Financial Market Integration

Presentation by
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Outline

Financial Market Integration

- Stock Market (Integration)
- Bond Market (Integration)
Stock Market Integration
Financial market integration means that spatially separated financial markets increasingly merge into a single financial market.

- Reduction of both capital flow barriers and erosion of the home bias effect (partially due to institutional integration) should increasingly lead market participants to consider shares of different countries as substitutes.
Perfect substitution requires elimination of exchange rate risk.

For the Eastern European countries this precondition is not fulfilled. Nevertheless, trade within the EU member countries has increased tremendously (BORBÉLY, 2006).

→ Amplified synchronization of business cycles.

→ Interlinkages of capital markets should also strengthen.

Measurement of financial (stock) market integration?

→ E.g. correlation, “beta”
The Capital Asset Pricing Model
The Capital Asset Pricing Model (CAPM)

- The market portfolio is central for the CAPM, which assumes that the market portfolio lies on the efficient set and that all investors hold the market portfolio in combination with a desired amount of risk free borrowing and lending.

\[ r_p = r_f + \left( \frac{r_m - r_f}{\sigma_m} \right) \cdot \sigma_p \]  

(1)
The Capital Asset Pricing Model (CAPM)

\[ E(r_i) = r_f + \beta_i (r_M - r_f) \]  \hspace{1cm} (2)

\[ \beta_i = \frac{\text{Cov}(r_i, r_m)}{\text{Var}(r_m)} = \frac{\sigma_{iM}}{\sigma_M^2} \]  \hspace{1cm} (3)

- \( \beta_i \): (future) beta factor of security i.

- \( \sigma_{iM} \): covariance between the future returns of security i \((r_i)\) and the securities of the market \((r_M)\).

- \( \sigma_M^2 \): variance of the future returns of the market.
The Beta factor measures the **market risk** (systematic risk) of a security.

- It is the risk component which cannot be eliminated through diversification.

- The second risk component – **unsystematic risk** (non-market risk) – can be diversified away, and it therefore will not be compensated (by the market).
The Market Model
The Market Model

- The return on a common stock is assumed to be related to the return on a market index (e.g. FTSE100) in the following manner:

\[ r_i = \alpha_i + \beta_i r_I + \varepsilon_i \]  

(4)

where:
- \( r_{il} \) = return on security i for some given period,
- \( r_I \) = return on market index for the same period,
- \( \alpha_i \) = intercept term,
- \( \beta_i \) = slope term,
- \( \varepsilon_i \) = random error term.
International CAPM

\[ E(r_i - r^h) = \gamma_1 \text{Cov}(r_i, r^w) + \gamma_2 \text{Cov}(r_i, \&) \]  

- \( r_i \): return on security i
- \( r^w \): return on world market portfolio
- \( r^h \): interest rate on domestic bonds
- \( \& \): relative change of exchange rate
- \( \gamma_1 \) and \( \gamma_2 \): prices of the respective covariance risks.

Problem with (1)!
- \( \gamma_1 \) and \( \gamma_2 \) must be determined somehow.
International CAPM

- $r^w$ and interest rate on foreign bonds are used as benchmarks.

- $E(r^w - r^h) = \gamma_1 \text{Cov}(r^w, r^w) + \gamma_2 \text{Cov}(r^w, \&)$
  \[= \gamma_1 \text{Var}(r^w) + \gamma_2 \text{Cov}(r^w, \&)\]  
  \[(2)\]

- $E(\& + r^f - r^h) = \gamma_1 \text{Cov}(\& r^w) + \gamma_2 \text{Cov}(\& \&)$
  \[= \gamma_1 \text{Cov}(\& r^w) + \gamma_2 \text{Var}(\&)\]  
  \[(3)\]

$E(\& + r^f)$: expected return on foreign bonds (denominated in domestic currency).
International CAPM

- Assumption: \( \text{Cov}(\& r_w) = 0 \)
  from (2) and (3) result
  
  \[ \gamma_1 = \frac{E(r_w^w) - r^h}{\text{Var}(r_w^w)} \] \hspace{1cm} (4)
  
  \[ \gamma_2 = \frac{E(\& + r_f^f - r^h)}{\text{Var}(\&)} \] \hspace{1cm} (5)

- (4) and (5) in (1)
International CAPM

\[
E(r_i - r^h) = \frac{E(r^w - r^h)}{\text{Var}(r^w)} \cdot \text{Cov}(r_i, r^w) + \frac{E(\&^f - r^h)}{\text{Var}(\&^f)} \cdot \text{Cov}(r_i, \&^f)
\]

\[
= \frac{\text{Cov}(r_i, r^w)}{\text{Var}(r^w)} \cdot E(r^w - r^h) + \frac{\text{Cov}(r_i, \&^f)}{\text{Var}(\&^f)} \cdot E(\&^f - r^h)
\]

\[
= \beta_{1i} \cdot E(r^w - r^h) + \beta_{2i} \cdot E(\&^f - r^h)
\]

\( (6) \)

- \( \beta_1 \) and \( \beta_2 \) (sensitivity measures) can be estimated as follows:

\[
r_i = \alpha + \beta_{1i} \cdot r_w + \beta_{2i} \cdot \&^f + u_t, \quad u_t \sim (0, \sigma^2)
\]
Technique employed:

- Cointegration Approach

\[ SP_{i,t} = \alpha + \beta \cdot DAX_t + u_t \] (requirement: \( \alpha = 0, \beta = 1 \))

Eight Eastern European countries are considered, i.e. Poland, Czech Republic, Slovenia and Hungary, Estonia, Lithuania, Latvia, and the Slovak Republic.

The benchmark market is the German stock market (DAX is used as a proxy).

Monthly data are used covering the period from March 1995 to August 2008 except for Estonia (with the starting point August 1996), Lithuania (with the starting point February 2000) and Latvia (with the starting point March 2000).
Stock Market Integration in Eastern Europe

Cointegration Approach

\[ y_t = a_0 + b_0 x_t + z_t^y \]  \hspace{1cm} (1)

\[ x_t = a_1 + b_1 y_t + z_t^x \]  \hspace{1cm} (2)

\[ \Delta y_t = \gamma_0^y - \gamma_y (y_{t-1}^y - a^y_0 - b^y_0 x_{t-1}^x) + \sum_{j=1}^{n_y} a_{yj} \Delta x_{t-j} + \sum_{j=1}^{n_y} a_{yj} \Delta y_{t-j} + u_{yt} \]  \hspace{1cm} (3)

\[ \Delta x_t = \gamma_0^x + \gamma_x (x_{t-1}^x - a^x_0 - b^x_0 x_{t-1}^x) + \sum_{j=1}^{n_x} b_{xj} \Delta x_{t-j} + \sum_{j=1}^{n_x} b_{yj} \Delta y_{t-j} + u_{xt} \]  \hspace{1cm} (4)
Stock Market Integration in Eastern Europe

\[ Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_p Y_{t-p} + U_t \]  
\[ \Delta Y_t = -\Pi Y_{t-1} + A_1^* \Delta Y_{t-2} + \ldots + A_{p-1}^* \Delta Y_{t-p+1} + U_t \]  
\[ \Pi = I - \sum_{j=1}^{p} A_j \quad A_j^* = - \sum_{i=j+1}^{p} A_i, \quad j = 1, 2, \ldots, p-1 \]  
\[ \text{Tr}(r) = \sum_{i=r+1}^{k} \ln(1 - \hat{\lambda}_i) \quad \text{(trace-test)} \]
## Stock Market Integration in Eastern Europe

### Series: Germany-Czech Rep.

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>6.31767</td>
<td>15.4947</td>
<td>0.6580</td>
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<td>At most 1</td>
<td>0.6407</td>
<td>3.8415</td>
<td>0.4235</td>
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### Series: Germany-Estonia

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>14.3109</td>
<td>15.4947</td>
<td>0.0748</td>
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<tr>
<td>At most 1</td>
<td>3.1338</td>
<td>3.8415</td>
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### Series: Germany-Hungary

<table>
<thead>
<tr>
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<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>16.9329</td>
<td>15.4947</td>
<td>0.0302</td>
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<tr>
<td>At most 1</td>
<td>2.8928</td>
<td>3.8415</td>
<td>0.0890</td>
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### Series: Germany-Latvia

<table>
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<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
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<tbody>
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<td>None</td>
<td>16.3184</td>
<td>15.4947</td>
<td>0.0375</td>
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<td>At most 1</td>
<td>5.7756</td>
<td>3.8415</td>
<td>0.0162</td>
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</table>
## Stock Market Integration in Eastern Europe

### Series: Germany-Lithuania

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>16.7550</td>
<td>15.4947</td>
<td>0.0322</td>
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<td>At most 1</td>
<td>4.7125</td>
<td>3.8415</td>
<td>0.0299</td>
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### Series: Germany-Poland

<table>
<thead>
<tr>
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<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
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</thead>
<tbody>
<tr>
<td>None</td>
<td>11.8812</td>
<td>15.4947</td>
<td>0.1627</td>
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<tr>
<td>At most 1</td>
<td>2.5319</td>
<td>3.8415</td>
<td>0.1116</td>
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</tbody>
</table>

### Series: Germany-Slovak Rep.

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>6.4957</td>
<td>15.4947</td>
<td>0.6369</td>
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<tr>
<td>At most 1</td>
<td>0.0518</td>
<td>3.8415</td>
<td>0.8200</td>
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### Series: Germany-Slovenia

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
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</thead>
<tbody>
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<td>None</td>
<td>4.2741</td>
<td>15.4947</td>
<td>0.8802</td>
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<tr>
<td>At most 1</td>
<td>0.2412</td>
<td>3.8415</td>
<td>0.6233</td>
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</tbody>
</table>

**MacKinnon-Haug-Michelis (1999) p-values**
Result:

- Only the Hungarian stock market index and the German stock market index are cointegrated. The other stock market indices are not cointegrated with the German stock market index.
### Stock Market Integration in Eastern Europe - Results

<table>
<thead>
<tr>
<th>Country</th>
<th>Constant (SE)</th>
<th>Beta (SE)</th>
<th>Adjusted R$^2$ (SE)</th>
<th>Theta (SE)</th>
<th>Adjusted R$^2$ (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Czech Rep.</td>
<td>0.0029 (0.0036)</td>
<td>0.5486 *** (0.0075)</td>
<td>0.5486 (0.00715)</td>
<td>0.6855 *** (0.00715)</td>
<td>0.3773</td>
</tr>
<tr>
<td>Estonia</td>
<td>0.0116 (0.0072)</td>
<td>0.5854 *** (0.1326)</td>
<td>0.1132 (0.0036)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hungary</td>
<td>0.0125 *** (0.0047)</td>
<td>0.8527 *** (0.0904)</td>
<td>0.3521 (0.0636)</td>
<td>0.8453 *** (0.0636)</td>
<td>0.5397</td>
</tr>
<tr>
<td>Latvia</td>
<td>0.0174 ** (0.0072)</td>
<td>0.2933 ** (0.1375)</td>
<td>0.0336 (0.0731)</td>
<td>0.1915 *** (0.0731)</td>
<td>0.0477</td>
</tr>
<tr>
<td>Lithuania</td>
<td>0.0146 *** (0.0051)</td>
<td>0.3692 *** (0.0970)</td>
<td>0.1157 (0.1049)</td>
<td>0.3336 *** (0.1049)</td>
<td>0.0619</td>
</tr>
<tr>
<td>Poland</td>
<td>0.0069 (0.0044)</td>
<td>0.6966 *** (0.0851)</td>
<td>0.2897 (0.0583)</td>
<td>0.4541 *** (0.0583)</td>
<td>0.2847</td>
</tr>
<tr>
<td>Slovak Rep.</td>
<td>0.0076 * (0.0045)</td>
<td>-0.1299 (0.0849)</td>
<td>0.0082 (0.0517)</td>
<td>0.5601 *** (0.0517)</td>
<td>0.4367</td>
</tr>
<tr>
<td>Slovenia</td>
<td>0.0091 ** (0.0046)</td>
<td>0.2005 ** (0.0874)</td>
<td>0.0256 (0.0241)</td>
<td>0.0184 (0.0241)</td>
<td>0</td>
</tr>
<tr>
<td>France</td>
<td>-0.0002 (0.0016)</td>
<td>0.7869 *** (0.0298)</td>
<td>0.8120 (0.1067)</td>
<td>1.6385 *** (0.1067)</td>
<td>0.6103</td>
</tr>
<tr>
<td>Portugal</td>
<td>-0.0005 (0.0028)</td>
<td>0.7537 *** (0.0530)</td>
<td>0.5539 (0.1067)</td>
<td>1.3171 *** (0.1067)</td>
<td>0.5024</td>
</tr>
</tbody>
</table>

***, **, * Significance at 1% level, 5% level and 10% level, respectively.
Stock Market Integration in Eastern Europe

Time-varying beta
Stock Market Integration in Europe
Stock Market Integration in Europe

Hungary

Corr(HUN-GER)mw_36
Stock Market Integration in Europe

Czech Rep.
Stock Market Integration in Europe

Poland

Corr(PL-GER) in w_36

The Stock Market
Stock Market Integration in Europe

Slovenia

The Stock Market
Stock Market Integration in Europe

Greece

Corr(GRE-GER)mw_36

The Stock Market
Stock Market Integration in Europe

Ireland

The Stock Market
Stock Market Integration in Europe

Portugal

The Stock Market
Stock Market Integration in Europe

Spain

Corr(ESP-GER)mw_36
Bond Market (Integration)
Introduction
Introduction

- Bonds are issued by governments or by firms.
  - If issued by the government or government agencies, the bonds are called government bonds.
  - If issued by firms (corporations), they are called corporate bonds.
- Bonds are traded in securities markets; this distinguishes from bank debt – claims held by banks cannot, in general, be sold to a third party.
- Bonds are rated for their default risk (the risk that the issuer of the bond will not pay back the full amount promised by the bond).
- A lower rating typically implies that the bond has to pay a higher interest rate, or else investors will not buy it.
Introduction

- The difference between the interest rate paid on a given bond and the interest rate paid on the bond with the highest (best) rating is called the **risk premium** associated with the given bond.

- Bonds with high default risk are sometimes called **junk bonds**.

- Bonds that promise a single payment at maturity are called **discount bonds**. The single payment is called the **face value** of the bond.
Introduction

Interest Rates (in %)

- Germany
- Poland
- Slovenia
- Hungary
- Czech Rep.
Introduction

Interest Rate Spreads (10y bonds; in %)

Poland  Slovenia  Hungary  Czech Rep.
Introduction

Interest Rate Spreads (10y bonds; in %)

- Lithuania
- Latvia
- Estonia
- Slovak Rep.
Introduction

- Bonds that promise multiple payments before maturity and one payment at maturity are called **coupon bonds**.

- The payments before maturity are called **coupon payments**.
- The final payment is called the **face value** of the bond.
- The ratio of coupon payments to the face value is called the **coupon rate**.
- The **current yield** is the ratio of the coupon payment to the price of the bond.
Example:
A bond with **coupon payments** of $5 each year, a **face value** of $100, and a **price** of $80 has a **coupon rate** of 5% and a **current yield** of $5/80 = 0.0625 = 6.25%.
Bonds with a maturity of up to 1 year are called Treasury bills, or T-bills. They are discount bonds, making only one payment at maturity.

Bonds with a maturity of 1 to 10 years when they are issued are called Treasury bonds. Treasury bonds are coupon bonds.

There are also other types of bonds.

Indexed bonds:
- Bonds that promise payments adjusted for inflation rather than fixed nominal payments.
- Instead of promising to pay, say, 100 dollars in a year, a 1-year indexed bond promises to pay 100(1 + π) dollars; π is the rate of inflation.
Introduction

- Bonds differ in two basic dimensions:
  - Default risk,
  - Maturity, the length of time over which the bond promises to make payments to the holder of the bond (1 year, 5 years, 10 years..).

- Bonds of different maturities each have a price and an associated interest rate called the **yield to maturity**, or simply the **yield**.

- Yields on bonds with a short maturity typically a year or less, are called **short-term interest rates**. Yields on bonds with longer maturity are called **long-term interest rates**.
Prices, Yields, and Interest Rates
Because we value the cash paid to us tomorrow less than the cash that is in our pocket today, we will discount those future receipts of cash that a bond entitles us to.

The yield on a bond is simply the rate of return that, when used to discount future cash receipts, makes their total value equal to the current market price of the bond.
Where \( C \) is the regular annual coupon payment on the bond, and \( F \) is the face value.

- The bond matures \( n \) years from now.
Prices, Yields, and Interest Rates

Yield to maturity

Bond Price
The yield to maturity is a measure of the average rate of return a buyer will earn on a bond if the buyer holds it to maturity.
Yield Curves
Interest Rates

Interest Rates on German Government Bonds with Different Maturities (M, Q, Y)

Data Source: Deutsche Bundesbank
Yield Curves

Upward Sloping

Flat

Downward Sloping

Yield vs. Maturity

Yield vs. Maturity

Yield vs. Maturity
Yield Curves

- A plot of the yields on default-free government bonds with differing terms to maturity is called a *yield curve*, and it represents the term structure of interest rates for the government bonds.

- Typically, the yield curve is upward sloping, but at times it is flat or downward sloping.
Yield Curve (Germany)

Upward Sloping (June 1997)

Yield (in %)

Data Source: Deutsche Bundesbank

Maturity

The Bond Market
Yield Curve (Germany)

Flat (October 1988)

Yield (in %)

Data Source: Deutsche Bundesbank

The Bond Market
Yield Curve (Germany)

Downward Sloping (February 1992)

Data Source: Deutsche Bundesbank

The Bond Market
Long-Term Interest Rates in Selected EU Countries (M, Q, Y)

Data Source: Eurostat.

The Bond Market
Interest Rates

Long-Term Interest Rates in Selected EU Countries \((M, Q, Y)\)

Yields (%)

Data Source: Eurostat.
Thank you for your attention!