Financial Market Integration

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Outline

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Financial Market Integration

- Stock Market (Integration)
- Bond Market (Integration)

Stock Market Integration

Stock Market Integration in Eastern Europe

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- 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.

Stock Market Integration in Eastern Europe

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- 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.

$$r_p = r_f + \left[\frac{r_m - r_f}{\sigma_m} \right] \cdot \sigma_p \qquad (1)$$

The Capital Asset Pricing Model (CAPM)

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$$E(r_i) = r_f + \beta_i (r_M - r_f) \tag{2}$$

$$\beta_i = \frac{Cov(r_i, r_m)}{Var(r_m)} = \frac{\sigma_{iM}}{\sigma_M^2} \tag{3}$$

- β_i: (future) beta factor of security i.
- σ_{iM}: covariance between the future returns of security i (r_i) and the securities of the market (r_M).
- σ_M^2 : variance of the future returns of the market.

The Capital Asset Pricing Model (CAPM)

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- 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 <u>index</u>** (e.g. FTSE100) in the following manner:

$$r_i = \alpha_{iI} + \beta_{iI} r_I + \varepsilon_{iI} \qquad (4)$$

where: r_{iI} = return on security i for some given period,

r_I = return on market index for the same period,

α_{iI} = intercept term,

β_{iI} = slope term,

ε_{iI} = random error term.

The International CAPM

International CAPM

- $E(r_i - r^h) = \gamma_1 Cov(r_i, r^w) + \gamma_2 Cov(r_i, \varepsilon)$ (1)

- r_i: return on security i
- r^w: return on world market portfolio
- r^h: interest rate on domestic bonds
- ε: relative change of exchange rate
- γ_1 and γ_2 : prices of the respective covariance risks.

- Problem with (1)!
- γ_1 and γ_2 must be determined somehow.

International CAPM

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

- $E(r^w - r^h) = \gamma_1 \mathrm{Cov}(r^w, r^w) + \gamma_2 \mathrm{Cov}(r^w, \tilde{e})$
$= \gamma_1 \mathrm{Var}(r^w) + \gamma_2 \mathrm{Cov}(r^w, \tilde{e})$ (2)

$E(\tilde{e}) + r^f - r^h = \gamma_1 \mathrm{Cov}(\tilde{e}, r^w) + \gamma_2 \mathrm{Cov}(\tilde{e}, \tilde{e})$
$= \gamma_1 \mathrm{Cov}(\tilde{e}, r^w) + \gamma_2 \mathrm{Var}(\tilde{e})$ (3)

$E(\tilde{e}) + r^f$: expected return on foreign bonds (denominated in domestic currency).

International CAPM

- Assumption: $\mathrm{Cov}(\varepsilon, r_w) = 0$

  from (2) and (3) result

$\rightarrow$

$$\gamma_1 = \frac{E(r^w) - r^h}{\mathrm{Var}(r^w)} \tag{4}$$

$$\gamma_2 = \frac{E(\varepsilon) + r^f - r^h}{\mathrm{Var}(\varepsilon)} \tag{5}$$

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

International CAPM

$$E(r_i - r^h) = \frac{E(r^w - r^h)}{Var(r^w)} \cdot Cov(r_i, r^w) + \frac{E(\epsilon_t + r^f - r^h)}{Var(\epsilon_t)} \cdot Cov(r_i, \epsilon_t)$$

$$= \frac{Cov(r_i, r^w)}{Var(r^w)} \cdot E(r^w - r^h) + \frac{Cov(r_i, \epsilon_t)}{Var(\epsilon_t)} \cdot E(\epsilon_t + r^f - r^h)$$

$$= \beta_{1i} \cdot E(r^w - r^h) + \beta_{2i} \cdot E(\epsilon_t + r^f - r^h) \qquad (6)$$

- β_1 and β_2 (sensitivity measures) can be estimated as follows:

$$\boxed{r_i = \alpha + \beta_{1i} \cdot r_w + \beta_{2i} \cdot \epsilon_t + u_t}, \qquad u_t \sim (0, \sigma^2)$$

Stock Market Integration in Eastern Europe

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- 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).

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Cointegration Approach

$$y_t = a_0 + b_0 x_t + z_t^y \qquad (1)$$

$$x_t = a_1 + b_1 y_t + z_t^x \qquad (2)$$

$$\Delta y_t = \gamma_0^y - \gamma_y \underbrace{(y_{t-1} - a_0 - b_0 x_{t-1})}_{= z_{t-1}^y} + \sum_{j=1}^{n_x} a_{xj} \Delta x_{t-j} + \sum_{j=1}^{n_y} a_{yj} \Delta y_{t-j} + u_{yt} \qquad (3)$$

$$\Delta x_t = \gamma_0^x + \gamma_x \underbrace{(y_{t-1} - a_0 - b_0 x_{t-1})}_{= z_{t-1}^y} + \sum_{j=1}^{n_x} b_{xj} \Delta x_{t-j} + \sum_{j=1}^{n_y} b_{yj} \Delta y_{t-j} + u_{xt} \qquad (4)$$

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$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_p Y_{t-p} + U_t \qquad (5)$$

$$\Delta Y_t = -\Pi Y_{t-1} + A_1^* \Delta Y_{t-1} + A_2^* \Delta Y_{t-2} + \ldots + A_{p-1}^* \Delta Y_{t-p+1} + U_t \qquad (6)$$

$$\Pi = I - \sum_{j=1}^{p} A_j \qquad A_j^* = -\sum_{i=j+1}^{p} A_i, \quad j = 1, 2, \ldots, p-1$$

$$Tr(r) = \sum_{i=r+1}^{k} \ln(1 - \hat{\lambda}_i)$$ (trace-test)

Stock Market Integration in Eastern Europe

Series: Germany-Czech Rep.

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Prob.**
None	6.31767	15.4947	0.6580
At most 1	0.6407	3.8415	0.4235

Series: Germany-Estonia

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Prob.**
None	14.3109	15.4947	0.0748
At most 1	3.1338	3.8415	0.0767

Series: Germany-Hungary

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Prob.**
None	16.9329	15.4947	0.0302
At most 1	2.8928	3.8415	0.0890

Series: Germany-Latvia

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Prob.**
None	16.3184	15.4947	0.0375
At most 1	5.7756	3.8415	0.0162

Stock Market Integration in Eastern Europe

Series: Germany-Lithuania

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Prob.**
None	16.7550	15.4947	0.0322
At most 1	4.7125	3.8415	0.0299

Series: Germany-Poland

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Prob.**
None	11.8812	15.4947	0.1627
At most 1	2.5319	3.8415	0.1116

Series: Germany-Slovak Rep.

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Prob.**
None	6.4957	15.4947	0.6369
At most 1	0.0518	3.8415	0.8200

Series: Germany-Slovenia

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Prob.**
None	4.2741	15.4947	0.8802
At most 1	0.2412	3.8415	0.6233

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

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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

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Country	Constant	Beta	Adjusted R^2	*Theta*	*Adjusted R^2*
Czech Rep.	0.0029 (0.0038)	0.5486 *** (0.0073)	0.5486	0.6855 *** (0.0715)	0.3773
Estonia	0.0116 (0.0072)	0.5854 *** (0.1326)	0.1132	-	-
Hungary	0.0125 *** (0.0047)	0.8527 *** (0.0904)	0.3521	0.8453 *** (0.0636)	0.5397
Latvia	0.0174 ** (0.0072)	0.2933 ** (0.1375)	0.0336	0.1915 *** (0.0731)	0.0477
Lithuania	0.0146 *** (0.0051)	0.3692 *** (0.0970)	0.1157	0.3336 *** (0.1049	0.0619
Poland	0.0069 (0.0044)	0.6966 *** (0.0851)	0.2897	0.4541 *** (0.0583)	0.2847
Slovak Rep.	0.0076 * (0.0045)	- 0.1299 (0.0849)	0.0082	0.5601 *** (0.0517)	0.4367
Slovenia	0.0091 ** (0.0046)	0.2005 ** (0.0874)	0.0256	0.0184 (0.0241)	0
France	- 0.0002 (0.0016)	0.7869 *** (0.0298)	0.8120	1.6385 *** (0.1067)	0.6103
Portugal	- 0.0005 (0.0028)	0.7537 *** (0.0530)	0.5539	1.3171 *** (0.1067)	0.5024

***, **, * Significance at 1% level, 5% level and 10% level, respectively.

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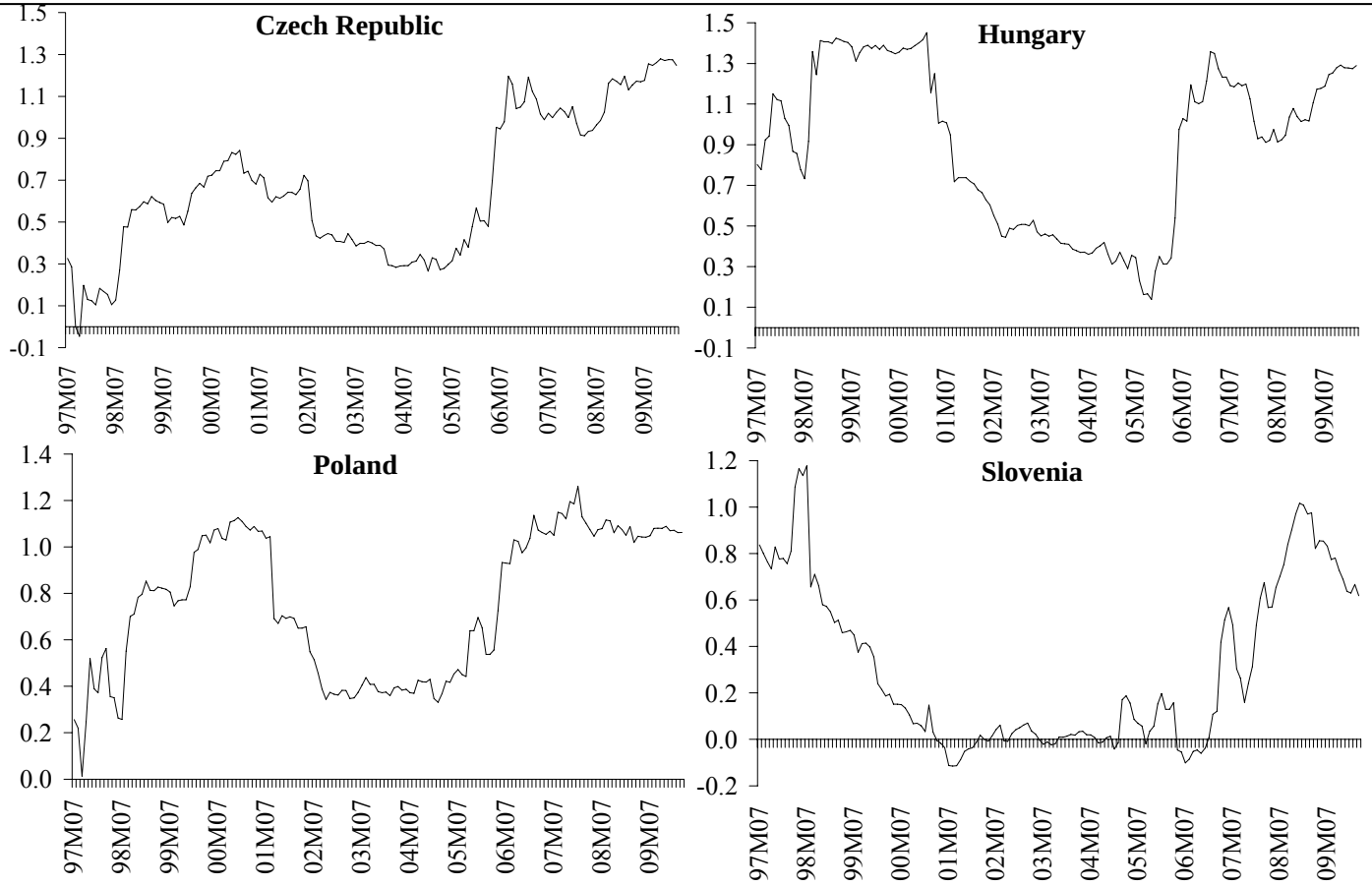
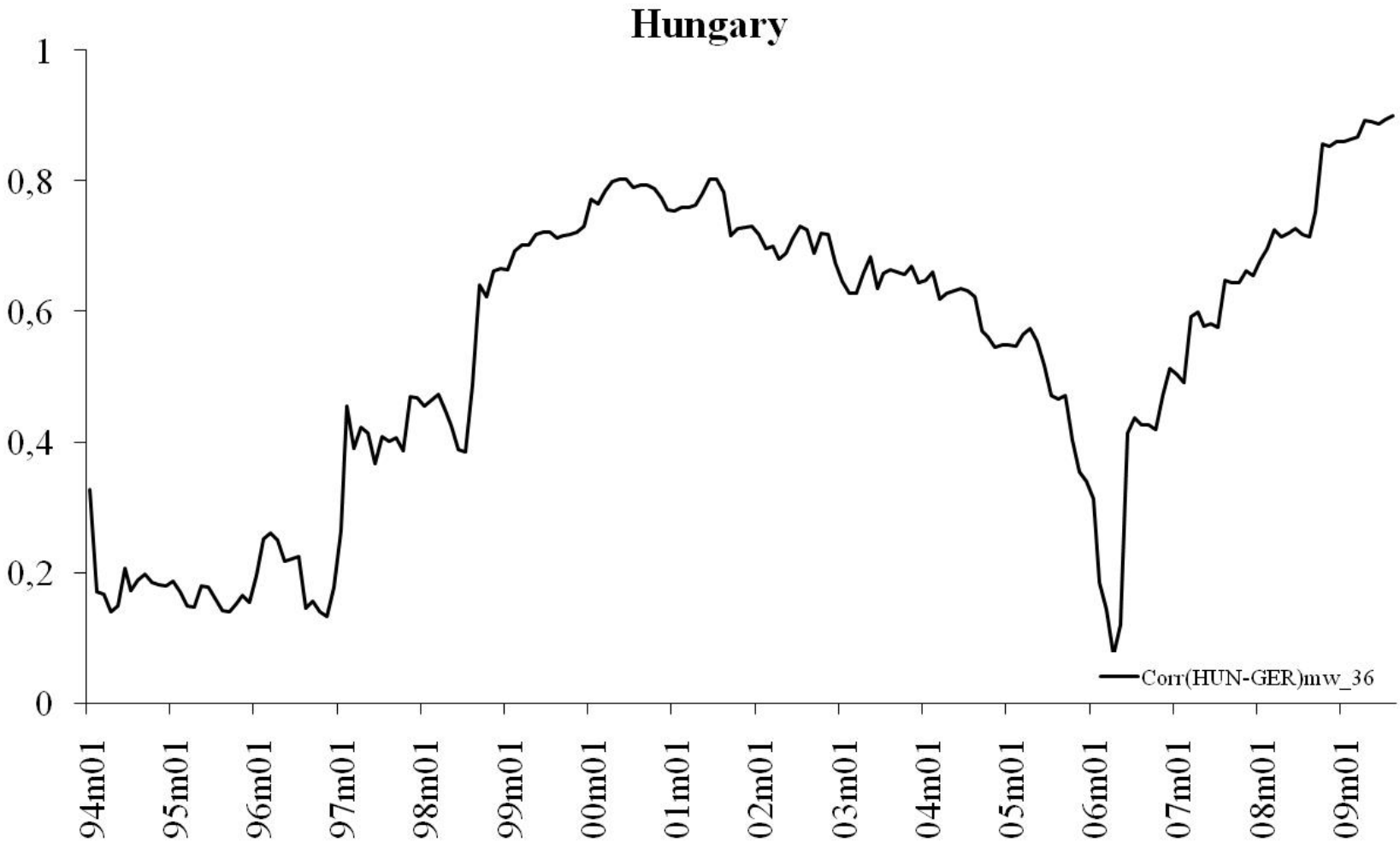
Time-varying beta



Stock Market Integration in Europe

Stock Market Integration in Europe



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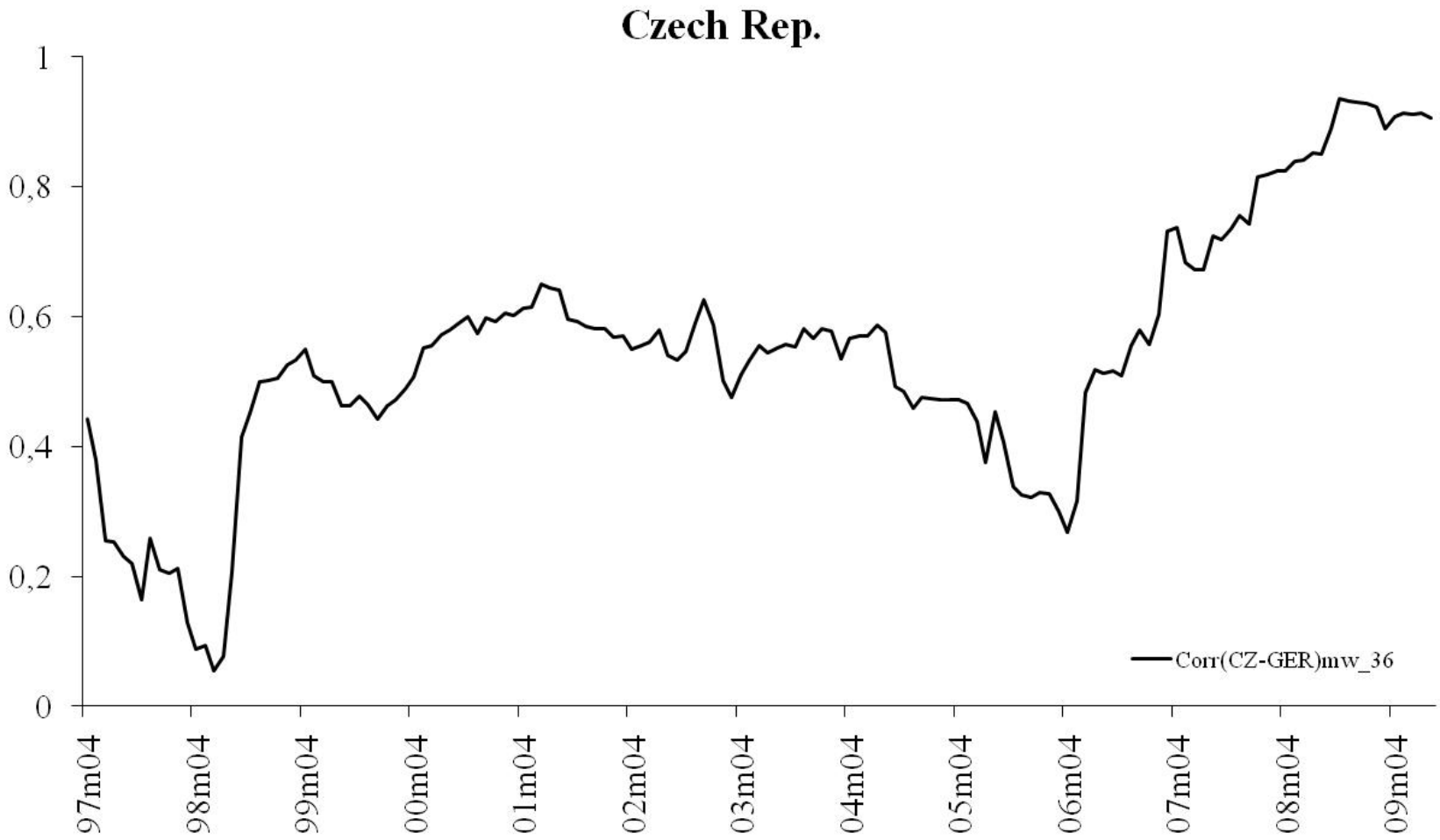

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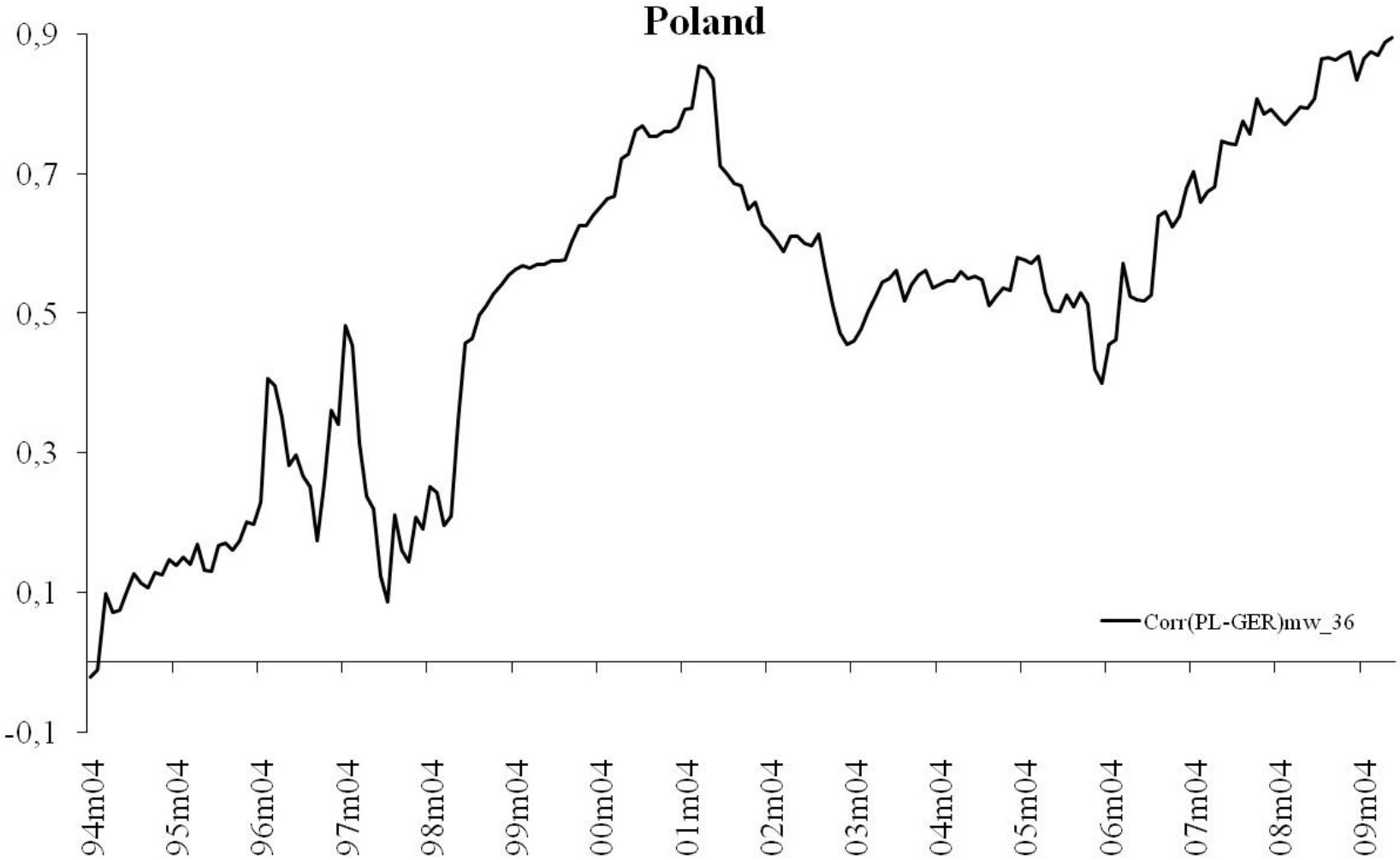

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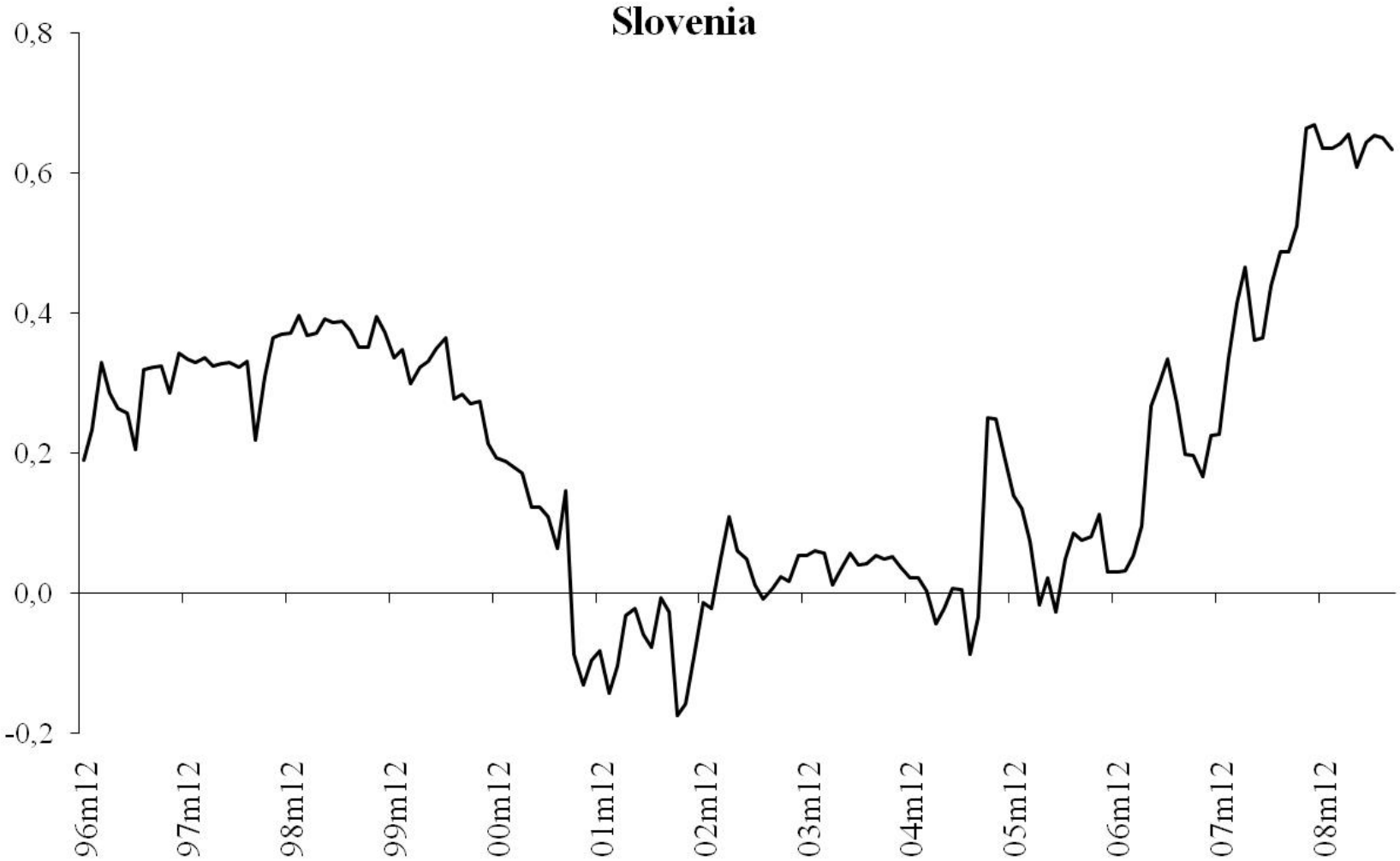

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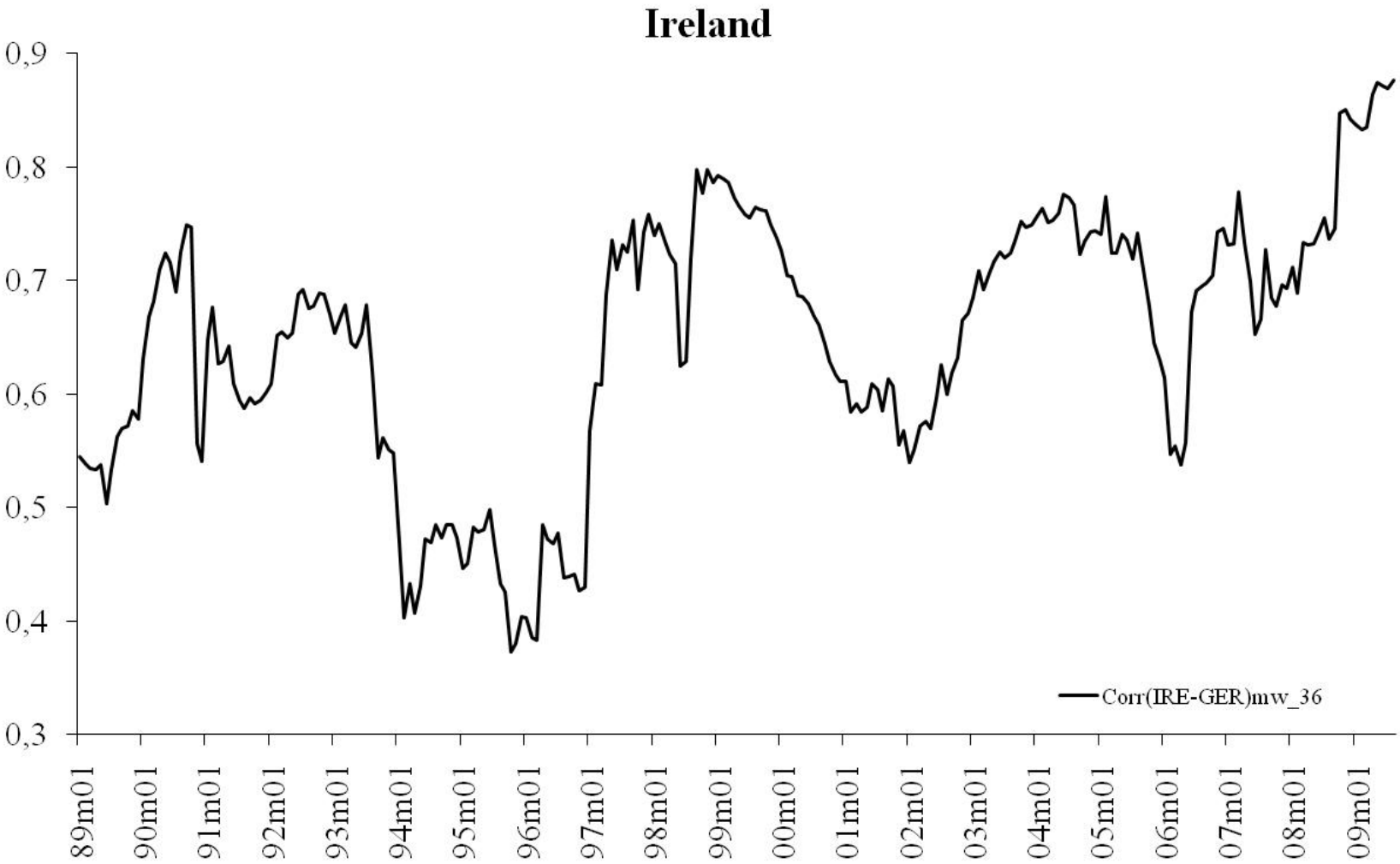

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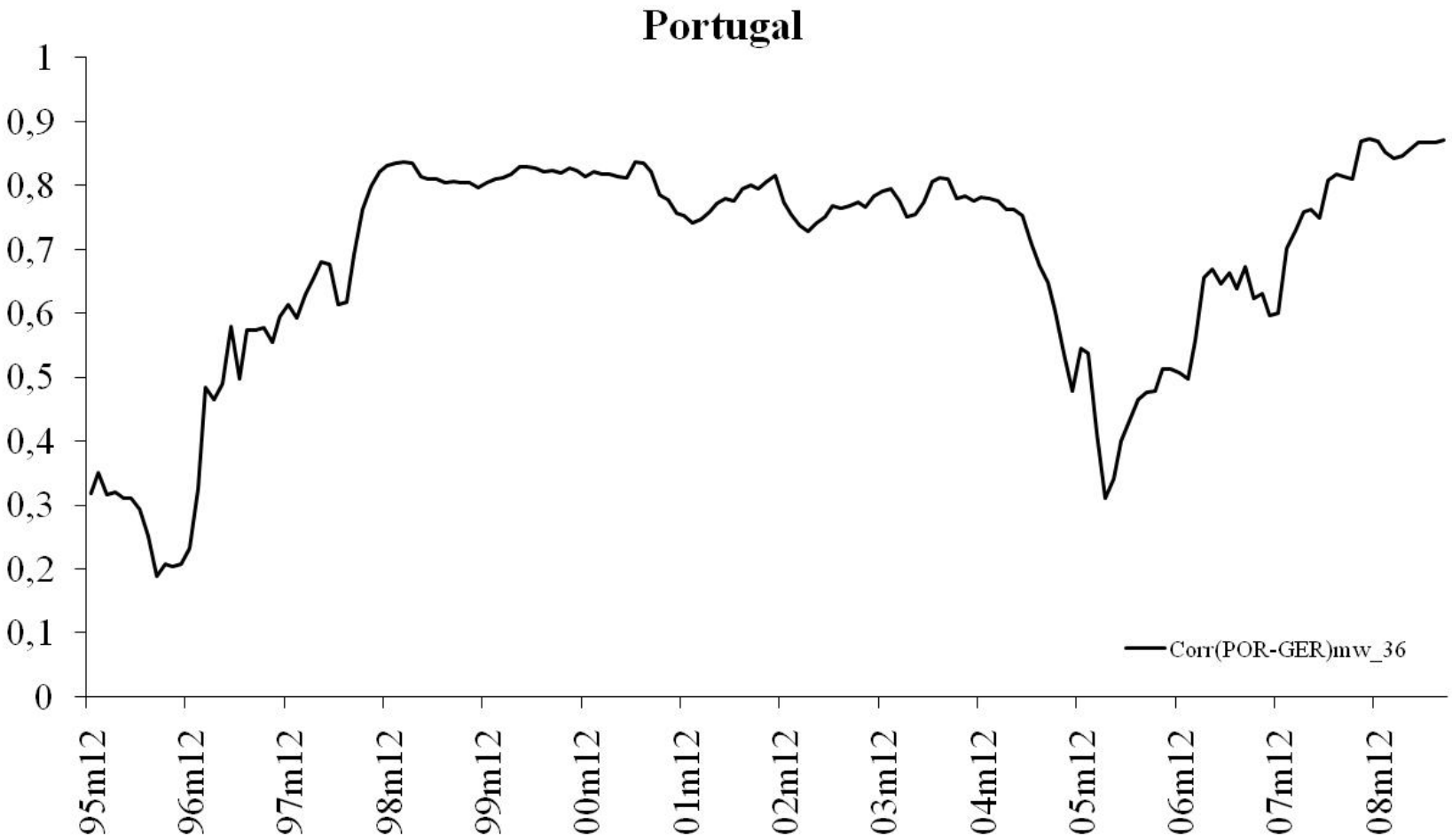

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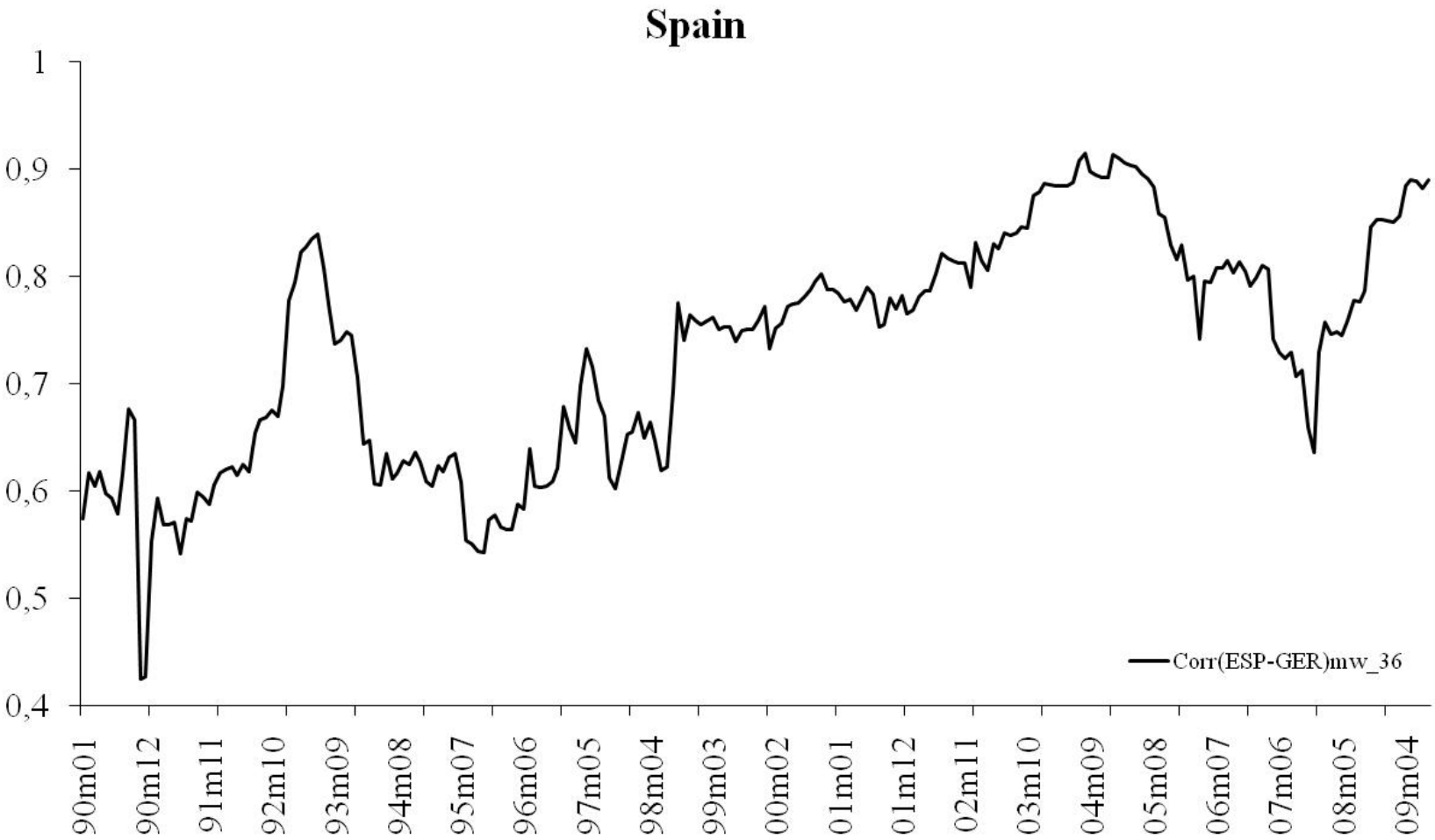


Bond Market (Integration)

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.

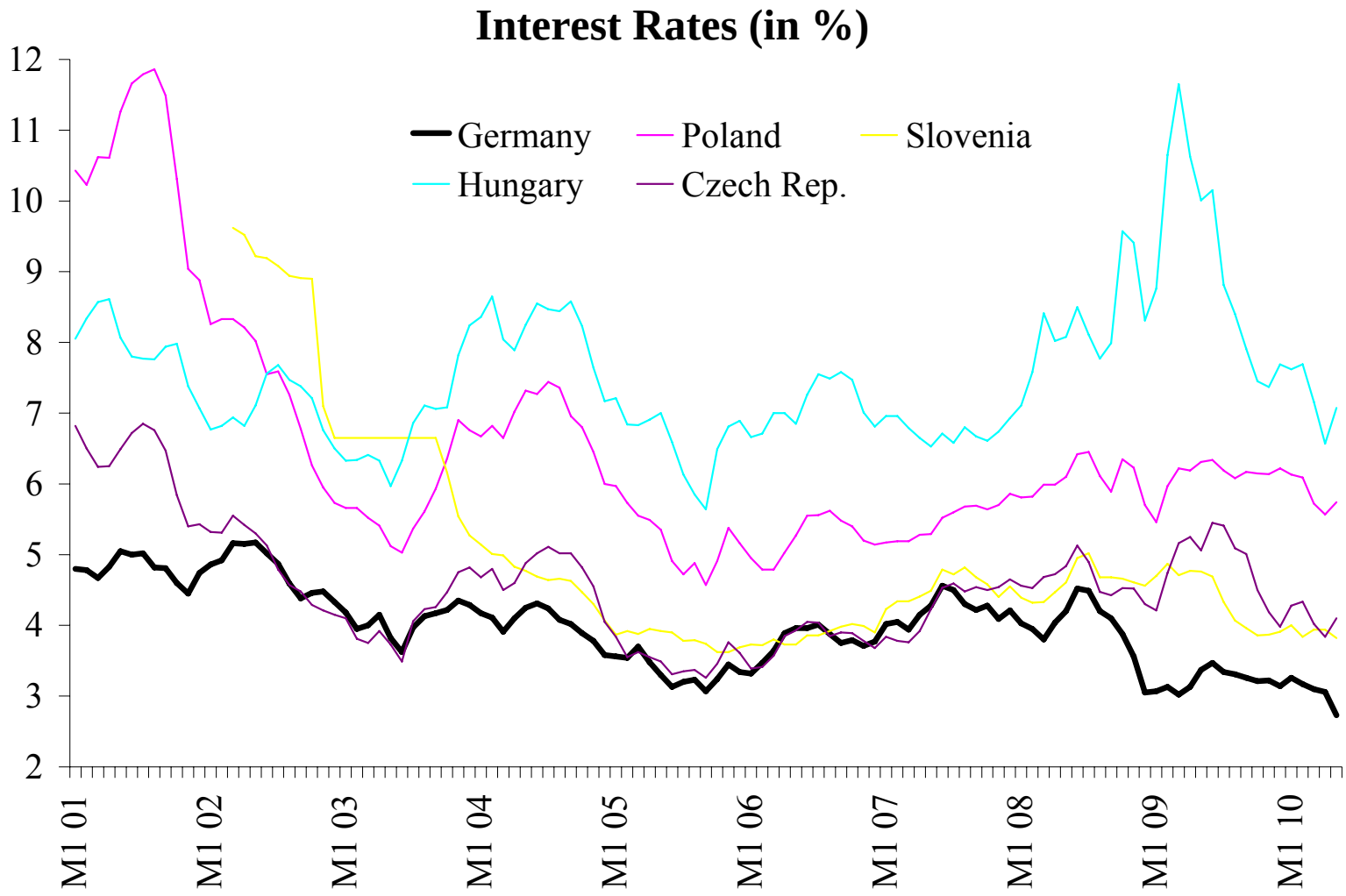
Introduction

- 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



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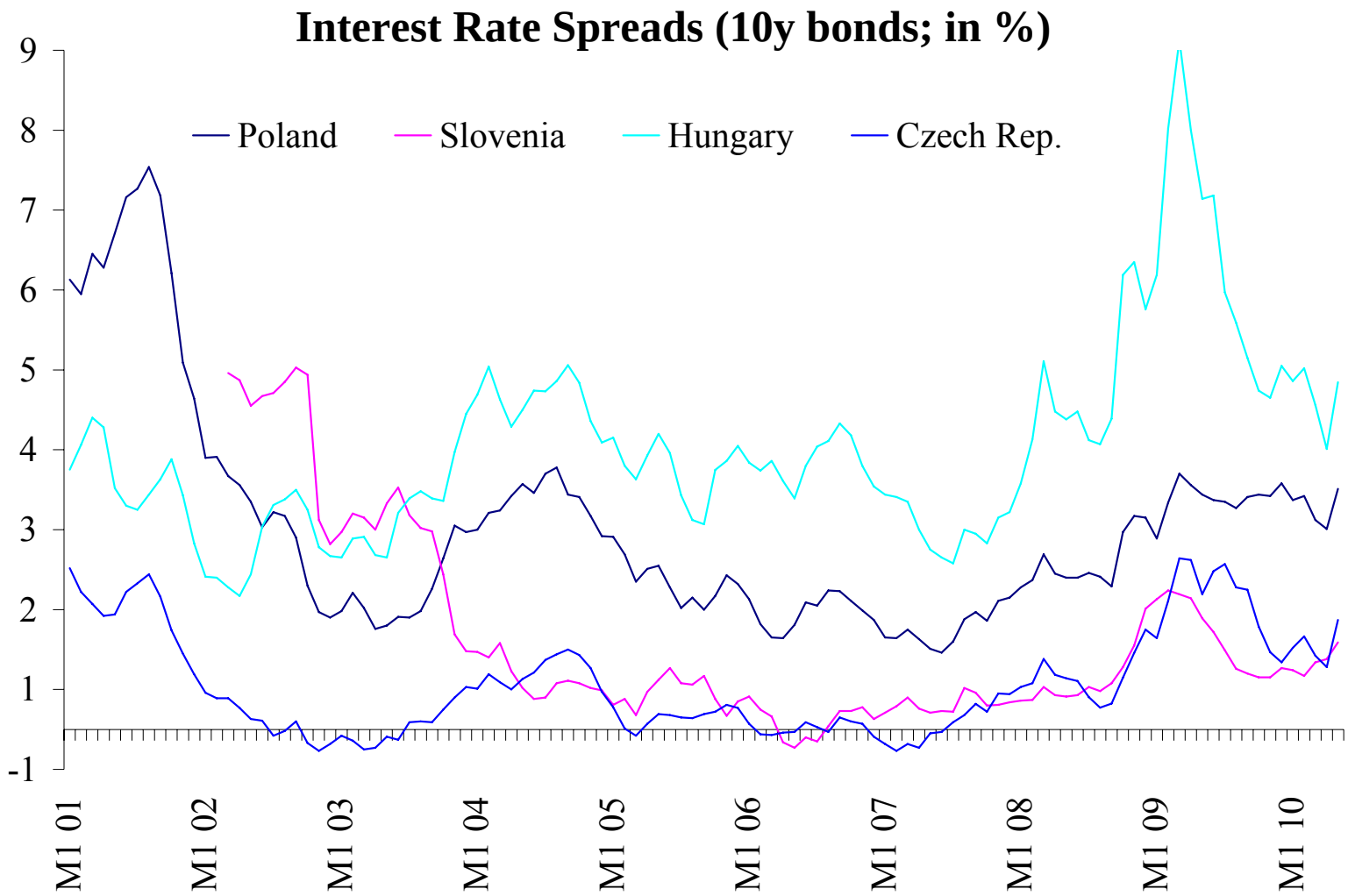
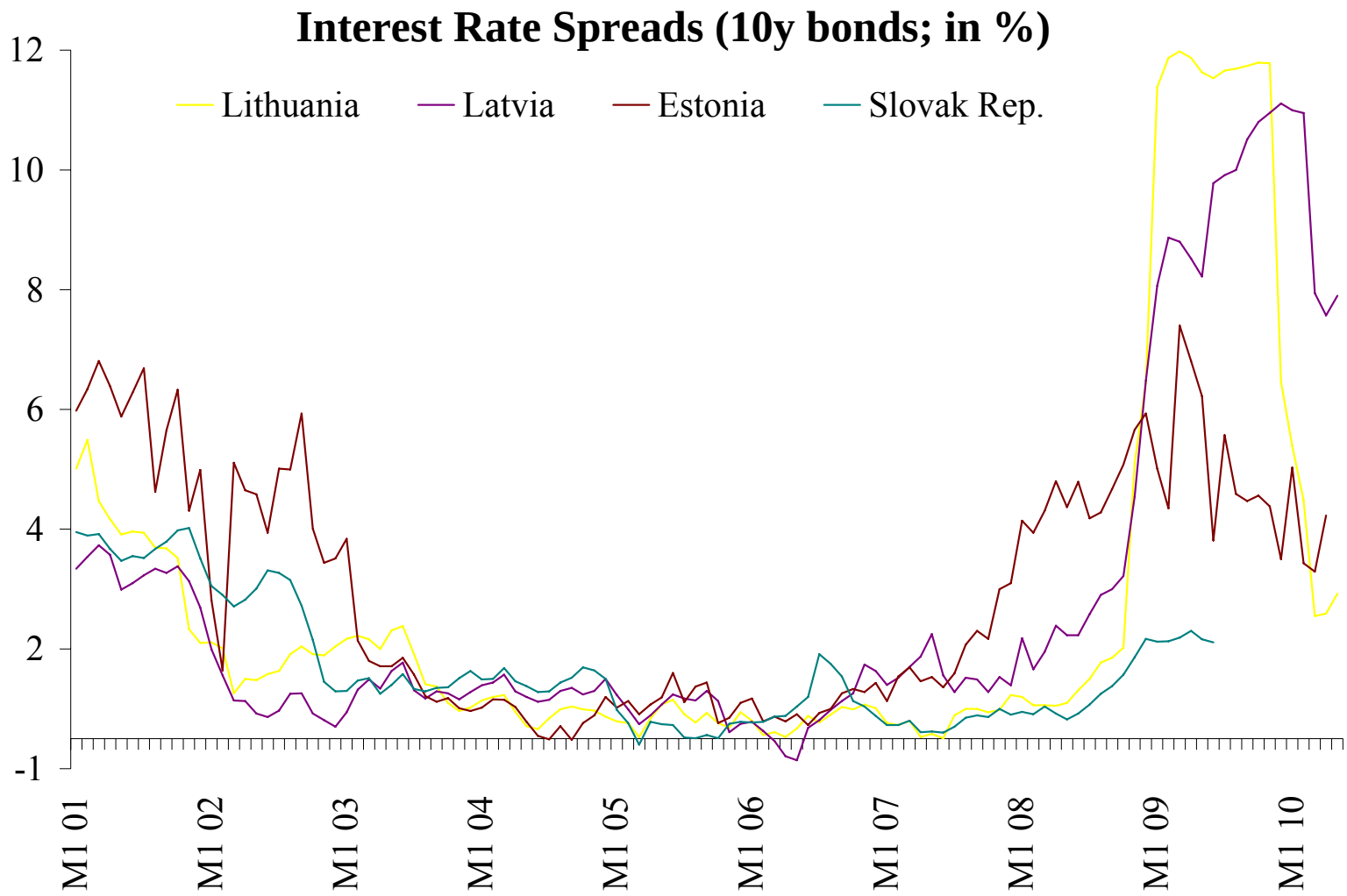


Introduction



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.

Introduction

- **<u>Example</u>**:

  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%.

Introduction

- 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 $100(1 + \pi)$ 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

Prices, Yields, and Interest Rates

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- Because we value the cash paid to us tomorrow less than the cash that is in our pocket today, we will <u>discount</u> 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.

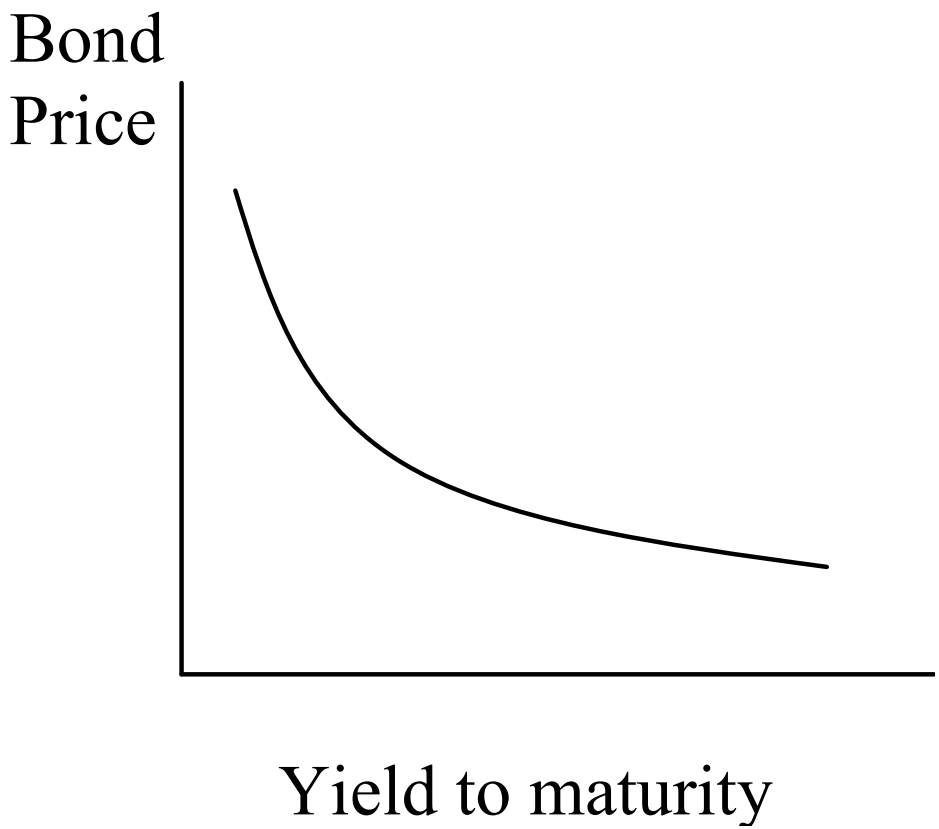
Prices, Yields, and Interest Rates

$$P_B = \frac{C}{1+i} + \frac{C}{(1+i)^2} + \ldots + \frac{C}{(1+i)^n} + \frac{F}{(1+i)^n}$$

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



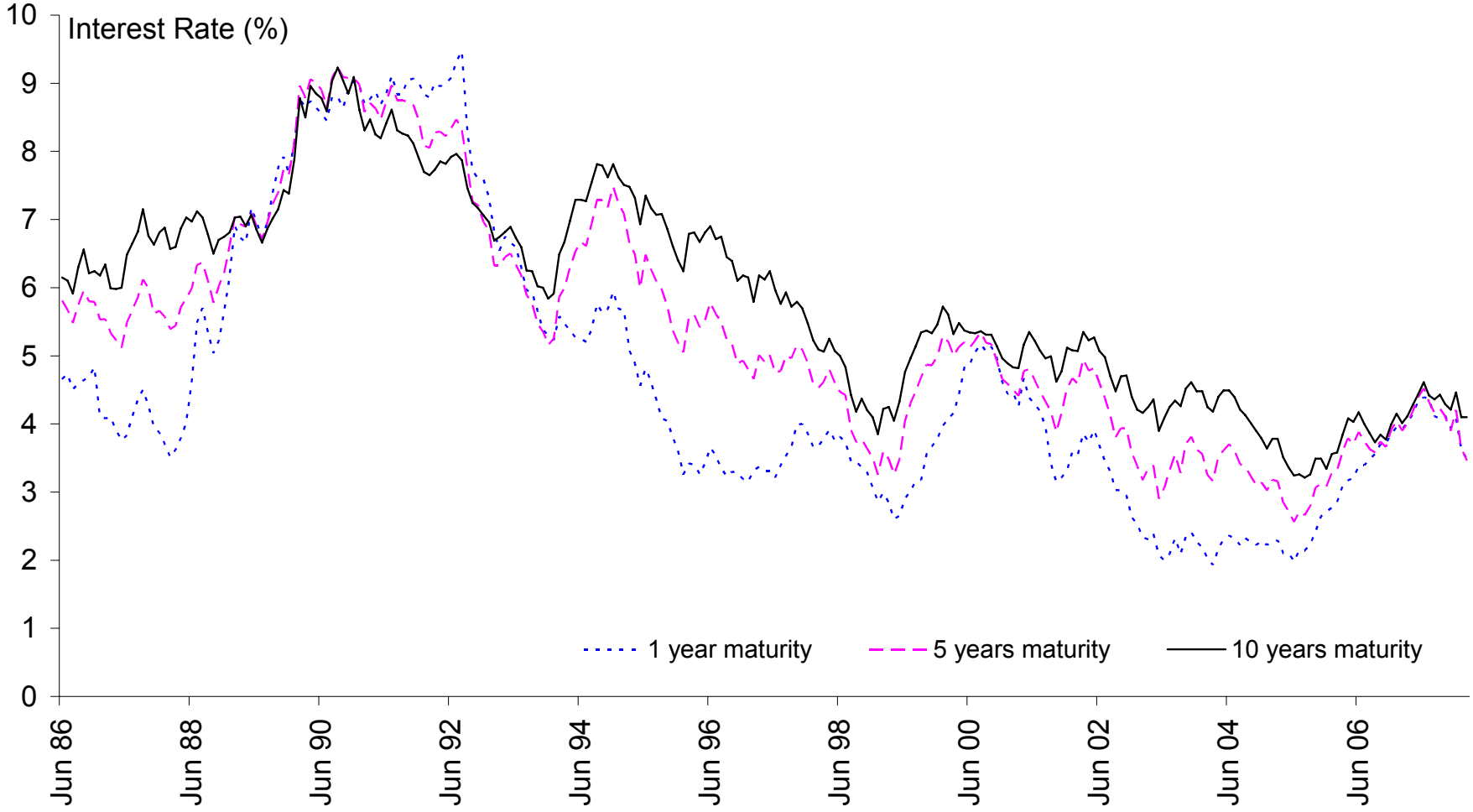
Prices, Yields, and Interest Rates

- **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

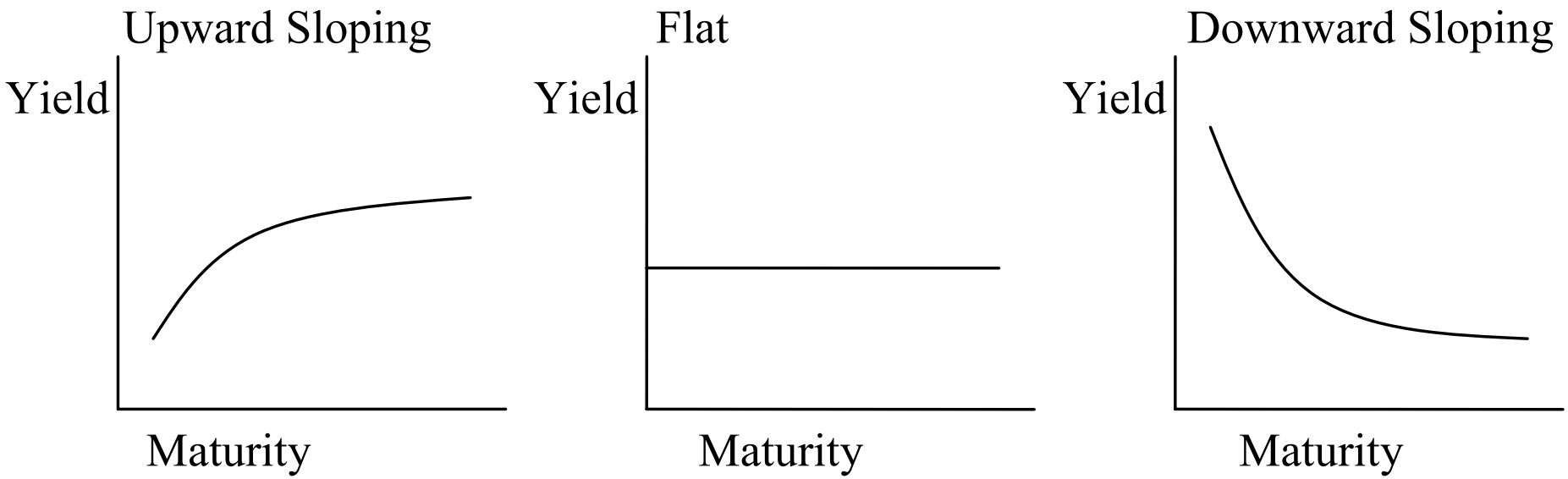
Interest Rates

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



Data Source: Deutsche Bundesbank

Yield Curves

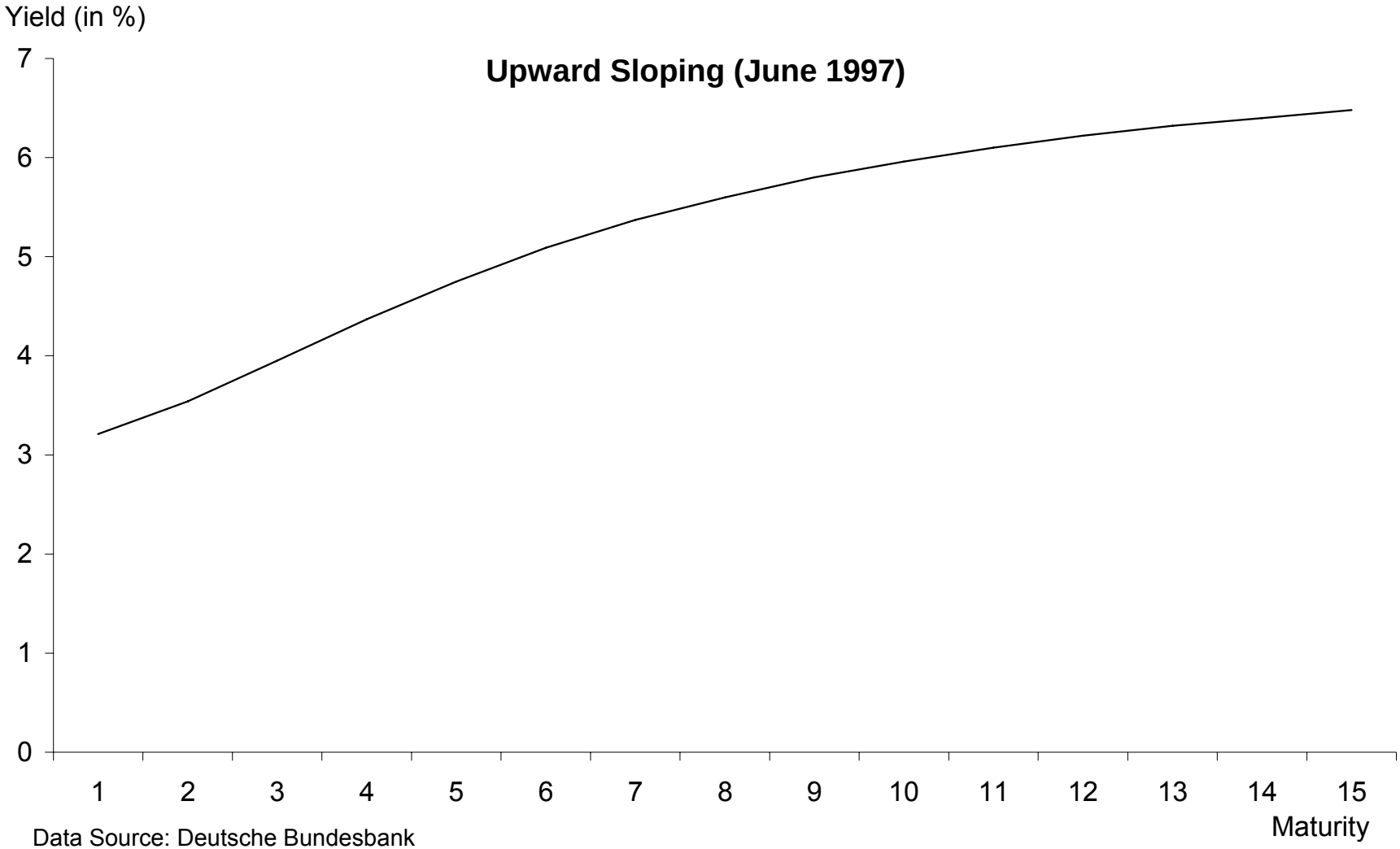


Yield Curves

- 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)



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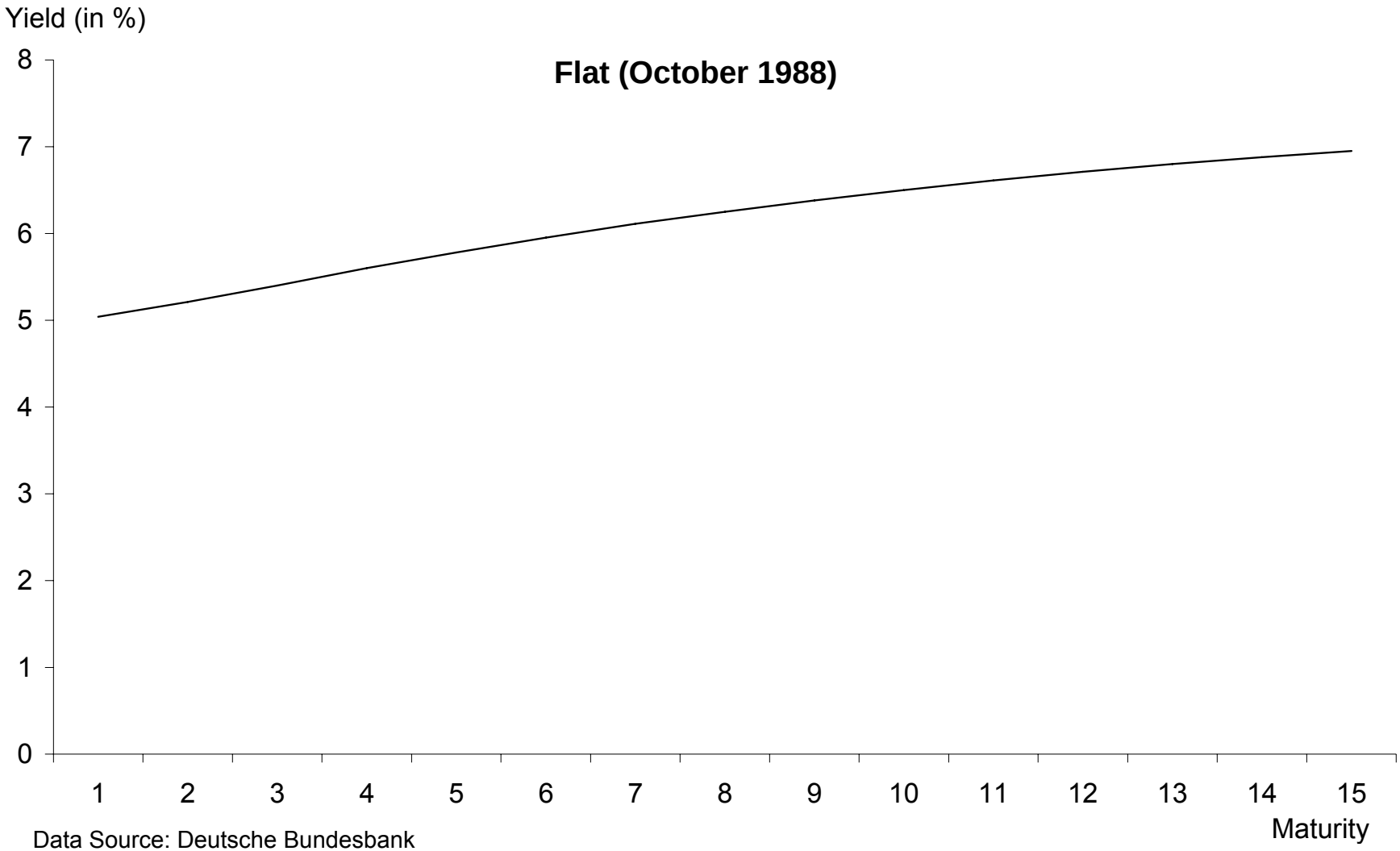

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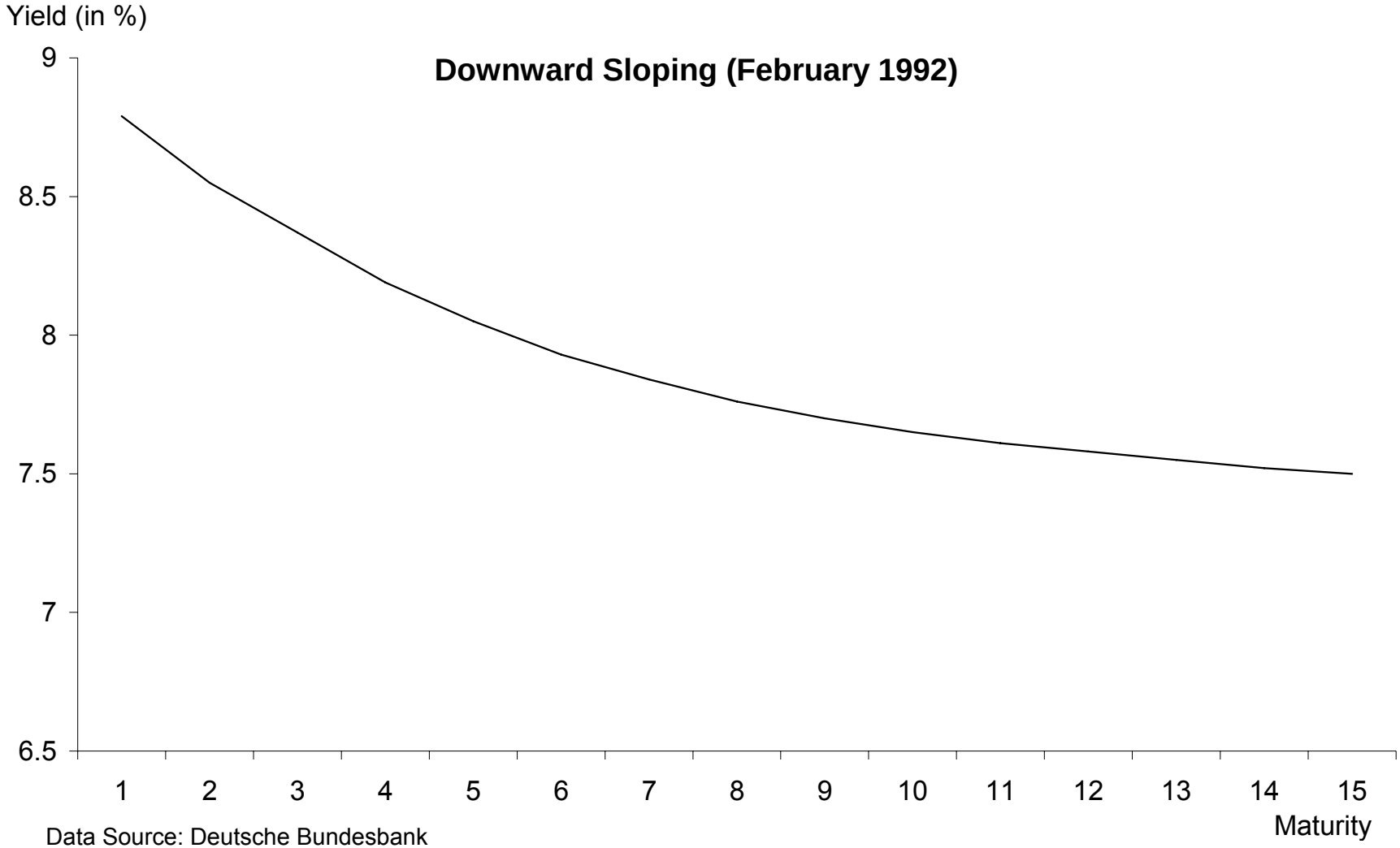

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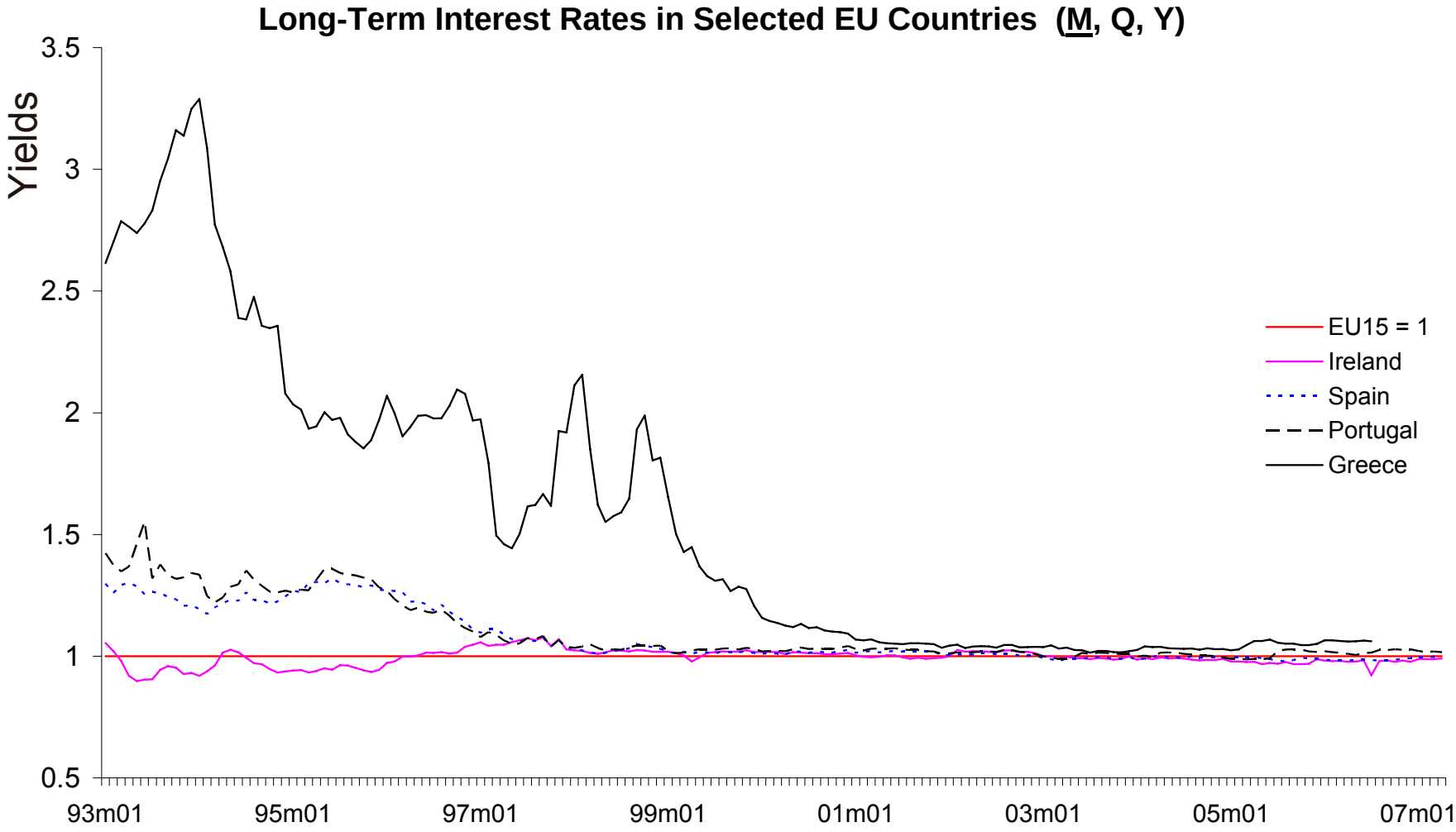
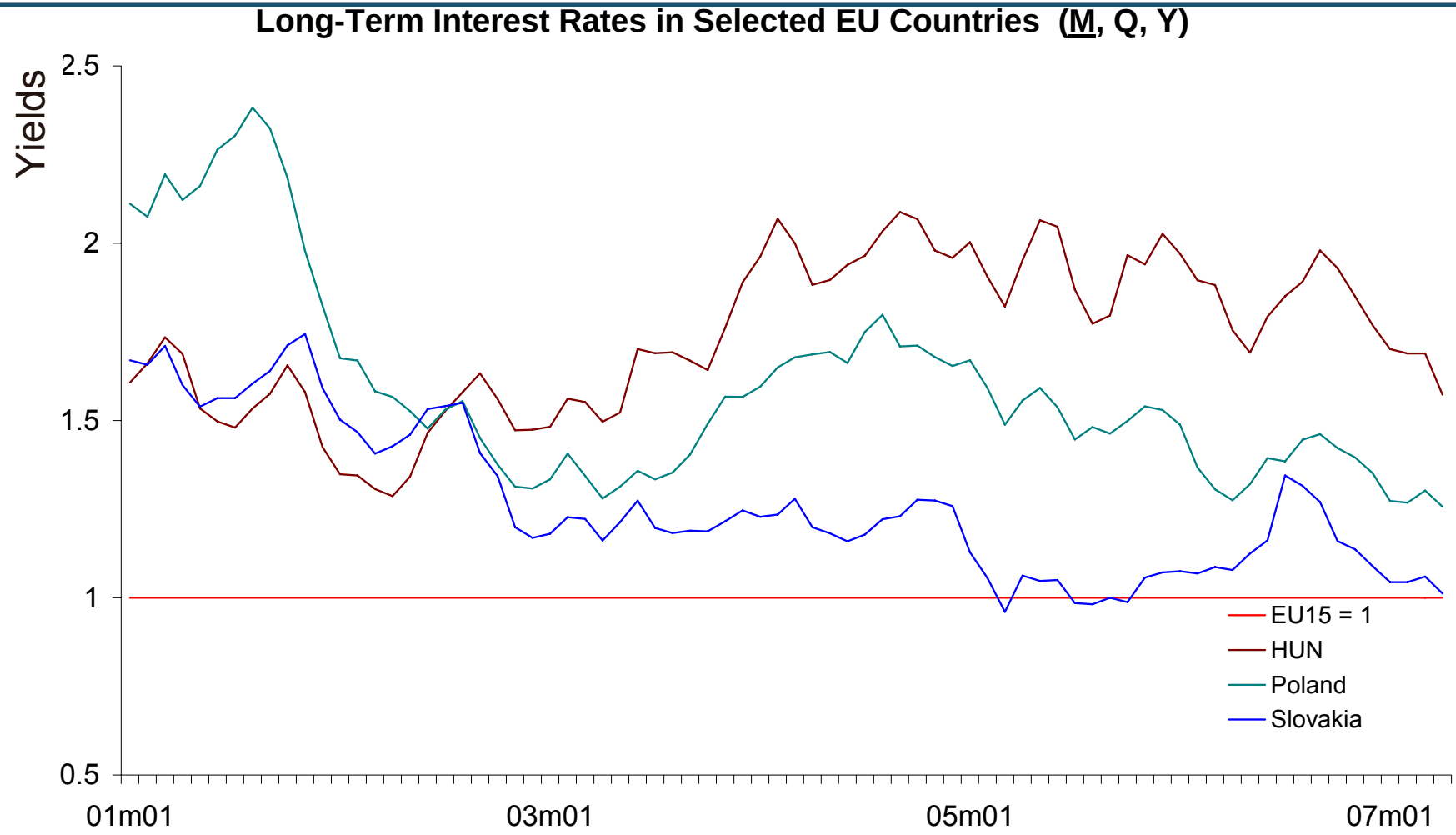
Interest Rates



Data Source: Eurostat.

Interest Rates



Data Source: Eurostat.

Thank you for your attention!