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On the Possibility of Negative Effects of EU Entry on Output, Employment, Wages and Inflation in Slovenia

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Contents

Povzetek

Vstop v EU je povezan tudi z negotovostjo glede eksogenih sprememb v konkurenčnosti slovenskega gospodarstva, ki naj bi prizadela predvsem sektorje z nižjo stroškovno učinkovitostjo. Pri tem gre v prvi vrsti za problematiko industrijske politike in nadaljnjega prestrukturiranja slovenskega gospodarstva, vendar lahko s pomočjo preprostega makroekonomskega modela vseeno preučimo posledice, ki bi jih morebiten tovrsten šok – eksogen padec agregatnega povpraševanja – imel na slovensko zaposlenost, dinamiko realnih bruto plač in inflacije. Od tovrstnega šoka gre pričakovati začasno nižjo gospodarsko rast in rast realnih plač, nižjo zaposlenost in kratkotrajno znižanje inflacije.

V ta namen je bil na kvartalnih podatkih (prvo četrtletje 1994 - prvo četrtletje 2003) ocenjen model kointegrirane vektorske avtoregresije z uporabo sledečih spremenljivk: bruto domačega proizvoda v stalnih cenah, realnih plač, agregatne zaposlenosti in inflacije. Z uporaba kointegracijske analize sta ocenjeni dve ravnovesni povezavi, in sicer ravnovesna povezava med zaposlenostjo in stroški dela na enoto bruto domačega proizvoda ter dolgoročna povezava med inflacijo, realnimi plačami in bruto domačim proizvodom.

Iz analize modela sledi, da slovensko gospodarstvo v preteklosti opisanim šokom ni bilo izpostavljeno. Analiza preteklih strukturnih šokov namreč pokaže, da pretekla podobna znižanja zaščite domačega gospodarstva (podpis prostotrgovinskega sporazuma z EU, priključitev CEFTA območju proste trgovine, podpis trgovinskih sporazumov z republikami bivše Jugoslavije) na slovensko gospodarstvo niso delovala tako, da bi večja izpostavljenost tuji konkurenci povzročala značilne istočasne padce v povpraševanju in zaposlenosti. Iz preteklih podatkov torej sledi, da je verjetnost večjih negativnih makroekonomskih učinkov na slovensko gospodarstvo nizka. Ta verjetnost se še nadalje zniža, če upoštevamo potencialne pozitivne učinke vstopa v EU na konkurenčne dele gospodarstva.

Kljub temu nam simulacija modela omogoča kvantifikacijo učinkov potencialnega eksogenega znižanja agregatnega povpraševanja. Rezultati kažejo, da eksogeno znižanje agregatnega povpraševanja v višini 1% BDP, ob predpostavki, da rigidnosti na trgu dela onemogočajo prilagajanje zaposlenosti in plač v kvartalu, v katerem do znižanja pride, na dolgi rok zniža BDP za 0.49% (95-odstotni interval zaupanja je 0.25–0.68), realnih plač za 0.21% (0.08–0.42) in zaposlenosti za 0.18% (0.09–0.32). Vse spremenljivke dolgoročno raven praktično dosežejo v obdobju enega leta.

Ključne besede: Slovenija, brezposelnost, vstop v EU, potencialni padec agregatnega povprasevanja, kointegriran VAR

Abstract

This paper provides an empirical investigation into the employment, wage, inflation and gross domestic output dynamics in Slovenia in the period before entering the European Union. The aim is to shed new light on the risk of increasing unemployment after entering the EU. The risk factor is based on the assumption that, after joining the EU, the Slovenian economy's competitiveness will decrease, leading to lower domestic output growth and higher unemployment. The scenario of lower competitiveness assesses the possible effects on the economy's partial structural maladjustment to the new conditions after joining the EU.

The possible consequences of the reduced competitiveness of labour-intensive industries for the Slovenian economy are estimated by a cointegrated vector autoregression model (using quarterly data from 1994 to 2003). The model evaluates two equilibrium relations: the relation between employment and labour costs per unit of GDP, and the long-term relation between inflation, real wages and GDP.

From the structural vector error correction model (SVECM), it follows that the Slovenian economy has not be exposed to similar shocks in the past. The analysis of past structural shocks shows that similar falls in the degree of protectionism in the past did not lead to any falls in demand and employment stemming from increased exposure to foreign competition. Increased competition in the past was the consequence of the entering into force of the free-trade agreement with the EU, the Central European Free Trade Agreement (CEFTA) and free-trade agreements with the countries of former Yugoslavia. Moreover, the data revealed the low probability of any serious negative macroeconomic consequences for the Slovenian economy. This probability is further reduced if the potential positive impact of joining the EU on the competitive part of the economy is considered.

In spite of all of this, the simulation of the model allows us to quantify the impacts of a potential exogenous fall in aggregate demand. The results show that, on the assumption that labour market rigidities hamper the adjustment of the workforce and wages in the quarter experiencing a fall in exports, a fall in aggregate demand by 1 percent could reduce GDP by 0.4 percent, real wages by 0.17 percent and employment by 0.14 percent in the long run. All variables practically achieve the long-term level in the period of one year.

Key words: Slovenia, unemployment, EU entry, potential drop in aggregate demand, cointegrated VAR

1. Introduction

The aim of the paper is to investigate the probability of increasing unemployment in Slovenia after entering the EU. The starting point is the assumption that, after entering the EU, the Slovenian economy's competitiveness will fall especially in those industries with less cost efficiency. The share of labour-intensive products in exports was 20.1 percent in Slovenia and 9.9 percent in the EU in 2002 (IMAD, 2004). What is more, there is also import protection of the food-processing industry.

Although this is primarily the problem of industrial politics and further restructuring of the Slovenian economy, the consequences of an exogenous drop in aggregate demand on Slovenian employment, dynamics of gross real wages and inflation can be analysed with a simple macroeconomic model. One can expect temporary lower growth of output and the growth of real wages, lower employment and a temporary reduction of inflation caused by the exogenous shock mentioned above. The paper proceeds as follows. Section 2 investigates the data, the methodology used is described in Section 3, the next section presents the results of the cointegration analysis, Section 5 explains the structural vector error correction results and, finally, a short conclusion is provided.

The risk factor is based on the assumption that, after joining the EU, the Slovenian economy competitiveness will decrease, leading to lower domestic output growth and higher unemployment.

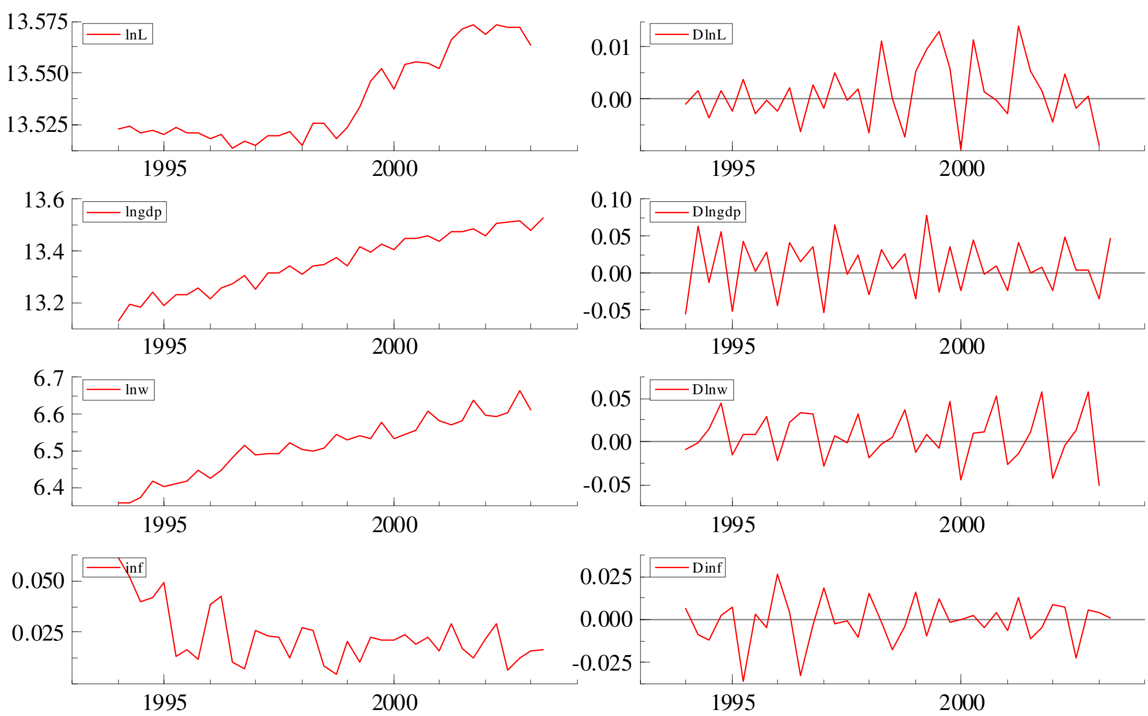
2. The sample data

The sample data are quarterly for the period 1994 (1) to 2003 (1). *lngdp* denotes the log of gross domestic output at 1995 prices, *lnw* is the log of real average wages, *lnl* is the log of aggregate employment, and *inf* is the quarterly inflation rate. Figure 1 shows the variables and their first differences.

As can be seen in Figure 1, all series appear to evolve around a deterministic linear trend, which is positive for *lnL*, *lngdp*, and *lnw,* and negative for *lninf.* There is also a seasonal component in the series, so we can assume that a stationary process probably does not generate the series. On the other hand, the series in the first differences exhibit a fluctuation around a constant mean and there are no changes in the variability of series in time so they give the visual impression of a time series generated by a stationary process.

Further, the inter-relationships amongst the variables of primary interest are multidimensional and dynamic; hence attention is turned to modelling a multivariate dynamic statistical system to characterise the evolution of employment, wages, inflation and gross domestic output between 1994 and 2003.

Figure 1: **Variables and their first differences**



Source: Own calculations using Bank of Slovenia data.

3. The statistical model

Since all the variables to be modelled are non-stationary, the cointegrated vector autoregressive model (VECM) with deterministic variables (such as seasonal and event-specific dummy) included is adopted as the statistical model for subsequent analysis. The VAR is an important and commonly-used class of econometric models for linear dynamic processes. Its main advantage is its good description of the dynamics of the data. What is more, it allows us to analyse the way that variables evolve around the long-term equilibrium. So, the consequences of exogenous shocks in the short run can be analysed, and also the influence of such a shock, a fall in aggregate demand for example, in the equilibrium. If the variables to be modelled cannot be well represented as a multivariate linear process then the VAR will not be congruent (see Hendry, 1995), and thus will exhibit signs of misspecification. Were this to be the case, a reformulation of the model (perhaps by a variable transformation or by the inclusion of intervention dummy variables), will often enable the reformulated system to be well characterised by a VAR. Hence, provided that attention is paid to ensuring that it is congruent the VAR can be expected to be a widely appropriate statistical model to use when modelling economic time series (Marcellino and Mizon, 2000).

Given a set of *K* time series variables $y_t = (y_{1t},..., y_{Kt})'$ the basic VAR model of the order *p* (VAR(p)) has the form

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + u_t, \qquad (1)$$

where $u_t = (u_{1t},...,u_{Kt})'$ is an unobservable Gaussian zero-mean independent white-noise process with a time-invariant positive definite covariance matrix $E(u_t u_t') = \sum_u$ and A_i are $(K \times K)$ coefficient matrices.

Also, $\det(I_K - A_1 z - ... - A_p z^p) \neq 0 \;\; for \;\; |z| \leq 0$ so the polynominal defined by the determinant of the autoregressive operator has no roots in and on the complex unit circle, which means that the process is stable.

If the variables have a common stochastic trend there can exist linear combinations of them which are *I(0*[1]*)*. In that case they are cointegrated. Although the model (1) is general enough to accommodate variables with stochastic trends, it is not the most suitable type of model if the interest centres on the cointegration relation because they do not appear explicitly. They are most easily analysed within the vector equilibrium-correction model (VECM) form:

$$\Delta y_t = \Pi y_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta y_{t-j} + u_t, \qquad (2)$$

where Δ is the first difference operator, $\Pi = -(I_K - A_1 - ... - A_p)$ and $\Gamma_i = -(A_{i+1} + ... + A_p)$ for *i=1,...,p-1*. Because Δy_t does not contain stochastic

[1] At this point it is assumed that all variables are at most *I(1)*.

trends on the assumption that all variables can be at most *I (1)*, the term Πy_{t-1} is the only one which includes *I(1)* variables. Hence, must also be *I(0)*. Thus, it contains cointegrating relations and represents the long-run part of the process. is referred to as the short-term part or short-run parameters. Π has rank *r<N* and can be written as a product $\alpha\beta'$, where α and β are $(K\times r)$ matrices with rank $rk(\alpha) = rk(\beta) = r$. $\beta' y_{y-1}$ is *I(0)* and contains cointegration relations among the components of y_{t-1}, and α is a so-called loading matrix and describes the adjustment to the error-correction term, which describes the adjustment to deviations from the long-run relationship. The matrices α and β are not unique so that there are many possible β matrices which contain the cointegration relations or linear transformations of them, and corresponding loading matrices α (see Johansen, 1988; Lutkepohl, 1991; Hendry, 1995).

In practice, the basic models (1) and (2) are usually too restrictive to represent the main characteristics of the data. In particular, deterministic terms such as intercept, a linear trend term or seasonal dummy variables may be required for a proper representation of the data. In addition, one may also wish to include further stochastic unmodelled variables on top of the deterministic part. A fairly general VECM form which includes all these terms is

$$\Delta y_t = \Pi y_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta y_{t-j} + CD_t + Bz_t + u_t \qquad (3)$$

where the z_t are unmodelled variables, D_t contains all regressors associated with deterministic terms and *C* and *B* are parameter matrices.

The statistical models adopted for the analysis are cointegrated vector autoregressive model and common trends model.

Model (3) is a reduced-form model because it does not include instantaneous relations between the endogenous variables y_t. In practice, it is often desirable to model the contemporaneous relations as well and therefore it is useful to consider a structural form:

$$A\Delta y_t = \Pi^* y_{t-1} + \sum_{j=1}^{p-1} \Gamma_j^* \Delta y_{t-j} + C^* D_t + B^* z_t + v_t, \qquad (4)$$

where v_t is a $(K\times 1)$ zero-mean white-noise process with a time-invariant covariance matrix Σ_v, and the matrices Π^*, Γ_j^* , C^*, B^* are structural-form parameter matrices. The invertible $(K\times K)$ matrix *A* allows modelling instantaneous relations among the variables in y_t. The reduced form corresponding to structural model (4) is given in (3) with

$$\Gamma_j = (A)^{-1} \sum_{j=1}^{p-1} \Gamma_j^*, \quad C = (A)^{-1} C^*, \quad \Pi = (A)^{-1} \Pi^*,$$
$$B = (A)^{-1} B^* \text{ and } u_t = (A)^{-1} v_t .$$

Structural shocks or structural innovations, denoted by ε_t, are the crucial quantities in the SVAR model. These shocks are unpredictable with respect to the past of the process and are an input of the linear dynamic system generating the K-dimensional time series vector. They are hence related to the residuals in (4) by linear relations $v_t = B\varepsilon_t$, where *B* is a $(K\times K)$ matrix.

The shocks are associated with an economic meaning, such as a productivity shock in this analysis. Because the shocks are not directly observed, assumptions are needed to identify them. There seems to be a consensus that structural shocks should be mutually uncorrelated and thus orthogonal. This assumption is required to consider the dynamic impact of an isolated shock.

To identify the structural form's parameters, we must place restrictions on the parameter matrices. Even if matrix A, which specifies the instantaneous relations between the variables, is set to an identity matrix, the assumption of orthogonal shocks ε_t is not sufficient to achieve identification. For a K-dimensional system, *K(K-1)/2* restrictions are necessary for orthogonalising the shocks because there are *K(K-1)/2* potentially different instantaneous covariances (Lütkepohl and Krätzig, 2004).

4. Cointegration analysis

In this section the results of estimating and evaluating the cointegrated VAR are discussed. Although many other variables could be relevant for explaining the dynamic inter-relationships between wages, prices, unemployment, and gross domestic output, including interest and exchange rates and measures of fiscal and monetary policy, I focus on modelling the four main variables in y_t. Attention is confined to modelling these four main variables chiefly due to the short time series.

As a starting point in the modelling all four variables entered with 6 lags, deterministic components, including an unrestricted constant, plus seasonal dummies and an impulse dummy in the second quarter of 1995 to avoid the effects of outlying observations. In the first step the appropriate lag length of the VAR model has to be specified. The choice was based on F-tests of lag reduction (as reported in Table 1). This is a simple test for the validity of a zero restriction imposed on the last 4x4 matrix of coefficients in a VAR. As can be seen in Table 1, the F-test confirms the validity of system reduction from a lag length of 6 to a lag of 1.

Table 1: **F-test of system reduction**

Tests of system reduction		
2 lags --> 1 lag:	F(16,61) = 0.26	[0.99]
3 lags --> 1 lag:	F(32,60) = 0.68	[0.88]
4 lags --> 1 lag:	F(48,48) = 0.87	[0.68]
4 lags --> 1 lag:	F(64,33) = 1.38	[0.16]
6 lags --> 1 lag:	F(80,18) = 1.09	[0.44]

The statistical specification of the 1-lag VAR is chosen

Before proceeding with the cointegration analysis, the statistical specification of the 1-lag VAR was checked by tests on residuals. The mis-specification tests check whether the system is deficient in the direction of a more general specification, such as a system incorporating serial correlation, the non-normality of residuals and ARCH effects. In order to perform cointegration tests, the model should have constant parameters and residuals that are not auto-correlated, non-normal and heteroscedastic.

The results of the misspecification test are reported in Table 2. Diagnostic testing was performed at two levels: individual equations and the system as a whole. Individual equation diagnostics take the residuals from the system and treat them as if from a single equation, ignoring that they form part of a system. Usually this means that they are only valid if the remaining equations are problem-free. As can be seen, the residuals are normally distributed and without an ARCH effect.

The next step was to determine empirical long-term stationary relationships among variables that are individually non-stationary. Rather than including deterministic terms separately, they may be included in the cointegrating relations. In this case, a suitable reparameterisation of the model is called for. The proper treatment of deterministic terms is particularly important in the context of testing for the cointegrating rank. If a linear trend is regarded as a possibility, none can just include such a term in the process in a fully general form to be on the safe side.

Table 2: **Residual analysis of unrestricted VAR with 1 lag**

	Multivariate	lnf	lnL	lnw	lngdp
AR 1-3 test*	0.80 [0.78]	1.58 [0.22]	0.04 [0.99]	0.04 [0.99]	0.56 [0.64]
Normality**	3.81 [0.87]	0.45 [0.80]	2.17 [0.34]	0.80 [0.67]	0.85 [0.65]
ARCH 1-3*	/	0.26 [0.86]	1.24 [0.32]	0.19 [0.90]	0.65 [0.59]
hetero test*	0.38 [1.00]	0.86 [0.59]	1.04 [0.46]	0.14 [0.99]	0.37 [0.94]
hetero-X test*	200.4 [0.47]**	0.28 [0.99]	0.68 [0.76]	0.28 [0.98]	0.97 [0.57]

Notes: *Tests use F-statistics' critical values.**The test for non-normality and hetero-X test for multivariate estimates use chi-square critical values.

This, however, may result in a substantial power loss if the time trend is not needed in the model. For further details here, see Doornik, Hendry and Nielsen (1998). Therefore, investing some effort in proper trend specification is worthwhile.

From Figure 1 it can be observed that there is linear trend present in the data generating process for all variables under analysis. Note, however, that the proper treatment of the linear trend in the model would already be required if only one variable exhibited signs of deterministic trend behaviour. In addition, with a considerable degree of confidence we can exclude the presence of a quadratic trend in the levels of the data. Thus, two possibilities remain as regards the inclusion of a deterministic trend in model (3): a model with a linear trend term restricted to the cointegrating space and a model with an unrestricted constant. In both models a linear trend is present in the levels; however, while in the former the linear trend is also present in the cointegrating relations, this is not the case in the latter.

We can use a formal likelihood ratio test to discriminate between these two options. This requires estimating a model with the linear trend term restricted to the cointegrating relation and one with an unrestricted trend term. To present the test, consider the VAR(p) model (1) with the linear trend included:

$$y_t = \sum_{j=1}^{p} A_j y_{t-j} + \mu_0 + \mu_1 t + u_t \,. \tag{5}$$

If the linear trend is confined to some individual variables and is absent from cointegrating relations, we have $\beta'\mu_1 = 0$, that is, the trend parameter is orthogonal to the cointegration matrix. Hence, for this case we get the following VECM form:

$$\Delta y_t = v_0 + \Pi y_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta y_{t-j} + u_t \,, \tag{6}$$

where all constant terms are collected in the constant, so $v_0 = -\Pi\mu_0 + (\sum_{j=1}^{p} jA_j)\mu_1$. If the linear trend is present in the cointegrating relations, the VECM can be written as:

$$\Delta y_t = v + \Pi^+ \begin{bmatrix} y_{t-1} \\ t-1 \end{bmatrix} + \sum_{j=1}^{p-1} \Gamma_j \Delta y_{t-j} + u_t, \qquad (7)$$

where $\Pi^+ = \alpha[\beta':\eta]$ is a *(K×K(K+1))* matrix of rank *r* with $\eta = -\beta'\mu_1$. Further, $v = -\Pi\mu_0 + (I_K - \Gamma_1 - ... - \Gamma_{p-1})\mu_1$. To test whether a linear trend is present in the cointegration space we need to test the hypothesis of whether all parameters in η are statistically significantly different from zero. The value of the corresponding likelihood ratio statistic, distributed as $\chi^2(2)$, is 5.38 and the null hypothesis cannot be rejected at the 5-percent level (the corresponding *p*-value is 0.07). This implies that the decision to dispense with a linear trend term for the cointegration relations is supported and we can continue with the analysis of model (6). In computing the test it has been assumed that the cointegration rank is two. This follows from the testing procedures that are described below.

The cointegrating rank of 2 is determined.

Ideally, the cointegrating rank has to be determined before the deterministic terms are tested. The test I used to decide on the deterministic term introduces an additional layer of uncertainty into the overall testing procedure because it assumes a specific cointegrating rank, i.e. the one obtained in model (7). Therefore, checking the robustness of the test results for the cointegrating rank with different specifications of deterministic terms is a useful strategy (Lütkepohl and Krätzig, 2004). Results of the Johansen (1995) likelihood ratio test, which is known as a trace test, are summarised in Table 3.

Table 3: **Cointegration statistics**

H0: rank ≤	Trace test [p value] Model with a restricted trend	Trace test [p value] Model with an unrestricted constant
0	81.32 [0.00]	66.70 [0.00]
1	42.82 [0.05]	32.32 [0.02]
2	18.83 [0.30]	9.59 [0.32]
3	3.49 [0.81]	1.58 [0.21]

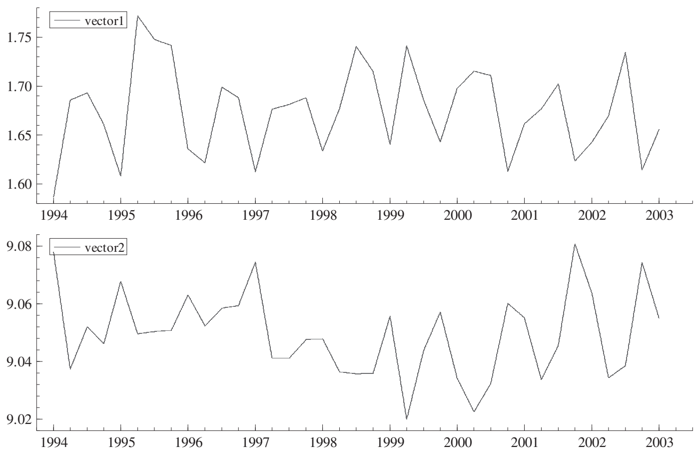
Note: Unrestricted variables are constant, seasonal dummies and an impulse dummy for 1995(2). The number of lags used in the analysis is 1.

The first two eigenvalues in both models are substantial (0.65 and 0.48 in the model with a trend and 0.60 and 0.46 in the model without a trend), suggesting that rank 2 might be appropriate. In fact, they turn out to be significantly different from zero on the basis of asymptotic trace statistics. The rank 2 in models (6) and (7) was also confirmed by the bootstrapped version of the trace test (p=0.38), which implies that the choice of rank 2 is robust to the choice of the deterministic linear trend in the VEC model.[2] A visual inspection of Figure 2 reveals that cointegration relations evolve around the constant mean without changing variances in time, which implies they are stationary. This additionally confirms the choice of rank 2 as being correct.

[2] The bootstrap procedure of the trace test was performed in the SVAR programme written by Anders Warne using 1999 bootstrap replications.

The adequacy of the model was further checked by conducting the usual diagnostic tests. They do not give rise to concern about the adequacy of the model; the residuals are normally distributed without serial correlation and ARCH effects.

Figure 2: **Cointegrating relations**



Source: Own calculations.

Equations (8) and (9) present the identified cointegration relations, while Table 4 presents the corresponding loading coefficients. Cointegration relations explain the movements of variables in a steady state, and both equations have logic economic interpretations. The first cointegration relation (8) describes a long-term positive relationship between output, inflation and wages. One over-identifying restriction is imposed on the second cointegration relation (9) (standard errors are in parenthesis). It implies that GDP and real wages enter the equilibrium relation as a homogeneous relation. The restriction is accepted with a *p*-value of 0.33 and leads to an intuitive interpretation of the second cointegration relation:[3] a negative long-term relationship between employment and real wage per unit of output with an elasticity of 0.65.

The first steady state equation describes a positive long-term connection between output, inflation and wages. The second one shows that behavior of wages in the steady state is asymmetric to the output and employment.

$$\ln gdp_t = \underset{(0.50)}{3.82}\inf_t + \underset{(0.90)}{1.78}\ln w_t + ec_t \tag{8}$$

$$\ln zap_t = \underset{(0.05)}{-0.65}\ln w_t + \underset{(0.05)}{0.65}\ln gdp_t + ec_t \tag{9}$$

On loading the coefficient to the cointegration relation I also imposed some restrictions. In particular, it emerged that only the inflation rate adjusts significantly and positively to deviations from the first cointegration relation, meaning that only changes in inflation restore the equilibrium represented by the first cointegration relation. Inflation, however, does not adjust to the deviations from the second

[3] The corresponding likelihood ratio test statistic, distributed as $\chi^2(1)$, takes the value of 0.93.

Table 4: **Loading coefficients**

	Cointegration relation (8)	Cointegration relation (9)
Δ lngdp	0.00 [0.00]	0.62 [0.17]
Δ lnL	0.00 [0.00]	-0.22 [0.05]
Δ inf	0.18 [0.03]	0.00 [0.00]
Δ lnw	0.00 [0.00]	-0.25 [0.17]

Note: Standard errors are in parentheses.

cointegration relation, which is also not surprising as this relation does not contain inflation. A joint likelihood-ration test of one over-identifying restriction on the cointegration space and four restrictions on the corresponding loading coefficients, distributed as $\chi^2(5)$, has a *p*-value of 0.60, which means that we can accept them with a high degree of confidence.

4.1. Interpretation of the cointegration coefficients

As shown by Johansen (2002), cointegration coefficients can be interpreted as elasticities in the usual sense; however, the interpretation does not follow the usual *ceteris paribus* logic we use when interpreting coefficients in usual regressions. VECM is a dynamic system and cointegrating coefficients describe long-run relations among endogenous variables. In the VECM there is no dichotomy between exogenous and endogenous variables and there is no natural way to pick some variables and interpret the others as functions of them. There is, however, a dynamic structure which makes a distinction between short-run and long-run, or between current values and long-run values. This fact gives the possibility to implement the changes in the long run needed for the interpretation of the coefficients instead of using a change in the exogenous variables to produce a change in the endogenous variables.

From the first steady state equation it follows that there is a positive long-term connection between output, inflation and wages. The second one shows that the behaviour of wages in the steady state is asymmetric to the output and employment.

Let us first interpret the long-run effect of *inf* on *lngdp* in the first cointegrating relation (8). That is, we need to determine what is the long-run change in *lngdp* if *inf* changes by *1*. As it turns out, it is not always the case that a long-run change in inflation by 1 percentage point results in 3.82% higher GDP. In fact, the result depends on the endogenous adjustment of two other variables in the system: real wages and employment. Let us consider all the relevant cases in turn.

It can be shown first that the cointegration coefficient between GDP and inflation (3.82) cannot be interpreted in the usual *ceteris paribus* sense i.e. the effect of the latter on the former while keeping real wages and employment unchanged. Such a long-run change can be written in vector form as

$$k' = (3.82, 1, 0, 0)$$

In order to keep the linear combination between the variables as determined by β and to achieve the desired long-term change the direction of long-run movements k' has to be orthogonal to β. In other words, $k'\beta$ must be equal to zero. Clearly this is not the case because the proposed vector *k* is not orthogonal to the second cointegrating vector. This is also very sensible from the economic point of view, because we can hardly envision a long-run change in GDP without changes in either real wages or employment.

In order to allow for an endogenous long-run adjustment in real wages and employment, consider a long-run change of the form

$$k'(\lambda) = (3.82, 1, \lambda_1, \lambda_2)$$

where λ_2 and λ_3 need to satisfy $k \perp \beta_1, \beta_2$. β_1 is the first cointegrating vector: (1, -3.82, -1.78, 0) and β_2 is the second: (-0.65, 0, 0.65, 1). From the condition $k'\beta_1 = 0$ we obtain $\lambda_1 = 0$, while it follows from $k'\beta_2 = 0$ that $\lambda_2 = 2.48$. This means that a percentage-point change in inflation is associated with a long-run change in GDP by 3.82 percent; however, employment also has to correspondingly increase by 2.48 percent. Real wages remain unchanged. Higher inflation does not have a positive effect on GDP as measured by the cointegration coefficient in the first cointegrating relation unless employment also increases.

If we want calculate the effect of a percentage-point change in inflation on GDP with an endogenous long-run adjustment of real wages without a change in employment then we need to consider the following long-run change:

$$k'(\lambda) = (\lambda_1, 1, \lambda_2, 0)\,. \tag{10}$$

This type of long-run change is interesting from the economic point of view because of the high degree of labour market rigidity in the Slovenian economy and the existence of structural (i.e. permanent) unemployment. λ_1 and λ_2 are also in this case chosen so that $k(\lambda)$ is orthogonal to both cointegrating vectors. Note that

$$k'(\lambda)\beta_1 = \lambda_1 - 3.82 - 1.78\lambda_2 = 0 \tag{11}$$

$$k'(\lambda)\beta_2 = -0.65\lambda_1 + 0.65\lambda_2 = 0 \tag{12}$$

From (12) it follows that $\lambda_1 = \lambda_2$, and from (11) we get $\lambda_1 = \lambda_2 = -4.9$. Thus by choosing $\lambda_1 = \lambda_2 = -4.9$, we make $k(\lambda)$ orthogonal to both cointegrating vectors. Thus, a long-run increase in inflation by 1 percent with constant employment is associated with a decrease (!) in output by 4.9 percent because it requires an equal downward adjustment in real wages. The described changes are quite representative of stylised dynamics in the Slovenian economy during the process of transition. During the past decade, Slovenia has witnessed a considerable

A long-run increase in inflation with constant employment is associated with an over proportional decrease in output, because it requires an equal downward adjustment in real wages.

economic recovery and real wage growth accompanied by the process of disinflation and relatively stagnating employment.

The long-run change in output is accompanied by an under-proportional change in wages and employment if inflation is fixed.

The question posed at the beginning of the paper is how entering the EU can influence employment or what would be the potential response of employment to an exogenous shock in aggregate demand. Thus, we are interested in what happens with employment and wages in the long run if output increases by 1 percent. It is also conceivable that such a shock could have a permanent effect on real wages and the general price level, but not on inflation. In this case, a long-run change is

$$k'(\lambda) = (1, 0, \lambda_1, \lambda_2) . \tag{13}$$

In order to obtain orthogonality between the long-run change and cointegrating relations the following conditions have to be satisfied:

$$k'(\lambda)\beta_1 = 1 - 1.78\lambda_1 = 0 \tag{14}$$

$$k'(\lambda)\beta_2 = -0.65 + \lambda_1 0.65 + \lambda_2 = 0 . \tag{15}$$

To conclude the discussion of the interpretation of cointegration coefficients, we can say that if output increases by 1 percent and inflation does not change, employment increases by 0.29 percent and real wages rise by 0.65 percent. Thus, we can observe that the long-run change in output is accompanied by an under-proportional change in wages and employment if inflation is fixed.

5. Structural vector autoregressive modeling

VAR and VEC models have the status of 'reduced-form' models and are therefore merely vehicles to summarise the dynamic properties of data (Lütkepohl and Krätzig, 2004). Without reference to a specific economic structure, such reduced-form VEC models are difficult to understand. Sims (1981, 1986), and Shapiro and Watson (1988) put forward a new class of econometric models: structural VARs (SVAR) or identified VARs. Instead of identifying the autoregressive coefficients, identification focuses on the errors of the system, which are interpreted as linear combinations of exogenous shocks. What is more, the innovations of VAR and VEC models are not identified with the underlying structural errors due to the correlation of residuals across equations as is the case of instantaneous causality. Therefore, the impulse responses generated by such VARs or VECMs also do not possess a structural interpretation. To make the conclusions more robust about the potential negative effects of EU entry on the Slovenian economy, I analyse the impulse responses of both the VECM presented thus far and the SVECM which is presented below.

In recent work, identifying shocks using restrictions on their long-run effects has become popular. This follows from the fact that in many cases economic theory suggests that the effects of some shocks are zero in the long run, that is, the shocks have transitory effects with respect to particular variables. In this respect, cointegration analysis can be used for the permanent-transitory decomposition of data. Such models are called common stochastic trends models or structural cointegrated VAR models (SVECM) and it is the use of cointegration analysis for permanent-transitory decomposition that makes them different from conventional SVAR models. In a common trends model structural shocks are identified separately in the permanent and transitory parts of the model.

My main interest in this paper is to investigate the consequences of a negative demand shock that affects less competitive industries. We have to be aware of the fact that there are also industries that will benefit from entering the EU. In order to analyse the consequences of the potential lower demand, the shocks have to be identified.

The restriction on the transitory component is that real aggregate demand shocks do not influence real wages and employment in the short-run. For identifying permanent shocks the restriction that a pure productivity shock has no long-run effect on inflation is employed.

With a 4-dimensional system and *2* cointegrating relations we can identify *2* permanent shocks or common stochastic trends that are orthogonal to *2* transitory shock components. Here, the identification of both permanent and transitory shocks is of concern. In order to distinguish permanent shocks from transitory ones, we have to introduce two additional identification restrictions: one restriction for the identification of transitory shocks and one for the identification of permanent shocks. These restrictions cannot be statistically tested, hence they have to be based on economic theory.

The motivation for identification restrictions is the following. We need to take into account that the Slovenian labour market is quite rigid. This means that (real) aggregate demand shocks do not influence real wages and employment in the short run. This is also used as the identifying restriction of transitory demand shock. On the other hand, short-run productivity shocks are left unrestricted. For identifying permanent shocks I employ the restriction that a pure productivity shock has no long-run effect on inflation, which is in line with the real business cycle theory and new-Keynesian theory of productivity shocks. Permanent and money-non-neutral shocks are left unrestricted.

It is probably undisputable that entering the EU will have a positive influence on the economy in the long run. However, EU entry might also have negative short-run consequences for some industries that are labour intensive. In the common market they will be exposed to foreign competition to a higher degree and the government can no longer use subsidies that do not comply with the EU legislation to support them in the event of economic distress. Both factors could erode their relative competitive position. The hypothesis is that such adverse developments in part of the economy might cause a fall in aggregate demand and a consequent decrease in output growth, the growth of real wages, employment and inflation. However, if not already in the short run then the positive effect of EU membership should eventually prevail. From this point of view we can argue that the shock we are looking for is transitory and not permanent. Assuming that entering the EU would present such a permanent negative shock for some industries that it would also have a permanent effect on the whole economy would imply that all less competitive firms go bankrupt and all laid-off employees in these firms remain unemployed. In other words, this would implicitly assume that firms would not respond to the shock by restructuring and laid-off workers would not seek alternative employment opportunities. I argue such an assumption is highly implausible.

5.1. Impulse response analysis

To answer the question about the potential short-run negative effects of EU entry we need to check whether any of the two identified transitory shocks exhibit the dynamics described above: a short-run fall in output growth, real wages, employment and inflation; all these effects caused by the reduced competitiveness of part of the economy.

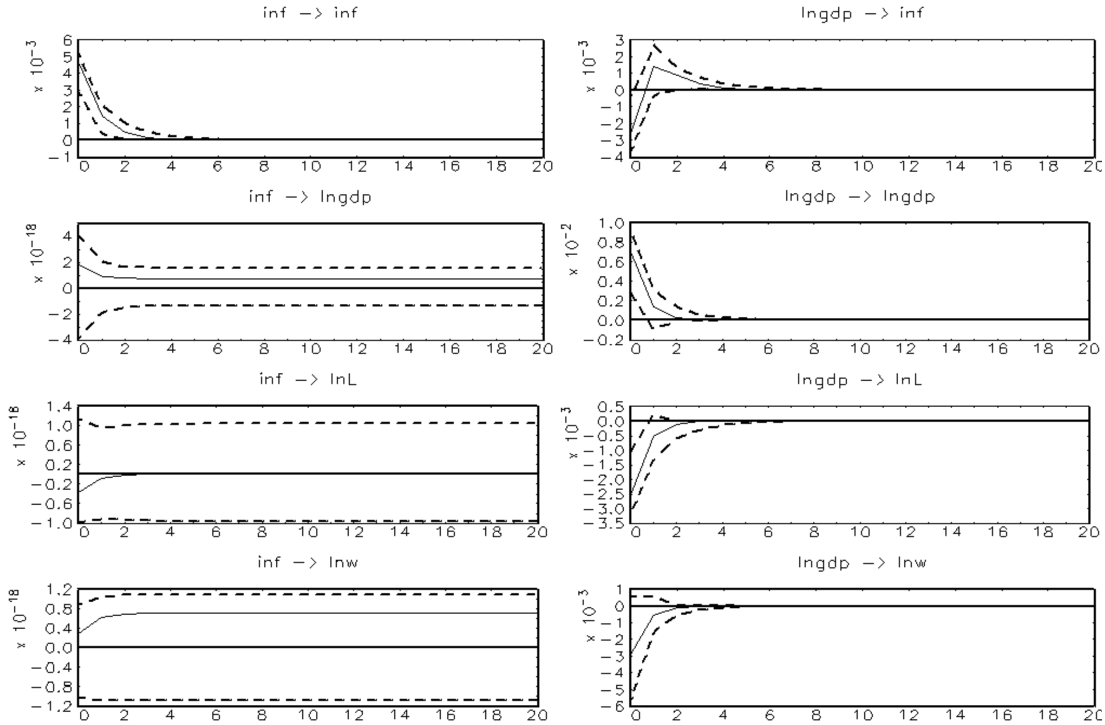
Table 5: **A matrix**

	v_1^T	v_2^T	v_1^P	v_2^P
inf	0.005 (5.3)	-0.003 (-2.8)	0.002 (1.6)	-0.001 (-1.0)
lngdp	0.000 (0.7)	0.007 (3.6)	0.001 (0.3)	0.009 (3.3)
lnL	0.000 (0.0)	-0.002 (-3.8)	0.002 (3.3)	0.001 (2.3)
lnw	0.000 (0.0)	-0.003 (-1.8)	-0.010 (-4.9)	0.003 (3.5)

Notes: v_1^T - first transitory structural shock, transitory demand shock, v_2^T - second transitory structural shock, v_1^P - permanent money-non-neutral shock, v_2^P - permanent productivity shock; bootstraped t-values in parentheses.

The estimation results of the matrix of contemporaneous correlations among structural shocks of the common trends model (matrix *A* in (4)) are presented in Table 5. The impact of transitory shocks can be seen in the first two columns. The results show that the first transitory shock, v_1^T, also called a real demand shock, has a significant impact only on inflation and so cannot describe the dynamics we are looking for. Also the second transitory shock, v_2^T does not exhibit the expected behaviour since GDP has a different sign from the other variables. Impacts of transitory shocks are better seen in Figure 3 below that presents the impulse responses of variables to structural transitory shocks with 95% confidence intervals, empirically computed by 1000 bootstrap replications.

Figure 3: **Impulse responses to structural transitory shocks**



Source: Own calculations.

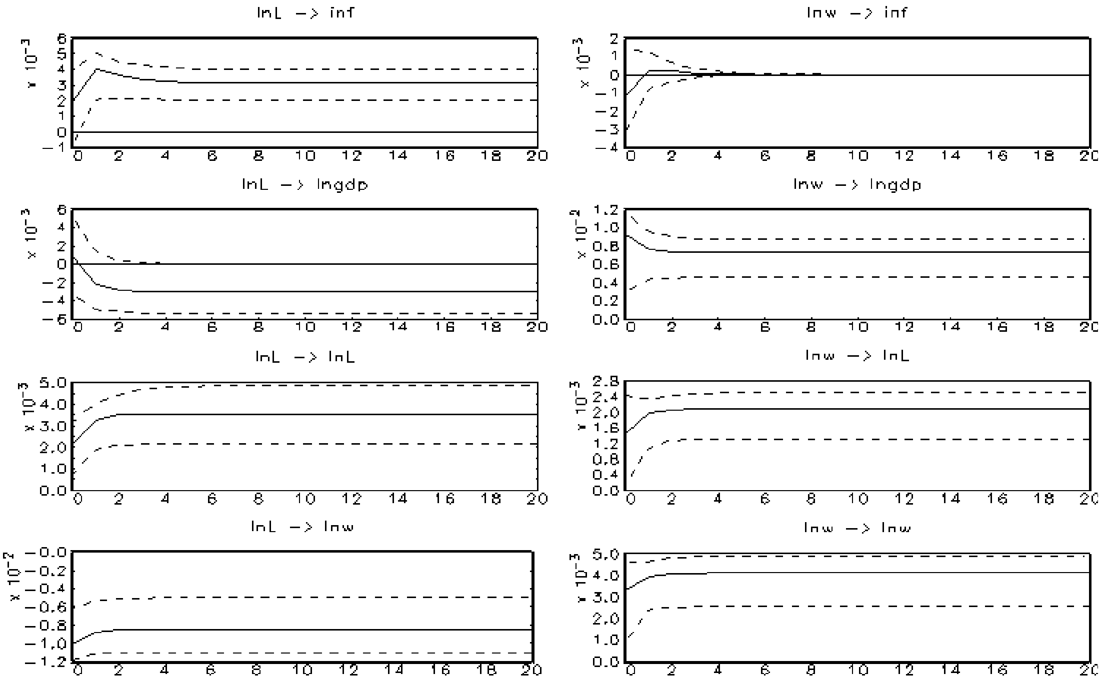
The plots on the left reveal that a significant increase in inflation in a year is accompanied by a negligible increase in output and wages, and a negligible decrease in employment. What is more, all responses of real quantities are not significant at the 5 percent level. The impulse responses to the second transitory shock are presented in the right panel of Figure 3. The significant fall of output for one quarter is accompanied by a significant increase of employment that lasts half of the year and by an insignificant increase in wages and decrease in inflation.

The short-run elasticities in matrix *A* and the impulse responses describe above reveal that in the past the Slovenian economy was not exposed to an aggregate demand shock that would cause a simultaneous fall in employment, real wages and inflation. Note that the Slovenian economy was already exposed to the liberalisation of foreign trade in the past: the entering into force of the free-trade agreement with the EU, the Central European Free Trade Agreement (CEFTA) and the free-trade agreements with the countries of former Yugoslavia. This fact combined with the empirical results presented here show that even though there may have been negative sectoral effects of trade liberalisation these were however such that they imposed a low probability of any serious negative macroeconomic consequences for the Slovenian economy. This also implies that the corporate sector is able to respond to adverse economic developments through successful restructuring. Moreover, the probability of significant negative macroeconomic effects of such a shock is further reduced if the potential positive impact of joining the EU on the competitive part of the economy is considered.

In the past Slovenian economy was not exposed to an aggregate demand shock that would cause a simultaneous fall in employment, real wages and inflation.

Although it has been argued thus far that any potential fall in aggregate demand due to EU entry is better considered as transitory, we can also consider the extreme

Figure 4: **Impulse responses to structural permanent shocks**



Source: Own calculations.

negative scenario and analyse the consequences if we assumed that such a shock had a permanent negative impact on the whole economy. Let us think of this as the worst-case scenario. The impulse responses to structural permanent shocks are reported in Figure 4.

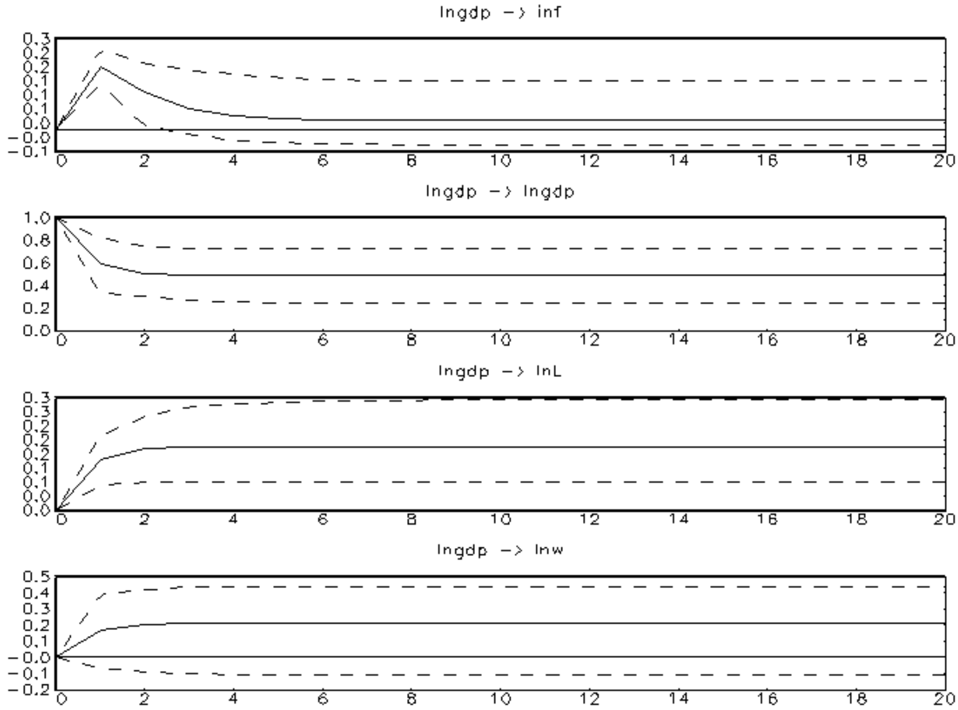
Plots on the right present a classic productivity shock, where a fall in output is accompanied by a significant fall in employment and real wages and an insignificant increase in inflation.

Under the assumption that labor market rigidities hamper the adjustment of the workforce and wages in the quarter experiencing a fall in exports, the fall in aggregate demand by 1 percent could reduce GDP by 0.4 percent, real wages by 0.17 percent and employment by 0.14 percent in the long run.

Similar conclusions are derived from impulse responses to a reduced-form shock to output. Although they cannot be given a structural interpretation, we can analyse the responses of variables to an aggregate demand shock on the assumption that employment and real wages cannot adjust in the first quarter. This assumption is quite realistic since the labour market in Slovenia is quite rigid. Further, it can be noticed that the reduced-form shock can be interpreted as a permanent shock. The results show that, with the exception of the initial response of inflation, other variables exhibit similar dynamics as for the productivity shock. This implies that a shock to the GDP equation can most closely be associated with productivity development in the economy. In particular, on the assumption that labour market rigidities hamper the adjustment of the workforce and wages in the quarter experiencing a fall in exports, a fall in aggregate demand by 1 percent could reduce GDP by 0.4 percent, real wages by 0.17 percent and employment by 0.14 percent in the long run. All variables practically achieve the long-term level in the period of one year.

How can we relate these results to the question about the potential negative consequences of greater exposure to foreign competition after EU entry? Such a shock would impose negative demand pressure and result in the negative dynamics described above only on the assumption that it would result in a permanent reduction

Figure 5: **Impulse responses to a reduced-form shock to the GDP equation**



Source: Own calculations.

of aggregate productivity. In other words, in such a scenario firms would not respond by restructuring. As already argued above, this is highly implausible given the fact that the Slovenian economy has already experienced significant waves of trade liberalisation in the past.

6. Conclusions

It is probably undisputable that entering the EU will have a positive influence on the economy in the long run. However, EU entry might also have negative short-run consequences for some industries that are labour-intensive. In the common market they will be exposed to foreign competition to a higher degree and the government can no longer use subsidies that do not comply with the EU legislation to support them in the event of economic distress. Both factors could erode their relative competitive position. The hypothesis tested in the paper is whether such adverse developments in part of the economy might cause a fall in aggregate demand and a consequent decrease in output growth, the growth of real wages, employment and inflation.

The possible consequences of the reduced competitiveness of labour-intensive industries for the Slovenian economy are estimated by using the cointegrated vector autoregression model. Two equilibrium relations are evaluated: the relation between employment and labour costs per unit of GDP and the long-term relation between inflation, real wages and GDP.

In order to make the conclusions more robust concerning the potential negative effects of EU entry on the Slovenian economy the SVECM is also analysed. This framework allows an analysis of the nature of shocks the Slovenian economy was exposed to in the past. The basic assumption is that, if not already in the short run, the positive effect of EU membership should eventually prevail. From this point of view it can be argued that the aggregate demand shock we are looking for is transitory and not permanent. The SVECM analysis shows that similar falls in the degree of protectionism in the past did not lead to any significant falls in aggregate demand and employment stemming from the increased exposure to foreign competition. Moreover, the data reveal the low probability of any serious negative macroeconomic consequences for the Slovenian economy. This probability is further reduced if the potential positive impact of joining the EU on the competitive part of the economy is taken into account.

Although it has been argued that the potential fall in aggregate demand due to EU entry is better seen as transitory, we can consider the extreme negative scenario and analyse the consequences as if we assumed that such a shock had a permanent negative impact on the whole economy. On the assumption that labour market rigidities hamper the adjustment of the workforce and wages in the quarter experiencing a fall in exports, a fall in aggregate demand by 1 percent could reduce GDP by 0.4 percent, real wages by 0.17 percent and employment by 0.14 percent in the long run. All variables practically achieve their long-term level in the period of one year.

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