CROATIAN TERMS OF TRADE; HISTORICAL PERSPECTIVE, MOVEMENTS AND WELFARE EFFECT

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Abstract

Croatia is a small – open – import dependent economy with strong trade imbalances. Thus it implies certain effect on national welfare. The aim of this paper is to examine the impact of the trend and volatility of terms of trade on economic growth of Croatia using time series data. Moreover, the paper in an indirect way evaluates the effectiveness of the openness on economic performance of Croatian economy. In such manner we can assess the dynamics of import and export prices on economic growth. Results are consistent with the theory, however they suggest that terms of trade do not have substantial welfare effect on the economy. Estimation is based on Prais-Winsten regression of iterative procedures which eliminates the problem of serial correlation, as one of the frequent problems in these

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types of estimation. In addition, stationary VAR was obtained in order to present the dynamics of changes in terms of trade.

1 INTRODUCTION

After gaining independence, Croatia developed in a highly open economy that liberalized fast in conformity to *Washington consensus*. Maybe this happened too quickly, because a young and uncompetitive economy such as Croatia was not ready for rivalry that the international markets and neoliberalism brought. The result was strong growth of import and not so strong growth of export. It implied great external imbalances and import dependency. High export/import to gross domestic product (GDP) ratio and high trade deficit bear out the necessity of studying how import and export prices shape Croatian trade and growth perspectives. Terms of trade, as a ratio of export prices to import prices, is a measure of relative prices and can have substantial welfare effect on the economy. This paper adds up to growing literature on the drivers of Croatian economic growth by examining how terms of trade affect the economy. Growth economists have discovered a very profound impact of terms of trade changes on economic growth, especially in developing countries. Terms of trade as well as the terms of trade volatility can have a critical impact on economic growth, particularly during the process of global integration when export/import prices converge/diverge worldwide, inducing strong changes in terms of trade and growth perspective of one country. Generally, an increase in terms of trade will lead to an increase in investment level and thus to economic growth (Mendoza, 1997; Blattman et al., 2007). On the other hand, terms of trade instability expressed as volatility measure has long-run relationship with output as well, both are negatively related with each other (Mendoza, 1997). Several studies have concluded that changes in terms of trade can account for half of the output volatility in developing countries (Fatima, 2010). Croatia is 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 economic growth and development. Contemporary literature that examines the relationship between

terms of trade and economic growth mainly includes studies that are based on cross-country evidence, where Croatia is mostly excluded. Furthermore, there exists no particular study that looks at terms of trade and/or terms of trade volatility and its impact on economic growth in the context of development in Croatia. This empirical issue justifies the research framework of this paper.

The paper investigates the impact of terms of trade on economic growth by using the time series quarterly data for period 2000-2010. Data are collected from Croatian Bureau of Statistics. Terms of trade[1] are constructed by the national accounts data on nominal and real exports and imports, just as Botriæ and Cota (2006). The volatility term of trade variable was obtained using the Hodrick-Prescott (HP) filter. Unit root tests are based on augmented Dickey and Fuller (ADF), Phillip and Perron (PP) and KPSS test statistics, some of which suggesting that we are dealing with stable terms of trade during observed time. Relationship between terms of trade, volatility terms of trade and economic growth was examined by using the Prais-Winsten regression which was completed by unrestricted stationary VAR in order to present the dynamics of terms of trade changes.

This paper is organized as follows. Section 2 discusses the theoretical background and the literature review of terms of trade and related issues. Section 3 gives a historical perspective of the movements and trend of terms of trade. Section 4 presents empirical results on the welfare effect of terms of trade. Section 5 provides evaluation of the topic and concluding remarks.

[1] Due to better data availability this paper uses goods and services terms of trade rather then the goods terms of trade. This implies that we use broadened type of barter terms of trade, thus we have to be very careful in our conclusions.

2 THEORETICAL BACKGROUND AND THE LITERATURE REVIEW

The relationship between terms of trade[2] and economic growth was first analyzed by Raul Prebish (1950) and Sir H. Singer (1950), both suggesting 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). Today their work is recognized as famous *Singer – Prebish hypothesis*. A broad, although not unanimous, consensus has now been reached that there has indeed been long-term deterioration in the net barter terms of trade of primary commodities in comparison to manufactures, as well as there is also considerable agreement that there has been a corresponding decline in the relative terms of trade of most developing countries *vis a vis* industrialized nations (Sarkar and Singer, 1991; Edstrom and Singer, 1992)[3].

In the same year as Prebish and Singer published their papers, Harberger (1950) on one hand and Laursen and Metzler (1950) on the other, suggested that a deterioration in terms of trade can reduce a country's real income/or increase real expenditure for a given income level, consequently decreasing savings through consumption smoothing effect; what in the end became known as the *Harberger – Laursen – Metzler effect*. Their works are primarily based on the observations of the impact of terms of trade shocks on the economy. Their idea is later extended by the works of Obstfeld (1982) and Kent and Cashin (2003) who introduced the concept of duration or persistence in the terms of trade shocks. Exchange rate variability can have, altogether a strong effect on the terms of

[2] The concept of terms of trade was introduced by J. S. Mill for determining the gains between the trading countries. In his context, terms of trade were understood as a quantitative relation between two commodities traded between two countries. In later discussions, various measures of the concept have been designed such as barter terms of trade, income terms of trade and single or double factoral terms of trade; all three having prominent position in contemporary literature (Fatima, 2010).

[3] The secular deterioration of net barter terms of trade of developing countries, as observed by Prebish and Singer in fact destroyed the established orthodoxy of mutually beneficial world markets.

trade, especially if we observe income terms of trade. A large depreciation in the value of the exchange rate would lead to a fall in export prices, subsequently rising the cost of import what worsens the terms of trade index. What effects will that have on the balance of payment depends on the change of the volume of export. On the contrary, a lower exchange rate could restore competitiveness (Fatima, 2010).

Another interesting subject is the newly arisen relationship between the debt and the terms of trade (Singer, 1991). The pressure to service debt in its impact on terms of trade can produce two vicious circles. One lies in the interaction of debt and terms of trade, whereat following Keynes in 1929, the debt-service pressure leads to deterioration of terms of trade. As Singer (1991) points out, a deterioration of terms of trade, in turn, can intensify debt pressure (by reducing export earnings it increases debt-service ratio which is normally defined as the ratio of debt-service to export earnings). The second vicious circle relates to import compression because of debt pressure. All mentioned is in line with the Fisher's paradox: «the more you pay the more you owe»!

We must stress that much of the contemporary literature analyze 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 (Mendoza, 1997; Bleaney and Greenaway, 2001; Blattman et al., 2003, 2004, 2007; Sala and 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 (1995, 2001) likewise Hadass and Williamson (2001) found that the growth performance, especially of developing countries, was hampered by global terms of

trade shocks; they suggested it could be due to what has come to be known as «resource course[4]». This could be results by the number of reasons; decline in competitiveness, the crowding out of human capital through the underinvestment in institutions or education, mismanagement in natural resource sector etc. (Borkin, 2006). In such a manner, according to later studies, we can conclude that it is not universally clarified how terms of trade affect growth, either as improvement or restriction; thus it would be interesting to find out what kind of results would empirical study in the content of Croatian economy show.
Moreover, it would also be interesting to see how variability (volatility) of terms of trade affects economic growth. Unlike the controversy surrounding the 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, Blattman et al, 2003, 2004, 2007). Such studies are usually tested through the channels of uncertainty on investment decisions where increased volatility/uncertainty is associated with increased risk; and as terms of trade can be seen as a return of investment, increased risk generally leads to a reduction in investment and consequently lower economic growth (Borkin, 2006). 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 science and analysis.

3 TERMS OF TRADE IN CROATIA – HISTORICAL PERSPECTIVE

This section looks at the historical trend in Croatia's terms of trade. In order to comprehend the nature of the terms of trade changes we have limited time span of analysis to interval 2000-2010[5]. Average share of export to GDP in

[4] 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.

[5] In order to gain stable results we have analyzed stable postransitional period; namely statistical isolation of time series ensures isolations from extreme results. Another reason is

observed time was 43%, which indicates that Croatian economy is not closed, but rather open. However, this export was insufficient in respect to demand and preferences towards import products (average share of import to GDP was 53%), thereby generating constant trade deficit (average share of trade deficit to GDP was 10%)[6].

Since the rise of export/import can either be the result of the rise in prices or/and in quantities, and we analyze the terms of trade as a ratio of export prices to import prices, it will be interesting to see how these prices behaved over the time.

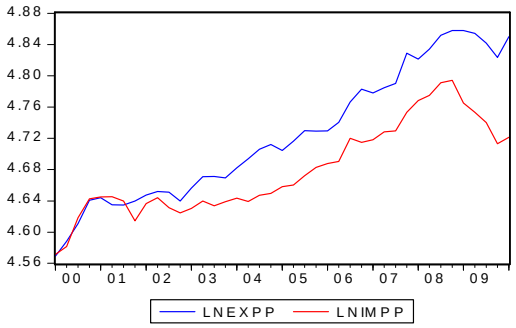

FIGURE 1 Logs of export and import prices in Croatia in the period 2000-2010 (mil. kn)

Source: Croatian Bureau of Statistics. Author's elaboration.

Stronger growth of export prices in comparison to import prices suggests improvement in terms of trade. Possible explanation of such rise in export prices, and so in import prices could be found in strong boost of world oil prices after 2002, that had it peak in 2008 with the price of 147 $/barrel (as is evident in Figure 1).

To answer the question why Croatian export prices grew stronger than import prices is somewhat difficult, since the growth was no so distinctive. It could be

associated with the statistical consistency of time series. All information about the source and the construction of data can be found in Section 4.

[6] Surplus on the service account of the balance of payments compensates to a large extent for the exceptionally high Croatian trade deficit.

due to higher foreign demand for Croatian products, which could be a result of diversification of export base, or it could be just a result of a common rise in price level of products that Croatia exports. Such notions implicate two issues; can Croatia influence their export or import prices and do we indeed talk about improvement in Croatia's terms of trade over the observed period? Next figure which represents logarithm terms of trade in level and in first difference will help us in reaching the conclusion.

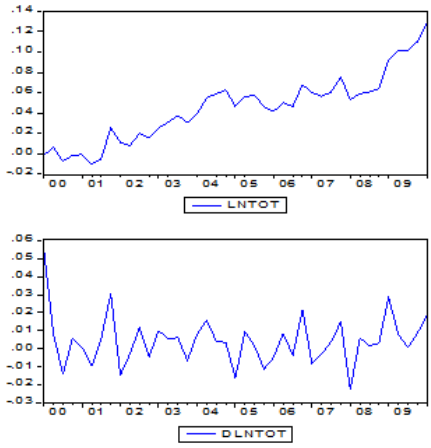

FIGURE 2 Croatian terms of trade in the period 2000-2010 (in logs); level and difference

Source: Croatian Bureau of Statistics. Author's elaboration.

First, developing countries are exposed to terms of trade fluctuations because they have little, if any, leverage over their export prices. World markets dictate the price of the goods they export[7]. Building on that fact, we can conclude that terms of trade in Croatia are largely exogenous, that is determined by the forces outside the countries' control (in particular by the price of oil, since oil constitute about 20% of Croatia's import).

[7] In contrast, developed countries and oil exporters can exert a substantial influence on export prices (Singer, 1991).

Next issue involves some needy implications. Namely, though the terms of trade graph in level (LNTOT) suggests there might be certain improvement, graph in first differences (DLNTOT) show that there are no such changes in terms of trade. To test these statements we have applied unit root tests (more in Section 4) which confirmed that the variable terms of trade was stationary (trend stationary) in level indeed, i.e. it did not change significantly over time. This conclusion is rather arguable for it suggests that if there has not been any improvement in terms of trade, then how can we analyze the impact of its change on GDP, and measure its welfare effect. So, we need to use different approach to test if Croatia's terms of trade have changed over time.

Unit root tests generally show that Croatia's terms of trade are stationary. However, all tests are able to reject the hypothesis of a unit root only when a trend is included. This may be a result of a small sample size, but also by the fact that the terms of trade had been generally increasing over this period. To test this hypothesis we will estimate linear trend in the logarithm terms of trade via OLS method. The results are displayed in Table 1.

TABLE 1 Estimation of linear trend of Croatian terms of trade in the period 2000-2010

Independent variables	**Regressions: dependent variable LNTOT**	
	1	***2***
α	- 0,039 ***	- 0,020 **
β	0,003 ***	0,002 ***
ρ	/	0,407 ***
β / (1 – ρ)	/	0,003 ***
Adjusted R^2	0,856	0,880
LM (χ^2) test (4)	p-value = 0,006	p-value = 0,073
ARCH (χ^2) test (4)	p-value = 0,163	p-value = 0,999

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

Source: Croatian Bureau of Statistics. Author's estimation in EViews 5.1.

Regression 1 is estimated following the:

$$LNTOT_t = \alpha + \beta T + \varepsilon_t \qquad (1)$$

and suggests that there has been a statistically significant upward trend in Croatia's terms of trade of 1,2% (β *coefficient)* per year. However, this regression exhibits strong problem of serial correlation, as well as problem of heteroscedasticity and regression stability; in that way it is in no use for us. To correct for this autocorrelation in the residuals, a lagged dependent variable is added to the regression as shown in (2) where ρ is the autoregressive parameter.

$$LNTOT_t = \alpha + \beta T + \rho\ (LNTOT_{t-1}) + \varepsilon_t \qquad (2)$$

The results show that the inclusion of the lagged dependent variable reduced the trend coefficient, whereat all coefficients remained statistically significant. Regression 2 suggests an upward trend of around 1%, however the long rung parameter, defined as $\beta\ /\ (1 - \rho)$, show that the trend is positive and highly significant at 1,2% per year[8]. LM and ARCH tests indicate no problem of autocorrelation. Regression exhibits no problem with normality of residuals and regression stability, but a minor problem with heteroscedasticity.

These results gave us strong evidence that the terms of trade in Croatia have experienced an upward trend over the past 10 years. Indirectly, it enables us to reject the *Singer – Prebish hypothesis* since there has not been any downward trend. Possible reason for such conclusion is the fact that we used terms of trade variable which includes services. Another reason is based on the fact that Croatian export is not so dominated by primary commodities, thereby terms of trade should not have to decline over time as hypothesis implies. However, this analysis observes a short period of time so we cannot take the conclusions for granted. Results in this section proved that Croatia's terms of trade have changed over time and in a positive manner, which gives us a proper base to study how this improvement affected GDP, as an approximation of national welfare. Next section is defined in such role.

[8] Estimations are based on seasonally adjusted quarterly date, so in order to comprehend annual results we had to multiply quarterly gained results with 4, and again multiply it with 100 to get percentages.

4 THE WELFARE EFFECT OF TERMS OF TRADE

Movements in terms of trade reflect changes in relative prices, so it is often unclear how these movements affect the real economy and national welfare. Although this has been debated extensively in the literature, there is still no consensus about how trends in terms of trade impact economic growth (Borkin, 2006). Hence, this section will provide us the answer to this question in the case of Croatia. Also it will analyze how volatility in 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. Before we tackle the subject, we present a short review of used methodology and data.

4.1 METHODOLOGY AND DATA

In order to test the welfare effect of terms of trade and volatility terms of trade on national output we have applied methodology used by Grimes (2006) and Borkin (2006). Their approach is based on an equation of the following form:

$$\Delta\ (LNGDP_t) = \beta_1 + \beta_2\ (LNTOT_t) + \beta_3\ (VTOT_t) + \varepsilon_t \qquad (3)$$

where $\Delta\ (LNGDP_t)$ is the logarithm of annual growth rate in GDP between year *t-1* and *t*, $LNTOT_t$ is the logarithm of the terms of trade in year t and $VTOT_t$ is the volatility of the terms of trade.

As the terms of trade is a ratio of export and import prices, Grimes (2006) suggests that it could be appropriate to test whether export and import prices individually affect economic growth. Therefore he extended the above into augmented equation where the terms of trade and volatility terms of trade are separated into their real export and import prices components:

$$\Delta\ (LNGDP_t) = \alpha_1 + \alpha_2\ (LNEXPP_t) + \alpha_3\ (VEXPP_t) + \alpha_4\ (LNIMPP_t) + \alpha_5\ (VIMPP_t) + \varepsilon_t \qquad (4)$$

where $LNEXPP_t$is the logarithm of real export prices, $VEXPP_t$is the volatility of export prices, $LNIMPP_t$ is the logarithm of import prices and $VIMPP_t$ is the

volatility of import prices. Restricted Equation 4 can be estimated and then tested whether it can be restricted to the form of the Equation 1. Both Grimes (2006) and Borkin (2006) did this by specifying four different regressions which show different aspects of independent variables. Our analysis is based on such variations (variables that present volatility in export and import prices are not taken into consideration since they obstruct the model severely; their function in model is undertaken by the volatility terms of trade variable).

All equations will be estimated using ordinary least square (OLS) regression, but if a problem of autocorrelation is noticed, a Prais-Winsten method of iterative procedures will be used in order to eliminate this problem. OLS regression can be improved considerably by a Prais-Winsten transformation, only if the errors have strong AR (1) autocorrelations. The Prais-Winsten procedure is an improvement to the original Cochrane-Orcutt algorithm for estimating time series regressions in the presence of autocorrelated errors. This transformation makes it possible to include the first observation in the estimation, and thus estimators using transformed Prais-Winsten are much more efficient than those using Cochrane–Orcutt procedure (Fried and Gather, 2005). Correcting serial correlation involves quasi-differencing to transform the error term. If we multiply the equation for time t-1 by ρ, and subtract it from the equation for time t, we obtain: y_t - $\rho y_{t-1} = (1$ - $\rho ? \beta_0$ $?+$ $\beta_1(x_t$ - $\rho x_{t-1}) + e_t$, since e_t, $= u_t$ - ρu_{t-1}. This is a feasible GLS estimation method, since we must use an estimate of ρ from regressing the residuals on the lagged residuals.

In order to detect an impact and causality between terms of trade and GDP, the unrestricted stationary vector autoregression (VAR) model will be obtained. Since we analyze both terms of trade and volatility terms of trade, Granger causality analysis within VAR model will show whether the past values of these variables help to explain current values of output. Methodology used by Grimes (2006) evaluates only present causality, since it ignores past values, so by using VAR model we can assess do terms of trade trend and volatility influence GDP, as well as does GDP causes certain movements in those variables. Granger causality provides a little evidence on the dynamic property of the system for it indicates only the causality of the dependent variable/s within the sample

period (Juselius, 2006). Thereby this analysis will also comprehend impulse response function and variance decomposition to unveil Granger causality in a dynamic context.

The data are quarterly and were obtained from Croatian Bureau of Statistics. The sample period is from 2001:1 to 2010:1. All data were seasonally adjusted using Census X12 seasonal adjustment procedure[9]. 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, similar to Botriæ and Cota (2006). The variable is constructed based on the national accounts data on nominal and real exports and imports[10]. Service sector plays an important role in Croatian economy, thereby terms of trade indicator includes prices of both, goods and services. The volatility term of trade variable was constructed using the Hodrick-Prescott (HP) filter (Blattman et al., 2007). 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[11] (Franke, 2006). Dummy variable for year 2000 was introduced 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] The procedure is carried out by using Eviews 5.1. Data are then transformed in their logarithmic form.

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

[11] It might be argued that there is one value of 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 should not be taken for granted, i.e. the appropriate smoothing parameter should be considered for each time series in its own context.

TABLE 2 Unit root tests

Augamented Dickey-Fuller Unit Root test (ADF)		
Variables	**Level**	
	constant	*constant + trend*
LNGDP	- 3.74 (0) ***	- 1.83 (0)
LNTOT	- 1,72 (0)	- 4,38 (0) ***
VTOT	- 4,36 (0) ***	- 4,39 (0) ***
LNIMPP	- 2,00 (0)	- 1,42 (0)
LNEXPP	- 2,50 (0)	- 4,43 (0) ***
Phillips-Perron Unit Root test (PP)		
Variables	**Level**	
	constant	*constant + trend*
LNGDP	- 3,55 **	- 2,11
LNTOT	- 1,67	- 4,61 ***
VTOT	- 4,62 ***	- 4,64 ***
LNIMPP	- 1,91	- 2,03
LNEXPP	- 2,33	- 4,43 ***
Kwiatkowski-Phillips-Schmidt-Shin Unit Root test (KPSS)		
Variables	**Level**	
	constant	*constant + trend*
LNGDP	0,73 **	0,15 **
LNTOT	0,76 ***	0,08
VTOT	0,14	0,08
LNIMPP	0,70 **	0,10
LNEXPP	0,77 ***	0,12

****, **, * 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.*

Source: Author's estimation in EViews 5.1.

The results of the ADF, PP and KPSS unit root test statistics are reported in Table 2. Generally, unit root tests show that all the variables are stationary in their level, except the GDP. As we already mentioned, variable terms of trade (LNTOT) is trend stationary, and in order to gain stationary variable volatility terms of trade (VTOT) with lower variability, HP filter with higher smoothing parameter was used. Variable that presents real export prices (LNEXP) showed also to be trend stationary. On the other hand, only KPSS test confirmed variable real import prices (LNIMP) to be stationary in level (graphical display

suggests that it could be stationary so we accept KPSS test results). Likewise, a problem occurred in unit root tests for GDP as well; ADF and PP test suggested that GDP is stationary in level. Similar circumstances were dwelling Erjavec and Cota (2003) with variable industrial production. Irrespective of these findings, KPPS tests, graphical illustration as well as all other studies in Croatia suggest that GDP variable is non-stationary in level, but become stationary after taking the first difference. In such form it will be used in following estimations.

4.2 EMPIRICAL RESULTS

The results of regressions based on Equation 3 and 4 are reported in Table 3. All coefficient show expected results (except the real export prices variable). Regression 1 is based on OLS, but it exhibits strong problem of first order serial correlation, heteroscedasticity, normality of residuals and stability. Due to specific problem (having AR (1) and negative residuals), a Prais-Winsten procedure is introduced in next two regressions[12].

Regression 2 displays significant coefficient with expected signs. It shows that terms of trade has positive impact on Croatian economic growth, whereas volatility terms of trade is negatively associated with growth. This suggests that Croatia can be adversely affected by massive terms of trade shocks. However, since GDP is presented in first difference, interpretation is somewhat ambiguous; i.e. we cannot interpret them as partial elasticity coefficients. Interestingly, real export prices are showing negative impact on GDP growth. Possible reason is that if the prices go up, many exporters could increase export simultaneously and the net effect in the short run could be worsening of terms of trade which could constrain the GDP growth. Regression 3 displays analogous results. Again, terms of trade seems to have positive effect on the growth of GDP, however this time the coefficient is smaller. The volatility term of trade variable shows again negative effect on GDP growth, all in accordance with the theory. Not surprisingly, variable real import prices shows negative impact on GDP in a way that

[12] Correlation matrix (in Appendix) shows high correlation coefficients (with expected signs) between almost all included variables, except the volatility terms of trade. This may indicate that volatility might not have crucial impact on GDP.

its increase reduces terms of trade and consequently national output. ARCH tests in both regressions confirm that there is no problem of autocorrelation. Regressions also show no problem of heteroscedasticity, normality of residuals and of stability, which in fact enables stable conclusions.

TABLE 3 Regression results

Independent variables	Regressions: dependent variable d(LNGDP)		
	1	*2*	*3*
LNTOT	1,005 *	1,009 *	0,529 *
VTOT	- 1,314 *	- 1,332 *	- 1,332 **
LNIMPP	/	/	- 0,480 **
LNEXPP	- 0,480 **	- 0,480 **	/
Dummy	0,021 *	0,020 *	0,020 *
Constant	2,233 **	2,230 **	2,230 **
Adjusted R^2	0,258	0,272	0,272
ARCH (χ^2) test (1)	p-value = 0,000	p-value = 0,106	p-value = 0,106
ARCH (χ^2) test (4)	p-value = 0,259	p-value = 0,250	p-value = 0,250

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

Source: Croatian Bureau of Statistics. Author's estimation in EViews 5.1.

To test the dynamic causal relationship between the variables, a stationary VAR model, in unrestricted form, was introduced. VAR model would enable us to comprehend the influence of lagged values, something that previous methodology did not assert. It will help us to find out if terms of trade trend and volatility influence GDP, as well as does GDP impact those variables. Based on assessment, VAR (2) was obtained[13].

Table 4 provides us with the information about Granger causality, which does not indicate the direction of causality between variables (direction was seen in Table 3). Yet it helps us to understand the causal relationship. Granger causality test indicates that terms of trade do affect GDP growth but it cannot trace any causal relationship between output growth and volatility of terms of trade (joint test indicates that both variables have Granger cause dependent variable).

[13] Lag length is based on SBC criterion. VAR (2) showed good properties; LM test (4): 0,066, Autocorrelation (2) (4): 0,595, ARCH (4): 0,741, Doornik-Hansen test for normality: 0,064 (estimated in Gretl).

This implicates certain conclusions. Namely, terms of trade do Granger cause certain change in GDP, but it seems that volatility may not have any particular influence on national output. Since VAR (2) included past values it is maybe indication that volatility variable in a long run impact GDP (as shown in Table 3), but in a short run it shows no causal relationship with it. As mentioned, correlation matrix (see Appendix) suggested very low correlation between GDP and volatility terms of trade. Other causal relationships are not of our interest. Next two analyses should give us a clearer view on the subject.

TABLE 4 VAR Granger Causality/Block Exogenity Wald Tests

Dependent variable: D(LNGDP)			
Excluded	Chi-sq	df	Prob.
LNTOT	8,795608	2	0,0123
VTOT	1,886777	2	0,3893
All	16,48446	4	0,0024
Dependent variable: LNTOT			
Excluded	Chi-sq	df	Prob.
D(LNGDP)	1,483629	2	0,4762
VTOT	11,46042	2	0,0032
All	15,36198	4	0,0040
Dependent variable: VTOT			
Excluded	Chi-sq	df	Prob.
D(LNGDP)	1,484961	2	0,4759
LNTOT	2,881868	2	0,2367
All	4,090373	4	0,3939

Source: Author's estimation in EViews 5.1.

In order to comprehend the causality of variables in a dynamic context, we introduce impulse response functions and variance decomposition analyses (see Appendix); as they offer assessment just from another angle. Impulse response function shows some odd results. First, it shows that terms of trade improvements negatively and very modestly affect GDP and second it suggests that volatility of terms of trade has no effect on Croatian output, whatsoever. Variance decomposition, on the other hand shows similar results to Granger causality test, whereby terms of trade influence GDP. After two quarter horizon, around 10% of the forecast error variance of GDP is explained by the shocks in terms

of trade. The rest is explained by its own shocks, which suggests that changes in volatility of terms of trade do not explain any changes in GDP.
Although other relationships are not of our interest, however it is interesting to point out that all three analyses in VAR model show that GDP has no crucial impact on the changes of either terms of trade or volatility variable. Possible explanation could be found in fact that Croatian terms of trade (which represents ratio of relative export and import prices) is exogenous variable and is not determined by on-goings in domestic market but rather by changes on the world markets. To comprehend the impact of GDP, volume of export and import should be introduced into analysis, hence it could be a subject of new study.

5 BEYOND THE TERMS OF TRADE - EVALUATION OF THE TOPIC INSTEAD OF CONCLUSION

The economic interpretation of the results in this study need not to be difficult, however in the case of Croatia they seem to be ambiguous. Looking back at the historical trend we found evidence that the terms of trade had improved since 2000; in that manner we can reject the *Singer – Prebish hypothesis* which suggests that terms of trade of developing country should decline in long-run. Reasons for improvement in terms of trade could be found in potentially higher export prices as a result of trade liberalization as well as the fact that Croatian export is not so dominated by primary commodities, thereby terms of trade should not have to decline over history as hypothesis implies. It would be interesting to examine if any compositional change in Croatia's goods and service export/import has affected the level of the terms of trade.
This study has also investigated the impact of terms of trade and terms of trade volatility on economic growth in Croatia. Results are consistent with the theory, as they broadly confirm the expectations of a positive relationship between terms of trade changes and GDP growth on one hand, and of negative associ-

ation between the volatility in terms of trade and GDP growth on the other. This implies that deteriorating terms of trade mean that less foreign exchange is generated by the sale of a given amount of exports and more foreign exchange goes to paying for a given amount of imports, including those needed for investment. This effect will presumably affect investment level and constrain future growth. However, results of this study indicate that changes in terms of trade do not have substantial impact on Croatian growth. It is important to remember that the degree of determination in our model was low, what illustrates the complexity of the factors affecting growth, of which terms of trade are only one. Not surprisingly volatility terms of trade showed negative relationship with economic growth. Namely, 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). This relationship showed to be ambiguous, due to a fact that one model implied statistically significant relation, and the other, VAR model, indicated no such relationship. This study indicated that both real export and import prices have negative effect on GDP, where one would expect that just higher import prices have an adverse effect through lower household consumption and investment.

Although, almost all variables showed expected mutual relations, in order to fully comprehend the scope and the nature of the relationship between terms of trade (trend and volatility) and economic growth, we would need to include some other phenomena in the analysis, such as: alternative measurements of terms of trade, export volume changes (show real improvement/deterioration in trade), changes in foreign exchange rate (through Marshall–Lerner condition it affect trade volume, balance of payment and GDP as well), how other variables influence terms of trade or terms of trade volatility etc. We observed net barter terms of trade, however even Singer and Prebish, and many authors after them, pointed out that single or double and income terms of trade are all more directly relevant than barter terms of trade as determinants of economic growth, since they involve above mentioned issues. Though their calculation is very complex,

analyses of such kind could clarify many blurs of the topic.

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7 APPENDIX

TABLE 5 Correlation matrix

Correlations	LNGDP	LNTOT	VTOT	LNEXPP	LNIMPP
LNGDP	**1,000000**	0,816536	-0,311432	0,933673	0,900003
LNTOT	0,816536	**1,000000**	0,230493	0,879871	0,713706
VTOT	-0,311432	0,230493	**1,000000**	-0,220982	-0,460139
LNEXPP	0,933673	0,879871	-0,220982	**1,000000**	0,960830
LNIMPP	0,900003	0,713706	-0,460139	0,960830	**1,000000**

Source: Author's estimation in EViews 5.1.

TABLE 6 Variance decomposition

Variance Decomposition of D(LNGDP):				
Period	S.E.	D(LNGDP)	LNTOT	VTOT
1	0,018826	100,0000	0,000000	0,000000
2	0,020028	89,20406	10,76653	0,029412
3	0,020109	89,22961	10,68580	0,084592
4	0,020156	89,05807	10,80365	0,138273
5	0,020169	88,94297	10,85939	0,197647
6	0,020210	88,61552	11,12574	0,258736
7	0,020262	88,16334	11,51899	0,317668
8	0,020316	87,69781	11,92797	0,374220
9	0,020375	87,20640	12,36575	0,427854
10	0,020434	86,71222	12,80950	0,478279
Variance Decomposition of LNTOT:				
Period	S.E.	D(LNGDP)	LNTOT	VTOT
1	0,011680	4,999485	95,00052	0,000000
2	0,012651	6,649402	93,32360	0,026995
3	0,012823	7,284131	92,64057	0,075296
4	0,012879	7,238206	92,60899	0,152807
5	0,012887	7,250138	92,49636	0,253499
6	0,012909	7,226279	92,41020	0,363517
7	0,012948	7,190628	92,33257	0,476801
8	0,013004	7,146097	92,26505	0,588856
9	0,013070	7,090733	92,21254	0,696724
10	0,013141	7,032466	92,16824	0,799290
Variance Decomposition of VTOT:				
Period	S.E.	D(LNGDP)	LNTOT	VTOT
1	0,011682	4,995917	95,00407	1,23E-05
2	0,012656	6,640407	93,33472	0,024870
3	0,012830	7,276271	92,65481	0,068918
4	0,012888	7,229008	92,63177	0,139221
5	0,012895	7,240313	92,52996	0,229725
6	0,012914	7,219808	92,45291	0,327282
7	0,012948	7,188918	92,38479	0,426291
8	0,012996	7,150525	92,32672	0,522755
9	0,013053	7,102819	92,28306	0,614125
10	0,013113	7,053150	92,24730	0,699546

Source: Author's estimation in EViews 5.1.

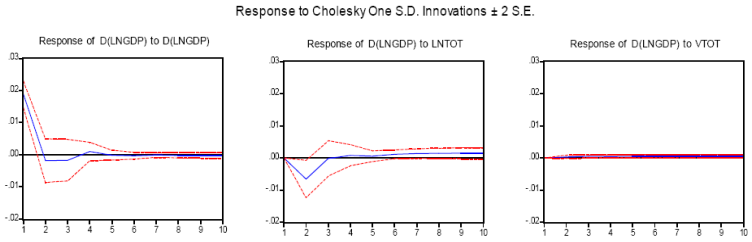

FIGURE 3 Impulse response function

Source: Author's estimation in EViews 5.1.