TREND I VOLATILNOST PRIHODOVNIH UVJETA RAZMJENE U HRVATSKOJ; PERSPEKTIVA RASTA

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INCOME TERMS OF TRADE TREND AND VOLATILITY IN CROATIA; A GROWTH PERSPECTIVE

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In the age of globalization, both domestic and foreign factors play an important role in determining country's position on the world market, labelling that country as an open economy. Today, with few if any exceptions, all countries are open. Croatia is a small and open economy characterized with strong import dependency and external imbalances, thus any serious fluctuation on a global market can endanger its economic stability. Terms of trade as the ratio of export to import prices is an important indicator which improvement can contribute to economic stability and long-term growth. Namely, stable terms of trade facilitate efficient resource allocation and reduce inflationary pressures.

While movements in terms of trade trend affect domestic purchasing power and real income, significant terms of trade shocks can lead to macroeconomic instability. This paper adds up to a growing literature on the drivers of Croatian economic growth by examining how terms of trade and its fluctuations affect the economy. Particular attention is placed on the relationship between short and long-run growth perspective and the long-run consequences of the changes in income terms of trade. Empirical modelling is based on an augmented production function and was completed with the usage of cointegration equations and parsimonious error correction models, all suggesting results that are consistent with the theory.

Keywords:

income terms of trade; trend and volatility

Johansen cointegration method
- parsimonious VECM
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I. INTRODUCTION

Revival of discussions on the relationship between terms of trade and economic growth occurred in the mid 20th century with the works of R. Prebisch (1950) and Sir H. Singer (1950) both suggesting that terms of trade of (mainly) developing countries have deteriorated over time. So-called *Singer-Prebisch hypothesis* is by many seen as an extended concept of Schumpeter's '*creative destruction*' which evaluates the background of global divergence (Raffer, 2005). Hence, global divergence and deterioration in terms of trade are often used to explain difference in income (income gap) and gross domestic product (growth perspective) between developing and developed countries. Terms of trade as a ratio of export to import prices reflects changes in relative prices and in such manner it is important indicator which improvement can contribute to economic stability, namely because it has three positive effects: (1) amplifies growth potentials, (2) increases import capacity and (3) improves capability for serving debts. Economic theory generally agrees that secular improvement in the terms of trade leads to higher levels of investment and long run-economic growth, while higher volatility in the terms of trade reduces investment and thus economic growth. Several studies have concluded that changes in terms of trade can account for half of the output volatility in developing countries (Fatima, 2010), meaning that fluctuations in terms of trade could have a stronger impact on national output than the trend variable. Croatia is a small – open – import dependent economy with strong trade imbalances, as well it is highly indebted country. However, Croatia is also a developing country with vast growth potentials, so it can be interesting to find out to what extent changes in terms of trade promote/limit growth perspectives. Contemporary literature in this area mainly includes studies that are based on cross-country analysis, where Croatia is mostly excluded. Another interesting aspect is calculation of income terms of trade for the Croatian economy. Such empirical issues justify the research framework of this paper.

The paper evaluates the impact of terms of trade on economic growth of Croatia by using the time series quarterly data for the period 1997Q1-2010Q1. Data are collected from Croatian Bureau of Statistics and International Financial Statistics. Terms of trade[4] are constructed from the national accounts data on nominal and real exports and imports, just as Botrić and Cota (2006), Belullo and Broz (2009), Tomić (2011) etc. Income terms of trade are then calculated simply by multiplying the export to import ratio with the export volume. The volatility of income terms of trade variable was obtained by using three different methods (historical volatility, GARCH model and H-P filter) in order to demonstrate its theoretical importance. In addition, the impact of oil price and real effective exchange rate on income terms of trade was examined as well. Unit root tests are based on augmented Dickey and Fuller (ADF), Phillip and Perron (PP) and KPSS test statistics, all suggesting that we are dealing with non-stationary time series. Empirical modelling of the relationship between income terms of trade, volatility in income terms of trade and economic growth was based on an augmented production function developed by Harrison (1996). *Ditto*, is estimated with the usage of Johansen cointegration method for the long-run and parsimonious vector error correction models (reduced VECM) for the short-run relationship. Research logic follows the work of Wong (2010) with few methodological improvements and conceptual adjustments.

This paper is organized as follows. Section 2, after the introduction, discusses the theoretical background and the literature review of terms of trade and related issues. While Section 4 reviews

[4] *Due toa better data availability this paper uses goods and services terms of trade rather then the goods terms of trade. This implies that we use very broadened type of barter terms of trade. Since income terms of trade are calculated from this variable, we have to be very carefull in our conclusions.*

used data and methodology, Section 5 presents empirical results on the subject. Section 6 provides some concluding remarks.

II. THEORETICAL BACKGROUND AND MAIN EMPIRICAL FACTS

The debate of whether or not there has been a secular decline in terms of trade of developing countries has been alive since the contributions of Prebisch (1950) and Singer (1950). R. Prebisch, along with Sir H. Singer argued that specialization in primary commodities, combined with a relatively slow rate of technical progress in the primary sector and a negative trend in the commodity terms of trade in fact caused developing economies to lag behind the industrialized world (Cuddington, Ludema and Jayasuriya, 2002). Ultimately they concluded that terms of trade of commodity exporting countries, mainly developing countries had deteriorated and would continue to deteriorate as long as they were to be specialized in production of these types of products (Wong, 2004). Their work is today recognized as famous *Singer – Prebisch hypothesis*[5]. Aside from the dilemma of how this decline occurs, there still remains an important question: 'what happens to the economy which is experiencing declining (or rising) terms of trade, in the context of economic growth'?

Much of the contemporary literature analyzes the relationship between terms of trade and economic growth based on cross-country evidence. Most of them suggest that the improvement in terms of trade will lead to an increase in investment and consequently to economic growth (see Barro, 1991; Barro and Sala-i-Martin, 1995; Mendoza, 1997; Bleaney and Greenaway, 2001; Blattman et al., 2007; Sala-i-Martin, 2004; Eicher et al., 2007; Urban, 2007). Namely, an increase in export prices relative to import prices allows a larger volume of import to be purchased with a given volume of export. The implied increase in the real purchasing power of domestic production is seen as a transfer of income from the rest of the world and can have substantial effect on consumption, savings, investment and growth. Terms of trade can also be seen as a rate of return on investment and therefore a secular improvement in terms of trade can lead to an increase in investment and hence economic growth (Borkin, 2006). However, some studies have shown that this relationship is ambiguous. Sachs and Warner in 1995 and 2001 likewise Hadass and Williamson in 2001 found that the growth performance, especially of developing countries, was hampered by global terms of trade shocks; they suggest it could be due to what has come to be known as «resource course[6]». Furthermore, there is interesting relation between 'basic' terms of trade (ratio of export prices to import prices) and income terms of trade (terms of trade multiplied with and index of the volume of export). Whereas, the 'basic' terms of trade just measures variations in prices, the income terms of trade includes the effect of the changes in volume of quantities exported. This means that 'basic' terms of trade could decline even though income terms of trade improve since the quantities of export could grow at the larger scale. Income terms of trade measure reveals whether the country would end up with net gain or net loss as a result of changes in terms of trade and export volume, which *de facto* depends on the elasticity of demand for its export or in broader terms on *Marshall-Lerner condition* (Fatima, 2010). In such manner it would be interesting to observe how changes in income terms of trade determine Croatian long-term economic prospect. This statement becomes even more important as Grirmay, Sharma and Grabowski in 1999 suggested that income terms of trade instability is in a long-run relationship with output since they are both negatively related to each

[5] *Secular deterioration of commodity terms of trade of developing countries, as observed by Prebisch and Singer in fact destroyed the established orthodoxy of mutually beneficial world markets.*

[6] *This phenomenon suggest that resource – rich countries generally grow more slowly than resource – poor countries and any relative price shock that increase the value of these resources will hamper development.*

other. Similar conclusion was reached by Lutz (1994) and Bleaney and Greenaway (2001) (Borkin, 2006).

This brings us to next important subject i.e. how fluctuations in terms of trade affect economic growth. Unlike the controversy surrounding relationship terms of trade – growth, it is generally agreed that terms of trade volatility has negative effect on economic growth (Edstrom and Singer, 1992; Mendoza, 1997; Turnovsky and Chatopadhyay, 2003; Blattman et al, 2007). Such studies are usually tested through uncertainty in investment decisions where increased volatility/uncertainty is associated with an increased risk. Since terms of trade could be perceived as a return of investment, increased risk generally leads to a reduction in investment and consequently lower economic growth (Borkin, 2006). Mendoza (1997) found strong evidence of a robust negative effect of terms of trade volatility on growth, whilst volatility as a variable showed to be much more important factor in explaining output volatility then the trend variable. As Williamson (2008) points out, researchers generally agree that terms of trade shocks are a key source of macroeconomic instability (especially in commodity export countries), but until very recently, they paid far less attention to the long-run growth implications of such instability. In order to meet the 'condition', this paper also tries to evaluate the effect of fluctuations in (income) terms of trade on economic growth in Croatia. As mentioned, changes in terms of trade can occur, last over time (as shocks, trends...) and have substantial repercussions; thereby this topic could be interesting in certain aspect of economic theory and empirics for Croatian macroeconomic management[7].

III. ECONOMETRIC MODELLING – METHODOLOGY AND DATA

Empirical model used to estimate the impact of income terms of trade and volatility of income terms of trade on economic growth in Croatia (as well as to assess the impact of selected variables on income terms of trade) is based on an augmented production function developed by Harrison (1996). Within the alternative approach, Harrison introduced openness to international trade as an independent variable in estimating the relationship between terms of trade and economic growth[8]. In such manner, an increase in terms of trade is seen as a channel through which technological progress spills-over in domestic economy. This paper, on the other hand includes two different measures directly related to terms of trade, namely income terms of trade and volatility in income terms of trade. For the purpose of estimating long-run relationship between the variables Johansen method of cointegration was used, whereas short-run relationship was estimated by modelling parsimonious vector error correction model (reduced VEC model or VECM). All the variables are previously tested for unit roots and examined for cointegration conditions.

Quarterly data are collected from Croatian Bureau of Statistics (CBS) and International Financial Statistics (IFS) for the period 1997Q1-2010Q1. All data were seasonally adjusted using Census X12 seasonal adjustment procedure and then transformed in their logarithmic form. Since the unit value index methodology, used by the Croatian Bureau of Statistics for obtaining import and export price indices, has been changed in 2002, the terms of trade variable had to be constructed. The variable is constructed based on the national accounts data on nominal and real exports and

[7] *For interesting discussion on terms of trade and related issues such as Harberger – Laursen – Metzler effect, exchange rate variability, debt service pressure etc, look at Tomić (2011).*

[8] *Augmented production function developed by Harrison (1996) is based on New growth theories which imply that all variables are treated as endogenous. Such position would be established for all variables included in the basic model. This type of modelling showed its applicability in the works of Wong (2004, 2010); research logic of this paper follows it with few methodological improvements and conceptual adjustments. The most important being that short-run relationship is estimated with the help of parsimonious VECM which is logical continuation when different normalization and variable restrictions are introduced, contrasting Wong's logic of getting back to VAR model and estimating general forecast error variance decomposition and general impulse response function (see Korap, 2007).*

imports[9]. Service sector plays an important role in Croatian economy, thereby terms of trade indicator includes prices of both, goods and services. Income terms of trade (**lnITOT**) variable is then calculated simply by multiplying the basic terms of trade measure with the export volume. The volatility of income terms of trade variable was obtained by using three different methods: historical volatility (**VITOT1**), GARCH model (**VITOT2**) and H-P filter (**VITOT3**) in order to demonstrate its theoretical, as well as empirical importance (see Appendix). Historical volatility is based on the observed (realised) movements of variable over a historical period. i.e. on historical moving standard deviation and it is widely used measure for volatility. For the second variable we used more sophisticated volatility estimation procedure, namely GARCH (1,1). Third variable of volatility term of trade variable was constructed using the Hodrick-Prescott (HP) filter. In order to extract the business cycle component that presents the volatility measure of the variable we used smoothing parameter λ of 25600 which penalizes the acceleration in the trend component relative to the cycle component. Higher λ was used because it exhibits lower variability and smaller persistence[10] (Franke, 2006). Other variables included in the model are: real gross capital formation (**lnK**), workers in manufacturing industry (**lnL**), ratio of banking claims on private sector over GDP (**lnFIN**), world oil price (**lnOIL**) and real effective exchange rate (**lnREER**) deflated with the consumer price index. Finally, national output approximating economic growth is expressed as real gross domestic product per capita (**lnGDPpc**). Dummy (**D**) variable for year 1999 was introduced in the short-run as an exogenous variable to correct possible parameter problems due to a fact that mentioned year has been quite unstable for Croatia, economically and politically as well (Kosovo crisis aftermath for tourism sector, growth of foreign and public debt, consequences of domestic bank crisis etc.).

[9] *Export/import prices are obtained as a deflator of the nominal volume of goods and services exports/imports from the national accounts.*

[10] *It might be argued that there is one value of λ for HP filter that is most commonly used for quarterly data (value of 1600), however there is no such convention as yet for the choice of the signal-to-noise ratio for the random walk variance (Franke, 2006). Gordon (2003) makes it clear that λ should not be taken for granted, i.e. the appropriate smoothing parameter should be considered for each time series in its own context.*

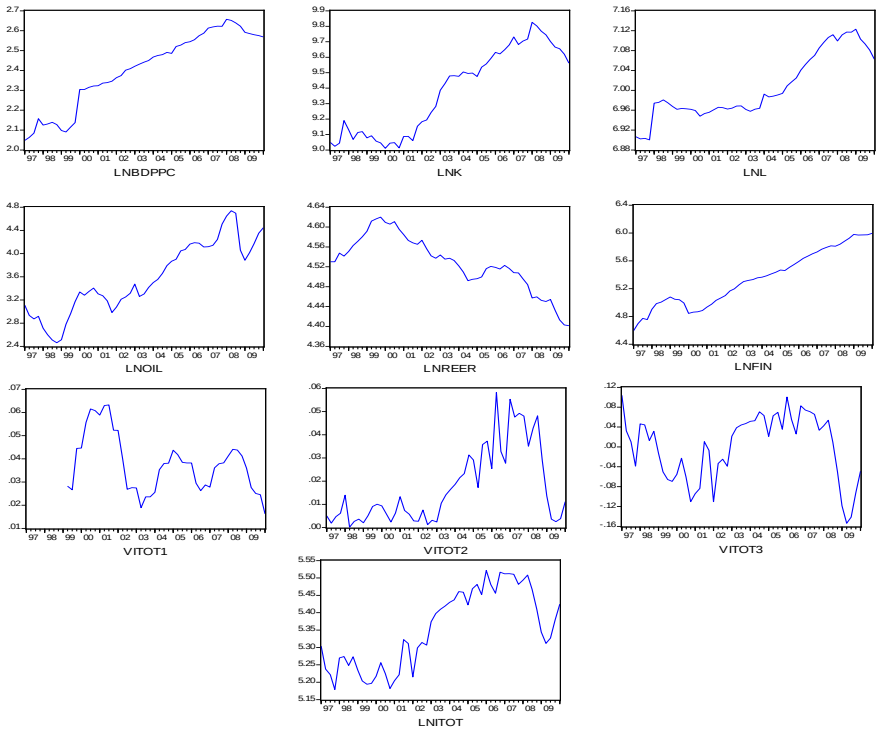

FIGURE 1—SELECTED VARIABLES (IN LEVELS)

Source: Author's calculation

Generally, all the variables showed positive growth trends in the observed period. This is especially noticeable after the year 2001 due to a political and economic stabilization. In the same period REER started slightly appreciating. That process lasted till the build up of a world economic crisis. Furthermore, we can notice strong boost of world oil prices after 2002, that had it peak in 2008 with the price of 147 $/barrel. Such economic situation, neglecting high prices of oil, made solid ground for the improvements in gross domestic product, personal incomes and wages, productivity, credits availability and etc. Very high (average) share of real consumption to real GDP of 61% strongly suggest that consumption was in fact a generator of Croatian GDP growth in the past and it still is. However, recent recession signified the imperfections of such growth path suggesting that due to volatile and unstable movements, consumption is in fact unreliable generator of growth. There is also relatively strong, statistically significant and stable correlation of real GDP with export and import, both of these variables showing high standard deviations. Therefore, by influencing its export and import, Croatia could determine or at least affect certain phase of business cycle. This implies that Croatia must seek its growth potentials by stimulating export towards the countries with strong foreign demand (such as EU countries). Income terms of trade, as well as volatility could play an important role in that path. *Figure 1.* suggests certain improvements in income terms of trade and its relatively stable volatility indicating stable macroeconomic framework (rise in consumer spending, investments, growth rates etc.), only world crisis in 2009 obstructing that positive trend. Graphic display indicates that Croatia's income terms of trade have changed over time and in a positive manner, which gives us an adequate base to study how this improvement affected economic growth perspectives.

Since all the variables have changed during time, we had to test them for the presence of unit root. For this purpose we used Augmented Dickey Fuller test (1979), Phillips-Perron test (1988)

and Kwiatkowski-Phillips-Schmidt-Shin test (1992). Generally, all tests confirmed the presence of unit root in the variables (see Appendix). Graphical displays of the observed variables also suggest that they are not stationary in levels. Based on the obtained results it can be concluded that all series are integrated of order I(1), i.e. they are stationary in their first differences. This assumption enabled us to consider cointegration method and VEC model in estimating augmented production function.

Engle and Granger (1987) indicated that a linear combination of two or more non-stationary series may be stationary. If so, for these series are said to be cointegrated. This linear stationary combination shows the long-run relationship among the variables and is called cointegrated equation. In order to test for cointegration, the methodology proposed by Johansen (1991, 1995) is used. Following that, unrestricted VAR model is then defined:

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + Bx_t + \varepsilon_t, \quad \varepsilon_t \approx IN(0, \Sigma), \tag{1}$$

where y_t is a k-vector of non-stationary I(1) variables, x_t is a d-vector of deterministic variables, ε_t is a vector of independently normally distributed errors with mean zero and covariance matrix Σ, while A and B are matrices of parameters. Model (1) can be reformulated into a vector error correction model, VEC model[11]:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + Bx_t + \varepsilon_t, \tag{2}$$

where

$$\Pi = \sum_{i=1}^{p} A_i - I, \quad \Gamma_i = -\sum_{j=i+1}^{p} A_j. \tag{3}$$

Number of lags in the VAR model is determined using standard information criteria (AIC, HQ, SC, FPE, LogL and LR tests)[12]. Although the criteria indicated roughly similar number of lags, the final model was estimated using one lag as suggested by SC and HQ test being the most restrictive ones. For determining the number of cointegrating vectors the Johansen's reduced rank procedure was introduced. Considering that five different models have to be evaluated, similar estimations were executed in every step of the way. Estimations were made by including constant and trend in the cointegration space following the results of LR test and trend component that was perceivable in the graphical displays of the variables.

Sometimes we can detect more than one cointegrating relationship in a system with more than two variables using Johansen procedure. In that situation, reduced rank regression procedure in fact provides information on how many unique cointegrating vectors span the cointegration space, while any linear combination of the stationary vectors is itself a stationary vector and thus the estimates produced for any particular column in β are not necessarily unique. This can easily be seen by nothing that $\alpha\beta' = \alpha\xi^{-1}\xi\beta' = \alpha^*\beta'^*$ where ξ is any rxr non-singular matrix. Namely if we can find a ξ matrix that transforms β into β^*, we still have the same unique number of cointegration vectors, but the vectors themselves are not unique. This would be a major

[11] *Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank $r < k$, then there exist $k \times r$ matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is I(0). r is the number of cointegrating relations (the cointegrating rank) and each column of β is the cointegrating vector. The elements of α are known as the adjustment parameters in the VEC model and p is the number of lags.*

[12] *AIC-Akaike Information Criterion, FPE-Final Prediction Error, HQ-Hannan-Quinn Information Criterion, SC- Schwarz Information Criterion, LogL – Log likelihood Criterion and LR – Likelihood ratio Criterion.*

limitation if we could not determine unique structural relationships for each cointegrating vector.

Therefore, since the Johansen approach only provides information on the uniqueness of the cointegration space, it will be necessary to impose restrictions motivated by economic arguments (e.g., that some of the βij are zero, or that homogeneity restrictions are needed such as $\beta_{1j}=-\beta_{2j}$) to obtain unique vectors lying within that space and then test whether the columns of β are identified (Korap, 2007). If needed, zero restriction could also be placed upon short term dynamics on α. In line with conditions, in specified models we applied unitary *lnGDPpc* homogeneity restriction in the first vector and *lnITOT* or *VITOT* homogeneity restriction in the second vector, following a zero restrictions on other β and some α coefficients (meaning that some weak exogenity restrictions are imposed as well). For this purpose, LR test for binding restriction was evaluated suggesting that all identifying restrictions in all the models could not be rejected, ultimately meaning that models are correctly specified. Hence, long-run empirical models evaluating the relationship between economic growth, income terms of trade and volatility income terms of trade (as well as prices of oil and exchange rate) are specified as follows[13]:

Model I:

$$lnGDPpc_t = \beta_{10} + \beta_{11}\, lnITOT_t + \beta_{12}\, lnK_t + \beta_{13}\, lnL_t + \beta_{14}\, lnFIN_t + \varepsilon_{1,t} \quad (4)$$

$$lnITOT_t = \beta_{20} + \beta_{21}\, lnOIL_t + \varepsilon_{2,t} \quad (5)$$

Model II:

$$lnGDPpc_t = \beta_{30} + \beta_{31}\, lnITOT_t + \beta_{32}\, lnK_t + \beta_{33}\, lnL_t + \beta_{34}\, lnFIN_t + \varepsilon_{3,t} \quad (6)$$

$$lnITOT_t = \beta_{40} + \beta_{41}\, lnREER_t + \varepsilon_{4,t} \quad (7)$$

Model III:

$$lnGDPpc_t = \beta_{50} + \beta_{51}\, VITOT1_t + \beta_{52}\, lnK_t + \beta_{53}\, lnL_t + \beta_{54}\, lnFIN_t + \varepsilon_{5,t} \quad (8)$$

$$VITOT1_t = \beta_{60} + \beta_{61}\, lnOIL_t + \varepsilon_{6,t} \quad (9)$$

Model IV:

$$lnGDPpc_t = \beta_{70} + \beta_{71}\, VITOT2_t + \beta_{72}\, lnK_t + \beta_{73}\, lnL_t + \beta_{74}\, lnFIN_t + \varepsilon_{7,t} \quad (10)$$

$$VITOT2_t = \beta_{80} + \beta_{81}\, lnOIL_t + \varepsilon_{8,t} \quad (11)$$

Model V:

$$lnGDPpc_t = \beta_{90} + \beta_{91}\, VITOT3_t + \beta_{92}\, lnK_t + \beta_{93}\, lnL_t + \beta_{94}\, lnFIN_t + \varepsilon_{9,t} \quad (12)$$

$$VITOT3_t = \beta_{100} + \beta_{101}\, lnOIL_t + \varepsilon_{10,t} \quad (13)$$

In order to present short-run dynamics we have to estimate VEC model on the same, but now differentiated dependent variables using a reduced form (so-called parsimonious VECM) with differentiated independent variables (with lag $t=j$, $j=1,2,3,4$ having quarterly data) and $_{t-1}$ lag estimated error correction terms from the main cointegration relationship. Since all the variables in the main models are I(0), statistical inference using t and F test is *per se* valid (Harris, 1995). All estimations are not reported here but are available upon request. Parsimonious VECM is used since different α restriction made the models so restrictive we could not analyze impulse

[13] *Presented equations were modelled after evaluating number of different relations with two cointegration vectors including lnOIL and lnREER, leading us to best possible solutions with Model I and II. Next three models were developed in the same manner evaluating impact (and robustness) of the change in VITOT.*

response functions and variance decomposition for all the variables, but also because selected lag in the long-run was eliminated within the interpretation of the short-run meaning that we could not interpret Granger causality as well. In such manner, reduced form of VEC model is only possible path that can reveal short-run relationship between the variables.

IV. THE GROWTH EFFECT OF INCOME TERMS OF TRADE

Movements in (income) terms of trade reflect changes in relative prices, so it is often unclear how these movements affect real economy. Although this has been debated extensively in the literature, there is still no consensus about how trend in terms of trade impact economic growth (Borkin, 2006). Hence, this section might provide us the answer to this question in the case of Croatia. In addition, we will analyze how volatility in income terms of trade is affecting Croatian economy, since Mendoza (1997) found that terms of trade movements can account for roughly half of the output volatility of some developing countries.

A. Income terms of trade and economic growth

In order to evaluate long-run dynamics between the income terms of trade and economic growth (together with the price of oil and real exchange rate) within the augmented production we estimated Model I and Model II[14]:

$$lnGDPpc_t = \underset{(0,09)\ [-6,80]^{***}}{-9,49} + \underset{(0,08)\ [-4,96]^{***}}{0,60\, lnITOT_t} + \underset{(0,21)\ [-6,32]^{***}}{0,42\, lnK_t} + \underset{(0,10)\ [9,44]^{***}}{1,35\, lnL_t} - \underset{(0,00)\ [-9,82]^{***}}{0,96\, lnFIN_t} + 0,02\, TREND \quad (14)$$

$$lnITOT_t = \underset{(0,07)\ [5,76]^{***}}{5,94} - \underset{(0,00)\ [-10,29]^{***}}{0,41\, lnOIL_t} + 0,03\, TREND \quad (15)$$

$$lnGDPpc_t = \underset{(0,06)\ [-12,37]^{***}}{-2,28} + \underset{(0,06)\ [-2,28]^{***}}{0,76\, lnTOT_t} + \underset{(0,05)\ [3,72]^{***}}{0,15\, lnK_t} - \underset{(0,00)\ [-3,56]^{***}}{0,18\, lnFIN_t} + 0,01\, TREND \quad (16)$$

$$lnITOT_t = \underset{(0,19)\ [-9,78]^{***}}{-3,40} + \underset{(0,00)\ [-13,49]^{***}}{1,83\, lnREER_t} + 0,02\, TREND \quad (17)$$

Long-run dynamics showed expected mutual relations. Furthermore, LR test for binding restriction confirmed that all identifying restrictions in both models could not be rejected and diagnostic tests suggested that models are adequately estimated i.e. that characteristics of the models are acceptable[15]. Estimations show no problem of heteroscedasticity, normality of

[14] ***, **, ** represent 1%, 5% and 10% of statistical significance; (.) standard errors, [.] t-values.

[15] Model I: LR test for binding restriction: $\chi^2(7) = 6,78$ (p-value = 0,45***), Portmanteau test (4) = 143, 44 (p-value = 0,34***), LM autocorrelation test (4) = 33,40 (p-value = 0,59***). Model II: LR test for binding restriction: $\chi^2(10) = 14,17$ (p-value = 0,17***), Portmanteau test (4) = 164, 56 (p-value = 0,05**), LM autocorrelation test (4) = 48,06 (p-value = 0,09*). Also, AR roots and cointegration graphs suggest adequately determined and stable model.

residuals and of stability, which in fact enables stable conclusions. Due to a noticeable structural brake in time series (evident in *Figure 1*), dummy for 1999 is included in as an exogenous variable only present among adjustment parameters. All explanatory variables showed expected signs, except the financial development. Generally capital, labour and income terms of trade are found to be important contributors to the GDPpc growth. Negative sign of financial development variable could be related to an inadequate distribution of credits towards household instead to private sector which generates no multiplicative effect in output growth. Trend component also showed its positive tendency. Most importantly, improvements in income terms of trade lead to growth of GDPpc. One percent increase in income terms of trade would lead to 0,60% (Model I) and 0,76% (Model II) increase in GDPpc. This implies next. An improvement in income terms of trade means that more foreign exchange is generated by the sale of a given amount of exports and less foreign exchange goes to paying for a given amount of imports, including those needed for investment. This effect will presumably affect investment level and increase future growth perspectives. We may conclude that favourable trend in income terms of trade was exhibited in stronger average growth of the Croatian GDPpc. Next, we found relatively strong relationship between income terms of trade, oil price and exchange rate. Whereat an increase in oil price (which can lead to a spill-over effect on domestic prices) leads to a decrease in income terms of trade (-0,41%), depreciation of the kuna leads to an improvement of the income terms of trade (1,83%). Though the second relation should be reverse within the basic terms of trade scope (appreciation – increase in terms of trade; depreciation – decrease in terms of trade), since income terms of trade also include the volume of export it is logically that depreciation makes domestic products on world markets more cheaper, increasing in that way the volume of export, hence the income terms of trade. This conclusion is however doubtful considering possible exogeneity of Croatian income terms of trade, a low competitiveness of export products and the controversy over the J-curve effect Croatia.

Short-run dynamics is presented through the results of the parsimonious VEC models in the *Table 1* and *2*. Results in the short-run are mostly consistent with the long-run results, suggesting positive impact of all the variables, except the financial development. On the whole, income terms of trade variable is found to have a long-run as well as short-run positive impact on economic growth in Croatia. However, we found no evidence of short-run relation between the variables income terms of trade, oil price and exchange rate suggesting that oil price and exchange rate possibly do not converge to a long-run equilibrium. Weak exogeneity tests confirmed the expectations suggesting that these variables in fact amplify disequilibrium over time. Nevertheless, since we are mainly focused on the long-run behaviour and the properties of VEC coefficients, we might say that results are consistent over the time. Significant error corrections coefficients (***COINTEQ***) with right (negative) sign and diagnostic tests (LR test, ARCH test, test for normality of residual, White test, QLR and CUSUM tests, Chow test)[16] certainly proved above mentioned.

[16] *All diagnostic tests are available upon request.*

TABLE 1. RESULTS OF THE PARSIMONIOUS VECM OF MODEL I

Dependent Variable: **D(lnGDPpc)**				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0,026791	0,002462	10,88316	0,0000
D(lnITOT)	0,123606	0,048225	2,563114	0,0139
D(lnK(-1))	0,172583	0,046809	3,686959	0,0006
D(lnL(-1))	0,454952	0,156579	2,905581	0,0057
D(lnFIN)	-0,742901	0,056396	-13,17302	0,0000
D	-0,029938	0,007420	-4,035087	0,0002
COINTEQ01(-1)	-0,145852	0,025680	-5,679499	0,0000
Dependent Variable: **D(lnITOT)**				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0,021293	0,008823	-2,413220	0,0199
D(lnGDPpc)	0,553116	0,279088	1,981872	0,0536
D(lnGPDpc(-1))	0,335616	0,195238	1,719009	0,0925
D(lnFIN)	0,575554	0,204465	2,814926	0,0072
D(lnOIL(-1))	0,076029	0,038507	1,974449	0,0545
COINTEQ01(-1)	0,173185	0,075465	2,294908	0,0265

Normality of residuals: 0,75; LM (4): 0,03; ARCH (4): 0,53, CUSUM: 0,26, Chow (2001:3): 0,10
Source: Author's calculation

TABLE 2. RESULTS OF THE PARSIMONIOUS VECM OF MODEL II

Dependent Variable: **D(lnGDPpc)**				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0,027255	0,002525	10,79606	0,0000
D(lnGDPpc(-1))	-0,479118	0,113042	-4,238419	0,0001
D(lnITOT(-1))	0,117714	0,044878	2,622957	0,0121
D(lnK)	0,114468	0,042905	2,667935	0,0108
D(LNK(-1))	0,172399	0,045161	3,817440	0,0004
D(lnFIN)	-0,408316	0,068443	-5,965737	0,0000
D	-0,070522	0,009535	-7,395771	0,0000
COINTEQ03(-1)	-0,583072	0,103177	-5,651184	0,0000
COINTEQ04(-1)	-0,292117	0,065249	-4,476992	0,0001
Dependent Variable: **D(lnITOT)**				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0,015224	0,009297	-1,637448	0,1084
D(lnGDPpc)	0,450565	0,291010	1,548282	0,1284
D(lnGDPpc(-1))	0,410192	0,197954	2,072155	0,0439
D(lnFIN)	0,412095	0,215292	1,914118	0,0618
COINTEQ04(-1)	-0,076679	0,042649	-1,797936	0,0788

Normality of residuals: 0,36; LM (4): 0,03; ARCH (4): 0,08, CUSUM: 0,35, Chow (2002:2): 0,47
Source: Author's calculation.

B Volatility of income terms of trade and economic growth

In order to evaluate long-run dynamics between the volatility of income terms of trade and economic growth (along side the price of oil) within the augmented production we estimated Models III, IV and V. In continuation we present results of Model III:

$$lnGDPpc_t = -2{,}72 - 1{,}00\ VITOT1_t + 0{,}36\ lnK_t + 0{,}62\ lnL_t - 0{,}56\ lnFIN_t + 0{,}02\ TREND \quad (18)$$
(0,48) (0,04) (0,19) (0,09) (0,00)
[2,06]*** [-8,56]*** [-3,40]*** [6,18]*** [-8,30]***

$$VITOT1_t = -0{,}07 + 0{,}06\ lnOIL_t - 0{,}004\ TREND \quad (19)$$
(0,01) (0,00)
[-5,14]*** [7,37]***

Long-run dynamics again suggested expected mutual relations. In order to preserve space, results of all three models are collectively presented in *Table 3*. Again, LR test for binding restriction confirmed that all identifying restrictions in all models could not be rejected and diagnostic tests suggested that models are adequately estimated[17]. Estimations show no problem of heteroscedasticity, normality of residuals and of stability.

TABLE 3. LONG-TERM RELATIONSHIP BETWEEN THE SELECTED VARIABLES

β coefficients	*MODEL III*	*MODEL IV*	*MODEL V*
First cointegration vector (independent variable lnGDPpc)			
lnITOT	/	/	/
VITOT1	– 1,00	/	/
VITOT2	/	– 2,57	/
VITOT3	/	/	– 0,75
lnK	0,36	2,29	7,17
lnL	0,62	0,87	1,37
lnFIN	– 0,56	– 2,55	– 6,68
Second cointegration vector (independent variable VITOT)			
lnOIL	0,06	0,03	0,10

** all coefficients are significant at 1%*

*** only coefficients of interest are presented in the table (excluding trend component and variables (lnK and lnFIN) in the second cointegration vectors that helped in stabilizing the models)*

Source: Author's calculation.

Similar to previous two models, all explanatory variables showed expected signs, except the financial development. Namely, capital and labour are again found to be important contributors to the GDPpc growth, whereas all three variables presenting volatility in income terms of trade showed negative sign, which is consistent with economic theory and empirics. Trend component demonstrated its positive but weak tendency. Price of oil impact also indicated expected mutual relation with the volatility in income terms of trade.

[17] *Model III: LR test for binding restriction: $\chi^2(6)$ = 11,88 (p-value = 0,06*), Portmanteau test (4) = 144, 81 (p-value = 0,27***), LM autocorrelation test (4) = 37,09 (p-value = 0,41***). Model IV: LR test for binding restriction: $\chi^2(6)$ = 0,48 (p-value = 0,99***), Portmanteau test (4) = 160,54 (p-value = 0,08*), LM autocorrelation test (4) = 42,73 (p-value = 0,20***). Model V: LR test for binding restriction: $\chi^2(5)$ = 1,21 (p-value = 0,94***), Portmanteau test (4) = 151,11 (p-value = 0,19***), LM autocorrelation test (4) = 42,52 (p-value = 0,21***).*

Income terms of trade is found to be a relevant factor influencing economic growth, however results suggest that volatility in income terms of trade having immediate negative impact on GDPpc growth is even stronger factor that can generate or diminish growth perspective. This is consistent with the theoretical postulates and our expectations. One percent increase in volatility in income terms of trade would lead to a 1,00% (Model III), 2,57% (Model IV) and 0,75 (Model V) decrease in GDPpc. This suggests that Croatia can be adversely affected by massive terms of trade shocks. Negative impact of volatility in income terms of trade can be interpreted as the negative effect of the size of terms of trade shocks on GDPpc growth, overshooting the expected positive (which is in fact smaller; 0,60-0,76%) response to changes in income terms of trade. This interpretation would in such manner explain why some studies found this effect to be exponential (Edstrom and Singer, 1992). Next, the full potential of sudden terms of trade improvement/worsening are not always easily channelled into growth in the most efficient way (inefficient allocation of more/less resources, decreased continuity and predictability in the profitability, inability to import crucial factors of production, etc.), so those shocks are likely to have detrimental effect on production. Export sectors are much more sensitive to extreme shocks, meaning that increase in volatility in income terms of trade would lead to disproportionally stronger decrease in export production in comparison to production for domestic markets. Following that, export growth is influenced by both, terms of trade and volume expansion. Since volume of export is likely to respond to price changes sluggishly (see Bobić, 2010) – considering inefficient competitiveness of Croatian export, cumulative effect of trend and volatility – income terms of trade changes could have negative impact on economic growth in Croatia. But, by analyzing three different measures of income terms of trade volatility we found no evidence of great fluctuations within that variable, suggesting that, thought it can have enormous negative effect, relatively stable variability in income terms of trade did not neutralize positive movements and growth perspectives in Croatia in the observed period of time.

Additionally, we found statistically significant impact of changes in price of oil boosting the volatility of income terms of trade (when controlled for direction of change). This is important finding since Croatia produces only 20% of needed oil, while more than 20% of import is related to oil and oil derivatives. Thus, large price shock (such as oil shocks) and thus terms of trade fluctuations are likely to affect imports in particular, since imported intermediate inputs into production are likely to be price inelastic, and as the resulting of shortage of fund, is likely to slow down production and growth process (Edstrom and Singer, 1992). Already mentioned spill-over effect on domestic prices and inflationary pressures could also affect economic, as well as political and social stability. This brings us to something that we did not expect, namely an increase in oil price has a stronger effect on trend income terms of trade (-0,41%) then on its volatility (0,03-0,10%), which is in contradiction with economic theory. But if we observe rates of change we can notice inverse movements between oil price and income terms of trade, as well as analogous movements between oil price, export and import prices, suggesting that changes in price of oil were simultaneously channelled towards modifications in export and import prices, having in such manner stabilizing effect on income terms of trade.

Short-run dynamics is presented through the results of parsimonious VECM of only Model III due to a similar results and the preservation of space[18]. Again, all the results in the short-run are mostly consistent with the long-run results, suggesting positive impact of capital and labour variables (except financial development which again showed negative sign). Volatility in terms of trade is found to be in immediate negative association with GDPpc. After one period (quarter) delay the variability of original shocks appears to be less significant and relative in its direction.

[18] *All results and all diagnostic tests are available upon request.*

On the whole, volatility in income terms of trade is found to have a long-run as well as short-run negative impact on economic growth of Croatia. Price of oil also shows statistically significant but economically insignificant impact on income terms of trade variability. Exclusion tests suggest that oil price is not weakly exogenous variable, but it is slow in converging to long-run equilibrium position. All the adjustment coefficients in the long-run as well as in the short-run have correct signs, meaning that they stabilise the system. Diagnostic tests (LR test, ARCH test, test for normality of residual, White test, QLR and CUSUM tests, Chow test) also confirmed the validity of the results.

TABLE 4. RESULTS OF THE PARSIMONIOUS VECM OF MODEL III

Dependent Variable: **D(lnGDPpc)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0,019052	0,002729	6,979983	0,0000
D(VITOT1)	-1,369352	0,366481	-3,736482	0,0007
D(lnK)	0,157223	0,050110	3,137556	0,0035
D(lnK(-1))	0,234188	0,059558	3,932063	0,0004
D(lnL)	0,478835	0,217594	2,200593	0,0347
D(lnL(-1))	0,638957	0,240243	2,659627	0,0118
D(lnFIN)	-0,712334	0,070605	-10,08903	0,0000
COINTEQ05(-1)	-0,259200	0,109294	-2,371585	0,0235

Dependent Variable: **D(VITOT1)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0,003696	0,001274	2,901483	0,0064
D(lnGDPpc)	-0,170322	0,043737	-3,894281	0,0004
D(lnL(-1))	0,160617	0,080214	2,002354	0,0530
D(lnFIN)	-0,098270	0,035251	-2,787742	0,0085
D(lnFIN(-1))	-0,041020	0,022212	-1,846739	0,0733
D(lnOIL)	0,013031	0,004832	2,697063	0,0107
COINTEQ06(-1)	-0,201184	0,042443	-4,740055	0,0000

Normality of residuals: 0,66; LM (4): 0,61; ARCH (4): 0,76, CUSUM: 0,08, Chow (2009:1): 0,11

Source: Author's calculation.

V. BEYOND THE CONCLUSION

There is little disagreement that growth in export revenues is likely to influence national output positively, *ceteris paribus*. However, all things rarely remain equal. Thus economic gains from export expansion can be compromised by changes in terms of trade – all of which must not be ignored having in mind that export volume is not the only important factor in explaining how trade relates to gross domestic product growth (Edstrom and Singer, 1992). Next, many economists observe net barter terms of trade. However even Singer and Prebisch, and many authors after them, pointed out that single or double factorial terms of trade and income terms of trade are more relevant determinants of economic growth than the barter terms of trade as they involve export volume changes (show real improvement/deterioration in trade), changes in foreign exchange rate (through *Marshall-Lerner condition* they affect trade volume, balance of payment and GDP as well) etc. Following these objectives, this paper tried to evaluate the impact of income terms of trade and its volatility on economic growth in Croatia within the augmented

production function. It is clear that changes in terms of trade are only one of many factors influencing output growth, therefore besides classical factors of economic growth our models include income terms of trade, as well as its volatility in explaining possible growth perspectives. Results are consistent with the theory, as they broadly confirm the expectations of a positive relationship between income terms of trade changes and GDPpc on one hand, and of negative association between the volatility in income terms of trade and GDPpc on the other.

All explanatory variables showed expected signs, except the financial development. Generally capital, labour and income terms of trade are found to be important contributors to the GDPpc growth. Positive influence of income terms of trade is so important for Croatian economy since it can boost growth potentials, raise import capacity (in order to widen productivity) and improve capability for serving debt. Volatility in income terms of trade (measured as historical volatility, conditional variance from GARCH (1,1) model and cyclical component from H-P filter) appears to constrain Croatian economic growth in magnitude that can over-ride any positive influence of improving income terms of trade. However, relatively stable variability in income terms of trade over the time suggests the fact that stability was favourable for GDPpc growth. Additionally, we found statistically significant impact of changes in price of oil boosting the volatility and reducing the income terms of trade trend. Some conclusion regarding real exchange rate have been drawn too, suggesting that real depreciation would in fact lead to an improvement in income terms of trade. This conclusion is however doubtful considering possible exogeneity of Croatian income terms of trade, a low competitiveness of export products and the controversy over the J-curve effect Croatia.

Presented empirical results have strong policy implications. It is important to detect whether transmission mechanism influences price changes more intensively through trend or volatility in income terms of trade. Since income terms of trade are important factor contributing to GDPpc growth in Croatia, sound domestic macroeconomic policy could avoid adverse price changes and negative tendencies from the world markets. This can be done by export diversification towards more competitive products with higher additional value. On the other hand, diversifying import could also help (through technological transfers and foreign competition) in increasing domestic productivity. If price changes are more intensively channelled through increased volatility in income terms of trade (plus large oil price shocks), macroeconomic management does not have wide manoeuvring space. Some aspects within fiscal policy (excise duty change, correction of the final price of oil, etc.; see Žiković and Vlahinić-Dizdarević, 2011) could be conducted. Furthermore, rise of investment in domestic oil extraction could be considered as well. Still, income terms of trade showed to be relatively stable suggesting that rare fluctuations did not have significantly adverse effect on Croatian growth perspective. None the less, while future movements in terms of trade remain uncertain, as long as macroeconomic policy remains sound, allocate its resources more productively thereby increasing the potential for growth, income terms of trade (especially through an increase in export volume) could be improving even more, generating new growth cycles in Croatia.

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Appendix

The **volatility of income terms of trade** variable was obtained by using three different methods: historical volatility (VITOT1), GARCH model (VITOT2) and HP filter (VITOT3).

1. Historical volatility; is based on observed (realised) movements in a variable over a historical period. It tells us how volatile variable has been in the past. Hence, the historical standard deviation of log returns is the volatility estimator touted in most textbooks. We estimated historical volatility following next two equations (see EC. 2009. Historical Price Volatility, European Commision, Directorate – General for Agriculture and Rural Development):

$$st.dev = \sqrt{\frac{n\sum x^2 - (\sum x)^2}{n(n-1)}}$$

$$Historical\ voiatility = st.dev * \sqrt{time}$$

2. Autoregressive Conditional Heteroskedasticity (ARCH) models are specifically designed to model and forecast conditional variances. The variance of the dependent variable is modeled as a function of past values of the dependent variable and independent or exogenous variables. ARCH models were introduced by Engle in 1982 and generalized ARCH known as GARCH by Bollerslev in 1986. In order to obtain volatility we estimated GARCH (1,1) following next equation.

$$\sigma_t^2 = \omega + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2 + \sum_{i=1}^{q} \alpha_i e_{t-i}^2$$

Results: α = 1,09 (st.dev. 0,80), β = - 1,19 (st.dev. 0,24), ω = 5,28 (st.dev. 0,01).

3. Hodrick-Prescott (HP) filter is a univariate procedure that has become standard method for removing long run movements from the data in the business cycle literature. In order to extract the business cycle component that presents the volatility measure of the variable we use smoothing parameter λ of 25600 which penalizes the acceleration in the trend component relative to the cycle component. Higher λ was used because it exhibits lower variability and smaller persistence. We estimated volatility following next equation:

$$min_t = \sum_{t=1}^{\tau}((y_t - \tau_t)^2 + \lambda((\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1}))^2)$$

Unit root tests

Variables	In level		In first difference	
	constant	*constant +*	*constant*	*constant +*
lnGDPpc	- 1,91 (0)	- 0,95 (0)	- 6,52 (0) ***	- 6,82 (0) ***
lnK	- 1,02 (0)	- 0,79 (0)	- 6,57 (0) ***	- 6.62 (0) ***
lnL	- 1,28 (0)	- 1,37 (0)	- 6,26 (0) ***	- 6,29 (0) ***
lnFIN	- 0,93 (0)	- 4,13 (3) **	- 5,32 (0) ***	- 5,25 (0) ***
lnOIL	- 0,43 (0)	- 3,81 (1) **	- 4,80 (0) ***	- 4,75 (0) ***
lnREER	1,38 (0)	- 2,08 (0)	- 4,83 (0) ***	- 5,51 (0) ***
lnITOT	- 1,29 (0)	- 2,22 (0)	- 7,30 (0) ***	- 7,23 (0) ***
VITOT1	- 1,24 (0)	- 2,00 (0)	- 5,02 (0) ***	- 5,21 (0) ***
VITOT2	- 2,23 (0)	- 2,49 (0)	- 9,48 (0) ***	- 9,48 (0) ***
VITOT3	- 2,60 (0) *	- 2,59 (0)	- 7,37 (0) ***	- 7,29 (0) ***

Variables	In level		In first difference	
	constant	*constant +*	*constant*	*constant +*
lnGDPpc	- 1,91	- 1,04	- 6,52 ***	- 6,82 ***
lnK	- 1,05	- 1,19	- 6,62 ***	- 6,71 ***
lnL	- 1,30	- 1,61	- 6,30 ***	- 6,32 ***
lnFIN	- 0,92	- 2,49	- 5,39 ***	- 5,32 ***
lnOIL	- 0,66	- 3,07	- 4,80 ***	- 4,76 ***
lnREER	0,59	- 2,13	- 4,83 ***	- 5,51 ***
lnITOT	- 1,30	- 2,33	- 7,30 ***	- 7,23 ***
VITOT1	- 1,98	- 2,53	- 5,30 ***	- 5.52 ***
VITOT2	- 2,09	- 2,52	- 9,76 ***	- 9,85 ***
VITOT3	- 2,70 *	- 2,69	- 7,37 ***	- 7,29 ***

Variables	In level		In first difference	
	constant	*constant +*	*constant*	*constant +*
lnGDPpc	0,82 ***	0,19 **	0,31	0,06
lnK	0,78 ***	0,12	0,20	0,17 **
lnL	0,85 ***	0,16 **	0,13	0,12 *
lnFIN	0,97 ***	0,12	0,06	0,06
lnOIL	0,89 ***	0,07	0,12	0,06
lnREER	0,79 ***	0,14 *	0,44*	0,07
lnITOT	0,72 **	0,14 *	0,09	0,09
VITOT1	0,26	0,06	0,13	0,07
VITOT2	0,54 **	0,11	0,15	0,11
VITOT3	0,13	0,13 *	0,10	0,08

****, **, * denotes 1%, 5% and 10% significance levels respectively*

The lag length used to estimate the ADF test is based on Schwarz Bayesian criterion (SBC) and the lag length used to compute the PP and KPSS tests is based on the Newey-West Bandwidth. KPSS test is based on inverse H_0 and H_1 relation in comparison to ADF and PP.

TREND I VOLATILNOST PRIHODOVNIH UVJETA RAZMJENE U HRVATSKOJ; PERSPEKTIVA RASTA

Sažetak: U vremenima globalizacije, domaći i inozemni faktori odigravaju važnu ulogu u određivanju profila jedne zemlje na svjetskom tržištu, naglašavajući time njezinu poziciju kao otvorenog gospodarstva. Danas su sve zemlje, uz određene iznimke, otvorena gospodarstva. Hrvatska je malo i otvoreno gospodarstvo koje je obilježeno snažnom uvoznom ovisnošću te vanjskom neravnotežom, stoga svaka ozbiljnija fluktuacija na globalnom tržištu može ugroziti njezinu ekonomsku stabilnost. Uvjeti razmjene kao odnos između izvoznih i uvoznih cijena predstavljaju važan indikator čije poboljšanje može doprinijeti gospodarskoj stabilnosti i dugoročnom rastu. Naime, stabilni uvjeti razmjene potiču efikasnu alokaciju resursa te smanjuju inflatorne pritiske. Nadalje, dok poboljšanje u trend uvjetima razmjene pozitivno djeluje na domaću kupovnu moć i realni dohodak, značajni šokovi u istima mogu voditi makroekonomskoj nestabilnosti. Analizirajući vremenske serije, ovaj rad predstavlja nadopunu hrvatske literature u aspektu gospodarskog rasta time što proučava kako uvjeti razmjene te fluktuacije istih utječu na hrvatsko gospodarstvo. Posebna pažnja usmjerena je na povezanost gospodarskog rasta u kratkom i dugom roku te dugoročne posljedice promjena u prihodovnim uvjetima razmjene. Empirijsko modeliranje zasniva se na proširenoj proizvodnoj funkciji koja je analizirana uz pomoć kointegracijskih jednadžbi te uvjetnih modela ispravljanja pogreški, a rezultati istraživanja pokazali su se konzistentnim teoriji.

Ključne riječi: prihodovni uvjeti razmjene, volatilnost, Johansenov kointegracijski pristup, uvjetni VECM, proširena proizvodna funkcija, Hrvatska