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In this paper we compute the foreign trade multiplier on Romanian exports and imports data during 1990-2008. Our motivation comes from the need to determine the trade performance and trade efficiency using proper indicators. The multiplier of foreign trade is highly quoted in the literature but little empirical work –even the easiest one– is done particularly in the case of Romania. We compare direct calculus based on time series data and simple regression analysis results. Based on these results, we conclude that foreign trade multiplier proves to be difficult in explaining correctly the relationship between trade and income for the Romanian case.

Keywords: foreign trade multiplier, open economy, marginal propensity of imports

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1. Introduction

The multiplier became of great importance in economic literature, especially after Keynes has discussed it in his famous book “General Theory of employment, interest and money” in 1936. The author sees the theory of multiplier as an integral part of his conception of employment. In his opinion, the multiplier tells that when an increase of global investments occurs, the income will grow with the level of multiplier of investments [5].

Harrod developed a multiplier for the foreign trade, on the same principles as the ones of Keynes multiplier of investments [2]. The multiplier of foreign trade shows how much increases the national income at a one-unit growth of exports [1]. But can we rely on this indicator when characterizing the trade performance of a country?

As studies like [1] and [6] argues on the importance of computing the multiplier of foreign trade when characterizing the trade performance, the objective of this paper will be to compute the trade multiplier and interpret the results on the empirical data of the Romanian economy. Our motivation toward this study comes also from the general task of finding the most suitable tools for empirically analyse the trade performance and efficiency for Romania.

To pursue our goal that consists in trying to compute the multiplier, we will calculate it in a deterministic way. We will investigate how the multiplier performs on the Romanian case, considering yearly data from 1990 to 2008. Results are helpful to see the impact of trade upon the economic growth of Romania particularly through the multiplier indicator. This indicator is much discussed from the theoretical perspective but we found very little empirical work, particularly for the case of Romania or other emergent countries.

The paper develops as follows. Section 2 introduces the formalization of the foreign trade multiplier. Section 3 computes the multiplier using the direct way supplied by the multiplier formula, for successive years. Section 4 tries to estimate the indicator for the whole period of study, using the regression technique from econometrics. Section 5 will discuss the results and conclude the paper.

2. Foreign trade multiplier: theoretical aspects

We will present the derivation of the foreign trade multiplier as in [1]. Reviewing [2] is useful for a reader interested how the debate over the indication evolved, when Keynes and Harrod proposed their ideas.

Richard Kahn (1931) was the first who generated a formal idea of a multiplier, applied for the economic topic of employment. He made the assumption that there is a distinction between wage goods and capital-intensive goods industries. Later, Keynes (1936) developed an income multiplier. We will shortly review the formal derivations toward the formula of the multiplier.

In a closed economy, the Keynesian equation of income states that, where Y is the income, C the consumption, I the investments and G the government consumption. The consumption can be expressed as a function of the level of the income $C = cY$, where c is marginal propensity to consumption. Furthermore, the marginal propensity to consumption can be stated as $s = 1 - c$,

where s is the marginal propensity to savings. We should note that $\frac{\partial C}{\partial Y} = c$ with $\frac{\partial C}{\partial Y} > 0$. If the

assumptions that consumption is endogenous is made and we consider that it depends on income; investments and government consumption thus the equation of the income can be rewritten as $Y = cY + I + G$. Therefore, we can infer that

$$Y = \frac{1}{1-c}(I + G) = \frac{1}{s}(I + G) \quad (1)$$

which represents the equation for the multiplier of investments. Therefore, the multiplier effect of investments to income is directly proportional to the marginal propensity of consumption. If the propensity to saving lowers to zero, the multiplier tends to infinite and if it is equal to 1, there is no consumption and the multiplier becomes 1.

Considering an open economy, the Keynesian model is extended as $Y + M = C + X$, where M represents the imports and X the exports. If we assume that investments are exogenous and we fix them at a given level $I = I_0$, the global demand is $C = C_0 + cY + I_0$ where C_0 represents the autonomous consumption. By replacing the global demand in the above-mentioned equation, we obtain

$$Y = \frac{1}{1-c}(C_0 + I_0 + X - M) \quad (2)$$

If we are interested how the national income varies at a growth of exports, we can compute the partial derivative of income with respect to exports, in an open economy, $\partial Y / \partial X = 1 / (1 - c)$.

Assuming that imports vary linear with the levels of national income, $M = M_0 + mY$ - with m the marginal propensity to import, we can derive the formula of the trade multiplier:

$$M_x = \frac{1}{1-c+m} \quad (3)$$

The multiplier of exports has a low value as the marginal propensity of imports is high, respectively as the degree of openness of the country based on imports is higher. It also depends directly with the marginal propensity to consumption.

3. Direct estimation of the foreign trade multiplier

A first handy calculus for estimating the foreign trade multiplier is based on the above-mentioned formulas where

$$m = \frac{\Delta M}{\Delta Y} = \frac{M_1 - M_0}{Y_1 - Y_0} \quad \text{and} \quad c = \frac{\Delta C}{\Delta Y} = \frac{C_1 - C_0}{Y_1 - Y_0} \quad (4)$$

where indices 0 and 1 represents 2 successive periods of time.

Simply applying the formulas (3) and (4) for two successive periods of time for the Romanian data from 1990 to 2008, we obtained the results of table 1.

Table 1 Multiplier of exports (or foreign trade) on the period 1990-2008, computed for every two successive periods of time

Year	Multiplier
1990	-
1991	2.176103
1992	1.596276
1993	2.156263
1994	2.227097
1995	1.960436
1996	1.837958
1997	2.345988
1998	4.5226
1999	1.79271
2000	1.588561
2001	1.634728
2002	1.461164
2003	1.501683
2004	0.816769
2005	-2.19231
2006	1.219734
2007	0.781878
2008	0.91956
Mean	1.574844

SOURCE: Own calculus on data from Statistical Yearbook of Romania, 2007, Eurostat, World Bank indicators for years 2007 and 2008

We observe that the values obtained are high and very unstable, fact that determines us to be strongly uncertain in what concerns the relevance of this indicator. We can evaluate the results, for examples stating that in the year 1992 with respect to the year 1991, the national income grew for 1.59 times at a unit grow of exports. An interesting value is that obtained for the year 2005, when the propensity to consumption exceeded 1. During this year, a high number of loans were given and the consumption increased a lot. This fact meant that the multiplier effect of exports on income vanished. The situation came to normal in the year 2006 when income grew 1.21 at a unit growth of exports. However, we can see that the accession of Romania to the European Union did not bring a very positive impact if we observe solely the multiplier indicator of foreign trade performance. A detailed analysis in the structure of exports would give us a more specific view on this aspect. The complete liberalisation of foreign trade after the year 2004 when Romania became a full member of the European Union meant the increasing of exports but also the increase in imports. Much of these imports were consumption oriented and this is revealed through the negative sign of the indicator in 2005 and small values in the next years. As a policy recommendation, we would state here that in order to achieve a better trade performance, Romania should focus on importing more technological goods and exports more value added products. In this way, steps to diminish the gap between Romania and the other old members of the European Union would certainly being taken.

It is difficult to express a general opinion about this indicator, as the values are calculated in chain, but we definitely can say that for Romania the instability is highly expressed by the multiplier of foreign trade.

More, if we want to assess a value for the overall study period, the only alternative is to consider the mean of the values which is 1.57. When we computed the standard deviation, we, however

obtained a high value for these values so there is no doubt that another techniques of computing the multiplier are required.

4. Regressions for assessing the multiplier of foreign trade

The idea of computing the multiplier with regressions comes from the formulas (4) by passing them to limit. Therefore,

$$m = \frac{dm}{dy} \text{ and } c = \frac{dc}{dy} \quad (5)$$

Therefore, equations (6) can be derived.

$$\begin{aligned} M &= mY + M_0 \\ C &= cY + C_0 \end{aligned} \quad (6)$$

Regressions can be employed directly with these equations, or considering their log form. Bairam (1997) specified in a similar way the multiplier of foreign trade, while Ghani used those specifications to compute the multiplier for more than 60 countries [4].

We will consider therefore, the following regressions:

$$M = mY + M_0 + \varepsilon_M \quad (7.1)$$

$$C = cY + C_0 + \varepsilon_C \quad (7.2)$$

$$\log M = m \log Y + m_0 + \varepsilon_m \quad (7.3)$$

$$\log C = c \log Y + c_0 + \varepsilon_c \quad (7.4)$$

We will try to estimate the parameters m and c by simple linear regression, during 1990-2008, for the case of Romania. As we have only 18 observations we intend to test the stability of the multiplier, by removing out of the model the first and the last statistical observations. Therefore, we will employ the analyses on 3 samples: 1990-2008, 1991-2008 and 1990-2008. We will estimate the multiplier both using the equations (6) and using the log forms of those equations.

Table 2 depicts the results.

Table 2. Estimating parameters m and c using linear regressions

Equation	m/c	F stat	T stat	DW statistic
7.1	0.42	8687.315	93.2	1.24
7.2	0.67	329.6809	18.15	1.076
7.3	1.076	5848.332	103.2	1.83
7.4	0.99	9259.222	96.22	0.83

SOURCE: Own calculus on data

As we can see from table 2, t statistics for all coefficients is high enough in order to pass the Student test for the significance of the regression coefficients. Therefore, the hypothesis that the regressions coefficients do not differ significantly from 0 is rejected. In order to determine if the exogenous variable (in our case Y) influences in a significant way the values of endogenous variables (in our case M and C) we employed the variance method, by applying the F-test. As we can see, the computed F statistics is high, which express the fact that, based on the sample data, the exogenous variable influences in a significant way the dependent one. The Durbin Watson statistic shows that in the case of the log regression for m we can for sure accept the null hypothesis of no autocorrelation of errors.

In order to validate the regressions, we need to perform tests on the residuals. A first test is the one of the normality of the residuals. As we have a small sample (with only 19 observations), have applied the Lilliefors test [3]. The results of the Lilliefors tests showed us that we can rely

on log versions of the data as residuals are smaller than in case of using real levels. We also performed stability tests which revealed that log regressions are more stable than direct regressions. Therefore, we have another reason to consider log regressions as being better estimators for the marginal propensity to consume and to import indicators¹¹³.

Table 3 depicts the values of the foreign trade multiplier, computed with both methods, with log regressions and with direct regressions. We can observe that lower values are obtained with regression techniques than when computing the multiplier on two successive years.

Table 3. The foreign trade multiplier

<i>Equations</i>	Multiplier value
7.1, 7.2	1.33
7.3, 7.4	0.92

A value of 0.92 of the multiplier of foreign trade, states that an increase with one unit of exports leads towards a smaller increase in the income.

5. Conclusion

In this paper we tried to compute the Harrod multiplier of foreign trade for the case of the Romanian economy. Our motivation was to check if the multiplier could be used as a valid indicator for characterizing the trade performance of a country.

We started the paper by formalizing the multiplier of foreign trade. Therefore, we presented and computed the multiplier using two techniques: one based on the successive yearly data, and one based on the regression technique. The study period was between 1990 and 2008 and we considered nominal values in national currency for the GDP, imports and the national consumption. The critical years that changed more the situation were years 2004, 2005 when since Romania was full member of the European Union.

Starting from the theoretical presentation of the multiplier developed in section 2, this indicator was conceived for characterizing the influence of the foreign trade on the income of a country for two successive periods of time. Therefore, probably, the results of section 3 are the ones that come closer with the economical theoretical foundation of the multiplier. But, as the values vary substantially from year to year on the study period, this indicator cannot represent a reliable one for our purpose of characterizing the relation between external trade and the income, before and after accession to the European Union. We can notice that for the first half of the period the multiplier values are around 2, and for the second half of the period, the values are about 1.5. It follows that for the period of transition, with high inflation and quite high economical instability high values of the multiplier are obtained. As the economy gets more stable, the values of the multiplier are lower.

Computing the multiplier using regressions, we concluded that using log values of the data is more significant than using direct nominal values. We performed tests for the regression residuals and, under some small concerns we can say that the regressions are valid. Although statistically we can base only on the log computations, the obtained value is far apart from the values of table 1. The overall value of the multiplier is smaller than in the case when using successive periods estimations. Therefore, the conclusions do not remain the same. Even more, if no log data would be considered for the regressions, the overall results come closer with the reality. But, in this case, the statistical tests are not any more fulfilled, due to high variability of the input data.

Relying on the overall multiplier value computed with regressions, we can infer a lower influence of foreign trade on the gross domestic product. Anyway, the value we obtained is comparable

113 Table with results on Lilliefors test and stability test can be provided upon request

with the ones of [4], which reports a wide range of values for the Harrod foreign trade multiplier for different countries. Reviewing the findings of [4], no inference pattern can be drawn out, as between less developed and developing countries with a high value for the multiplier (like Brazil, Panama, Dominican Republic etc.) we can find countries with a good welfare as South Korea, Ireland, Italy etc. Developed countries like Austria, Germany, US, Spain, Sweden have a multiplier around unity, but in this category there are countries like Argentina, Uruguay, Nepal, Nigeria etc.

Based on our analysis, we can conclude that the Harrod foreign trade multiplier is not a good indicator for characterizing trade performance. Regarding this direction, our results could be influenced by the fact that we had only 19 yearly data available for analysis. Probably, the equations used for estimating the propensity to consumption and to imports should be more specified, and other relationships or supplemental variables need to be adopted for this.

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