International Journal of Humanities and Social Science Research
ISSN: 2455-2070; Impact Factor: RJIF 5.22
Received: 26-10-2020; Accepted: 11-11-2020; Published: 28-11-2020
www.socialsciencejournal.in
Volume 6; Issue 6; 2020; Page No. 87-91

An empirical study on the import demand in Sri Lanka, ARDL approach

Saravanamutthu Jeyarajah
Senior Lecturer in Economics, Eastern University, Sri Lanka

Abstract
The main objective of this present study is to estimate an import demand function for Sri Lanka using time series data from 1980 to 2018. It also assesses the elasticity of import demand for the determinants of aggregate imports function. The results revealed the long-run relationship among the variables. There is a positive impact of real national income on imports. The elasticity of import regarding real national income is proportional. The elasticity coefficient is 0.8286. One percentage increase in real national income leads to 0.8286 percentage increase in import. On the other side, there is a negative impact of import price on imports. The coefficient for this variable is statically significant at 5% level. The elasticity coefficient is -1.5617. It indicates that the percentage change in import price leads to a percentage change in import. A one percentage increase in import price leads to a decrease in import by 1.5617 percentage. The domestic price is found insignificant.

Keywords: Sri Lanka, import demand, import price, domestic price, ARDL model

Introduction
Sri Lanka has reached the status of an upper-middle-income country with a GDP per capita of USD 4,073 (2017) and has a service-oriented economy which is responsible for a little over 60 % of the GDP of Sri Lanka. The developing countries like Sri Lanka require certain imports that they cannot produce domestically. Specifically, they need capital goods, intermediate goods and many raw materials. Sri Lanka imports petroleum, textile fabrics, foodstuffs, and machinery and transportation equipment. Sri Lankan imports were estimated US$18.7 billion in 2018, dipping -2.7% since 2014. In 1977, Sri Lanka introduced an economic reform aimed at opening up its economy to external trade and investment. The open economy reforms enabled the Sri Lankan government to liberalize the import trade. The import liberalization policy, by removing constraints on imported intermediate goods, certainly contributed to growth in the manufacturing sector, but simultaneously contributed to wiping out the current account surplus very quickly (Herring, 1987). In 1977, the balance of payment of Sri Lanka was 508 million rupees with a positive sign. The terms of trade of Sri Lanka also indicated very favour this year. From 1978, Sri Lanka produces larger trade balance deficits. Kelegama, (2010) highlighted that the imports as a revenue earner and growth facilitator in the economy of Sri Lanka.

It is interesting to investigate the import demand behaviour of a country. A large number of studies have been done on estimating the import demand functions for different countries. Jayaraman (1977) [14]. Bautista, (1978) [5], Arize & Afifi (1987) [2], Kabir (1988) [16], Emran & Shilpi (2002) [10], Chimobi & Ogbonn (2008) [6], Butts and Mitchell (2012) [4], Knobel (2013) [18], Aipi & Sabok (2015) [1], Durmaz & Lee, (2015) [9], Hor, Keo, & Suttiprapa (2018) [13], Keho, (2019) [17] and Emran, & Shilpi (2020) [11] have studied the import demand for various countries using different approaches. The import demand specification is important for policy analysis in many counties. Nguyen and Bhuyan (1977) estimated the import demand function for India using the Ordinary Least Square (OLS) method. Arize (1987) [2] estimated the elasticities in the import demand function in Nigeria from 1960 to 1977 using the Cochrane–Orcutt and two-stage least-squares methods. Butts & Mitchell, (2012) [4] inspect the relationship between import demand and a set of foreign exchange supply channel variables using annual time series data for Guyana over forty years using single equations and vector autoregression (VAR) frameworks. Coefficients are estimated to establish both, the short- and long-run relationships between import demand, gross national income, and channel variables. An aggregate import demand function is examined using five types of co-integration tests including the ARDL bounds (Mishra, Mohanty, 2017) [20]. Culha, Eren and Ogunç, (2019) [7] reexamined the import demand function for Turkey using the newly defined national income data and the income and price elasticities over time. Demand functions were estimated for the total imports and its subcomponents separately. Kalman filter method was used for the data between 2003 and 2018.

The objective of the study
The main objective of this study is to estimate an import demand function for Sri Lanka using time series data from 1980 to 2018. It also assesses the elasticity of import demand concerning the various determinants of aggregate imports and their components.

Theoretical background
The import demand for a country conceptually lake a commodity demand model. Price and quality demanded are assumed to be inversely related. There are three major classified import demand models in the literature. The traditional import model, the import-exchange model and the monetarist model. The traditional import model is considered as the benchmark for import demand of a country. It was used as the main theoretical framework for

initial studies on import demand analysis. The traditional import model is an analysis of import demand based on the consumer theory of demand. In the traditional model, the aggregate import demand relates the real quantity of imports demanded by a country to the ratio of import prices to domestic prices and real income of the country. However, the traditional model assumes the absence of import quota restrictions on imports. Harvey & Sedegah, (2011) [12] highlights that Bertola and Faini, (1991) have defended quantitative restrictions do affect the magnitude of both price and income elasticity of import demand, as well as import levels. Considering the weaknesses of the traditional model led to the proposition of the import-exchange framework. Imports of goods and services represent the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income and transfer payments

Method and materials and model specification

Early studies on import demand analysis the least squares and two-stage least squares methods were used. For these purposes, secondary data was used from various sources and publications. Mainly, annual data from the Central Bank of Sri Lanka. Khan (1974) [15] and Magee (1975) [19] identified that the most commonly used functional forms for import and export demand relationships are either linear or log-linear formulations. Recent studies by Doroodian *et al*. (1994) [8], Sinha (1997) [27], and Raijal *et al.* (2000) [25] used the Box and Cox (1964) procedure and showed that log-log specifications are more preferable to the linear specification. Tennakoon (2010), conducted a study on price and income elasticity of disaggregated import demand in Sri Lanka. Sinha (2001) investigates the price and income elasticity of imports and exports in Sri Lanka and some other countries using relative price and income as explanatory variables. Afzal (2001) estimated the import demand function for Pakistan using annual data using the OLS method. However, Afzal's study suffers from a methodological problem in that they used non-stationary data in estimating the import demand function. Based on the literature, the following model is proposed to estimate using annual data from 1980 to 2018 on Sri Lankan import. The present study is an attempt to estimate the aggregate import demand function for Sri Lanka employing ARDL (Raj Dhungel, 2019) [24] techniques that provide more accurate and reliable estimates

$$lnIM_t = \beta_0 + \beta_1 lnRINY_t + \beta_2 lnIP_{mt} + \beta_3 lnDP_{dt} + u_t$$

IM = Volume of imports. (In Million Rupees)
RIN = Real National income. (In Million Rupees)
IP = Import prices. (Index)
DP = Domestic prices. (Index of CCPI)
Ui = Error term.
Bs = coefficients
Ln = Natural log

Empirical analysis and results

The study covers the sample period of 1980 -2018. All the variables are collected at a constant price. Table 1 present the summary of the selected variable in the study for the 1980–2018 period. Import volume (IM) in million rupees, Real income (RIN) in million rupees, import price index (IMP) and domestic price index. The average import volume over the period was 898,215.5 million rupees with a minimum and maximum of 33,942.00 and 3587, 048, respectively. The economy has been fairly open at an average openness index of about 63.18 % over the study period.

Table 1: Summary of Variables

	IM	RIN	IMP	DP
Mean	898215.5	2381675.	146.4744	1377.697
Median	416223.0	808299.0	129.0000	744.1000
Maximum	3587048.	9456499.	262.7000	5416.100
Minimum	33942.00	120.4470	89.80000	113.8000
Std. Dev.	1029172.	3230066.	48.36696	1414.509
Skewness	1.167751	1.208502	1.134157	1.184371
Kurtosis	3.125080	2.770185	3.107690	3.491745
Jarque-Bera	8.889096	9.578930	8.379874	9.510714
Probability	0.011742	0.008317	0.015147	0.008605
Sum	35030403	92885329	5712.500	53730.20
Sum Sq. Dev.	4.02E+13	3.96E+14	88895.79	76031777
Observations	39	39	39	39

The log-linear form is considered most appropriate by various empirical studies. This functional form gives elasticity coefficients directly. Moreover, the log-linear form reduces the problem of heteroscedasticity in an empirical analysis. Therefore, empirical results estimated by this model are appropriate for policy implication. For these purposes, all variables are expressed in natural logarithmic form. Table 2 express the summary of log variable used in this study.

Table 2: Summary of log Variables

	LIM	LRIN	LIMP	LDP
Mean	12.84197	13.23415	4.940714	6.618852
Median	12.93898	13.60269	4.859812	6.612175
Maximum	15.09284	16.06221	5.571013	8.597131
Minimum	10.43241	4.791210	4.497585	4.734443
Std. Dev.	1.499958	2.291355	0.297753	1.201084
Skewness	-0.142105	-1.202863	0.751139	-0.046747
Kurtosis	1.689547	5.773745	2.495856	1.674734
Jarque-Bera	2.921848	21.90692	4.080378	2.868240
Probability	0.232022	0.000017	0.130004	0.238325
Sum	500.8368	516.1319	192.6879	258.1352
Sum Sq. Dev.	85.49522	199.5117	3.368955	54.81893
Observations	39	39	39	39

Unit root tests

This part analyses the time-series properties of the data from 1980 to 2018. It is usual to test the stationary of time series variable in the econometric analysis. If a data series is found to be stationary, it implies that the mean, variance, and autocovariance of the series are independent of time. Augmented Dickey-Fuller (ADF) and Philips Perron (PP) unit root tests have been conducted to check the stationarity of time series data in logarithmic form. These unit-root tests are performed on both levels and first differences of all the variables. Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) have been used for optimum lag selection. The results of the ADF and PP test are reported in Table-3. According to the results given in Table-3, log form of variables, Volume of Imports, Real Income, import Price and Domestic price are not stationary at the level I (0). This implies that the null hypothesis of unit root at the level I (0) cannot be rejected for all variables. However, all the variables are stationary at the first difference I (1)

Table 3: Unit Root Tests - ADF & PP

Variable	ADF		PP	
	Level I (0)	**1st Diff. I (1)**	**Level I (0)**	**1st Diff. I (1)**
Log of Import	-0.818472 (0.8017)	-5.603352 ** (0.0000)	-0.666020 (0.8432)	-6.576331** (0.0000)
Log of Real Income	-0.310656 (0.9128)	-2.966361 ** (0.0490)	-2.142388 (0.2300)	-26.91065 ** (0.0001)
Log of Import Price	-2.642826 (0.0935)	-6.427846 ** (0.0000)	-2.728163 (0.0787)	-6.427928 ** (0.0000)
Log of Domestic Price	-1.130513 (0.6937)	-6.169804 ** (0.0000)	-1.154027 (0.6840)	-6.170017 ** (0.0000)

*and ** shows the level of significance at 1% and 5% respectively.

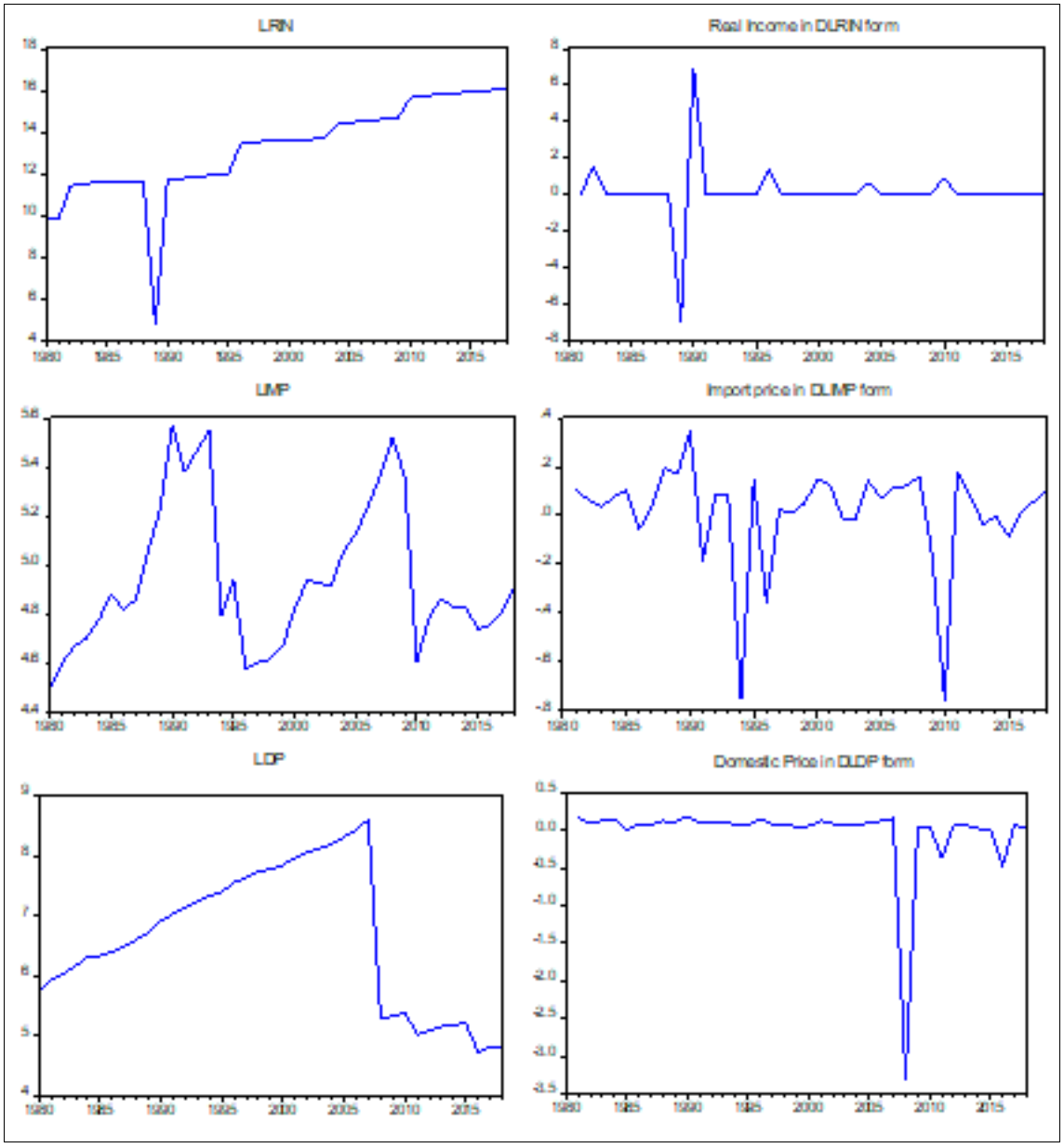

Fig 1: property of variables

ARDL model

The empirical analysis involves a series of steps. As a first step, we test for the order of integration of the series using the ADF and PP test of Phillips and Perron (1988). Secondly, the researcher test whether there is a long-run relationship between the variables. For this purpose, this study employs the Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration. Many studies on import demand use ARDL bounds testing approach to cointegration. This approach is applicable irrespective of the order of integration such as I (0) or I (1). Two variables are said to be co-integrated if they have a long term or equilibrium relationship between them. To establish the existence of a long-run relationship among the variables, the bounds test is employed under the ARDL approach framework. Bound test for cointegration was used through the ARDL approach to in the study. The Bound test involves the comparison of the F-statistics against the critical values. The calculated F-statistics are reported in Table 5 with the corresponding critical values. The computed value of f-statistics is 15.94. This value is higher than the upper bound critical value at 5% significance level. If the calculated value of test statistics is greater than the critical value at 5% significance level we can reject the null hypothesis. Based on the empirical results calculated F value = 15.94 is higher than the upper bound critical value of 4.08 at 5%

significance level. It rejects the null hypothesis of no cointegration among the variables. It confirms that these variables have a long-run relationship or they are cointegrated. To verify whether the residuals from the model are serially uncorrelated Breusch-Godfrey Serial Correlation LM Test was conducted. Based on the F-statistic of 0.85 and p-value of 0.7475 indicates that it fails to reject this null. Therefore, the residuals are serially uncorrelated.

Table 4: Results of the ARDL Cointegration Test

Log length	**F-stat.**	
ARDL: (5,5,4,4)	16.92	
Critical values		
Significant level	Lower bounds	Upper bounds
10%	2.72	3.77
5%	2.33	4.35
1%	4.29	5,66
Diagnostic tests		
	LM	F
Normality		35.43(0.0000)
Heteroskedasticity		0.63(0.8221)
serial correlation	0.85 (0,551)	

If the results confirmed the cointegration among the variables the next task is to estimate the long-run model. The long-run estimation results through ARDL (5, 5, 4, 4) model is reported in Table 6. The value of R-square is 0.95. It implies that 95 per cent variation in import has been explained by RIN, IMP and DP. The results reveal that there is a positive impact of real national income on imports. The coefficient for this variable is statically significant at 5% level. As expected the elasticity of import concerning real national income is proportional. The elasticity coefficient is 0.8286. It indicates that the percentage change in real national income leads to a percentage change in import. One percentage change in real national income leads to 0.8286 percentage increase in import. The measured long-run income elasticity of import demand of Sri Lanka is 0.8286. On the other side, there is a negative impact of import price on imports. The coefficient for this variable is statically significant at 5% level. The elasticity coefficient is -1.5617. It indicates that the percentage change in import price leads to a percentage change in import. A one percentage increase in import price leads to a decrease in import by 1.5617 percentage. The domestic price variable is not statically significant in this model. It means the domestic price has no impact on Sri Lankan imports during the study period.

Table 5: Long-Run Relationship of Variables

ARDL (5, 5. 4, 4) selected based on AIC			
Dependent variable LIM			
Variable	Coefficient	t statistics	P-value
C	8.060242	2.756657	0.0174 *
LRIN	0.828639	26.73062	0.0000 *
LIMP	-1.561684	-2.479569	0.0290 *
LDP	0.001089	0.024921	0.9805
R-squared.	0.95		

* And **significant at 5 & 10 per cent respectively.

Stability tests

To test whether the import demand function is stable, the CUSUM test was used in this study.

The test is based on the cumulative sum of the recursive residuals and plots the cumulative sum together with the 5% critical lines over time. The test finds parameter stability if the cumulative sum goes within the area between the two critical lines. The results of the stability test are presented in figure 2

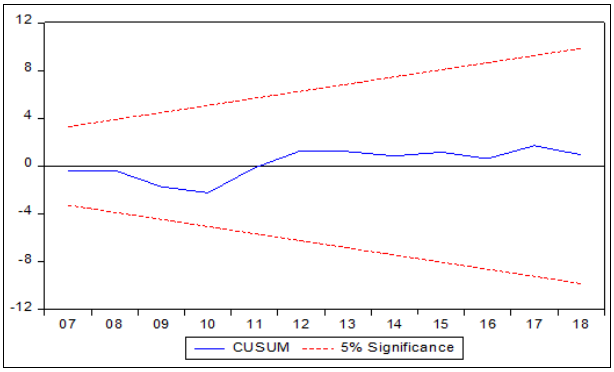

Fig 2: stability test import demand function

The plots of the figure are between critical boundaries at 5% significance. It means they are within the lower and upper critical limits. It reports the accuracy of short and long-run parameters and verifies the stability of ARDL model.

Table 6: Results of the ARDL Cointegration Test

Variable	**Coefficient**	**t-Statistic**	**Prob.**
C	-1.503439	-8.496460	0.0000
D (LIM(-1))	-1.028503	-7.048178	0.0000
D (LIM(-2))	-0.451963	-3.896088	0.0021
D (LIM(-3))	-0.259106	-3.155791	0.0083
D (LIM(-4))	-0.108631	-1.308030	0.2154
D (LRIN)	-0.002771	-0.514237	0.6164
D (LRIN(-1))	0.143376	8.168011	0.0000
D (LRIN(-2))	0.096557	7.662339	0.0000
D (LRIN(-3))	0.077702	7.531651	0.0000
D (LRIN(-4))	0.078833	7.018714	0.0000
D (LIMP)	0.649820	6.537599	0.0000
D (LIMP(-1))	-0.126700	-2.832161	0.0151
D (LIMP(-2))	-0.312301	-5.590902	0.0001
D (LIMP(-3))	-0.052063	-1.246307	0.2364
D (LDP)	0.018075	1.449308	0.1729
D (LDP(-1))	0.077973	6.140854	0.0001
D (LDP(-2))	-0.052947	-2.414443	0.0326
D (LDP(-3))	-0.035103	-1.817446	0.0942
Coint Eq (-1)*	0.186525	9.200001	0.0000
R-squared	0.951902	Durbin-Watson stat	2.191485
F-statistic	16.49227 (0.000001)		

The model selection results using the AIC value stated that the ARDL model (5, 5, 4, 4) was the best model with the smallest Akaike Information Criterion value of 3.27. The Adjusted R Square value of 0.99 shows that each independent variable can explain 99% of the dependent variable's variation in the selected ARDL model. The estimation test results of the short-term ARDL model in Table 3 show that the value of Coint Eq (-1) = 0.1865 and significant at the 5% level (Prob 0.0000).

This result means that there is no short-term cointegration in this model.

The Coint Eq coefficient then uses to measure the speed of adjustment, which is the speed of adjustment in response to changes. The value of CointEq is positive and less than 1

there will be no equilibrium in the short run. With a CointEq value of 0.1865 means that in this study, the ARDL model (5, 5, 4, 4) has fulfilled the validity requirements, so it can conclude that the model will go to equilibrium at a speed of 18.65 per cent per year.

Conclusion

The present study aims to estimate the import demand function for Sri Lanka for real income, import price and domestic price using ARDL approach. The order of these variables I (1) examined through unit root test of ADF and PP tests. The bound test employed to prove the existence of a long-run relationship between the variables. The results revealed the long-run relationship among the variables. The results reveal that there is a positive impact of real national income on imports and the negative impact of import price on imports. The domestic price is found insignificant in Sri Lanka's import demand function. The findings also report the accuracy of short and long-run parameters and verify the stability of the model.

References

1. Aipi B, Sabok G. Estimating an Aggregate Import Demand Function for Papua New Guinea. Retrieved, 2015. from https://www.bankpng.gov.pg/wp-content/uploads/2014/06/Estimating-an-Aggregate-Import-Demand-Function-for-PNG.pdf
2. Arize A. The Elasticities and Structural Stability of Import Demand for Nigeria, 1960-1997. Social and Economic Studies. 1987; 36:171-86.
3. Arize A, Afifi R. An Econometric Examination of Import Demand Function in Thirty Developing Countries. Journal of Post Keynesian Economics. 1987; 9(4):604-616. DOI: 10.1080/01603477.1987.11489648
4. Butts, Mitchell. An empirical analysis of small country import demand function: a case of Guyana. Problems and Perspectives in Management, 2012, 10(1).
5. Bautista R. Import Demand in a Small Country with Trade Restrictions. Oxford Economic Papers, 30(2), new series, 1978, 199-216. Retrieved March 19, 2020, from www.jstor.org/stable/2662888
6. Chimobi O, Ogbonna B. Estimating Aggregate Import-Demand Function in Nigeria: A Co-Integration Approach. Journal of Research in National Development, 2008, 6(1). DOI:10.4314/jorind.v6i1.42411.
7. Çulha O, Eren O, Öğünç F. The import demand function for Turkey. Central Bank Review. 2019; 19(1):9-19. DOI: 10.1016/j.cbrev.2019.03.001
8. Doroodian K, Koshal R, Al-Muhanna S. An examination of the traditional aggregate import demand function for Saudi Arabia. Applied Economics. 1994; 26(9):909-915. https://doi.org/10.1080/00036849400000052
9. Durmaz N, Lee J. An empirical analysis of import demand function for Turkey: An ARDL bounds testing approach. The Journal of Developing Areas. 2015; 49(4):215-226.
10. Emran M, Shilpi F. Foreign Trade Regimes and Import Demand Function: Evidence from Sri Lanka. SSRN Electronic Journal, 2002.
11. Emran M, Shilpi F. Estimating an Import Demand Function in Developing Countries: A Structural Econometric Approach with Applications to India and Sri Lanka. Retrieved 22 January 2020, from, 2020.
12. Harvey S, Sedegah K. Import Demand in Ghana: Structure, Behaviour and Stability, 2011. Aercafrica. Org. Retrieved 10 October 2020, from https://aercafrica.Org/wp-content/uploads/2018/07/RP233.Pdf.
13. Hor C, Keo K, Suttiprapa C. An Empirical Analysis of Cambodia's Import Demand Function. Journal of Management, Economics and Industrial Organization, 2018, 1-12. DOI: 10.31039/jomeino.2018.2.1.1
14. Jayaraman T. Import Demand Function of India. Foreign Trade Review. 1977, 11(4):362-372. DOI: 10.1177/0015732515770403
15. Khan M. "Import and export demand in developing countries", IMF Staff Papers. 1974; 21:678-693.
16. Kabir MR. Estimating import-demand and export-demand functions: The case of Bangladesh. Bangladesh Development Studies. 1988; 16(4):115-127.
17. Keho Y. An-Econometric-Testing of Traditional Import Demand Function for Cotevoire. Journal of Economics and Business, 2019, 2(3). DOI: 10. 31014/aior. 1992. 02. 03. 113
18. Knobel A. Estimation of Import Demand Function in Russia. SSRN Electronic Journal, 2013.
19. Magee S. "Prices, Income and Foreign Trade: A Survey of Recent Economic Studies," in Kenen, P., ed., International Trade and Finance: Frontiers for Research, Cambridge University Press, 1975.
20. Mishra BR, Mohanty A. An Empirical Analysis of Aggregate Import Demand Function for India. Global Economy Journal, 2017, 1-13. DOI: 10.1515/gej-2017-0049
21. Murray T, Ginman P. An Empirical Examination of the Traditional Aggregate Import Demand Model. The Review of Economics and Statistics. 1976; 58(1):75-80. doi:10.2307/1936011
22. Narayan S, Narayan P. An empirical analysis of Fiji's import demand function. Journal of Economic Studies. 2005; 32(2):158-168. DOI:10.1108/01443580510600931
23. Nguyen DT, AR Bhuyan. "Elasticities of export and import demand in some South Asian countries." The Bangladesh Development Studies. 1977; 2:133-152.
24. Raj Dhungel K. Estimation of Import Demand Function Using ARDL Method: Evidence from Nepal. International Journal of Econometrics and Financial Management. 2019; 6(2):45-52. https://doi.org/10.12691/ijefm-6-2-3
25. Raijal A, Koshal RK, Jung C. 'Determinants of Nepalese Imports', Journal of Asian Economics. 2000; 11:347-54.
26. Tennakeen T. Price and Income Elasticities of Disaggregated Import Demand in Sri Lanka. Staff Studies. 2012; 40(1):59. DOI: 10.4038/ss.v40i1.4681
27. Sinha D. An aggregate import demand function for Pakistan. Atlantic Economic Journal. 1997; 25(1):114-114. DOI.org/10.1007/bf02298482