

MEASURING THE INTEGRATION OF CREDIT MARKETS¹

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Abstract

The need for adequate integration of financial markets is increasingly emphasized in the eurozone countries. The aim of this paper is to describe how to measure credit market integration. The financial and credit market integration are defined in second chapter. Three methods of measuring credit market integration are described in third chapter. Price indicators are based on law of one price. Moreover, they enable us to measure the speed of integration (with beta convergence measure) and the degree of financial convergence (with sigma convergence measure). Quantity indicators involve measures of market penetration of foreign banks and measures of home bias. News-based indicators try to separate local and common effects on the change of interest rates. For all methods, data availability and quality are crucial.

Keywords: *financial integration; credit market; price indicators, quantity indicators, news-based indicators*

JEL codes: *F 36, G 15*

1. Introduction

With the enlargement of the European Union and adopting the common currency in the new EU member countries, the need for adequate integration of financial markets is increasingly emphasized in the eurozone countries.

The aim of this paper is to describe how to measure credit market integration. The paper is structured as follows. The financial integration and credit market integration are defined in Chapter 2. Chapter 3 characterizes three methods for measuring credit market integration. First part of the chapter describes price indicators and methods for measuring the speed and degree of integration, second part of the chapter is devoted to quantity indicators and the last part of the chapter deals with news-based indicators.

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2. Definition of Credit Market Integration

European Central Bank (2008) considers the market for a given set of financial instruments or services to be fully integrated, when all potential participants in such market:

- are subject to a single set of rules when deciding to buy or sell those financial instruments or services,
- have equal access to this set of financial instruments or services,
- and are treated equally when they operate in the market.

Adam et al. (2002) define financial markets as integrated when the law of one price holds. This states that assets generating identical cash flows command the same return, regardless of the domicile of the issuer and of the asset holder. Otherwise, the arbitrage opportunity exists and it should adjust prices to same level.

According to Cabral et al. (2002), the concept of integration refers to a situation in which, out of previously segmented markets for a single product (or substitute products), one coherent market is created. It should manifest again with the law of one price.

Credit markets are integrated when terms of credits (both financial and non-financial) are not influenced by geographical location of the bank.

Different revenues of identical assets are caused mainly by legislative barriers, economic barriers (information asymmetry) or other barriers (different language, different preferences of consumers, insufficient mobility of borrowers etc.).

However, reducing of barriers is highly important because more integration is likely to generate more competition (the competition is extended from the local market to a larger set of European markets). Increasing competition implies that banks' profit margins decrease to the benefit of consumers.

3. Methods of Measuring Credit Market Integration

In practice, measuring of credit market integration is quite complicated. The key to an accurately measured integration is to find assets, which have the same level of risk and generate identical cash flows. Then it is possible to choose which method to choose:

- method based on price indicators,
- method based on quantity indicators,

- method based on indicators of new information.

These methods will be described in next chapters.

3.1 Price Indicators

Price indicators as a measure of integration refer to the definition of integration, based on law of one price. According to Cabral et al. (2002), prices can refer to investment returns which, in integrated markets, should converge to the same levels, provided that the risk features are identical. In addition, they can refer to bank service charges, which should be similar in integrated markets.

The most common price indicator is the difference of interest rates charged in different countries to borrowers of the same risk class and for the same maturity. This measure can be computed for interest rates on consumer credits, mortgage credits, corporate credits and on public debt as well. If markets are integrated, rates should move together. It is very important to control risk characteristics of borrower in such tests.

Some studies² came to conclusion that retail and wholesale markets differ in their degree of integration (wholesale markets are usually more integrated than retail markets). It should be therefore more accurate to analyze separately different market segments. The interest rate offered by small and large banks should be analyzed separately, too, because small banks usually operate in a more segmented credit market than large banks.

Except of the differences of interest rates, Pungulescu (2002) recommends other price indicators such as:

- correlations among interest rates in different countries,
- tests of common trend in the term structure of interest rates,
- tests of volatility transmission,
- tests of covered and uncovered interest rate parity.

Price indicators allow analyzing the progress towards financial integration with two special measures: beta convergence and sigma convergence³. Convergence is understood as convergence to an average across the countries in the sample.

² See e.g. Adam et al. (2002)

³ These measures used e.g. ECB (2008), Komárková et al. (2008), Babetskii et al. (2007), Adam et al. (2002)

Beta convergence concept is typically used for the analysis of integration of economic growth when the average growth rate of gross domestic product is regressed on its initial level and a negative correlation is interpreted as a sign of convergence. However, it is possible to apply this methodology on credit market. Beta convergence enables us to measure the speed of integration of the specified market segment with following equation (1):

$$\Delta R_t = \alpha + \beta R_{t-1} + \sum_{k=1}^L \gamma_k \Delta R_{t-1} + \varepsilon_t \quad (1)$$

- where R ... the difference between average interest rate in a country and the benchmark interest rate⁴,
- Δ ... differential operator,
- α ... constant,
- L ... number of periods lagged,
- t ... time,
- ε ... the error term which denotes exogenous shocks that force interest rate differentials between the considered countries,
- β ... the indicator which signals the speed of convergence.

If β is equal to zero, there is no convergence (respectively, the speed of the convergence is zero). A negative β signals that there is the convergence; furthermore, the magnitude of β denotes the speed of convergence. The more is the value of β closer to -1, the greater is the speed of convergence.

Babetskii et al. (2007) provide a way how to analyze whether the speed of convergence is greater in one period relative to another. For this purpose, we can decompose β as in equation (2):

$$\beta = \beta_1 I + (-I) \beta_2 \quad (2)$$

⁴ The benchmark interest rate is usually the average interest rate in selected group of countries (e.g. in Eurozone countries). This is based on assumption that the benchmark interest rate signals the level to which interest rates in other countries should converge.

where $I_{i,t}$... a dummy variable that takes on the value of 1 in a particular sub-period.

An alternative way to address the dynamics is to put the equation (1) to the state-space form:

$$\Delta R_{i,t} = \alpha_i + \beta_t R_{i,t-1} + \sum_{k=1}^L \gamma_k \Delta R_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

$$\beta_t = \beta_{t-1} + \mu_t \quad (4)$$

where β_t ... the time-varying parameter,

$\varepsilon_{i,t}, \mu_t$... the white-noise disturbance.

Estimation of β_t can be obtained by applying the Kalman filter to (3) and (4). To apply this specification, the original series have to be first-difference stationary.

According to Komárková et al. (2008), in case of “ideal” estimation, the value of coefficient γ should be close to zero and the error term should have attributes of normal distribution.

Country specific effects are captured by the constant α . Such effects could be barriers of integration (legislative, economic or other). High values of α indicates the existence of heterogeneous markets; therefore more integrated markets should have lesser values of α .

To measure the degree of financial convergence, it is possible to use σ -convergence. The cross-sectional standard deviation of interest rates is used for quantification of σ -convergence and can be calculated with equation (5):

$$\sigma_t = \sqrt{\left(\frac{1}{N-1}\right) \sum_{i=1}^N \left[\log(y_{it}) - \log(\bar{y}_t) \right]^2} \quad (5)$$

where y_{it} ... the yield on asset in country i at time t ,

\bar{y}_t ... the cross-section mean yield at time t ,

i ... countries ($i = 1, 2, \dots, N$).

The cross-sectional standard deviation can be only positive. The lower the value of cross-sectional standard deviation, the higher degree of convergence has been achieved. If the cross-sectional distribution collapses to a single point and the standard deviation converges to zero, full integration is achieved.

It is important to note that the two convergence indicators have different informational contents: β -convergence does not imply σ -convergence. The reason is that mean reversion does not imply that the cross sectional variance decreases over time (in fact, β -convergence could even be associated with σ -divergence).

However, it should be noted that differences in interest rates can be caused not only by insufficient integration, but as well by:

- different conditions in national economies (such as credit and interest rate risk, size of companies, industrial structure, the degree of capital market development),
- institutional factors (taxation, regulation and supervision, consumer protection law),
- financial structure (whether economic subjects prefer financing through capital markets or bank credits),
- variability of bank products (product are often different in banks and countries, which is caused also by different preferences of customers).

Indicators based on interest rate differentials have several advantages:

- they are based on readily available data that are comparable across EU countries,
- they are reliable,
- they were constructed using statistical tools,
- they are informative (they can be used to test the speed and the degree of integration),
- they are easy to compute.

However, before using price indicators, it is necessary to identify assets which are associated with same risk and are generating identical cash flows. Considering slightly different assets, the results could be misleading or even completely wrong.

3.2 Quantity Indicators

Cabral et al. (2002) shows that many financial products and services are heterogeneous or different quality or even tailored to the needs of individual clients. Hence, the validity of the law would be very difficult to establish, as the price signals are obscure. For these reasons, it is useful to evaluate also quantity-based indicators, which can be interpreted as weaker, but still valuable, indicators of integration in the light of portfolio theory (e.g. allocation of investments across the single market area).

Quantity indicators are statistical data which should quantify determinants of demand and supply of investment opportunities and capture the importance and size of financial connections between countries. It involves market penetration of foreign banks and home bias.

Market penetration of foreign banks should increase in more integrated markets. Foreign banks can serve domestic customers directly by cross-border lending without establishing branches in the foreign country, by acquiring domestic banks or creating domestic branches. It is possible to measure market penetration of foreign banks by:

- the share of assets held by foreign banks,
- the share of foreign banks in the total number of banks operating in a country.

Baele et al. (2004) define home bias as the fact that agents tend to invest more in domestic assets even though risk is shared more effectively if foreign assets are held. Home bias related to the degree of integration because the existence of home bias is a sign that financial integration is still not complete. When markets are perfectly integrated, the home bias should disappear. Adam et al. (2002) recommend these indicators of home bias:

- the share of foreign assets held by the national banking sector in a country, which should be benchmark with those shares that banks would hold if they lent to all countries in proportion to the relative size of the corresponding credit market,

- the aggregate foreign asset index for the domestic banking sector of the whole Euro area, constructed by weighting the shares of foreign assets in each country's banking sector by the relative size of domestic credit markets,
- the share of foreign liabilities held by the national banking sector in a country, which should be benchmark with those shares that banks would hold if they relied on national financing sources in proportion to the size of the domestic markets for deposits, money market instruments and bonds,
- the aggregate foreign liability index for the domestic banking sector of the whole Euro area, constructed by weighting the shares of foreign liabilities in each country's banking sector by the relative size of domestic markets for deposits, money market instruments and bonds.

These indirect, quantity-based indicators of integration need to be interpreted prudently, however. For instance, an entry by a foreign bank via the purchase of an existing local bank does not necessarily imply integration, as the acquired bank may continue to operate as before in the local market, and the pricing conditions will not necessarily converge across local markets.

3.3 News-based Indicators

Although most studies used price or quantity indicators, it is possible to measure the integration also with indicators based on news. These indicators are described e.g. by Baele et al. (2004) or Čermák (2006). News-based indicators are designed to distinguish the information effects from other frictions or barriers. In integrated markets, portfolios should be well diversified. Therefore, news of a regional character should have little impact on prices, whereas common or global news should be relatively more important. The reason is that for integrated market, the degree of systematic risk should be identical across assets in different countries.

To use news-based indicators, it is necessary to provide a proxy for common news. It is possible to specify explicitly the relevant local and common information variables and then test whether local information has any statistically significant power to explain changes in interest rates. The possible way to do this is to assume that the changes of a benchmark interest rate are a good reflection of all relevant common news.

As Baele et al. (2004) recommend, as a benchmark interest rate we should choose the interest rate in a market which we consider to be highly integrated with the markets we study. To separate common influences from local influences,

$$\Delta R_{i,t} = \alpha_{i,t} + \beta_{i,t} \Delta R_{b,t} + \varepsilon_{i,t} \quad (6)$$

where $\Delta R_{i,t}$... the change in the interest rate in country i at time t ,
 $\Delta R_{b,t}$... the change in the benchmark interest rate at time t ,
 $\alpha_{i,t}$... the time-varying intercept,
 $\beta_{i,t}$... the time-dependent β with respect to the benchmark interest rate,
 $\varepsilon_{i,t}$... the country specific shock.

Increasing integration requires:

- the intercept $\alpha_{i,t}$ to converge to zero (in fully integrated markets, changes of interest rates in one country should not be systematically larger or smaller than those in the benchmark interest rate),
- the $\beta_{i,t}$ to converge to one (for the explanation, see Baele et al. (2004)),
- and the proportion of the variance in explained $\Delta R_{i,t}$ by the common factor $\Delta R_{b,t}$ to increase towards 1 (the country specific error $\varepsilon_{i,t}$ should shrink as integration increases).

At fully integrated credit markets, the changes in domestic interest rate can be fully explained by the change of benchmark interest rate.

4. Conclusion

The aim of this paper was to describe how to measure credit market integration. Credit markets are integrated when terms of credits (both financial and non-financial) are not influenced by geographical location of the bank. In practice, measuring of credit market integration is quite complicated. One can choose one of three methods: price indicators, quantity indicators and news-based indicators.

Price indicators refer to the definition of integration, based on law of one price. The most common price indicator is the difference of interest rates charged in different countries to borrowers of the same risk class and for the same maturity. Interest rates should move together on integrated markets. One should also consider correlations among interest rates. Price indicators allow us to analyze the speed of integration (with beta convergence measure) and the degree of financial convergence (with sigma convergence measure).

Quantity indicators involve market penetration of foreign banks and home bias. Market penetration of foreign banks should increase in more integrated markets. On the contrary, home bias should disappear at perfectly integrated markets.

According to news-based indicators, the changes in domestic interest rate can be fully explained by the change of benchmark interest rate at fully integrated credit markets.

For all methods, data availability and quality are crucial. Availability is important to observe development in time, quality is important to obtain reliable indicators.

References

- [1] ADAM, K., JAPPELLI, T., MENICHINI, A., PADULA, M., PAGANO, M. *Analyse, Compare and Apply Alternative Indicators and Monitoring Methodologies to Measure the Evolution of Capital Market Integration in the European Union*. Palermo: University in Palermo, 2002.
- [2] BABIETSKII, I., KOMÁREK, L., KOMÁRKOVÁ, Z. Financial Integration of Stock Markets among New EU Member States and the Euro Area. *CNB Working Paper Series*, No. 7, 2007.
- [3] BAELE, L., FERRANDO, A., HÖRDAHL, P., KRYLOVA, E., MONNET, C. Measuring Financial Integration in the Euro Area. *ECB Occasional Paper Series*, No. 14, 2004. ISSN 1725-6534.
- [4] CABRAL, I., DIERICK, F., VESALA, J. *Banking Integration in the Euro Area*. Frankfurt, European Central Bank, 2002. ISSN 1607-1484.
- [5] ČERMÁK, P. *Integrace finančního trhu EU*. Praha: Ministerstvo financí, 2006. [online]. Dostupné z www: <<http://nf.vse.cz/download/veda/workshops/IntegraceFT.pdf>>
- [6] ECB. *Financial integration in Europe*. Frankfurt: European Central Bank, 2008. ISSN 1830-7159.

- [7] KOMÁRKOVÁ, Z., FRAIT, J., KOMÁREK, L. *Integrace úvěrových trhů vybraných nových členských zemí Evropské unie s eurozónou*. Ostrava: VŠB-TU, 2008. [online]. Dostupné z www: <http://www.ekf.vsb.cz/shared/uploadedfiles/cul33/S154_Frait_Jan_Komarek_Lubos.pdf>
- [8] PUNGULESCU, C. *Measuring Financial Market Integration: An Application for the East-European New Member States*. Tilburg: Tilburg University, 2002. [online]. Dostupné z www: <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1271891>