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Measuring the Influence of the J-Curve Effect on Trade in Romanian Forest Products

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Abstract. *This paper examines the dynamic effect of the Romanian exchange rate indices on bilateral trade of Romanian forest products namely fibreboard, particle board and pulp for paper. Special attention is given to investigate the J-curve hypothesis: whether the trade balance for Romanian forest products benefits from a decline in the value of Romanian Leu (RON). We adopted the autoregressive distributed lag (ARDL) approach to cointegration to estimate the annual bilateral trade data of Romanian forest products from 1991 to 2013 with various countries in the world. We found no evidence of the J-curve phenomenon for the trade in Romanian forest products. The long-run analysis showed the exchange rate to be insignificant in influencing the trade balance of Romanian forest products. This implies that there are no changes in the trade balance for fibreboard, particle board and pulp for paper trade, regardless of whether the Romanian exchange rate depreciates or appreciates. However, income variables were found to be important factors in determining Romanian trade, only in pulp for paper products.*

Keywords: Autoregressive distributed lag approach to cointegration, exchange rate, J-curve effect.

JEL Classification: C32, F14, L7.

1. Introduction

The Romanian fibreboard and particle board trade has been always experiencing a surplus (Table 1). Clearly, our exports of fibreboard and particle board have not been affected by the financial crisis. Table 1 reveals that the exports value of fibreboard and particle board experienced an increasing trend even after the financial crisis years. For example, the export value for fibreboard increased from 204 million euro in year 1997 to 395 million euro in year 2000. Similarly, the export value for particle board increased from 20 million euro in year 1997 to 21 million in year 2000. However, Romania experienced a deficit in pulp for paper product trade.

From the 1999s till the present, the increasing value of Romanian Leu (RON) over time is shown in Figure 1. For example, from year 1999 to 2003, the real exchange rate indices apreciated gradually by approximately 18.34 percent annually. Subsequently, it appreciated till year 2004 and then began to depreciate from 4.0532 in year 2004 to 3.3817 in year 2006. From year 2006 till the present, a stable increase was seen till year 2014 as the exchange rate had been fixed (Figure 1). However, the highest rate of apreciation occurred from 2006 till 2013 due to the European financial crisis.

The conventional wisdom of the effect of exchange rate changes on the trade balance is known as the J-curve effect. Assuming that the Marshall-Lerner (ML) condition-the sum of domestic and foreign price elasticity of demand (in absolute value) is greater than one - holds, it is possible that after depreciation, an initial deterioration in the trade balance occurs before an improvement is realised.

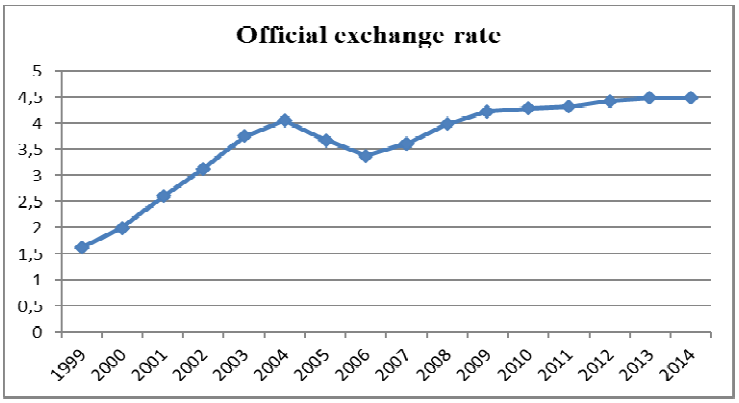
Table 1. *Romanian trade in forest products*

Euro 1000

Year	Fibreboard		Pulp for paper		Particle board	
	Export value	Import value	Export value	Import value	Export value	Import value
1991	43199	10452	5879	36	11598	2521
1992	68835	3870	5482	145	10872	2239
1993	91333	5096	5128	781	14824	1439
1994	125738	462	5348	666	15624	412
1995	124700	825	6173	431	18447	539
1996	162259	495	8046	513	16854	561
1997	204432	1040	12262	1774	20057	818
1998	221885	1244	19757	1224	17557	1484
1999	291683	1455	23455	1452	15544	3553
2000	395907	3051	33818	1982	21816	4043
2001	359218	4157	45805	2403	25583	4263
2002	386943	4414	54636	4361	31913	6191
2003	378960	4290	61355	5720	33761	6260
2004	420076	7234	66156	6705	46204	9458
2005	405377	8583	63472	8227	47464	12349
2006	442197	13157	63524	8252	45679	16420
2007	455869	18673	69256	19223	48841	20786
2008	400284	32009	70662	19815	42021	30553
2009	415431	20691	67864	14596	38613	19307
2010	557061	19341	78144	15157	46083	17243
2011	618282	21307	91368	18092	54330	22263
2012	675218	22682	99281	14656	58377	22566
2013	721304	26209	107318	12677	70591	24361

Source: www.tempoonline.ro

Figure 1. *Romanian official exchange rate 1999-2014*



The hypothesis response of the trade balance over time resembles a titled J shape. The issue of the exchange rate devaluation on international trade has long been a major topic of study in international economics. According to Marshall (1923) and Lerner (1944), the demand elasticity for both exports and imports must exceed one, if the trade balance is to improve after a devaluation.

The J-curve effect is attributed to a lagged adjustment of quantities to changes in relative prices (Magee 1973). However Dornbusch and Krugman (1976) argue that there would be a temporal negative response of the trade balance to real depreciation in the short-run, followed by larger export and import elasticity that would improve the trade balance. The J-curve phenomenon is mainly due to the price effect being overtaken by volume effect at an early stage.

The objective of this study is to examine the dynamic effects of exchange rate changes on the trade balance in Romanian forest products. The empirical focus is on the characteristics of the short-run response (J-curve effect) and empirically determining whether the trade balance of the forest products benefits from a decline in value of the Romanian Leu. For this purpose, we used trade data of forest products which were classified into three categories: fibreboard, particle board and pulp for paper. The ARDL model of short-run effects was used to examine the sign of the coefficients. The sign of the coefficients of the exchange rate determines the existence of the J-curve effect. That is, an initial negative sign followed by a positive one on the lag coefficients would be consistent with the J-curve phenomenon (Baek, 2007).

2. Literature Review

International economics literature is replete with studies examining the J-curve effect. The evidence that emerges from the literature is rather mixed. Some studies have confirmed the presence of the J-curve phenomenon (for example, Bahmani-Oskooee 1985; Noland 1989), while others have completely denied its existence (for example, Rose and Yellen 1989; Rose 1991). However, the simultaneous occurrence of currency depreciation and recession during the Mexico crisis (1995) and the Asian Financial Crisis

(1997/1998) appears to be contradicting the conventional view that devaluations are expansionary, as noted by Rajan and Shen (2001) and Ahmed et al. (2002).

On the other hand, in the literature on forest economics, most studies mainly focus on the impacts of exchange rate changes on trade volume or prices of forest products (Adams et al. 1986; Buongiorno and Uusivouri 1991; Sun and Zhang 2003; Bolkesjo and Buongiorno 2006). For example, Adams et al. (1986) used a structural econometric model (i.e., two-stage least squares) to analyse the role of exchange rate on the North American softwood lumber market. They concluded that an increase in exchange rate played a key role in the expansion of the Canadian share of the US market for the 1950-1983 period. Recently, Bolkesjo and Buongiorno (2006) adopted the vector autoregressive (VAR) model to examine the short and long-run impacts of exchange rate changes on US trade in forest products. They found a change in the value of the EURO to significantly affect forest products trade, both in the short and long-runs.

Relatively little attention has been paid to investigate the impact of exchange rate changes on trade balance particularly on the trade of forest-based products. The earlier study by Kaiser (1984) investigated the effect of changes in exchange rate on the trade balance of US forest products. He found the depreciation of the US dollar to be the most effective trade policy to increase US forest product exports and stabilise the US trade balance. A more recent study by Baek (2007) examined the dynamic effects of exchange rate changes on US trade balance in forest products. He found little evidence of the J curve phenomenon for US forest products trade with Canada.

In the case of Romania, no study has been done to examine the J-curve effect particularly in the case of forest-based products. For example, Wilson (2001) examined total trade balance for Singapore and Romania and found no persuasive evidence for the J-curve effect. Later, Duasa (2007) examined the short- and long-run relationships between Romanian total trade balance, real exchange rates, income and money supply. Nevertheless, no attention has been made to examine the J-curve effect on trade in Romanian forest products. Hence, this is the first attempt to examine the existence of the J-curve effect on trade in Romanian forest products with the rest of the world.

3. Methoology and Data

To construct the ARDL model, we adopted the trade balance model of forest products derived by Baek (2007) by relying on the theoretical framework developed by Rose and Yellen (1989). The demand for imported forest commodities at home and in a foreign country is specified as follows:

$$M^d = M^d(P_m, Y) \; and \; M^{d*} = M^d(P_m^*, Y^*) \quad (1)$$

where M^d (M^{d*}) is the import quantity of the home (foreign) country; P^m (P^*,,) is the relative price of imported forest goods to domestically produced goods in the home (foreign) country; Y (Y*) is the real income of the home (foreign) country. Similarly, the supply for exported forest commodities at home and in a foreign country is stated as follows:

$$X^S = X^S(P_X, Y^*) \; and \; X^{S*} = P_X^*, Y \quad (2)$$

where $X^S(X^{S*})$ is the export volume of the home (foreign) country; and P_X (P) is the home (foreign) country's relative price of export goods. The market equilibrium conditions for exports and imports are then:

$$M^d = X^{S*} \; and \; M^{d*} = X^S \quad (3)$$

Assuming that the law of one price prevails in a perfectly competitive market, we can write P = ER.P*, where ER is the exchange rate between the domestic and the foreign currency. Given Eqs. (1) - (3), the trade balance (TB) is defined as the difference between value of exports and value of imports and can be specified as follows:

$$TB= (X^S Y^*, ER) - M^d (Y, ER). \quad (4)$$

Finally, in the reduce form, equation (4) shows the following relationship:

$$TB= TB(Y, Y^*, ER). \quad (5)$$

To define the ARDL modeling approach, I expressed the sixth equation in log-linear form as follows:

$$\ln TB_t = \alpha + \beta_1 \ln Y_t^M + \beta_2 \ln Y_t^W + \beta_3 \ln ER_t + \varepsilon_t$$

In this study, trade balance (TB) is defined as (X_t/M_t), where X_t, is the value of exports and M_t, is the value of imports. Hence, we examined these trade balance measurements to observe the J-curve effect.

With regard to the signs of the coefficients in Equation (6), it is expected that $\beta_1 > 0$ and $\beta_2 < 0$, since a rise in Romanian (world) income would lead to an increase in Romanian imports (exports), thereby deteriorating (improving) the trade balance. As for the effect of exchange rate, it is expected that $\beta_3 > 0$, since the depreciation of the RL increases exports and decreases imports, thereby improving the trade balance.

The ARDL approach involves estimating the error correction version of the ARDL model for variables under estimation (Pesaran et al., 2001). From equation (6), the ARDL model of interest then can be written as follows:

$$\Delta \ln TB_t = \propto_0 + \sum_{i=1}^{p} \varepsilon_i \, \Delta \ln TB_{t-i} + \sum_{i=1}^{p} \theta_i \, \Delta \ln Y^M{}_{t-i}$$

$$+ \sum_{i=1}^{p} \varphi_i \, \Delta \ln Y^W{}_{t-i} + \sum_{i=1}^{p} \gamma_i \, \Delta \ln ER_{t-i} +$$

$$\lambda_1 \ln TB_{t-1} + \lambda_2 \ln Y_{t-1}^M + \lambda_3 \ln Y_{t-1}^W + \lambda_4 \ln ER_{t-1} + \mu_i$$

where Δ is the difference operator; p is lag order; and μ, is assumed serially uncorrelated. equation (7) is the error correction version related to the ARDL, since the terms with the summation sign (∑) represents the short-run dynamics between the trade balance and its main determinants (i.e., J-curve effect) while the second part {term with λ. 's) corresponds with the long-run (cointegration) relationship. The null hypothesis in

equation (7) is defined as H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$, indicating the non-existence of a long-run relationship.

The ARDL model has certain econometric advantages in comparison to the standard cointegration methods (for example, Engle and Granger 1987; Johansen 1995). First, the ARDL model is applicable irrespective of whether the underlying regressors are purely I (0), purely I (1) or mutually cointegrated. In other words, this approach does not require the same order of integration among variables and pre-testing for unit roots. Second, the ARDL model applies a sufficient number of lags to capture the data generating process in a dynamic framework of a general-to-specific modeling. Third, an error-correction model (ECM) can be derived from the ARDL model through a simple linear transformation. The ECM captures the short-run dynamics while restricting the long-run equilibrium. The ARDL thus estimates the short and long-run parameters of the model simultaneously. Finally, for small sample size, the ARDL model is more robust and performs better compared to the standard cointegration methods (Pesaran and Shin 1999).

The total value of imports and exports for Romanian plywood were obtained from the Food Agriculture Organisation (FAO) CD-ROM provided by the Forestry Department of Romania {FDR). All of the data are on an annual time series basis from 1970 to 2010. The Romanian trade balance (TB,) is then expressed as mentioned above.

The Romania real income and average world real income (Y_t^M and Y_t^W) are measured as real GDP index (2000 = 100) and are taken from the International Financial Statistics (IFS) published by the International Monetary Fund (IMF). The Romania - European Union (EU) real exchange rate (ER_1) was gathered by the Economic Research Service (ERS) in the European Union Department of Agriculture (EUROA) and e_1 is the error term. Since the exchange rate is expressed as Leu Romania (RL) per USO, a decline in exchange rate indicates a real depreciation of the euro. We have selected RL per euro exchange rate because all Romanian imports and exports of forest products are typically quoted in euro. Finally, it is noted that since all variables are converted into natural logarithms, the estimated coefficients can be interpreted as elasticity.

4. Empirical Results

The ARDL approach in this analysis involved several steps (see Pesaran 1997) for more details), while the data analysis involved using econometric software, Microfit 4. We excluded the unit root test as the ARDL model is applicable irrespective of whether the underlying regressors are purely 1(0), purely 1(1) or mutually cointegrated. Hence, in the first step, the determinant of forest products trade balance in Romania namely fibreboard, particle board and pulp for paper was estimated. The second step estimated the long-run coefficient of forest products trade balance and lastly the short-run error correction representation for the selected ARDL model of Romanian forest products trade balance was estimated.

The methods adopted in the past literature mainly concentrated on the cases in which the underlying variables were integrated in order 1(1) form (Pesaran et al., 2001). The ARDL approach has some advantages over the other approaches. First, the series used does not have to be 1(1) (Pesaran and Pesaran, 1997). Second, even with small samples, a more

efficient cointegration relationship can be determined (Ghatak and Siddiki, 2001). Finally, according to Laurenceson and Chai (2003) the ARDL approach overcomes the problems resulting from non-stationary time series data that lead to spurious regression coefficients that are biased towards zero.

The next step was to test the cointegration of this model using bounds test in ARDL model. The results indicate evidence of a cointegrating relationship for Romanian forest products trade balance given that the computed F-statistic is greater than the upper bound critical value at 1, 5 and 10 per cent level of significance for particle board, fibreboard and pulp for paper respectively (Table 2).

Subsequently, we employed the model to estimate the coefficient of the long-run relationships. More specifically, the long-run model can be estimated from the reduced form solution of equation (7), when the first-differenced variables jointly equal to zero. The lag lengths were determined by Schwartz Bayesian Criteria (SBC) criterion following the suggestion from Pesaran and Pesaran (1997). The long-run test results (Table 3) reveal that the coefficient of exchange rate and the income variable signs of the Romanian forest products trade balance model are as expected. Most are insignificant except for income variables (Romanian income and average world income) in pulp for paper trade balance. More specifically, the Romanian forest products trade balance has a positive long-run relationship in real exchange rate with the various countries in the world. This implies that the depreciation of the RL indeed improves the trade balance in the long-run. In addition, the Romanian forest products trade balance has a positive long-run.

Table 2. *Cointegration results of bounds test for equation of trade balance in Romanian forest products*

variable:lnTBlnY^{M}lnY^{W}lnER				
Trade balance			Computed f-statistic	
Fibreboard			5.46**	
Particle board			4.54***	
pulp for paper			4.25*	
			Critical value	
		Lower-bound		Upper-bound
	11% significant level	2.617		3.654
	6% significant level	2.957		4.254
	2% significant level	3.654		5.996

Note: The bounds critical values are obtained from Narayan (200S); Appendix: Critical values for the bounds test; Case II: restricted intercept and no trend (k = 3), ** Significant at S %.

Table 3. *Estimated long-run coefficients equation for trade balance in Romanian forest products*

Trade balance	Exchange rate	Romanian income	Average world income	Constant
TB_t	ER	Y_t^M	Y_t^W	
Fibreboard	6.51(0.69)	31.62(0.42)	-64.01(0.31*)	142.7(0.55)
Particle board	1.01(1.09)	2.46(0.92)	-5.96(0.84)	-11.06(0.61)
pulp for paper	0.52(0.22)	2.61(**0.06)	-7.92(***0.01)	15.37***(0.02)

Note: ***Significant at 1 %, **Significant at S %, *Significant at 10 %. Figures in parentheses are p-values.

Relationship with real domestic income and a negative relationship with average world income. This suggests that a rise in real Romanian (world) income leads to an increase in the domestic (world) demand for world import (domestic exports), thereby worsening (improving) the trade deficit.

Finally, the error correction model [denoted by ecm (-1) in Table 4] is estimated by the ARDL approach to capture the short-run dynamic effects of depreciation on the trade balance or the J-curve effect. The coefficient of the exchange rate sign determines the existence of the J-curve effect. Thus, an initially negative sign followed by a positive sign on the lag coefficients would be consistent with the J-curve phenomenon. However, the results show inconsistencies in signs to reflect the existence of the J-curve effect for forest products trade balance in the short-run analysis. Most of the signs show a positive relationship even at the current year exchange rate except for particle board (Table 4). It is statistically insignificant for most of the parameters used except for pulp for paper trade balance. This indicates that the exchange rate for the current year, lagged by one year and two years, are significant at 1, 10 and 5 per cent respectively in the pulp for paper trade balance. The results therefore indicate that there is no J-curve effect for the Romanian forest products trade balance with the world market.

Table 4. Estimated short run coefficient of exchange rate and error correction term based on Autoregressive Distributed Lag (ARDL) Model.

Trade balance	ΔER_t	ΔER_{t-1}	ΔER_{t-2}	ΔER_{t-3}	ΔER_{t-4}	ΔER_{t-5}	ecm(-1)
Fibreboard	7.01	-8.02	9.74	3.74	4.65	2.61	-0.60***
	(0.96)	(1.03)	(0.66)	(1.02)	(1.12)	(1.03)	(0.00)
Particle board	-1.19	-2.36	-1.13	0.69	0.89	0.50	-0.40**
	(1.01)	(0.68)	(1.01)	(0.81)	(0.96)	(0.76)	(0.04)
Pulp for paper	3.45***	-3.63*	2.31**	0.36	0.38	-0.64	-0.41***
	(0.00)	(0.02)	(0.04)	(0.74)	(0.75)	(0.13)	(0.00)

Note: ER, is the Romanian official exchange rate. ecm(-1) refers to the error correction term i indicates the first difference of a variable. ** denotes significance at 5%. Figures in parentheses are p-values.

Notice that the error correction term is found to be negative and statistically significant for fibreboard, particle board and pulp for paper at the 1, 5 and 10 per cent level respectively. These confirm the existence of a long-run relationship between dependent and independent variables. The finding further justifies the cointegration of the ARDL model of the Romanian forest products trade with the world market.

5. Conclusions

This paper examines the hypothesis of the J-curve for the Romania-world trade in Romanian forest products trade for fibreboard, particle board and pulp for paper. For this purpose, the ARDL approach of cointegration was used to estimate annual Romanian trade balance of forest products from year 1990 to 2014. We did not find any evidence of the J-curve phenomenon for trade balance in forest products. However, there was a significant cointegration of exchange rate and trade balance in pulp for paper in the short-run analysis. This implies that in the short-run, Romania will increase (decrease) the trade

balance for its pulp for paper trade, if the exchange rate depreciates (appreciates). Similarly, our results showed that the nation's real income and average world real income are significant factors influencing the Romanian pulp for paper trade in the long-run. It is also found that an insignificant causality between exchange rate and the remaining forest products trade (fibreboard and particle board) in the short-run as well as in the long-run exists. This implies that the exchange rate does not play an important role in determining fibreboard and particle board trade balance for both the short and long-runs.

The results for fibreboard and particle board trade were consistent with those of Buongiorno et al. (1998) and Baek (2007). For example, Baek (2007) showed that a real depreciation of the euro may not be useful in increasing exports of forest products in the short-run. However, this result is in contrast with Bolkesjo and Buongiorno (2006) who found a substantial short-run effect of exchange rate on forest products trade. This finding further reveals that the increasing Romanian forest products (fibreboard and particle board) trade surplus and pulp for paper trade deficit with the decline in the value of the RL during the period of study cannot be explained by the J-curve effect. This is because the sign of the estimated coefficient of the exchange rate failed to determine the existence of the J-curve effect. As mentioned in the introduction part, for the J-curve to exist, it should start with the negative sign followed by a positive one on the lag coefficients. However, we found no persuasive evidence of the J-curve. Hence, we failed to accept the assumption of Marshall-Lerner (ML) condition that after a depreciation, an initial deterioration in the trade balance occurs before an improvement is realised.

On the other hand, the results in this study found that the exchange rate plays a vital role in determining the short-run behaviour of Romanian forest products trade balance with the world market in the case of pulp for paper only. This suggests that any fluctuation of the exchange rate of the RL against the EURO would affect the international trade of pulp for paper products.

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