

## BANKING SECTOR STABILITY DURING THE PROCESS OF EURO ADOPTION\*

Yrd. Doç. Dr. Bilge Kağan ÖZDEMİR\*\*

### ABSTRACT

*In this paper, reasons of the rapid credit expansion in three biggest new European Union member states (i.e., Czech Republic, Hungary and Poland) are investigated during the process of Euro Adoption. Credit expansion is identified as a boom, if it exceeds the standard deviation of the country's credit fluctuations around trend by a factor of 1.75. Following the literature on credit booms, the trend is estimated by using Hodrick-Prescot (HP) filter. Furthermore, to investigate the direction of the causal relationship between the credit expansion and economic growth, the traditional Granger causality test is applied in an vector error correction (VEC) context.*

**Keywords:** Credit Booms, Euro Area, Banking Sector Stability.

## EURO'NUN KABUL EDİLME SÜRECİNDE BANKACILIK SEKTÖRÜNDE İSTİKRAR

### ÖZ

*Bu çalışmada, Çek Cumhuriyeti, Macaristan ve Polonya gibi en büyük üç yeni Avrupa Birliği üyesinin Euro'yu kabul etme sürecinde yaşadığı hızlı kredi genişlemesinin sebepleri incelenmiştir. Kredi dalgalanmalarının standart sapmasının ülkeye özgü trend değerinden 1.75 ve üzerinde aştığı durumlarda kredi genişlemesi balon olan tanımlanmış ve kredi balonları ile ilgili mevcut literatüre bağlı kalınarak trend değeri Hodrick-Prescott filtreleme yöntemi ile elde edilmiştir. Bunun yanı sıra, kredi genişlemesi ile ekonomik büyüme arasındaki nedensellik ilişkisinin yönünü araştırmak amacıyla, geleneksel Granger nedensellik testi kısıtsız vektör hata düzeltme yönetiminde uygulanmıştır.*

**Anahtar Kelimeler:** Kredi Balonları, Euro Alanı, Bankacılık Sektöründe İstikrar

\* An earlier version of this paper was presented at the ICBME Conference, June13- June 17, 2007.

\*\* Anadolu Üniversitesi İ.İ.B.F. İktisat Bölümü, e-mail: bilgeko@anadolu.edu.tr.

## 1. INTRODUCTION

During the process of Euro adoption, some participating member states were faced with unprecedented lending booms. Not surprisingly, mostly affected ones were the lower-income, catching up countries (i.e., Greece, Portugal and Ireland). The stylized facts about lending booms in these three EMU members make it obvious that a similar story may be underway in the new EU accession countries. These countries are poor relative to the rest of Euro area, face currently higher nominal and real interest rates (Brzoza Brzezine, 2005, p.4-5) and financial sectors in these countries were dominated by commercial banks. Since, banking crises tend to be preceded by lending booms (see, for example, Bell and Pain, 2000, Gavin and Hausmann, 1998, Gourinchas Valdes, Landerretche, 2001) and there is ample empirical evidence that credit overexpansion and banking crises related (see, for example, Demirgüç-Kunt and Detragiache 1998, Honahan 1997), rapid credit extension has become a key topic for policy discussion during the process of Euro adoption.

In this paper, reasons of the rapid credit expansion in three biggest new EU member states (i.e., Czech Republic, Hungary and Poland) are investigated during the process of Euro adoption. The main motivation of the study is to answer the question; “*whether we have to concern about all credit extensions or not*”. On one side, many economists (see, for example, Schumpeter, 1911; Goldsmith, 1969; McKinnon, 1973; Shaw, 1973; Odedokun, 1996; King and Levine (1993a, 1993b)) have underlined the importance of financial sector in the process of economic development and in literature it has been accepted that one of the main indicators of financial development is credit extension. On the other side, some other scholars have concentrated on the potential negative impact of finance on growth (see, for example, Van Wijnbergen, 1983; Buffie, 1984, Lucas 1988, Honahan, 1997). Besides, it has been well known issue that there are such situations in which credit extensions have been followed by sharp economic downturns and financial crises. Demirgüç-Kunt and Detragiache (1998), for instance, show that after controlling for the existence of deposit insurance, the ratio of private credit to gross domestic product (GDP) and the (lagged) real growth of private credit are significant determinants of banking crises. In order to answer the question, we should separate credit booms from episodes of rapid credit growth. For this aim, credit expansion is identified as a boom if it exceeds the standard deviation of the country’s credit fluctuations around trend by a factor of 1.75. In this context, for determining the trend Hodrick-Prescot (HP) filter has been used.

According to the results, the situations, which have been happening in Czech Republic, Hungary and Poland, cannot be accepted as lending booms. Based on these results, the reasons of credit extension in these three countries is tried to be find. As Terrones and Mendoza (2004) explain, three factors can cause rapid credit grow; financial deepening (trend), normal cyclical upturns and excessive capital movements. In their study, excessive capital movement accepted as credit growths. In order to find the reason of rapid credit growth, either financial deepening or normal cyclical upturns, the traditional Granger non-causality test is applied in a vector error correction (VEC) context. As a result, I found that for the case of Hungary and Poland, in the short-run, causality runs from credit extension to economic growth and in the long-run, there is two way causalities between credit extension and economic growth and for the case of Czech Republic causality runs from economic growth through credit extension. Thus the reason of credit extension can be accepted as financial deepening.

The remainder of the paper is organized as follows; the following part provides a brief review of literature on lending booms. Section three discusses the methodological issues and presents empirical results we obtained. Finally, in section four, we will finish with some concluding remarks.

## 2. BRIEF OVERVIEW OF THE LITERATURE ON LENDING BOOMS

Credit booms have been used to explain many banking crises, including Chile's in 1982, Mexico's in 1994, and Thailand's in 1997. In each case, reliance on foreign capital led to financial disturbances that combined banking crises with a balance-of-payments collapse. The experience of credit booms had led some academics and practitioners to advocate the use of controls on short-term capital inflows or on private credit growth. Gourinchas, Valdes, Landerretche (2001), define a credit boom as a period when the ratio of private credit to private gross domestic product deviates from a country-specific stochastic trend. They show that during a boom, credit to the private sector increases rapidly whereas, the quality of funded projects declines, and the banking sector becomes more vulnerable. Terrones and Mendoza (2004) accept excessive capital movements as credit booms and identify credit booms as deviations from trend. In this study the reasons of rapid credit growth is explained by three reasons; financial deepening (trend), normal cyclical upturns and excessive capital movements. In both Gourinchas Valdes, Landerretche (2001) and Terrones and Mendoza (2004) studies, a credit expansion in a given country is identified as a boom if it exceeds the standard deviation of the country's credit fluctuations around trend by a factor of 1.75. This threshold motivated by the fact that, if the yearly credit deviations from trend were normally distributed, there would be a 5 percent probability of observing these extreme values. Also Balls (2002) defines credit booms as a period when the ratio of private credit to private gross domestic product deviates from its historical trend.

According to literature, there are some main reasons of credit booms. For example, Kindleberger (1978), explains credit booms as a result of herding behavior by banks. Peterson and Rajan (1995), suggest that agency problems that lead to the implementation of lending policies by some banks that may be affected by others can cause credit booms. According to Corsetti, Pesenti and Roubini (1999), the main reason of credit booms are explicit or implicit government guarantees. And Calvo (1986) asserts that lack of credible economic policies cause to credit booms. Also it has been well known issue that there is a strong relationship between credit booms and banking sector balance sheet structure, both as a reason and a result.

Apart from excessive cyclical movements (credit booms), there are two more reasons which might cause to rapid credit growths: financial deepening and normal cyclical upturns. In the case of financial deepening, credit extension would cause to real economic growth (the supply-leading phenomena). And in the normal cyclical upturn case real economic growth would cause credit extension (demand-following case).

Gurley and Shaw (1955) pinpoint the credit channel in the supply of funds to the real activity, and underscore the idea that differences in financial systems development may explain economic performances across countries. Patrick (1966), who first introduced the idea of the bi-directional relationship between financial development (FD) and economic growth (EG), suggests two patterns in the relationship between financial development and economic growth. In the first pattern, which is called "supply-leading", FD causes EG by allocating resources to more productive sectors. Patrick explains the functions of the supply-leading phenomenon as follows: "to transfer resources from the traditional, low-growth sectors to the modern, high-growth sectors and stimulate an entrepreneurial response in these modern sectors".

In the second pattern suggested by Patrick, called "demand-following", economic growth creates demand for developed financial institutions and services. According to Patrick, the creation of modern financial institutions, their financial assets and liabilities and related financial services are a response to the demand for these services by investors and savers in the real economy.

### 3. METHODOLOGICAL ISSUES

#### 3.1. The Data

One of the most important issues in assessing the relationship between credit expansion, financial development and economic growth is how to obtain a satisfactory empirical measure of financial development. Construction of financial development indicators is an extremely difficult task due to the diversity of financial services catered for in the financial system. What represent an appropriate measure of financial development seems to be controversial in the literature. The four most commonly used proxies for financial development are: the ratio of money to income, the ratio of banking deposit liabilities to income, the ratio of private sector credit to income and the ratio of domestic credit to income (see, for example, Goldsmith 1969, World Bank, 1989, King and Levine 1993a, 1993b, Levine et al, 2000). In this study, the aim is only investigating the relationship between credit extension and economic growth. As Mc Kinnon (1998, p.561) puts it, *“what is the cause and what is the effect? Is finance a leading sector in economic development or does it simply follow real output which is generated elsewhere?”* For several reasons, the specification is tried to keep as simple as possible. First, the availability of time series for accession countries is limited. A number of time series starts only very recently. Since I would like to have the same data set for all three new member states, this substantially limits our possibilities. Second, even the longest available series are relatively short (not longer than 10 years of quarterly observations).

I use quarterly data starting Q1 1994 for the Czech Republic and Poland and Q4 1994 for Hungary, whereby the starting points are given by data availability and the ending points are limited with the EU accession of these countries. In light of the preceding arguments, the value of credit offers by the commercial banks to the private sector divided by GDP (denoted by DomCred\_GDP) is used as a measure of credit extension. This indicator is frequently used in order to provide direct information about the allocation of financial assets. This variable can also be used as a proxy for financial market development. Here it is worth mentioning that this proxy does not include credit to the private sector by non-deposit money banks, the central bank (credit issued to governments or public enterprises) and hence is an exclusive measure of the intermediary role of commercial banks. In addition to domestic credit as a ratio of GDP, I use following variables that can also be use as financial development proxies; M2 money supply as a ratio of GDP (denoted by M2\_GDP), growth rate of real GDP (denoted by ReGDP) and real interest rate (denoted by ReInt). M2 money supply as a ratio of GDP has become a standard measure of financial depth and an indicator of the overall size of financial intermediary activity. An increase in M2/GDP may reflect an extensive use of bank deposits, and for this reason this measure can be used as an indicator of the degree of financial intermediation by banking institutions. The growth rate of real GDP is a proxy for measuring economic growth that provides a high indicative power of the quality and quantity of economic growth. Finally, the real interest rate included in to model as a control variable for both economic growth and financial development.

All variables are transformed in logarithmic form to stabilize the variance of a series. The data were collected from the International Financial Statistics (IFS: CD-ROM Version) of the International Money Fund (IMF) for all variables. Since all variables are in log form, the first differences give us the growth rates of the variables.

### 3.2. Method of Estimation and Empirical Results

The central question in this sub section is whether we have to concern about all credit extensions or not. In order to answer this question we should separate credit booms from episodes of rapid credit growth. The approach by Terrones and Mendoza (2004) and Gourincha et al (1999) is followed and a credit expansion in a given country is identified as a boom if it exceeds the standard deviation of the country's credit fluctuations around trend by a factor of 1.75. This threshold motivated by the fact that, if the yearly credit deviations from trend were normally distributed, there would be a 5 percent probability of observing these extreme values. The results are robust to using thresholds of 1.5 and 2. Following the literature on credit booms the trend is estimated by using Hodrick-Prescott (HP) filter. Moreover, to investigate the direction of the causal relationship between the credit expansion and economic growth, the traditional Granger non-causality test is applied in an unrestricted vector auto regression (VAR) context.

#### 3.2.1. Identifying Credit Booms

In order to separate credit booms from episodes of rapid credit growth, the trend is estimated by using Hodrick-Prescott (HP) filter. A Hodrick-Prescott filter applied to a time series  $\{y_t\}$  produces the filtered series  $\{\hat{y}_t\}$  which solves the following minimization:

$$\min \sum_{t=1}^T (y_t - \hat{y}_t)^2 + \lambda \sum_{t=2}^{T-1} ((\hat{y}_{t+1} - \hat{y}_t) - (\hat{y}_t - \hat{y}_{t-1}))^2 \quad (1)$$

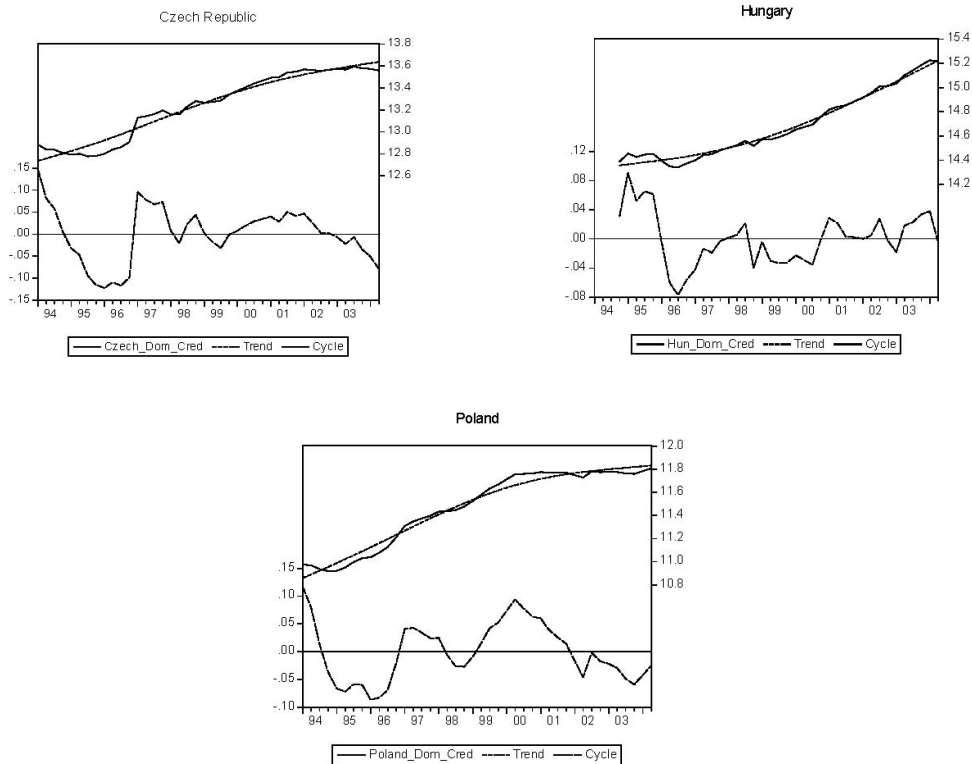
The first term is standard sum of squared residuals; the second term is a penalty factor for changing the slope of  $\{\hat{y}_t\}$  too much.  $\lambda$  controls the importance given to the penalty. If  $\lambda = 0$  then  $\hat{y}_t = y_t$  for all  $t$ ; as  $\lambda \rightarrow \infty$  the H-P filter becomes a simple least squares linear regression.<sup>1</sup>

Figure 1 shows the trend values of real loans to the private sector ratio which estimated by using Hodrick-Prescott (HP) filter<sup>2</sup>. To make deviations more obvious we can subtract the trend values which we found by using HP method by current values of real loans to private sector. As can be seen from Figure 1, during the period 1995:1 to 2004:4, the deviations of credits from trend values do not exceed the threshold value 1.75 in all of the three new member states.

Summing up, in case of our sample, we cannot regard the main factors which cause credit booms like herding behavior by banks, agency problems that lead to the implementation of lending policies by some banks, explicit or implicit government guarantees or lack of credible economic policies. Furthermore, the H-P filtering method shows that the standard deviation of credit fluctuations stay below the threshold value. Hence, we cannot accept the rapid credit grow as credit booms in these three biggest new EU members.

<sup>1</sup> For more information about basic properties and applications of Hodrick-Prescott filtering method see Edward C. PRESCOTT (1986), **Theory Ahead of Business Cycle Measurement**, Carnegie-Rochester Conference Series Public policy, Vol.25, No:1

<sup>2</sup> As I mention before H-P Filter is one of the most common method for estimating trends in credit booms, for example see Allen, Gale, (2000), Gourincha, Valdes, Landerrretche (1999), Terrones (2004)



Source: Own Calculations.

**Figure 1. Credit Booms versus Episodes of Rapid Credit Growth in Czech Republic, Hungary and Poland**

### 3.2.2. Unit Root Testing

The order of integration of each variable needs to be identified before any sensible econometric analyses can be undertaken and so the first step in the empirical test is the univariate characteristics of the variables. Testing stationarity of time series lead to the implementation of the econometric model using the appropriate methodology. Therefore, as a first in the empirical analysis, the stationarity conditions of the each variable is checked by using the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests assuming constant and trend terms in the regressions. Thus for the ADF and PP tests, we compare the ADF and PP statistics obtained with the MacKinnon (1996) critical values also possible in EViews 5.1, and for the case of stationarity we expect that these statistics are larger than the MacKinnon critical values in absolute value and that they have a minus sign. Although differencing eliminates trend, we report the results of the unit root tests for the first differences of the variables with a linear time trend in the test regression. The results of unit root tests are presented in Table 1.

Table 1. ADF and Phillips-Perron Unit Root Tests

Test with a Constant	Czech Republic		Hungary		Poland	
	ADF	PP	ADF	PP	ADF	PP
ReInt	-0.19206	-1,51293	-2.73956	-2,60026	-1.65867	-1,626377
$\Delta$ ReInt	-3.29910**	-4,34233*	-6.42687*	-6,59064*	-4.27327**	-6,13582*
lReGDP	0.48390	-2,54173	-0.98435	-0,39853	-3.27459	-0,18639
$\Delta$ lReGDP	-3.11402**	-3,60559**	-4.35320*	-4,62053*	-4.80023**	-2,61254***
IM2_GDP	-0.73530	-1,54824	-2.05760	-0.23124	-2.65452	-1,57016
$\Delta$ IM2_GDP	-7.21179	-5,46781*	-3.05402**	-7,58578*	-4.04021*	-7,46756*
lDomCre_GDP	-0.46396 (0)	-1,11670	-1.78345	-0.53691	-2.23696	-0,51391
$\Delta$ lDomCre_GDP	-4.88003* (1)	-2,96301**	-6.78703*	-4,94356*	-3.73546*	-4,92181*
Test with a Constant and Trend	ADF	PP	ADF	PP	ADF	PP
ReInt	-0.19206	-1,20263	-2.73956***	-2,55377	-1.65867	-2,33769
$\Delta$ ReInt	-3.29910**	-4,34286*	-6.42687*	-6,50944*	-4.27327**	-6,27603*
lReGDP	0.48390	-1,03840	-0.98435	-3,11789	-3.27459	-1,13606
$\Delta$ lReGDP	-3.11402**	-3,72461**	-4.35320*	-4,40199*	-4.80023**	-3,20332***
IM2_GDP	-0.73530	-1,16412	-2.05760	-0.23124	-2.65452	-3,93812***
$\Delta$ IM2_GDP	-7.21179	-4,32521**	-3.05402**	-7,58578*	-4.04021*	-7,25537*
lDomCre_GDP	-0.46396	-0,86013	-1.78345	-0.53691	-2.23696	-1,93355
$\Delta$ lDomCre_GDP	-4.88003*	-3,25830*	-6.78703*	-4,94356*	-3.73546*	-4,83898*

\*, \*\*, \*\*\* denote rejection of null hypothesis at the 1%, 5% and 10% level respectively. Number of lags was chosen in accordance with the Schwarz info criterion. Critical values are from McKinnon (1996).

The results of the test for all variables are presented in Table 1. The results show that only one variable, real interest rate of Hungary, is stationary in levels with constant and trend according to Phillips-Perron statistics. The rest of the series are non-stationary when the variables are defined in terms of levels. First differencing the series removed the non stationary components in all series, concluding that all series are integrated of order one. Since the variables are stationary, the next step is to use Johansen (1988; 1995) full information maximum likelihood to test for cointegration.

### 3.2.3. Co-integration Tests

Once the tests of integration (i.e., unit root test) achieved it is possible to implement tests of co-integration to check the existence of a stable long run relationship between credit extension and growth. Engle and Granger (1987) points that a linear combination of two or more non-stationary series may be stationary and if such a stationary linear combination exists the non-stationary time series are said to be cointegrated. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables.

The purpose of the cointegration test is to determine whether a group of non-stationary series is cointegrated or not. For two series to be cointegrated, both need to be integrated of the same order, 1 or above. If both series are stationary or integrated of order zero, there is no need to proceed with cointegration tests since standard time series analysis would then be applicable. If both series are integrated of different orders, it is safely possible to conclude non-cointegration. Lack of cointegration implies no long-run equilibrium among the variables such that they can wander from each other randomly. Their relationship is thus spurious. For any  $k$  endogenous variables, each of which has one root, there will be  $0$  to  $k-1$  cointegrating relationships.



This study uses the Johansen (1988) and Johansen and Juselius (1990) approaches to test for co-integration and the non-standard critical values are from Mc Kinnon, Haug, Michelis (1999), which is also provided by the EViews program. Suppose for that, that we have a general VAR model with  $k$  lags:

$$X_t = \sum_{i=1}^k \pi_i X_{t-i} + c + \varepsilon_t \quad (2)$$

which can also be written as

$$\Delta X_t = \sum_{i=1}^k \Gamma_i \Delta X_{t-k} - \pi X_{t-k} + c + \varepsilon_t \quad (3)$$

$$\text{where } \Gamma_i = -I + \pi_1 + \pi_2 + \dots + \pi_i \\ i = 1, 2, \dots, k-1 \quad \text{and} \quad \pi = I - \pi_1 - \pi_2 - \dots - \pi_k$$

here  $p$  is equal to the number of variables under consideration. The matrix  $\pi$  captures the long-run relationship between the  $p$ -variables. For example,  $X_t$  is linked with the matrix  $\pi$  by some long-run relationship, from which they can deviate in the short run but must return to in the long run. If variables diverge without bound (i.e. non-stationary residuals) no equilibrium relationship could be said to exist.

Johansen (1988, p.231-254) suggests two test statistics to determine the co-integration rank. The first one is known as the trace statistic and the second one is known as max test (maximum eigenvalue test). These tests are mainly based on the comparison of  $H_0 (r - 1)$  against the alternative  $H_1(r)$ , where  $r$  represents the number of co-integrating vectors. In some cases Trace and Maximum Eigenvalue statistics may yield different results. Kütkepol et.al. (2001) compare maximum eigenvalue and trace tests for the cointegrating rank of a VAR process. The comparison is performed for test variants suitable for different types of deterministic terms. In this study, writers show that in a small-sample simulation comparison trace tests tend to have more heavily distorted sizes whereas their power performance is superior to that of the maximum eigenvalue competitors. In particular, the trace tests are advantageous if there are at least two more cointegrating relations in the process than are specified under the null hypothesis. Similarly, Alexander (2001) indicates that results of trace test should be preferred.

In order to estimate the cointegration regression equation, I regress economic growth on credit extension and other variables as follows;

$$ReGDP_t = \beta_1 + \beta_2 DomCred\_GDP + \beta_3 M2\_GDP + \beta_4 ReInt + u_t \quad (4)$$



This can respectively, be written as;

$$u_t = (\text{Re } GDP_t - \beta_1 - \beta_2 \text{DomCred}_t - \beta_3 M2\_GDP - \beta_4 \text{Re Int}) \quad (5)$$

If the residuals, from the above regressions are subject to unit root analysis are found stationary, then the variables are said to be cointegrated and hence interrelated with each other in the long run or equilibrium. If there exists a long term relationship between the above two series, in the short run there may be a disequilibrium. There fore one can treat the error term  $u_t$  in the above equations as the “equilibrium error”. This error term can be used to tie the short run behavior of the dependent variable to its long-run value.

The Johansen co integration procedure gives the results as reported in Table 2. The null hypothesis of no cointegration can be rejected for both three countries either using the maximum eigenvalue or the trace statistic. They are both greater than their critical value. Therefore, we can conclude that the maximum eigenvalue and trace statistics show that there are at least one co integrating vector between financial development proxies and economic growth at the 5 per cent level for each of the new member states. This confirms the existence of an underlying long-run stationary steady-state relationship between the dependent and explanatory variables in logarithm. One can see from Table 2 that, trace statistics and eigenvalues present some contradictions. As mentioned early in this subsection, Kütkepol et.al. (2001) and Alexander (2001) indicates that results of trace test should be preferred. According to trace statistics presented in Table 2 there are more than one co integrated relationship between financial development proxies and economic growth for Czech Republic and Hungary and one long term co integrated relationship for Poland. Here it is worth mentioning that, it is not uncommon to find more than one cointegrating relationship in a system with more than two variables using Johansen procedure and such a case shows that there are more than one long term stable relationship between variables.

**Table 2. Johansen Cointegration Tests Result**

Country	Hyp no of CE	Trace Statistics	5%Critical Value	Hyp. no of CE	Max Eigenvalue	5% Critical Value
Czech Republic	None*	77.63334	54.07904	None*	36.66250	28.58808
	At most 1*	40.97084	35.19275	At most 1	18.18060	22.29962
	At most 2*	22.79024	20.26184	At most 2	15.00800	15.89210
Hungary	None*	93.75613	54.07904	None*	32.84574	28.58808
	At most 1*	60.91039	35.19275	At most 1*	31.34195	22.29962
	At most 2*	29.56844	20.26184	At most 2*	19.14010	15.89210
Poland	None*	64.64932	48.34295	None*	31.74350	24.98465
	At most 1*	38.94332	36.97445	At most 1*	21.93487	17.96548

\* denote rejection of null hypothesis at the 5% level. Critical values are from Mc Kinnon, Haug, Michelis (1999)

### 3.2.4. Investigating the causality of Credit Extensions by Using VECM

When a set of variables is stationary or cointegrated, causality test can be conducted. Following the work of Granger (1969, 1988) an economic time series X said to Granger cause another series Y, if the lags of X can improve a forecast for variable Y. In a VAR model, under the null hypothesis that variable X does not Granger cause variable Y, all the coefficients on the lags of variable X will be zero in the



equation for variable Y. Wald test is commonly used to test for Granger causality. The causative relationship can go from X to Y only, Y to X only, or Y to X and X to Y. Granger causation is tested by regressing Y on an arbitrary number of its own lagged values and the same number of lagged values of X. If the hypothesis that the parameters on the lagged values of X are jointly equal to zero is rejected, it is claimed that X Granger cause Y.

The causal relationship between credit extension and the other variables is examined with the help of Granger-Causality procedure based on Unrestricted Vector Auto Regression using the error correction term. This procedure is particularly attractive over the standard VAR because it permits temporary causality to emerge from firstly, the sum of the lagged differences of the explanatory differenced variable and secondly, the coefficient of the error-correction term. It must be pointed out that the standard Granger-causality test omits the additional channel of influence. VAR model is estimated to infer the number of lag terms required (with the help of simulated results using VAR) to obtain the best fitting model and appropriate lag lengths were then used in causality tests yielding the F-statistics and respective p-values. For any F-statistic, the null hypothesis is rejected when the p-value is significant (less than 0.05 or 5% level of significance or those stated otherwise). A rejection of the null hypothesis would imply that the first series Granger-causes the second series and vice versa. The equation (7) includes the error correction term as depicted in the following equations respectively (Monaj and Manasvi, 2007, s.15);

$$\Delta X_t = \phi_0 + \sum_{i=1}^p \phi_{1,m} \Delta X_{m,t-i} + \sum_{i=1}^q \phi_{2} Y_{t-1} + \Psi RES_t + \varepsilon_t \quad (6)$$

Where the error terms is taken from the following cointegrating equation

$$\Delta X_t = \beta_0 + \beta_m (\Delta Y_{m,t} + \varepsilon_t) \quad (7)$$

The independent variables in the equations are first differenced. The null hypothesis  $\Delta Y$  doesn't Granger cause  $\Delta X$  is rejected if the estimated coefficients  $\phi_{1,m}$  as well as the estimated coefficient of error term are jointly significant.

The direction of causality between variables is summarized in Table 3. As can be seen from Table 3, for the case of Czech Republic, at traditional levels of significance, the causality runs from economic growth through proxies for financial development. This pattern can be evaluated under the context of "demand following" economic growth. It is not possible to draw a firm conclusion as to whether the demand-following or supply-leading hypotheses are predominant in the Hungarian and the Polish case. Although chi2 values show stronger causality from credit extension and M2/GDP ratio through economic growth, we can say causality works two sides. So we can say, in the short-run, causality runs from credit extension to economic growth and in the long-run, there are two way causalities between credit extension and economic growth. Thus we can accept the reason of credit extension as financial deepening

**Table 3. Granger Wald Causality Tests Results**

	Equation	Excluded	Chi2	Prob>chi2	df	Direction of Causality
<b>Czech Republic</b>	IReGDP	IDomCred_GDP	0.8187	0.6641	2	---
	IDomCred_GDP	IReGDP	3.8791	0.0442	2	IReGDP $\Rightarrow$ IDomCred_GDP
	IReGDP	IM2_GDP	0.6205	0.7333	2	---
	IM2_GDP	IReGDP	3.9782	0.0356	2	IReGDP $\Rightarrow$ IM2_GDP
	IReGDP	ReInt	6.8029	0.032	2	---
	ReInt	IReGDP	9.7472	0.076	2	IReGDP $\Rightarrow$ ReInt
<b>Hungary</b>	IReGDP	IDomCred_GDP	0.8334	0.2057	2	---
	IDomCred_GDP	IReGDP	5.6515	0.0493	2	IReGDP $\Rightarrow$ IDomCred_GDP
	IReGDP	IM2_GDP	4.1624	0.0557	2	IM2_GDP $\Rightarrow$ IReGDP
	IM2_GDP	IReGDP	1.5383	0.4634	2	---
	IReGDP	ReInt	0.0527	0.9740	2	---
	ReInt	IReGDP	4.2243	0.0495	2	IReGDP $\Rightarrow$ ReInt
<b>Poland</b>	IReGDP	IDomCred_GDP	8.4815	0.013	2	IDomCred_GDP $\Rightarrow$ IReGDP
	IDomCred_GDP	IReGDP	5.8132	0.051	2	IReGDP $\Rightarrow$ IDomCred_GDP
	IReGDP	IM2_GDP	5.8932	0.039	2	IM2_GDP $\Rightarrow$ IReGDP
	IM2_GDP	IReGDP	6.3962	0.038	2	IReGDP $\Rightarrow$ IM2_GDP
	IReGDP	ReInt	.0347	0.938	2	---
	ReInt	IReGDP	7.913	0.019	2	IReGDP $\Rightarrow$ ReInt

#### 4. CONCLUSION

In this paper, reasons of the rapid credit extension in three biggest new EU member states (i.e., Czech Republic, Hungary and Poland) are investigated during the Euro adoption. I use quarterly data starting Q1 1994 for the Czech Republic and Poland and Q4 1994 for Hungary, whereby the starting points are given by data availability and the ending points are limited with the EU accession of these countries. Credit extension is identified as a boom if it exceeds the standard deviation of the country's credit fluctuations around trend, which is estimated by using Hodrick-Prescott (HP) filter, by a factor of 1.75. This threshold motivated by the fact that, if the yearly credit deviations from trend were normally distributed, there would be a 5 percent probability of observing these extreme values. The results are robust to using thresholds of 1.5 and 2. Furthermore, to investigate the direction of the causal relationship between the credit extension and economic growth, the traditional Granger non-causality test is applied in a vector error correction (VEC) context.

The empirical findings in the paper suggest that, in the case of our sample, we can not speak about the main factors which cause credit booms like; herding behavior by banks, agency problems that lead to the implementation of lending policies by some banks, explicit or implicit government guarantees or lack of credible economic policies. Indeed, results of Johansen co-integration tests confirm the existence of an underlying long-run stationary steady-state relationship between the credit extension and economic growth for all of the three new EU member states. Moreover, Granger-Causality test based on unrestricted Vector AutoRegression (VAR) using the error correction term further reveals that, for the case of Czech Republic, at traditional levels of significance, the causality runs from economic growth through proxies for financial development. This pattern can be evaluated under the context of "demand following" economic growth. It is not possible to draw a firm conclusion as to whether the demand-following or supply-leading hypotheses are predominant in the Hungarian and the Polish case. Although, empirical results show stronger causality from financial development proxies through economic growth, it can be said causality works two sides. Hence, in the short-run, causality runs from credit extension to economic growth and in the long-run, there are two way causalities between credit



extension and economic growth. To this extent, this study provides robust empirical evidence in favor of financial deepening causes the credit extension for the three biggest new EU member states during the process of Euro adoption.

## REFERENCES

- Alexander, C. (2001).** *Market Models: A Guide to Financial Data Analysis*. John Wiley & Sons Ltd.
- Allen, G. (2000).** “Asset Price Bubbles and Monetary Policy”, Riskbank Conference on Asset Markets and Monetary Policy: 1-28.
- Buffie, E. F. (1984).** “Financial Repression, the New Structuralists, and Stabilization Policy in Semi-industrialized Economics”, *Journal of Development Economics*, 14, 305-22.
- Brzoza-Brzezina, M. (2005).** “Lending Booms in Europe’s Periphery: South-Western Lessons for Central-Eastern Members” *ECB mimeo*.
- Charemza, W.W. and D. Deadman (1997).** *New Directions in Econometric Practice*. 2nd Edition, Edward Elgar Publishing House, England.
- Corsetti, G., P. Pesenti and N. Roubini, (1999).** “Paper Tigers? A Model of the Asian Crisis,” *European Economic Review*, Vol: 43:1211-1236.
- Demigruc-Kunt, A. and E. Detragiache (1998).** “The Determinants of Banking Crises in Developed and Developing Countries”, *IMF Staff Papers*, Vol. 45: 81-109,
- Engle, R. and Granger, C. W. J. (1987).** “Cointegration and Error-correction: Representation, Estimation and Testing”, *Econometrica* (55): 251-276.
- Gavin, M. and R. Hausmann (1996).** “The Roots Of Banking Crises: The Macroeconomic Context”, *Inter American Development Bank Working Paper* 318 Washington D.C. June.
- Goldsmith, R. (1969).** *Financial Structure and Development*. New Haven, CT: Yale University Press.
- Gourinchas, P.O., Valdes, R. and Landerretche, O. (2001).** “Lending Booms: Latin America and the world”, *NBER Working Paper* 8249.
- Granger, C.W.J. (1969).** "Investigating Causal Relations by Econometric Models and Cross- Spectral Methods”, *Econometrica*, Vol:37:24-36.
- Gurley, J. G. and Shaw, E. S. (1955).** “Financial Aspects of Economic Development”, *American Economic Review*, 45(Sept): 515-538.

- 
- Granger, C. W. J. (1988).** “Granger Causality, Cointegration, and Control”. *Journal of Economic Dynamics and Control*, 12: 551-59.
- Holden, K. and Thompson, J. (1992).** “Co-integration: An Introductory Survey”, *British Review of Economic Issues*, Vol: 14(33):.1-55.
- Honohan, P. (1997).** “Banking Systems Failures in Developing and Transition Countries: Diagnosis and Prediction”, *BIS Working Paper* No:39.
- Johansen, S. (1988).** “Statistical Analysis of Cointegration Vectors”, *Journal of Economic Dynamics and Control*, Vol: 12: 231-254.
- Johansen, S. and Jeselius, K. (1990).** “Maximum Likelihood Estimation and Inference on Cointegration With Applications of the Demand For Money”, *Oxford Bulletin of Economics and Statistics*, May:169-210.
- Kar M. and E.J. Pentecost (2000).** “Financial Development and Economic Growth in Turkey: Further Evidence on the Causality Issue”, *Loughborough University, Economic Research Paper* No. 00/27.
- Kindleberger, C. P. (1978).** *Manias, Panics, and Crashes*. New York: Basic Books.
- King, R. G and R. Levine (1993a).** “Finance, Entrepreneurship, and Growth”, *Journal of Monetary Economics*, 32:513-42.
- King, R. G and R. Levine (1993b).** “Finance and Growth: Schumpeter Might Be Right”, *Quarterly Journal of Economics*, 108: 717-37.
- Levine, R. (1997).** “Financial Development and Economic Growth: Views and Agenda”, *Journal of Economic Literature*, Vol: 25: 688-726.
- Levine, R. (2004).** “Finance and Growth: Theory and Evidence”, *NBER Working Paper Series*, 10766.
- Levine, R., N. Loayza and T. Beck (2000).** “Financial Intermediation and Economic Growth: Causality and Causes”, *Journal of Monetary Economics*, Vol. 46: 31-77.
- Levine, R. and Zervos, S., (1998).** "Stock Markets, Banks and Economic Growth", *American Economic Review*, Vol: 8:537-558.
- Lucas, R. E. (1988).** “On the Mechanics of Economic Development”, *Journal of Monetary Economics*, 22:3-42.
- Lütkepohl, H., Saikkonen, P. And Trenkler, C. (2001).** “Maximum Eigenvalue Versus Trace Tests for the Cointegrating Rank of a VAR Process”, *Econometrics Journal* , Vol 4:287–310.
- McKinnon, R. I. (1973).** "Money and Capital in Economic Development", Washington, DC, Brookings Institution.
- MacKinnon, J.G. (1996).** “Numerical Distribution Functions for Unit Root and Cointegration Tests”, *Journal of Applied Econometrics*, No: 11, 601-618.



- MacKinnon, J.G., Haug, A.A. and Michelis, L. (1999).** “Numerical Distribution Functions of Likelihood Ratio Tests For Cointegration,” *Journal of Applied Econometrics*, Vol: 14: 563-577.
- Manoj, K. and K. Manasvi (2007).** “Does Financial Growth lead Economic Performance in India? Causality-Cointegration Using Unrestricted Vector Error Correction Models”, *MPRA Paper No.* 6154.
- Odedokun, M. O. (1996).** “Alternative Econometric Approaches for Analyzing the Role of the Financial Sector in Economic Growth: Time-Series Evidence from LDCs”, *Journal of Development Economics*, 50(1):119,135.
- Patrick, H. T. (1966).** “Financial Development and Economic Growth in Underdeveloped Countries”, *Economic Development and Cultural Change*, Vol:14:174-189.
- Prescott, E. C. (1986).** “Theory Ahead of Business Cycle Measurement”, *Carnegie-Rochester Conference Series Public Policy*, Vol.25, No:1.
- Rajan, R. G. and Zingales, L., (1998).** “Financial Dependence and Economic Growth”, *American Economic Review*, Vol. 88:559-586.
- Schumpeter, J. A. (1911).** *The Theory of Economic Development*. Cambridge, Mass: Harvard University Press.
- Shaw, E. S. (1973).** *Financial Deepening in Economic Development*. New York: Oxford University Press.
- Terrones, M, and Mendoza, E. (2004).** “Are Credit Booms in Emerging Markets a Concern?” in *World Economic Outlook*, IMF, Washington.
- Trabelsi, M. (2002).** “Finance and Growth : Empirical Evidence from Developing Countries, 1960-1990” *Center for Interuniversity Research in Quantitative Economics (CIREQ)*, No 13.
- Tsuru, K (2000).** “Finance and Growth: Some Theoretical Considerations, and a Review of the Empirical Literature”, *Economics Department Working Papers*, OECD, January, No.228
- Yamamoto T. and E. Kurozumi (2002).** *Tests for Granger Non-Causality in Cointegrated Systems*, Hitotsubashi University.
- Valderrama, D. (2003).** “Financial Development, Productivity and Economic Growth”, *FRBSF Economic Letter*, Vol: 2003-18
- Van Wijnbergen, S. (1983).** Credit policy, Inflation and growth in a financially repressed economy, *Journal of Development Economics*, 13: 45-65
- World Bank (1989).** *World Development Report 1989*. New York: Oxford University Press for the World Bank.