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Do Asset Prices in Transition Countries Contain Information About Future Economic Activity?

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Do Asset Prices in Transition Countries Contain Information About Future Economic Activity?

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Abstract

There is ample empirical evidence for developed economies that asset prices contain information about future economic developments. But is this also the case in transition economies? Using a panel of monthly data for the Czech Republic, Hungary, Poland, Russia, Slovakia, and Slovenia for the period 1994-1999 it is shown that historical values for interest rates, exchange rates, and stock prices signal future movements in real economic activity. This result has significant implications for policymakers, and a composite leading indicator based on the three asset prices is presented, which contains information about the future development of economic activity.

JEL Classification Numbers: F30, G14, G15, P34

Keywords: Asset prices in transition countries, Leading indicator analysis, Tracking portfolio

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I. INTRODUCTION

The purpose of this paper is to assess if the prices observed in stock, money, and foreign exchange markets in transition countries contain information about future real economic activity. This is investigated in three different empirical analyses, examining if stock prices, short term interest rates, and the exchange rate signal future movements in industrial production, unemployment, and real wages. The conclusion is that asset prices do contain information about future movements in real variables, and in particular it is found that asset prices significantly signal future movements in industrial production. These results have important implications for policymakers in transition countries and a composite leading indicator based on the stock price, the interest rate, and the exchange rate is suggested which can yield information about future developments in real activity.

A key component in transition to a market-economy is the development of financial systems and institutions that can support a market-based economy. The starting point of transition was a banking system that was based on directed credit plans where no financial markets or market instruments were available. Market-based financial systems had to be introduced from scratch and there was no textbook solution available to solve this enormous challenge. Policymakers have had to forge compromises to accommodate divergent objectives and in general financial sector development in transition economies is the result of trial-and-error processes. Despite the pitfalls, several countries have come some way in their institution-building and mechanism-design. Russia, and a number of the Central and Eastern European countries, have established equity, money, and foreign exchange markets that have now functioned for several years, although many of these markets have been characterized by low liquidity, missing or malfunctioning supporting institutions, and allegations of political interference and insider manipulation. As transition has progressed and enforcement mechanisms have improved, some of these abnormalities have been eliminated, but more still needs to be done before the financial sectors in transition countries are fully developed. The motivation for this paper is that financial sector development now has progressed sufficiently to conduct a meaningful empirical study of the relationships between real and financial variables in certain transition countries.

The paper is organized as follows. The next Section discusses the characteristics of financial sector developments in transition and Section 3 presents the three econometric analyses. Section 4 contains the conclusion.

II. FINANCIAL SECTOR DEVELOPMENT IN TRANSITION COUNTRIES

Before discussing the characteristics of financial sectors in transition countries it is useful to describe an ideal financial system, or what could also be called the terminal point of transition.[2] Ideally, a financial system should be characterized by private banks, with universal licenses, offering a wide range of sophisticated financial products, supported by

[2] As suggested by for example Roe, Siegelbaum, and King (1998).

strong collateral, bankruptcy and other laws, publishing accounts on a sophisticated basis acceptable under international standards. Furthermore, banks should also be subject to Basle Committee-based prudential standards enforced by an effective regulatory system, normally by a modern central bank. Such a system should eventually also encompass relatively deep and well-regulated securities markets, dealing in both government paper and private debt and equity issues, as well as some significant level of specialized finance, private insurance, and pension activity.

In the ideal situation, financial intermediaries assist firms, households, and governments to finance their expenditure and to save or invest their liquid funds in a world with market imperfections. There is ample evidence that such a liberalized financial system has beneficial effects for the real economy.[3] Beck, Levine, and Loayza (1999) show that financial intermediary development exerts a large, causal impact on economic growth, and present evidence that the relationship goes from financial sector development to growth rather than the other way around. Furthermore, Filer, Hanousek, and Campos (1999) using Granger-causality tests find evidence of a positive and significant causal relationship going from stock market development to economic growth, particularly for less developed countries. Hence, there is strong evidence that the degree of liberalization and the design of the financial sector matter for economic performance.

However, liberalizing markets and forming effective institutions in the financial sector is tremendously challenging and transition countries have been under significant constraints when undertaking the task of restructuring their financial sectors. In particular, dealing with incomplete trust in the financial system has been a key challenge.[4] Furthermore, in many cases, financial markets were liberalized before all of the appropriate institutions were in place.[5] In the following, three issues will be discussed: the main characteristics of the banking sector and capital markets, respectively, in transition countries,[6] and the way asset markets in transition economies differ from asset markets in developed economies.

The banking sector

Most transition economies moved early in implementing banking regulation. In particular the Czech Republic, Hungary, and Poland decided to adopt banking regulations that were taken directly from EU regulations, including universal licensing for all banks both commercial and savings banks. One motivation behind this choice was the desire to join EU. However, implementing effective banking supervision turned out to be difficult because of a lack of

[3] Goldsmith (1969), King and Levine (1993), Demirgüç-Kunt and Levine (1996) and Levine and Zervos (1998).

[4] Bossone (1999) and Kogut and Spicer (1999).

[5] Demirgüç-Kunt and Detragiache (1998) and Stiglitz (1994).

[6] For individual country presentations see the papers in Helmenstein (1999) and Bonin and Wachtel (1999). The discussion below draws on these two references.

trained personnel and supporting infrastructure. Furthermore, at an early stage of transition, minimum capital requirements for a bank license were set at fairly low levels and the review process for new entrants were rather lax. This created a significant amount of new private banks burdened with concentrated loan portfolios. For the state-owned banks achieving independence both from the state via privatization and from the legacies of the past, (i.e. inherited bad loans and bad clients), turned out to be a longer and more complicated process than anticipated. Unfortunately, in some cases governments have promoted financial sector development by absorbing or subsidizing financing; efforts which quickly created moral hazard. Effective bank restructuring also involves a change in lending practices to preclude the need for continuing bailouts and experiences from several transition countries show that foreign participation in bank privatization has been one effective road to independent strong banks.

Overall, the early stages of transition in the banking system were dominated by establishing rules and regulations and only later enforcement of the rules and regulations was improved.

Capital markets

The element dominating capital markets in transition countries has been the large-scale privatization that has taken place, and is still taking place, in many countries. The majority of equities listed on stock exchanges in transition economies are formerly state-owned companies that have been privatized.[7] Privatization programs have been driven by a desire to make enterprises more efficient, the desire of government to gain revenue, and a desire to increase liquidity and develop domestic stock markets.

There were, however, two problems with the rapid expansion of stock markets that these policies created in the transition economies. First, it was unrealistic to expect the stock market to provide liquidity and access to capital for so many firms. Second, the stock markets expanded before all of the institutional infrastructure for markets had been created, such as transparent share registration, the ability to transfer ownership, sufficient liquidity to limit manipulation of prices, and minimum standards of financial disclosure by firms. These institutional elements were lacking in many countries in the initial years of transition and in a few cases widespread stock ownership emerged before there was a reliable institutional structure for trading, clearing, settlement, registration and oversight of brokers and dealers.

Foreign investment in equities in the transition countries was in general modest until 1995 but this has changed rapidly subsequently. In Poland, the Czech Republic, Russia, and Hungary, foreign stock ownership is now widespread. For example over one-half of the total capitalization of the Hungarian stock market is foreign owned, and at the start of 1998 around 40 percent of Polish equities were owned by foreigners. Furthermore, net portfolio inflows into transition countries averaged $21.1 billion per year from 1994-1997. In sum, after some initial years where the capital market infrastructure was inadequate, market infrastructures

[7] For a discussion of the privatization strategies adopted by different countries see Nellis (1999), Aussnegg (1999), and Perotti and Oijen (1999).

and market efficiency have improved dramatically since the mid-1990s in most of the advanced transition economies.[8]

Asset prices and economic activity

There is extensive empirical evidence that asset price changes tend to yield information about future economic activity in developed economies.[9] In general, the leading indicator properties of asset prices follow the main assumptions of valuation models,[10] where current asset prices represent the discounted value of the expected dividend growth. In the simplest of these frameworks asset prices are a function of interest rates and output trend. When interest rates change, the discounted value of the asset, and thus the price, changes. When the output trend changes it changes expectations about future earnings and hence also asset prices today. Both these channels have effects on wealth and the cost of capital and hence also real activity. Empirically, it is, however, difficult to identify through exactly which channels asset prices affect real economic activity.

The effect from asset prices to real economic activity in transition economies as in developed economies may come through a number of different channels. There are, however, several differences between asset markets in developed economies and in transition economies, which also could affect the relationship between asset prices and the real economy. First, markets in transition economies are often smaller in size relative to GDP. Second, stock markets in transition economies are dominated by former state-owned companies, where it may be harder to assess the true value. Third, transition countries are in the process of restructuring their economies and hence new information about future major reforms can have a significant impact on the discounted value of firms in transition economies. Fourth, the ownership structure is different, and in some cases privatization in transition countries has lead to widespread stock ownership. Fifth, asset prices in transition economies may be one of the few indicators consumers have in assessing the state of the economy and hence it may be a more important news signal for agents in the economy. Sixth, the degree of foreign ownership has increased dramatically in transition economies.[11]

These differences make it even more difficult to identify the exact nature of the transmission. It is, however, useful to know if asset prices overall yield information about future movements in real economic variables in transition economies. If they do, then this

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[8] Filer and Hanousek (1997, 1999) and Rockinger and Urga (1997). There is also a strand of literature discussing contagion effects between the capital markets in Eastern Europe: Gelos and Sahay (2000), Linne (1999), and Morck, Yeung, and Yu (1999).

[9] Fama (1981, 1990), Barro (1990), Breeden, Gibbons, and Litzenberger (1989), Mauro (2000), Lamont (1999), Choi et al (1999), and IMF (2000).

[10] Such as the Gordon equation (Gordon, (1962)).

[11] Baekert, and Harvey (1997, 1998) and Garibaldi et al. (1999) analyze what determines capital flows to individual transition countries.

information can be taken into account for example when conducting monetary policy. Hence, both for developed and transition economies it primarily becomes an empirical issue whether asset prices signal changes in real economic activity.

III. ASSET PRICES AND ECONOMIC ACTIVITY - THREE ECONOMETRIC ANALYSES

The overall idea in the following is to assess whether changes in current stock returns, interest rate, and exchange rate returns signal changes in future movements in the real economy. First, data will be described, then causality tests will be carried out on the panel of countries and finally, a composite index of asset returns will be constructed which will constitute a leading indicator of industrial production.

Data

Since transition countries are at different stages of transition towards a market-economy they also differ in terms of data coverage and existence of financial markets. There is, however, a group of countries that are fairly advanced in their transition, which have good data coverage, and which have had financial markets in existence for a number of years now. These countries are the Czech Republic, Russia, Poland, Hungary, Slovenia, and Slovakia. Data has been collected on a monthly basis for these countries covering the period 1994:1 to 1999:12. As discussed in the previous Section, the early 1990s were characterized by initial institution-building and hence starting the analyses in the mid-1990s seems reasonable. Choosing a later starting date does not significantly change the reported results. The asset returns series used are real stock returns, real 3-month money market interest rates, and changes in the real exchange rate, where the exchange rate is measured against the US dollar.[12] The real economic variables used are industrial production, unemployment rate, and real wage. The data is described in the Appendix and can be seen in Figures 1 and 2. All economic series are seasonally adjusted.

To deflate the nominal financial and economic variables into real terms one would ideally want to use a CPI core inflation rate. However, this variable is only available for three of the countries and for these countries the series are very short and cover only the last few years. The overall CPI index was not used in order to avoid spikes in the deflator from liberalization of administered prices and other once-off events. Instead, the seasonally adjusted PPI is used as the best alternative deflator of all nominal variables, although this might create a bias towards measuring inflation in tradables, which probably underestimates overall inflation in transition economies. Figure 1 shows the three real economic variables for each of the six countries. First differences in logs (times 100) are shown of all series except of the unemployment rate which is reported in first differences in levels. Descriptive statistics of the series can be seen in Table 1.

[12] The US dollar is used because it in general is the main currency used for trade but, as discussed below, redoing the analysis using a synthetic Euro exchange rate does not change the results.

It is evident that the data is very noisy and characterized by the occurrence of large outliers. For example, the Slovakian monthly growth in industrial production appears to exhibit much more volatility than the Hungarian series, but the scale of the latter is much larger and is dictated by a few large outliers in 1996. The presence of outliers is clear from Table 1 as well. The Jarque-Bera test of normality (column three shows the p-values) is rejected for many of the series. Fortunately, the existence of a unit root in the monthly rates is clearly rejected for most series with the exception perhaps of the short-term real money market rates.[13] The variability of the monthly real economic data is indeed staggering. From Table 1, the standard deviation of monthly growth rate in industrial production is typically ten times larger than the average monthly growth rate.

Real foreign exchange (FX) and equity returns are constructed by deflating the end-of-month values of the dollar exchange rates and the local currency stock indices by the seasonally adjusted PPI. Monthly returns are then calculated as simple differences in logs (times 100). The real money market returns are calculated as the end-of-month nominal 3-month money market interest rates less the 12-month inflation in PPI. The real asset returns in Figure 2 clearly display a lot of variation across countries, and the data for individual countries is therefore again plotted on separate scales. Extreme events such as the Russian crisis in August 1998 are evident and in some cases completely dominate the variation in a series. Finally notice that, consistent with the unit root test results in Table 1, the real money market returns in the first column clearly appear much more persistent than the real FX returns in the middle column, and the real equity returns in the third column of Figure 2.

[13] The unit root hypothesis is tested using an augmented Dickey-Fuller test with a constant term and one lag. See Table 1 for the test values (column 4) and their p-values (column 5).

Figure 1. Monthly Growth Rates in Real Economic Variables

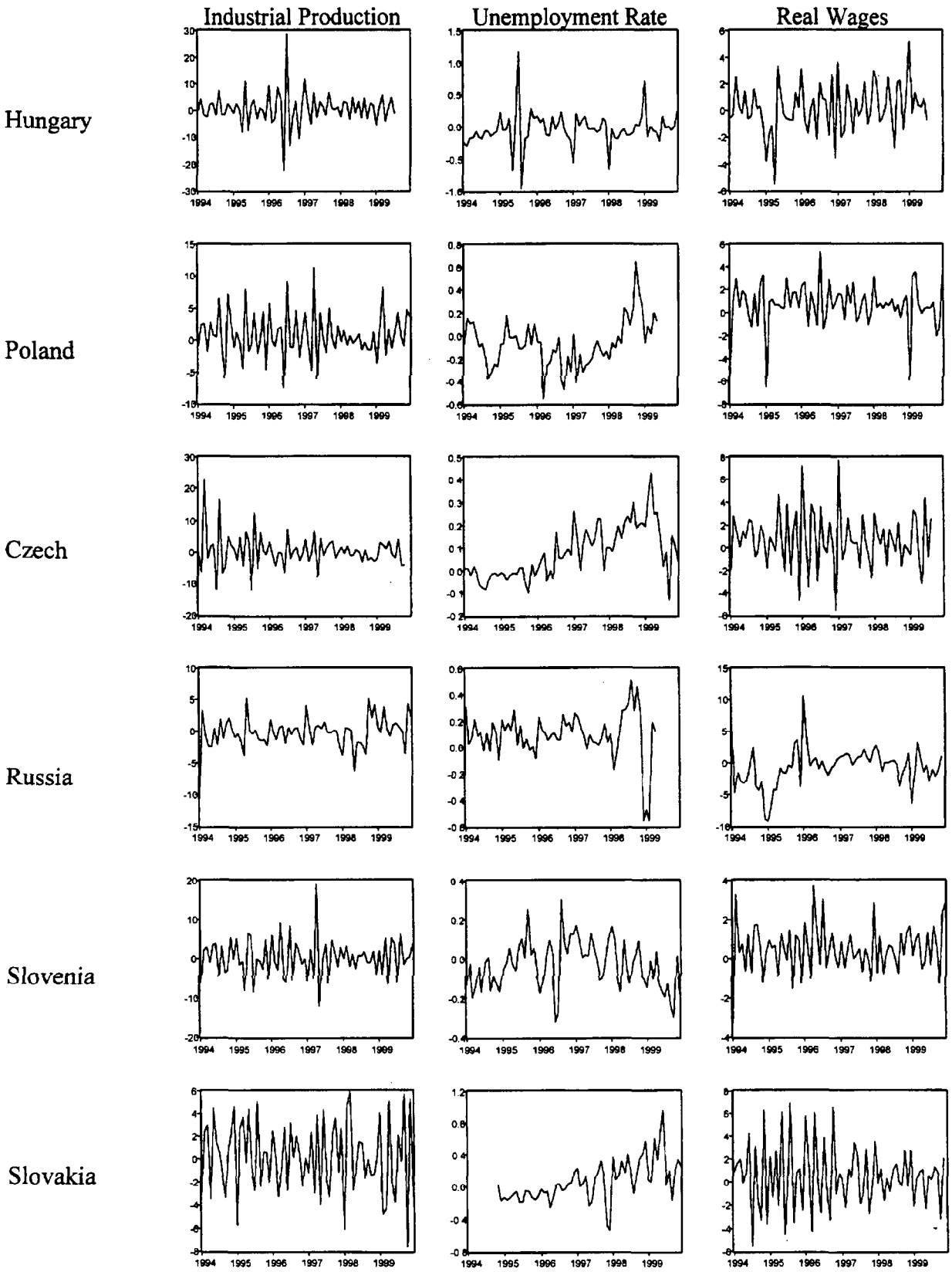


Figure 2. Monthly Real Financial Returns

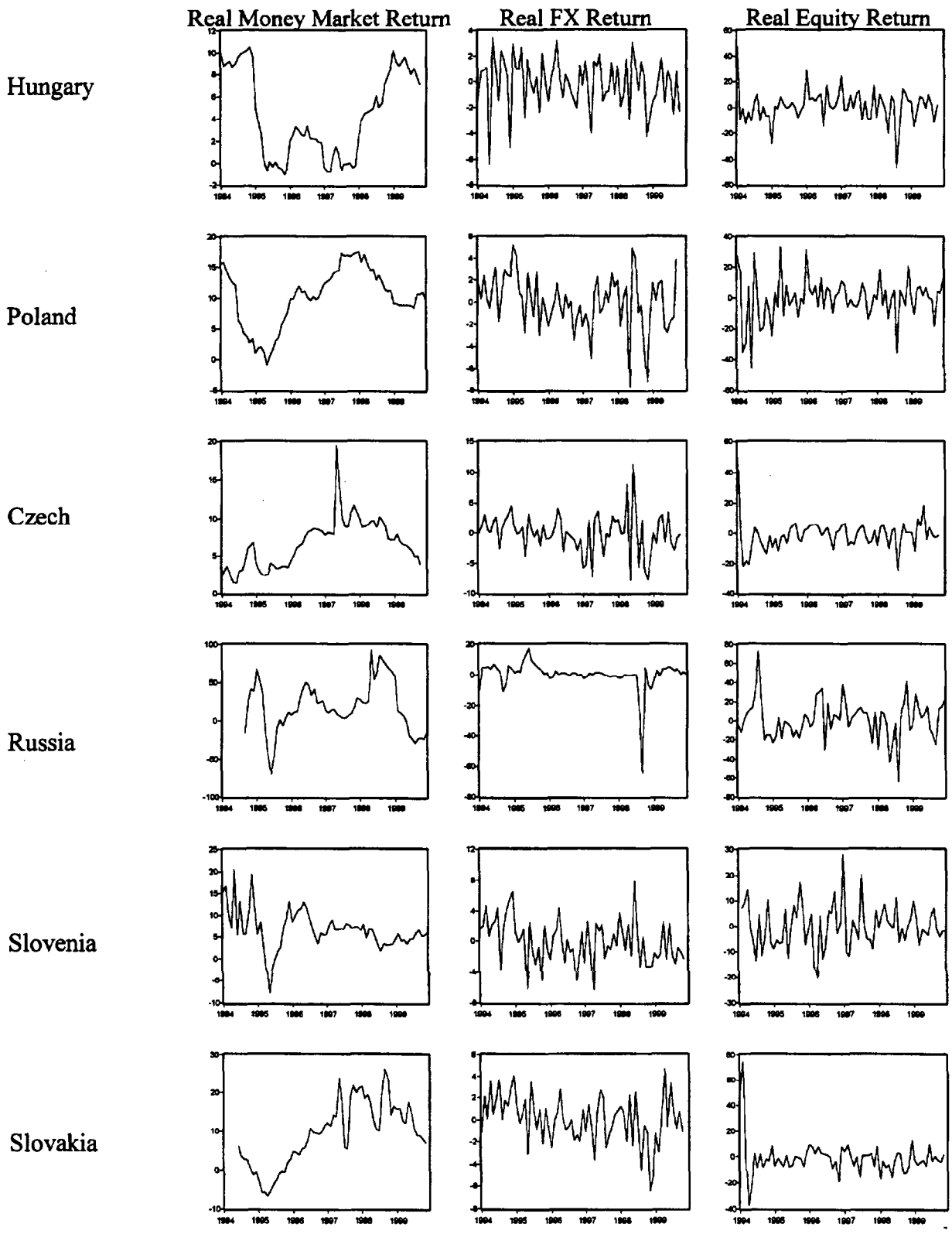


Table 1. Descriptive Statistics

I.Prod	Mean	Std.dev.	Jarque-Bera	Unit Root	5% C.V.	N. Obs.
Hungary	0.64	6.43	0.00	-13.96	-2.90	67
Poland	0.78	3.59	0.18	-12.26	-2.90	72
Czech R.	0.36	5.40	0.00	-9.18	-2.90	70
Russia	-0.19	2.50	0.00	-5.80	-2.90	72
Slovenia	0.16	4.89	0.00	-11.02	-2.90	72
Slovakia	0.20	3.20	0.38	-10.18	-2.90	72
U.Rate						
Hungary	-0.04	0.27	0.00	-7.31	-2.90	72
Poland	-0.07	0.21	0.03	-2.47	-2.91	65
Czech R.	0.08	0.12	0.15	-2.46	-2.90	72
Russia	0.09	0.19	0.00	-4.21	-2.91	64
Slovenia	-0.03	0.12	0.97	-4.85	-2.90	72
Slovakia	0.07	0.26	0.01	-3.78	-2.91	62
Wage						
Hungary	0.19	1.87	0.43	-6.85	-2.90	67
Poland	0.69	1.92	0.00	-10.10	-2.90	72
Czech R.	0.68	2.48	0.52	-12.46	-2.90	68
Russia	-0.65	3.04	0.00	-4.04	-2.90	71
Slovenia	0.49	1.22	0.41	-9.59	-2.90	72
Slovakia	0.48	2.79	0.58	-12.22	-2.90	71
Money						
Hungary	4.37	3.92	0.03	-1.50	-2.90	70
Poland	10.23	4.79	0.16	-1.54	-2.90	72
Czech R.	6.67	3.22	0.00	-2.54	-2.90	70
Russia	18.55	33.20	1.00	-2.34	-2.91	64
Slovenia	6.77	4.53	0.00	-3.63	-2.90	72
Slovakia	9.20	8.38	0.41	-2.17	-2.91	66
FX						
Hungary	-0.09	2.01	0.07	-7.42	-2.90	70
Poland	0.07	2.52	0.04	-5.40	-2.90	69
Czech R.	0.08	3.39	0.10	-5.43	-2.90	70
Russia	0.17	9.40	0.00	-4.90	-2.90	72
Slovenia	-0.03	2.91	0.72	-4.67	-2.90	71
Slovakia	0.06	2.17	0.43	-4.57	-2.90	70
Equity						
Hungary	1.19	12.70	0.00	-6.33	-2.90	70
Poland	-0.46	14.24	0.01	-6.11	-2.90	72
Czech R.	-0.89	9.83	0.00	-4.90	-2.90	70
Russia	1.71	20.90	0.01	-4.82	-2.90	72
Slovenia	0.01	8.67	0.11	-6.34	-2.90	71
Slovakia	-0.87	13.83	0.00	-6.39	-2.90	71

Analysis A: Leading Indicator Properties of Asset Returns

As a first analysis, it is investigated if a change in any of the real asset returns signals a change in the real economic variables for the group of countries under study. In order to do this, the data for all six countries has been pooled together to run a fixed-effect panel Granger-causality regression of the following type:

$$Y(i,t) = \alpha(i) + \sum_{j=1}^{J} \beta_j X(i,t-j) + \sum_{j=1}^{J} \gamma_j Y(i,t-j) + \varepsilon(i,t),$$

where the economic growth rate for country *i* at time *t* is denoted by *Y(i,t)* and the financial return at time *t-j* is denoted by *X(i,t-j)*. The fixed effects are captured in the country-specific constant terms. Based on the lessons from the descriptive data analysis above, we also allow for the error term to have country-specific variances. The variance matrix is estimated using White's heteroskedasticity and autocorrelation consistent method.

The motivation for applying a panel data methodology is two-fold. First, the sample available is short and thus the panel setup is helpful in providing additional degrees of freedom and thereby adding precision to the estimates. Second, it is of separate interest to assess if these first-wave transition countries have common features, which could be relevant for policymakers in countries with newer and less developed financial markets.

A null hypothesis is tested that all betas are jointly zero in the above regression. Three cases are considered corresponding to maximum lag orders of J=1 month, J=3 months, and J=6 months.

The results show (Table 2) that changes in real money market, real foreign exchange, and real equity returns significantly signal changes in future growth in industrial production across the choices of maximum lag order. For the unemployment rate and the real wage the relationship is less remarkable. One explanation could be that labor market variables in general are strongly influenced by political decisions such as wage increases and labor market policies. Furthermore, the industrial production is clearly in the tradable sector of the economy and therefore also under more influence of asset prices such as the interest rate, exchange rate, and stock prices. In contrast to this, the unemployment rate and wages, which also include the non-tradable part of the economy (such as the public sector), are less sensitive to changes in these market-driven asset prices. Finally, it is also tested whether the imposed common coefficient in the panel estimation can be said to be identical for all countries. The p-value of this test is reported under 1 Lag in Table 2 (in italics) and in most cases it is accepted that the coefficients for the six countries can be said to be identical and pooling the data in a panel estimation seems justified. In particular, it should be noted that across the three asset prices, the coefficients could be said to be identical between countries in the estimations in the case of industrial production.

Table 2. Granger Causality Tests

1 Lag	I.Prod	U.Rate	Wage
Money	3.06	0.08	1.40
p-value	0.08	0.78	0.24
Id coeffs	*0.91*	*0.00*	*0.61*
FX	1.87	3.75	1.56
p-value	0.17	0.05	0.21
Id coeffs	*0.70*	*0.52*	*0.14*
Equity	13.20	3.66	1.24
p-value	0.00	0.06	0.27
Id coeffs	*0.11*	*0.60*	*0.00*

3 Lags	I.Prod	U.Rate	Wage
Money	29.02	3.00	5.61
p-value	0.00	0.39	0.13
FX	25.79	7.91	3.78
p-value	0.00	0.05	0.29
Equity	13.46	7.52	2.07
p-value	0.00	0.06	0.56

6 Lags	I.Prod	U.Rate	Wage
Money	45.59	5.32	11.78
p-value	0.00	0.50	0.07
FX	32.24	35.26	12.65
p-value	0.00	0.00	0.05
Equity	26.29	10.30	6.36
p-value	0.00	0.11	0.38

Notes: The table reports Wald tests of the hypothesis that all coefficients on the lagged financial indicators are jointly zero. The coefficients are estimated in a fixed-effect panel model with country specific variances and lagged left-hand-side variables. The p-values are calculated using White's heteroskedasticity and autocorrelation consistent variance matrix. At one lag length, allowing coefficients to the asset price to be country specific (and the lagged endogenous to have a common coefficient) it is possible to test if the six country specific coefficients are identical or not. "*Id coeffs*" report the p-values from this F-test.

Analysis B. Assessing Dependence in the Tails

It is clearly the case that both real and financial variables in transition countries are very volatile and more importantly, plagued by the occurrence of large outliers. But outliers can distort estimation and inference in the standard linear least-squares modeling approach by dominating all the other data points. Consider therefore the following approach which also aims at assessing the leading indicator properties of asset returns, but which is robust to the prevalence of extreme events.

Let again the economic growth rate at time t be denoted by $Y(t)$ and the financial return at time t be denoted by $X(t)$. Let $TY(p)$ be a threshold for variable Y which implicitly

corresponds to some percentile, p, in the unconditional distribution of Y. Similarly, define $TX(q)$ to be a threshold for variable X which also implicitly corresponds to some percentile, q, in the unconditional distribution of X.

Now define a scoring variable for the economic variable, $SY(p,t)$ as

$$SY(p,t) = \begin{cases} +1, \text{if } Y(t) > TY(1-p) \\ 0, \text{otherwise} \\ -1 \text{ if } Y(t) < TY(p) \end{cases}$$

and similarly for the financial indicator, define $SX(q,t-1)$, as

$$SX(q,t-1) = \begin{cases} +1, \text{if } \mathrm{X}(t-1) > TX(1-q) \\ 0, \text{otherwise} \\ -1, \text{if } \mathrm{X}(t-1) < TX(q) \end{cases}$$

Then we can define the dependence scoring variable, as

$$SZ(p,q,t) = SY(p,t)*SX(q,t-1).$$

The idea behind this variables is that it resembles the cross-product inside a covariance calculation, but where the deviations have been replaced by zeros and plus/minus ones. Notice that under the null hypothesis the economic and financial variables are independent, and the SZ variable will be i.i.d. trinomial with distributional parameters

$$SZ(p,q,t) = \begin{cases} +1, \text{with Prob} = 2pq \\ 0, \text{with Prob} = 1 - 4pq \\ -1 \text{ with Prob} = 2pq \end{cases}$$

Thus each realization will have a mean of zero and a variance of $4pq$.[14]

[14] The mean is $E[SZ] = +1*2pq + 0*(1-4pq) - 1*2pq = 0$, and the variance is $E[SZ^2] - E^2[SZ] = (+1)^2*2pq + (0)^2*(1-4pq) + (-1)^2*2pq - 0 = 4pq$.

Standard asymptotic theory produces the approximate distribution of the sample average of SZ, call it $\overline{SZ}$, as a standard normal variate when the sample size, T, is large. Formally, the tail test statistic (TT) is

$$TT = \sqrt{T} * \overline{SZ} / \sqrt{4pq} \sim N(0,1).$$

The data for all countries are pooled together and a single SZ variable is defined for all countries. Allowing the thresholds to be different for each country conveniently captures the country-specific effects.

The test can be calculated for different values of p and q and Table 3 reports the TT statistic for p and q equal to the four different combinations of .25 and .5. Notice that when p=q=.5, the test corresponds to a sign-test. Interestingly, using this test, significant relationships are now consistently found between the asset returns and the unemployment rate and real wage, whereas less of a relationship is obvious in the case of industrial production using this metric. This result suggests that nonstandard modeling methods might be needed to capture the relationships between financial and labor market variables.

Table 3. Tail Tests of Leading Financial Indicators

		q=.25				q=.50		
		I.Prod.	U.Rate	Wage		I.Prod.	U.Rate	Wage
	Money	-0.29	**2.23**	-1.16	Money	-0.07	**3.22**	**-1.71**
P=.25	FX	0.58	-0.87	**-2.71**	FX	0.48	-1.16	**-2.26**
	Equity	1.16	-0.39	-1.16	Equity	0.89	0.14	0.21
		I.Prod.	U.Rate	Wage		I.Prod.	U.Rate	Wage
	Money	-0.14	**2.67**	0.27	Money	0.34	**3.05**	-0.82
P=.50	FX	0.27	-1.37	**-2.88**	FX	0.53	-1.26	**-2.52**
	Equity	**1.92**	-0.34	-0.96	Equity	0.92	-0.48	0.24

Notes: The table reports tests of the hypothesis that tail events in the current financial indicator are independent of tail events in next month's economic variable. **Boldface** typed statistics indicate significance at the ten- percent level in a two-sided test.

Analysis C: Constructing A Leading Indicator Index

The analyses above indicates that asset returns are better linear signals of industrial production than any of the two labor market variables, whereas nonlinear techniques might be necessary for the other two economic variables. As discussed, there are several good explanations for this. In this section, a composite leading indicator for industrial production will be constructed based on the three asset returns. An optimal weighting of the three asset prices will constitute a leading indicator, or what has been referred to as an economic tracking portfolio (Lamont (1999)). The tracking portfolio or leading indicator is constructed

using the panel data set and the weights applied are the ones found in an estimation of the growth in industrial production (IP) on the lagged real money market returns (Money), and lagged real exchange rate (FX) and real equity returns (Equity). Formally, the estimated panel-relationship is,

$$IP(i,t) = \alpha(i) + \beta_1 Money(i,t-1) + \beta_2 FX(i,t-1) + \beta_3 Equity(i,t-1) + \sum_{j=1}^{3} \gamma_j IP(i,t-j) + \varepsilon(i,t)$$

Again, the fixed effects are captured in the country-specific constant term, the error term is allowed to have country-specific variances, and the variance matrix is estimated using White's heteroskedasticity and autocorrelation consistent method. The lagged IP terms are included to capture potential simple predictability in IP.

The results of the panel regressions are shown in Table 4. Eight specifications are estimated, four without and four with the FX return which is the least significant indicator. The four FX and non-FX specifications vary with respect to the number of lags of industrial production growth (zero through four) included on the right-hand-side.

Table 4. Industrial Production. Leading Indicator Index Regressions

	1.	2.	3.	4.	5.	6.	7.	8.
Money lag	-0.0036	-0.0090	-0.0141	-0.0124	-0.0113	-0.0140	-0.0149	-0.0139
p-value	0.3410	0.1088	0.0596	0.0883	0.0025	0.0272	0.0791	0.0888
FX lag					-0.0532	-0.0352	-0.0034	-0.0086
p-value					0.0003	0.0458	0.8830	0.7067
Equity lag	0.0313	0.0388	0.0403	0.0422	0.0299	0.0377	0.0395	0.0413
p-value	0.0000	0.0000	0.0002	0.0001	0.0000	0.0001	0.0003	0.0001
IP lag 1		-0.4801	-0.6754	-0.6425		-0.4797	-0.6793	-0.6459
p-value		0.0000	0.0000	0.0000		0.0000	0.0000	0.0000
IP lag 2			-0.3616	-0.3037			-0.3673	-0.3088
p-value			0.0000	0.0000			0.0000	0.0000
IP lag 3				0.0851				0.0848
p-value				0.1226				0.1272
R-sq.	0.0244	0.2415	0.3529	0.3555	0.0319	0.2437	0.3575	0.3599
Adj. R-sq.	0.0073	0.2263	0.3383	0.3392	0.0124	0.2264	0.3412	0.3420
F-test p-val.	0.0017	0.0000	0.0000	0.0000	0.0016	0.0000	0.0000	0.0000
DW test	2.9189	2.3292	1.9654	2.0096	2.9253	2.3443	1.9757	2.0214

Notes: The dependent variable in each regression is the monthly growth rate in industrial production. The coefficients are estimated in a fixed-effects panel regression with country-specific variances. The p-values are calculated using White's heteroskedasticity and autocorrelation consistent estimator.

The specifications without lagged IP (regression 1 and 5) can be interpreted as pure leading financial indicator regressions, whereas the other specifications can be interpreted as tracking portfolios or "news" regressions. Viewing the lagged industrial production regressors as a proxy for agents' expectations about future growth in industrial production, the financial indicators in regressions 2-4 and 6-8 are picking up only the unexpected or news component of growth in industrial production.

The qualitative results are quite robust to the specifications chosen. An increase in the real money market rate indicates that next period's industrial production growth will decrease (ceteris paribus), and an increase in the real equity return indicates that future growth in industrial production will increase. A positive FX return (i.e. an appreciation) consistently signals a decrease in industrial production growth, but this effect is not always statistically significant. The qualitative results are independent of the number of lags chosen for IP. Note also that the absolute magnitude of the financial indicator coefficients actually tends to increase, as lags for IP are included. This indicates that the news interpretation of the estimates seems valid: Financial returns signal changes in the *unexpected* growth in industrial production.

The main motivation for the multivariate analysis is to construct a leading indicator index for future IP growth, using the estimated regression coefficients as weights. The leading financial indicator index (i.e. the tracking portfolio) for IP, call it *IPI*, is simply constructed as:

$$IPI(i,t) = \hat{\alpha}(i) + \hat{\beta}_1 Money(i,t-1) + \hat{\beta}_2 FX(i,t-1) + \hat{\beta}_3 Equity(i,t-1)$$

This indicator is in Figure 3 plotted for each of the six countries using the coefficients from Equation 7 in Table 4.[15] In order to ease interpretation, a six-month backward moving-average of *IPI* is shown, along with simple empirical plus/minus one standard deviation bands around the unconditional mean growth rate. When for example the indicator is above the positive band then the lagged asset returns (i.e. the leading indicator) strongly points in the direction that industrial production will go up. On the other hand when the leading indicator is below the negative band then it strongly suggests that industrial production growth will go down. For example before the Russian crisis in 1998 the financial indicators were for most countries pointing down indicating that industrial production would drop. When the crisis broke, this tendency was reversed immediately, the Russian Ruble depreciated, and the indicator quickly turned significantly positive whereby the financial variables suggested that growth in industrial production would go up.

Note that the indicator differs from a monetary or financial conditions index. The index calculated above is a leading indicator where the weights given to the lagged right hand side

[15] The pictures are very similar across the regressions shown in Table 4.

variables are optimized to explain variation in future industrial production. A monetary or financial conditions index on the other hand is a weighted sum of contemporaneous asset price effects on total demand where the weights are imposed based on results of simulations of larger econometric models. Note also that the indicator here is not based on a maximization of R-squared but rather an index that can indicate if industrial production is on the way up or down. In addition to the eight specifications shown in Table 4, a series of robustness checks were performed.

First, the results are robust to the use of Euro versus US dollar exchange rates. This is not surprising since the Euro/dollar exchange rate has been relatively stable compared to the movements seen in some of the exchange rates analyzed here.

Second, the coefficients in Table 4 are in general robust to removing each country one at a time from the estimation. Furthermore, experimenting with de-trending the economic variables did not improve the results.

Third, in the analysis above monthly changes are used. Using 3-month or 12-month changes yields almost identical coefficients and improves the fit significantly. The main reason why the analysis was kept in monthly changes was to make the method as simple and easy to use as possible. Furthermore, potential econometric problems arise when using "overlapping" data or short time series.

Fourth, and finally, the results are robust to a different choice of estimation period. For example, varying the estimation period for Equation 7 in Table 4 gives the coefficients shown in Table 5. The results indicate that the coefficients on money and equity market returns have not changed much as transition has progressed. Actually, they have increased in absolute value, indicating an increasing importance through the transition period.

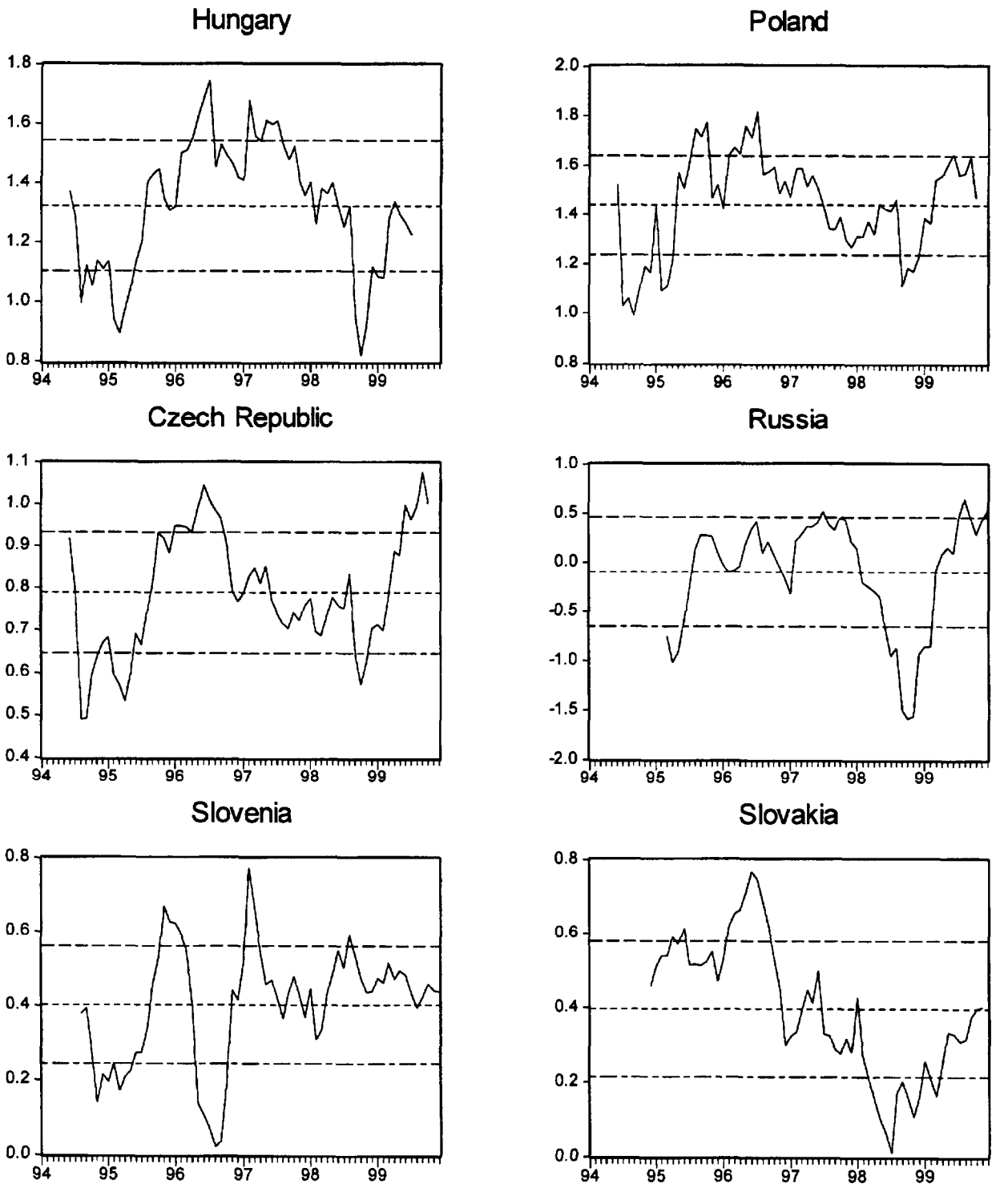
Table 5. Sensitivity of Coefficients to Choice of Sample Period

	1994:01-1997:12	1994:01-1998:12	1994:01-1999:12
Money lag	-0.0123	-0.0139	-0.0149
FX lag	0.0181	0.0027	-0.0034
Equity lag	0.0230	0.0399	0.0395

Note: Only the coefficients to the three variables in Equation 7 in Table 4 are shown.

One explanation behind the change in the sign of the coefficient to FX is that it simply reflects the different exchange rate policies the analyzed countries have had over this period. Another explanation can be that in the early transition phase the real exchange rate appreciates for structural reasons (such as through Balassa-Samuelson effects) while industrial production (of tradable goods) increases at the same time. Then later in the transition process the negative sign comes into effect, indicating that the more traditional market-based relationship dominates (i.e. when the currency depreciates it makes industrial production go up). Finally, an alternative explanation of this shift in sign is that perhaps the Russian crisis in 1998 dominates the exchange rate data for several of these countries. If this is the case we could perhaps in the future again experience a positive relationship between a real appreciation and industrial production (see De Broeck and Sløk (2000) for a discussion).

Figure 3. Financial Indicators of Monthly Growth in Industrial Production



Notes: The figure shows the multivariate one-month-ahead financial indicator calculated from the fixed-effects panel regression. The horizontal lines are plotted at the unconditional mean and +/- one standard deviations of the indicator.

IV. CONCLUSION

It is a well-known phenomenon that asset prices in developed economies contain information about future developments in the real economy. Is this also the case in transition economies? The analyses in this paper indicate that the answer to this question is yes. Conducting three different econometric analyses it was shown that lagged values of asset prices contain significant signals of changes in real economic activity, in particular industrial production.

A composite leading indicator based on interest rates, stock prices, and the exchange rate was constructed which yields information about future movements in industrial production. This leading indicator (and the method presented) can be of use for central banks in transition economies when assessing the business cycle of the economy. There are, however, numerous structural changes going on in all transition economies and such a composite leading indicator should be closely followed and re-estimated as more data becomes available in order to capture ongoing changes in the transition process.

Stock Indices

Hungary

The Budapest Stock Index (Bloomberg Mnemonic: BUX) is a capitalization-weighted, price-only index tracking the daily price performance of 20 large, actively traded shares on the Budapest Stock Exchange. The index accounts for 58% of the domestic equity market capitalization.

Poland

The Warsaw Stock Exchange WIG Index (Bloomberg Mnemonic: WIG) is a total return index including dividends and pre-emptive rights. The index includes all domestic companies listed on the main market excluding investment funds.

Czech Republic

The HN-Wood Index (Bloomberg Mnemonic: HNWD) is weighted by capitalization, is based on the 60 largest shares, and is constructed by Hospodarsky Noviny and Wood & Company using IFC's emerging market methodology. The index changed from HN-Wood 30 on March 4, 1995.

Russia

The AKM Composite Price Index (Datastream Mnemonic: RSAKMCO) is the comprehensive index for the Russian stock market with the longest history of data.

Slovenia

The Ljubljana SBI Index (Bloomberg Mnemonic: SVSM) comprises the 20 most traded shares listed on the Ljubljana Stock Exchange. The index is weighted by market capitalization.

Slovakia

The Bratislava SAX Index (Bloomberg Mnemonic: SKSM) is capitalization-weighted and consists of 16 stocks which account for 76% of the total market capitalization.

Interest Rates

Hungary

NBH Base rate, 3 month active rate
Source: National Authorities

Poland

Interbank 3 month - middle rate
Source: Datastream, mnemonic POIBK3M

Czech Republic

Interbank 3 month - middle rate
Source: Datastream, mnemonic PRIBK3M

Russia
Interbank 90 day - middle rate
Source: Datastream, mnemonic RSIBK90

Slovenia
Time deposits: 31-90 days
Source: National Authorities

Slovakia
Interbank 3 month - middle rate
Source: Datastream, mnemonic SXIBK3M

Real variables
Industrial production: For Hungary and the Czech Republic it is taken from IMF International Financial Statistics (IFS) and for Poland it is taken from Datastream. For the remaining countries it is from the OECD Non-member countries data file, which can be found at: http://www.oecd.org/std/dnm/STDKei10.htm

PPI: Is for all countries from IFS.

Unemployment Rate: For Poland and Russia it is from IFS and for the remaining countries it comes from Bloomberg.

Wages: For all countries the data is from national authorities. Hungary: Total average gross wages, Poland: Total average monthly gross wages, Czech Republic: Industry average wages, Russia: Average monthly wages, Slovenia: Gross wages and salaries, Slovakia: Industrial monthly wages.

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