table 5. Common Correlated Effects (CCE) Estimation Results

	Coefficient	P-Values
LnVol	-0.016***	0.003
LnY	0.483**	0.023
LnREX	0.403**	0.011

Note: ***, **, * indicate the rejection of the null hypothesis at 1%, 5%, and 10%, respectively.

CONCLUSION

This study focuses on the co-integration relationship between imports, exchange rate volatility, income, and real exchange rate for the period 2000-2020. 19 emerging market countries are discussed. The reason for focusing on emerging markets is that the imports of emerging markets increased 3.5 times during the analysis period. Existing literature has generally examined the co-integrated relationship between imports and volatility. However, it is noticed that the cross-section dependency is ignored in the previous studies on emerging markets. Therefore, we tested the existence of cross-section dependency by using LM, Scaled LM, and CD tests. Robust results were obtained from all tests, and the existence of cross-section dependence was accepted.

For the co-integration analysis, Westerlund and Edgerton (2007) co-integration test was used to obtain effective results by allowing autocorrelation and varying variance in the co-integration equation under the assumption of cross-section dependence. The results show that there is a co-integration relationship between imports, GDP, real exchange rate, and real exchange rate volatility. The co-integration test only supports that imports and their stated determinants come into equilibrium together in the long run. After establishing the co-integration relationship, the CCE estimator was used to estimate the coefficients. The obtained findings support the existing literature. However, the effect of volatility on imports is quite less compared to other variables. Another interesting result is that exchange rate increases have a positive effect on imports. This is contrary to the theoretical expectation. However, the dependence of exports on imports in emerging markets may be the reason for this situation. It is noticed that the variable that affects imports is income mostly. An 1% increase in domestic income increases imports 0.4%.

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