What effects is EMU having on the euro area and its member countries?
16 – 17 June 2005, Frankfurt am Main

# Session III: Financial integration

**Leading paper:**

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# The Impact of the Euro on Financial Markets

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# Introduction

- The Lisbon Agenda has put the integration of the European financial system high on the agenda
- Objective: Increase the competitiveness of the European economy
- Various reforms over time, for example
  - Single European Act 1987
  - Liberalization of capital flows 1990
  - Second Banking Directive 1992
  - Financial Services Action Plan 1999-2005
  - Green Paper on financial sector policies 2005-2010
- EMU is, arguably, the largest monetary union in human history and one major factor in the integration and competitiveness of the European financial system

# Plan of the paper and presentation

- We look at changes in the European financial system and at the impact of the euro from two main perspectives
- Micro-financial developments (Part I)
  - Objective: Integration of European financial markets
  - Short term: Time-varying return correlations
  - Long term: Structural breaks in spillover probabilities
- Macro-financial developments (Part II)
  - Objective: Interaction of monetary policy with financial markets through the term structure of interest rates
  - Changes in macroeconomic fundamentals
  - Changes in risk premia
- For central bankers both are important and belong together

# Part I

# Asset return dynamics before and after the euro: Integration of stock and government bond markets

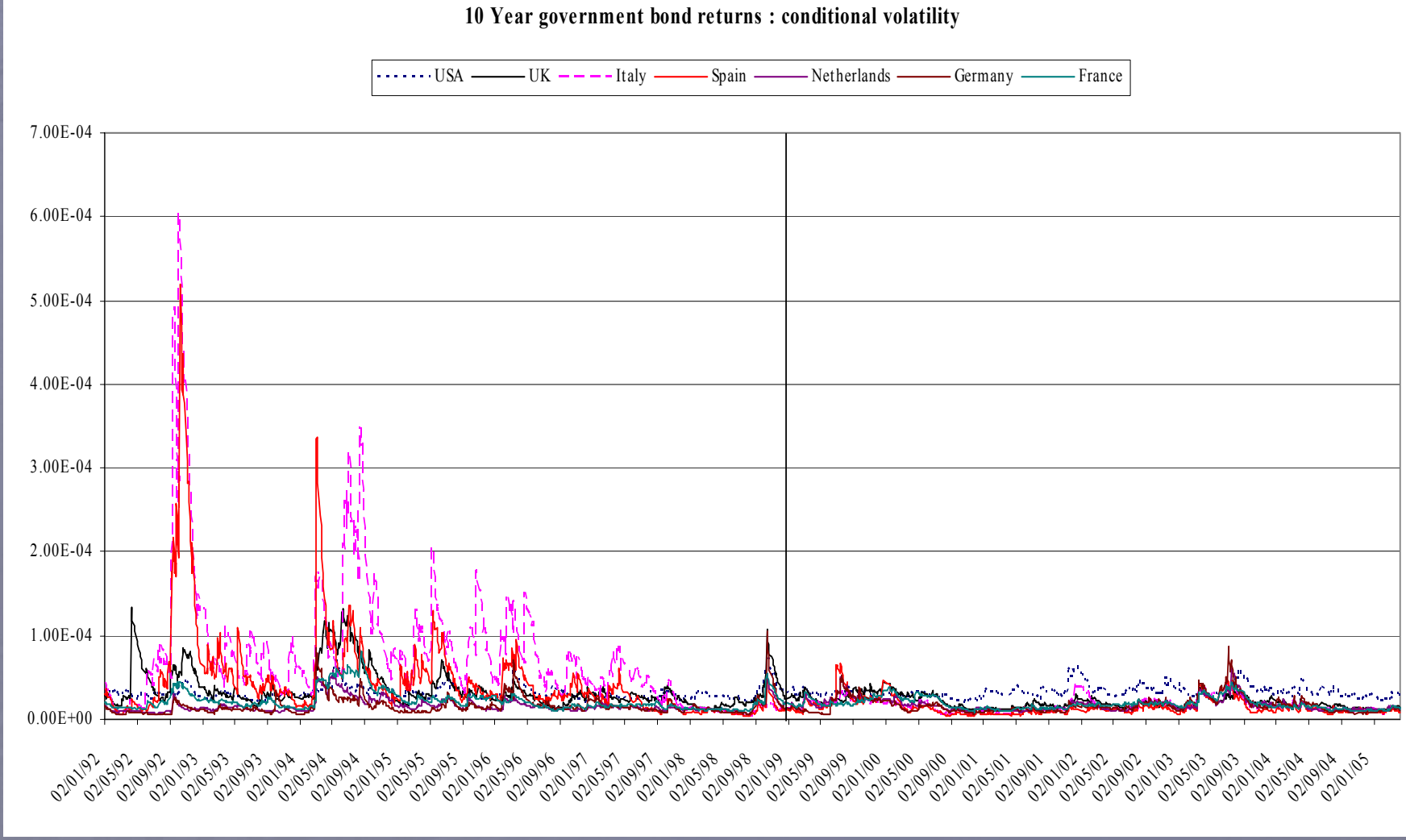
# Time-varying correlations and variances

- Dynamic conditional correlation GARCH model by Engle (2002)
  - Daily volatilities and correlations
  - Parametric estimation
- Estimation: Two-step procedure
  - (i) Univariate GARCH models
  - (ii) Model correlation of standardized asset returns
- Structural breaks
  - dummy variable in the covariance matrix corresponding to the introduction of the euro

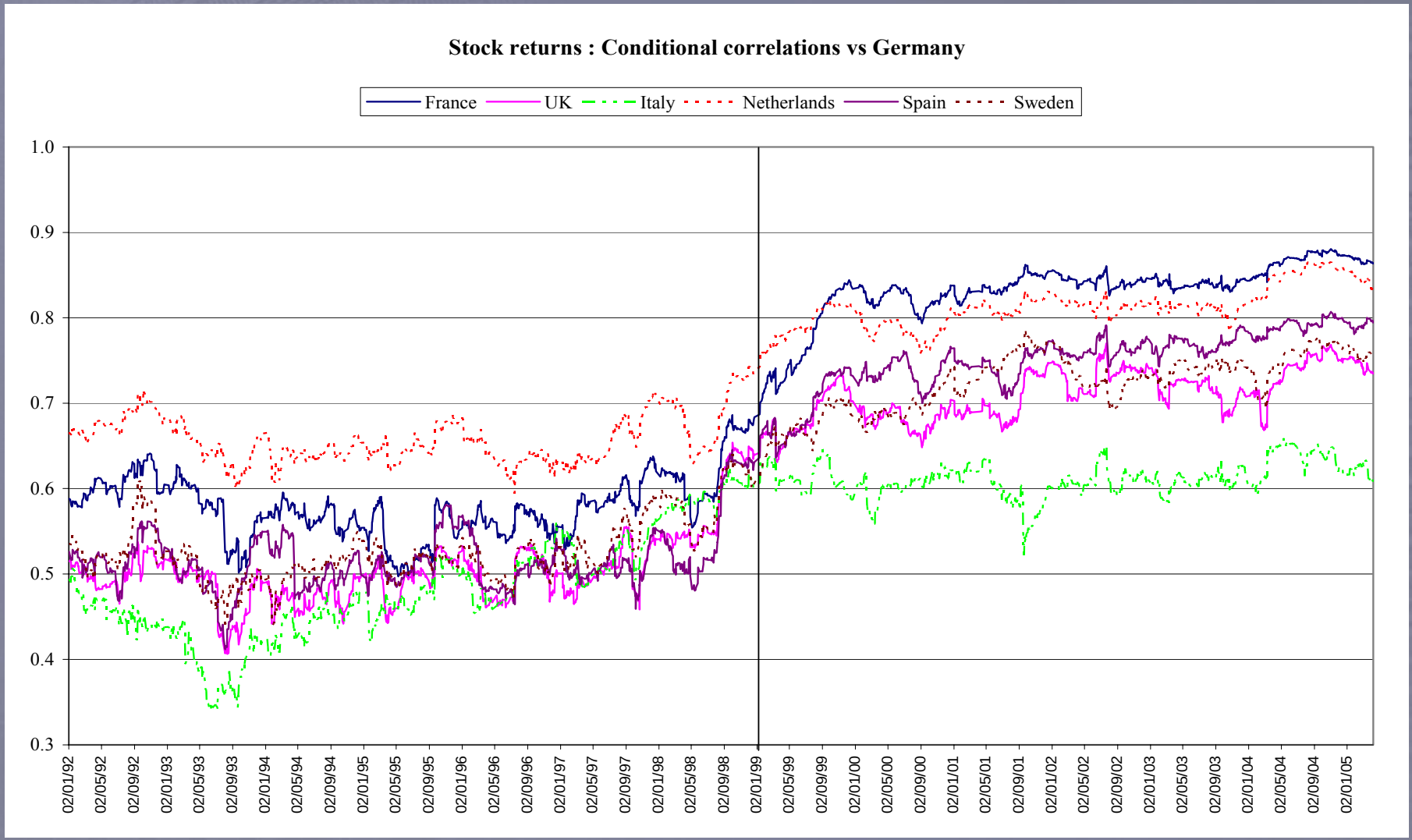
$$\mathbf{Q}_t = \overline{\mathbf{Q}}_1 (1-a-b)(1-d_t) + \overline{\mathbf{Q}}_2 (1-a-b) d_t + a\boldsymbol{\varepsilon}_{t-1}\boldsymbol{\varepsilon}'_{t-1} + b\mathbf{Q}_{t-1}$$

$$\mathbf{Corr}_t = diag\{\mathbf{Q}_t\}^{-1/2} \mathbf{Q}_t diag\{\mathbf{Q}_t\}^{-1/2}$$

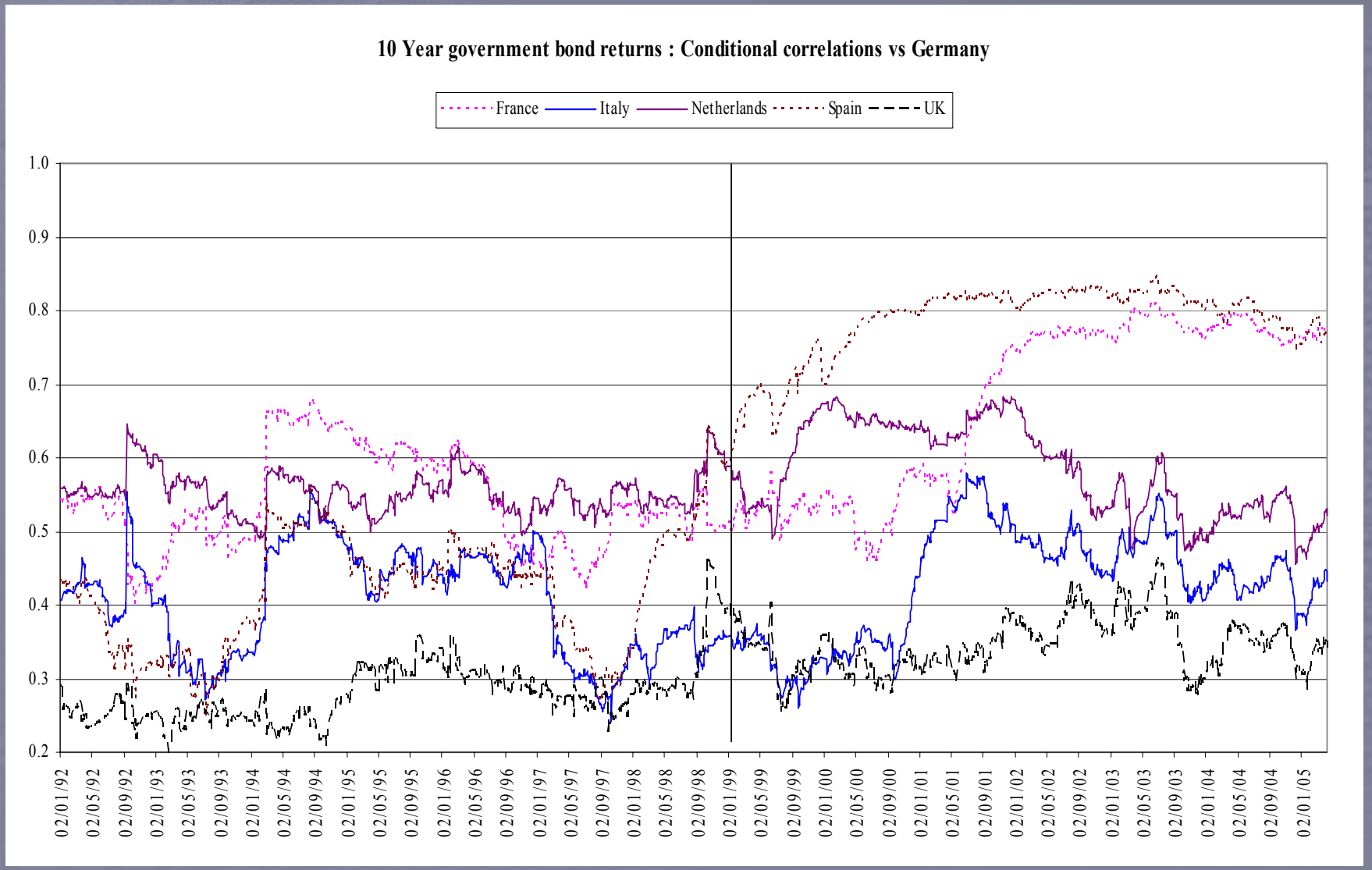
# Conditional volatility of government bond returns



# Conditional correlations of equity index returns



# Conditional correlations of government bond returns



# Spillover probabilities from quantile regressions

- Basic tool of analysis: Conditional probability

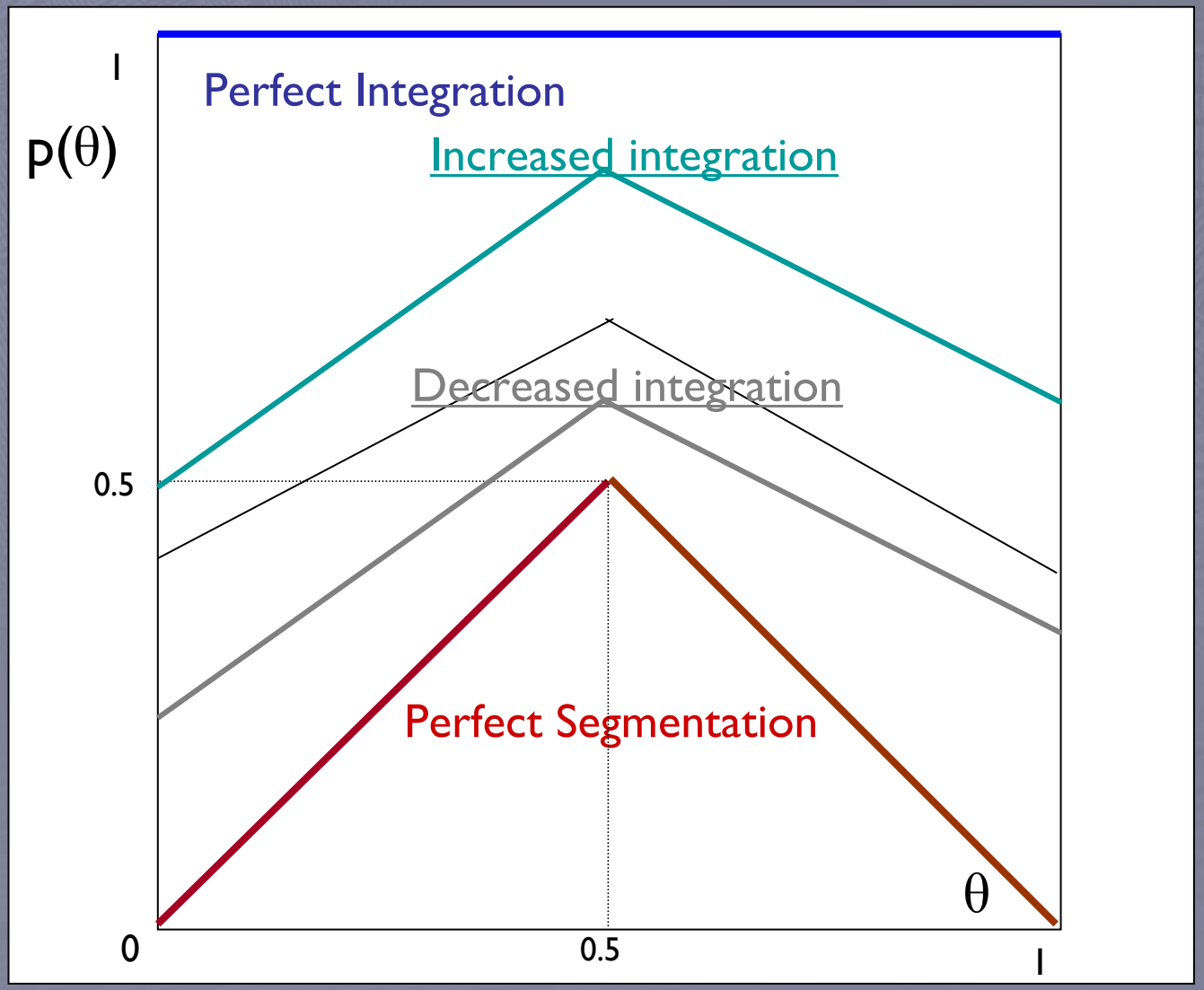
$x_t, y_t$ Market returns, $q^X_{\theta t}, q^Y_{\theta t}$ $\theta$-quantiles, $\theta \in (0,1)$

$$p_t(\theta) \equiv \begin{cases} Pr\left[y_t < q^Y_{\theta t} \mid x_t < q^X_{\theta t}\right] & \text{if} \quad \theta \leq 0.5 \\ Pr\left[y_t > q^Y_{\theta t} \mid x_t > q^X_{\theta t}\right] & \text{if} \quad \theta > 0.5 \end{cases}$$

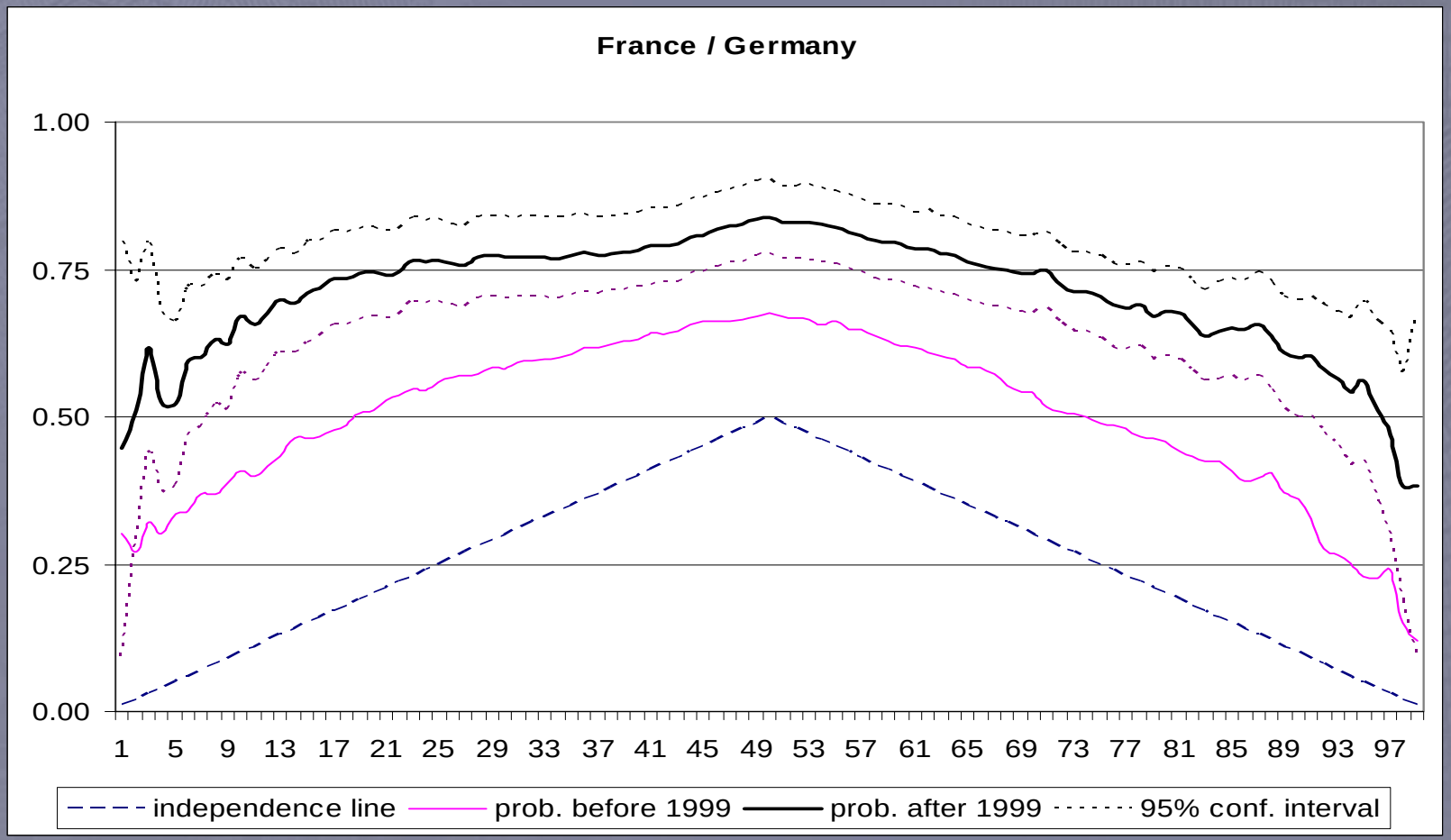
- Three step procedure:
  - Estimate individual time-varying quantiles for *X* and *Y*
  - Construct indicator functions $I(y_t < q_{\theta t}^Y)$ and $I(x_t < q_{\theta t}^X)$
  - Run OLS regression with euro effect dummy $D_t$:

$$I_t\left(y_t < q^Y_{t\theta}\right) = \alpha_{\theta_i} I_t\left(x_t < q^X_{t\theta}\right) + \gamma_{\theta_i} I_t\left(x_t < q^X_{t\theta}\right) D_t + \varepsilon_t$$

# Illustration of integration in the "co-movement box"

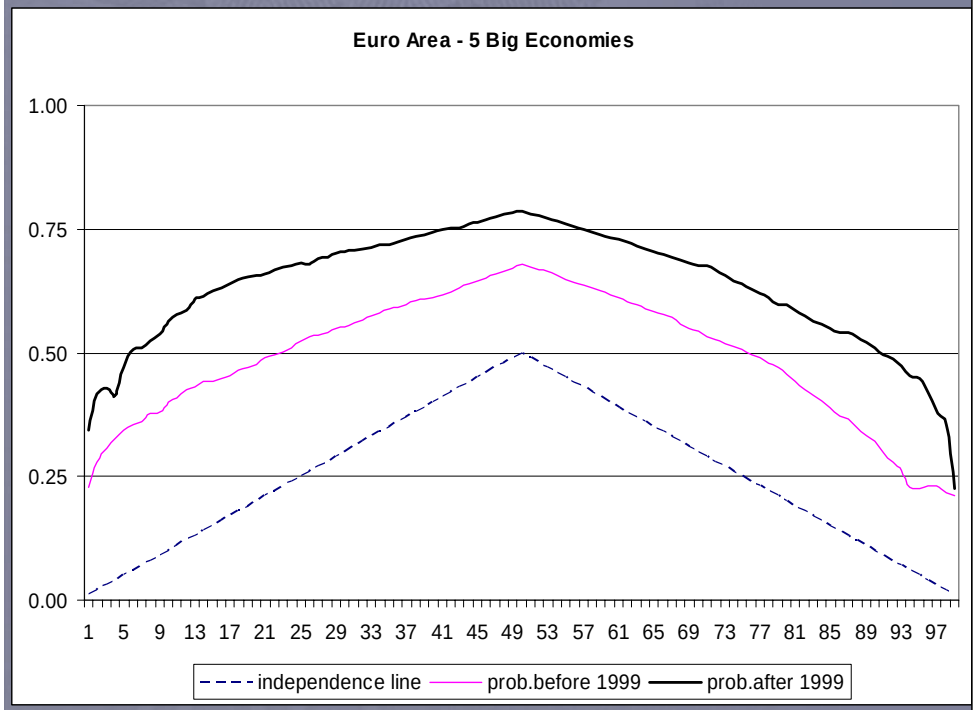


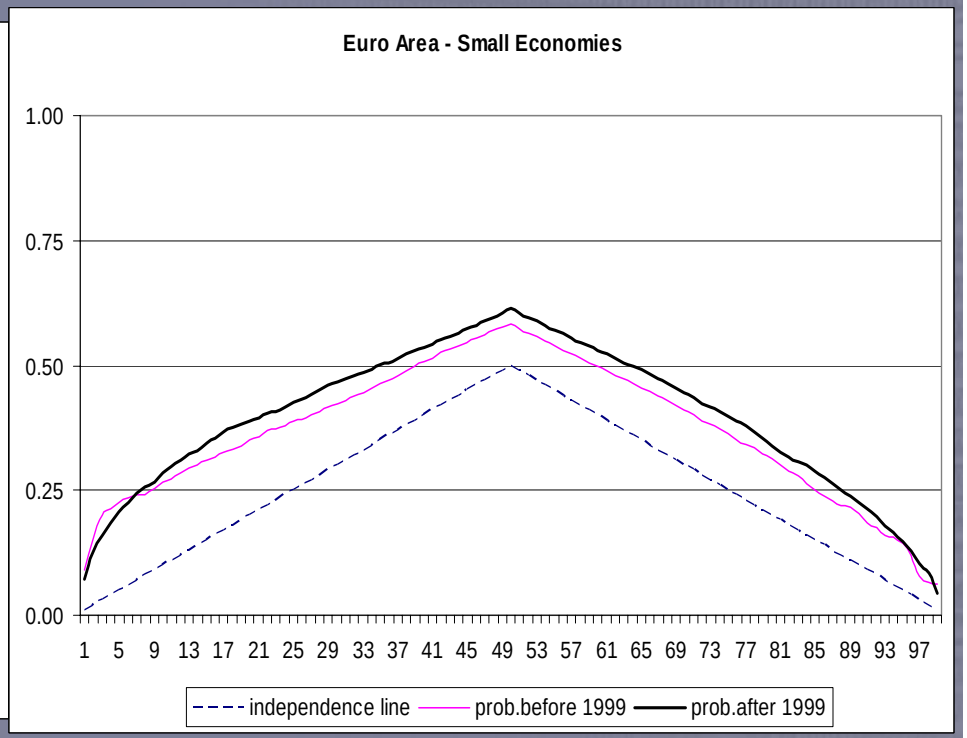
# Equity market integration



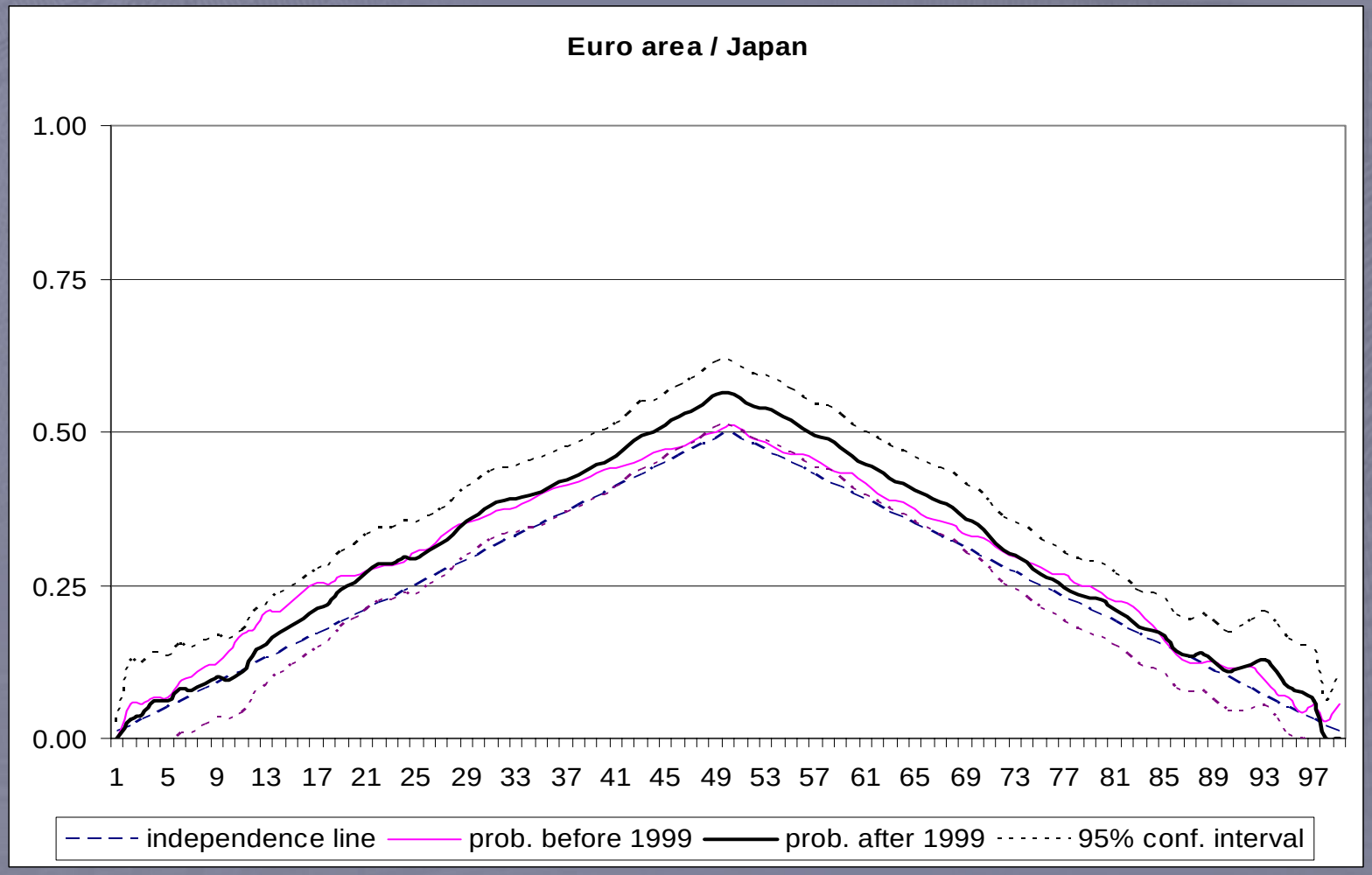
# Equity market integration

## Large versus small euro area country stock markets

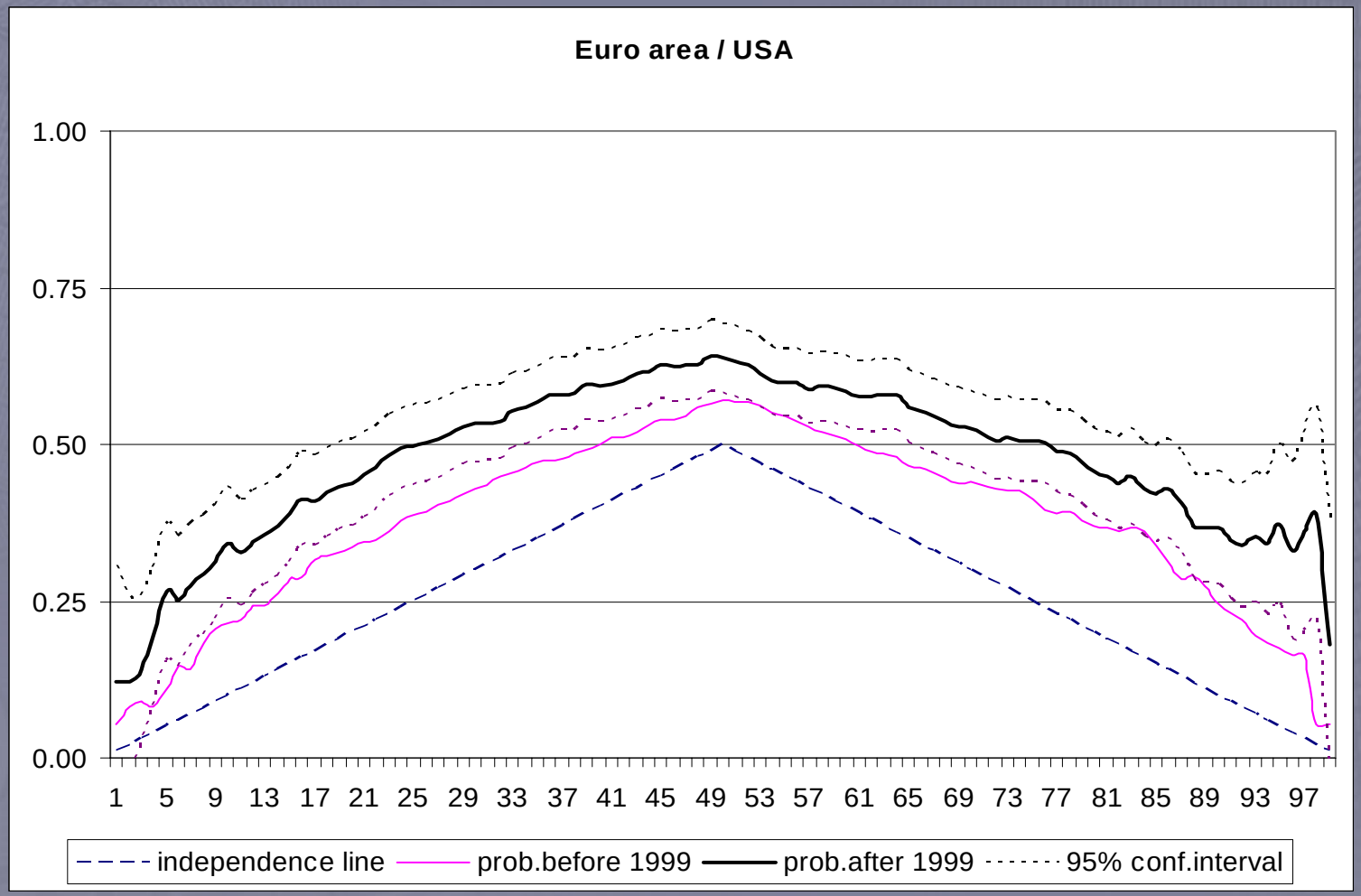


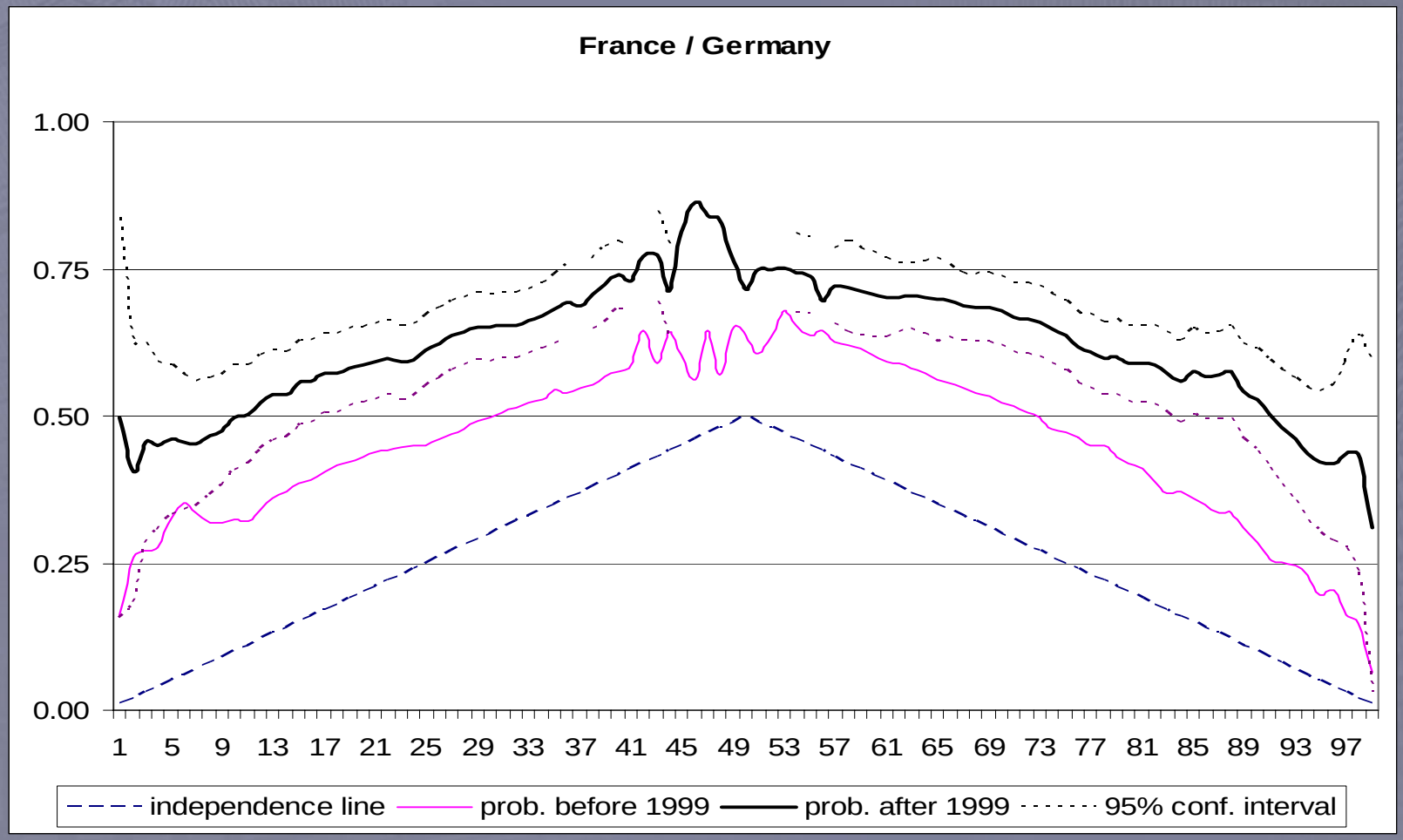
# Equity market integration



# Equity market integration

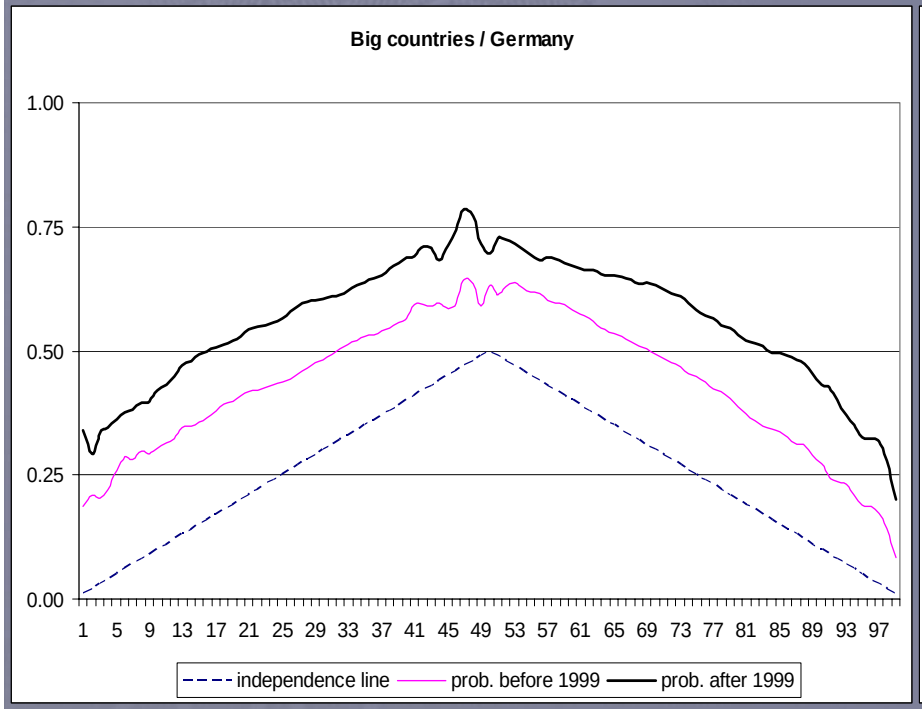


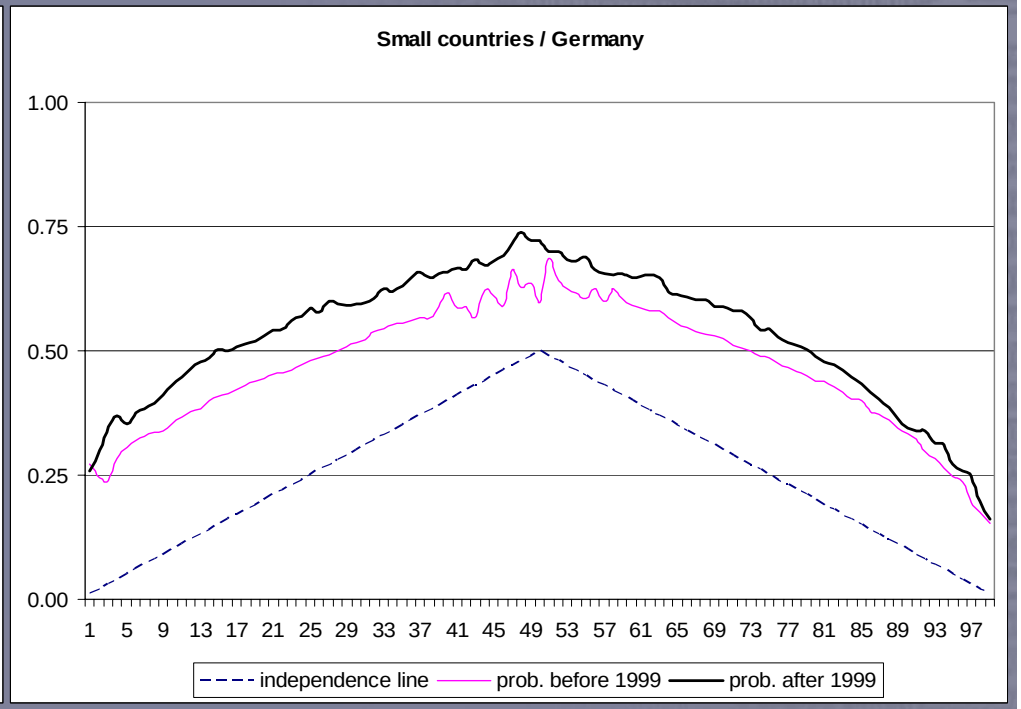
# Government bond market integration



# Government bond market integration

## Large versus small euro area country bond markets



# Part II

# Asset pricing before and after the euro: The behavior of the term structure

# Affine macro-finance model: Macro-economy

- Inflation:

$$\pi_t = \mu_\pi E_t[\pi_{t+1}] + (1-\mu_\pi)\pi_{t-1} + \delta_x x_t + \varepsilon_t^\pi$$

- Output gap:

$$x_t = \mu_x E_t[x_{t+1}] + (1-\mu_x)x_{t-1} - \zeta_r(r_t - E_t[\pi_{t+1}]) + \varepsilon_t^x$$

- Forward-looking Taylor rule ($r_t$ is policy instrument):

$$r_t = (1-\rho)\left[\beta\left(E_t[\pi_{t+1}] - \pi_t^*\right) + \gamma x_t\right] + \rho r_{t-1} + \eta_t$$

- Perceived inflation target (unobservable):

$$\pi_t^* = \phi_{\pi^*}\pi_{t-1}^* + u_t^{\pi^*}$$

# Macro model solution

- Let $X_1$ be the vector of predetermined variables, which include lags of $x$, $\pi$, $r$, contemporaneous values of $\pi^*$, and the shocks
- Let $X_2$ be the vector of not predetermined variables, which include the contemporaneous values of $x$ and $\pi$ and forward-looking expectations of these variables as well as $r_t$
- The solution provides two matrices $M$ and $C$ such that:

$$\mathbf{X}_{1,t} = \mathbf{M}\mathbf{X}_{1,t-1} + \xi_{1,t}$$

$$\mathbf{X}_{2,t} = \mathbf{C}\mathbf{X}_{1,t}$$

# Term structure of bond yields

- Yield to maturity are derived assuming absence of arbitrage opportunities and specifying a process for the stochastic discount factor (sdf)
- Market prices of risk are assumed to be affine in the state vector (Duffie, 2002), i.e. the state of the economy determines the compensation for bearing risk
- The macro model, coupled with the assumptions on the sdf, determines yields to maturity:

$$y_t^n = \mathbf{A}_n + \mathbf{B}_n' \mathbf{X}_{1,t}$$

# Term structure of bond yields

- Yields to maturities depend on predetermined variables through:
  - Expectations on the short term interest rate
  - A risk (or term) premium, i.e. a compensation for risk

# Impact of the euro on fundamentals

- Inflation:

$$\pi_t^{pre-euro} = \underset{(0.011)}{0.132}\, E_t[\pi_{t+1}] + (1-0.132)\pi_{t-1} + \underset{(0.054\,x10^{-2})}{0.038\times10^{-2}}\, x_t + \varepsilon_t^{\pi} \qquad \sigma_{\pi}\times10^2 = \underset{(0.001)}{0.022}$$

$$\pi_t^{euro} = \underset{(0.054)}{0.152}\, E_t[\pi_{t+1}] + (1-0.152)\pi_{t-1} + \underset{(1.028\,x10^{-2})}{0.905\times10^{-2}}\, x_t + \varepsilon_t^{\pi} \qquad \sigma_{\pi}\times10^2 = \underset{(0.002)}{0.015}$$

- Output gap:

$$x_t^{pre-euro} = \underset{(0.029)}{0.303}\, E_t[x_{t+1}] + (1-0.303)x_{t-1} - \underset{(0.023)}{0.027}(r_t - E_t[\pi_{t+1}]) + \varepsilon_t^{x} \qquad \sigma_x\times10^2 = \underset{(0.004)}{0.097}$$

$$x_t^{euro} = \underset{(0.159)}{0.396}\, E_t[x_{t+1}] + (1-0.396)x_{t-1} - \underset{(0.123)}{0.109}(r_t - E_t[\pi_{t+1}]) + \varepsilon_t^{x} \qquad \sigma_x\times10^2 = \underset{(0.005)}{0.041}$$

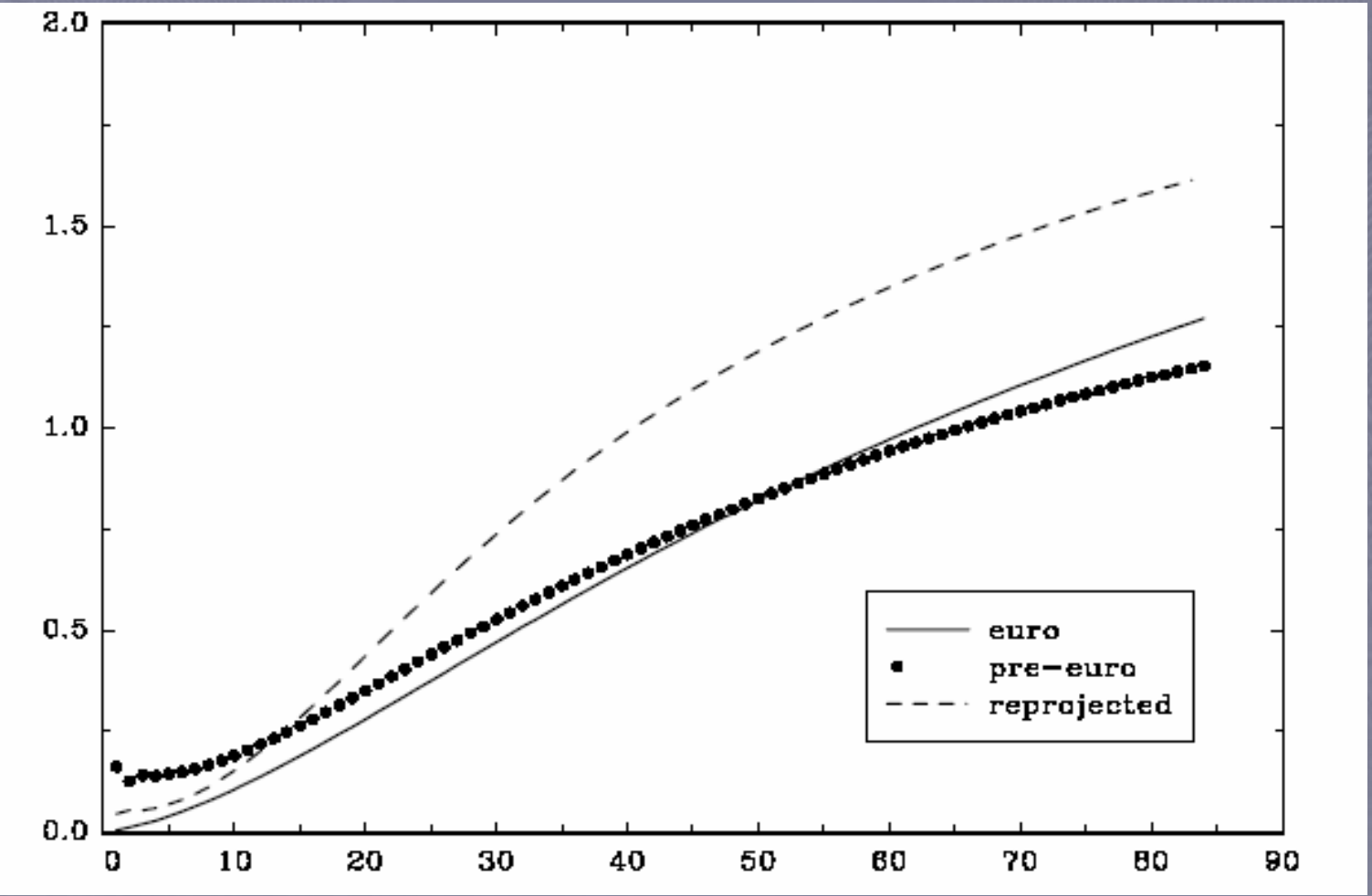
- Monetary policy rule:

$$r_t^{pre-euro} = (1-0.976)\left(\underset{(0.855)}{2.087}(E_t[\pi_{t+1}] - \pi_t^*) + \underset{(0.925)}{1.243}\, x_t\right) + \underset{(0.015)}{0.976}\, r_{t-1} + \eta_t \qquad \sigma_{\eta}\times10^2 = \underset{(0.001)}{0.040}$$

$$r_t^{euro} = (1-0.925)\left(\underset{(0.044)}{1.016}(E_t[\pi_{t+1}] - \pi_t^*) + \underset{(0.459)}{0.404}\, x_t\right) + \underset{(0.052)}{0.925}\, r_{t-1} + \eta_t \qquad \sigma_{\eta}\times10^2 = \underset{(0.002)}{0.014}$$

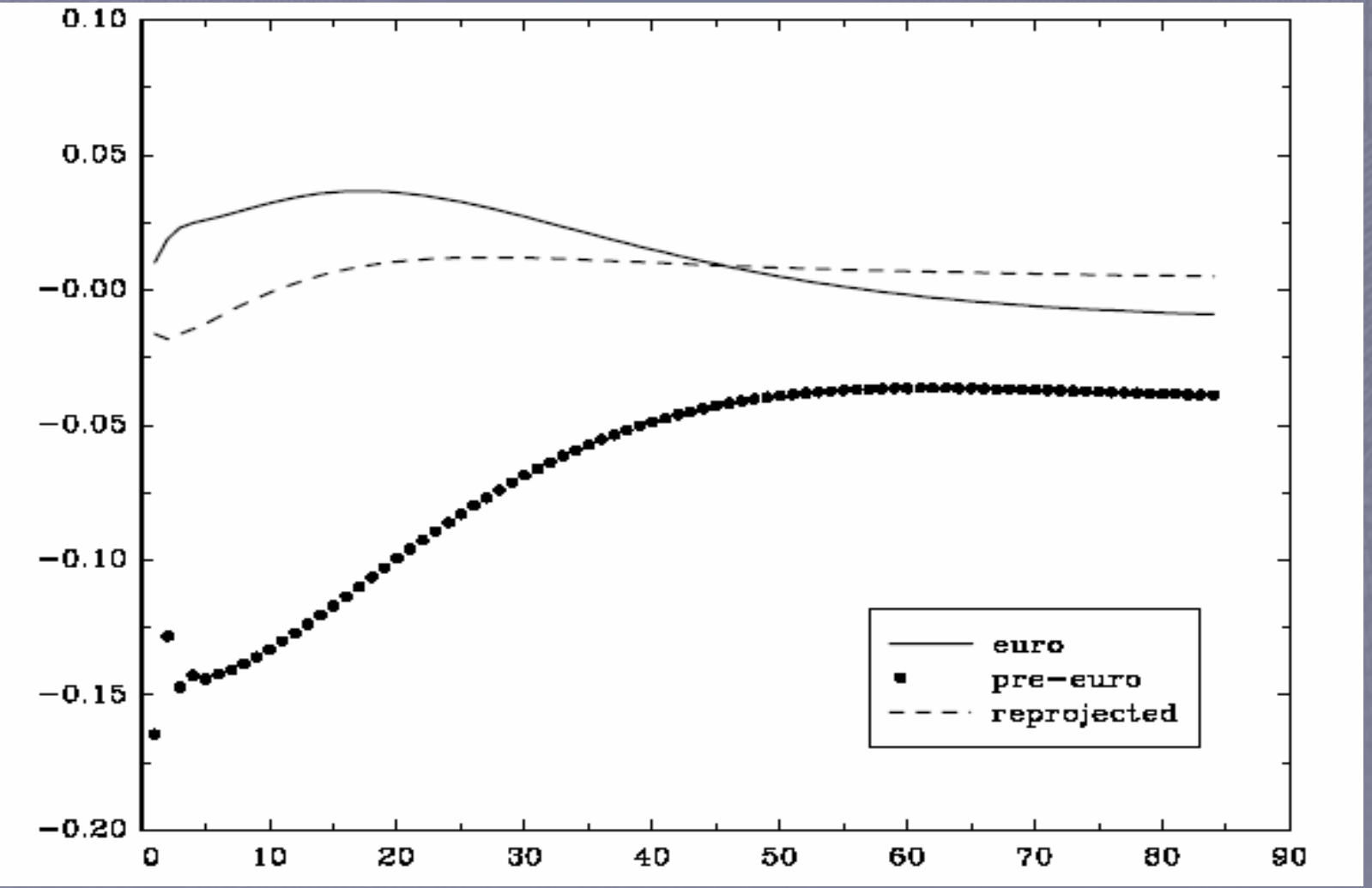
# Impact of the euro on risk premia

Term structure of average risk premia



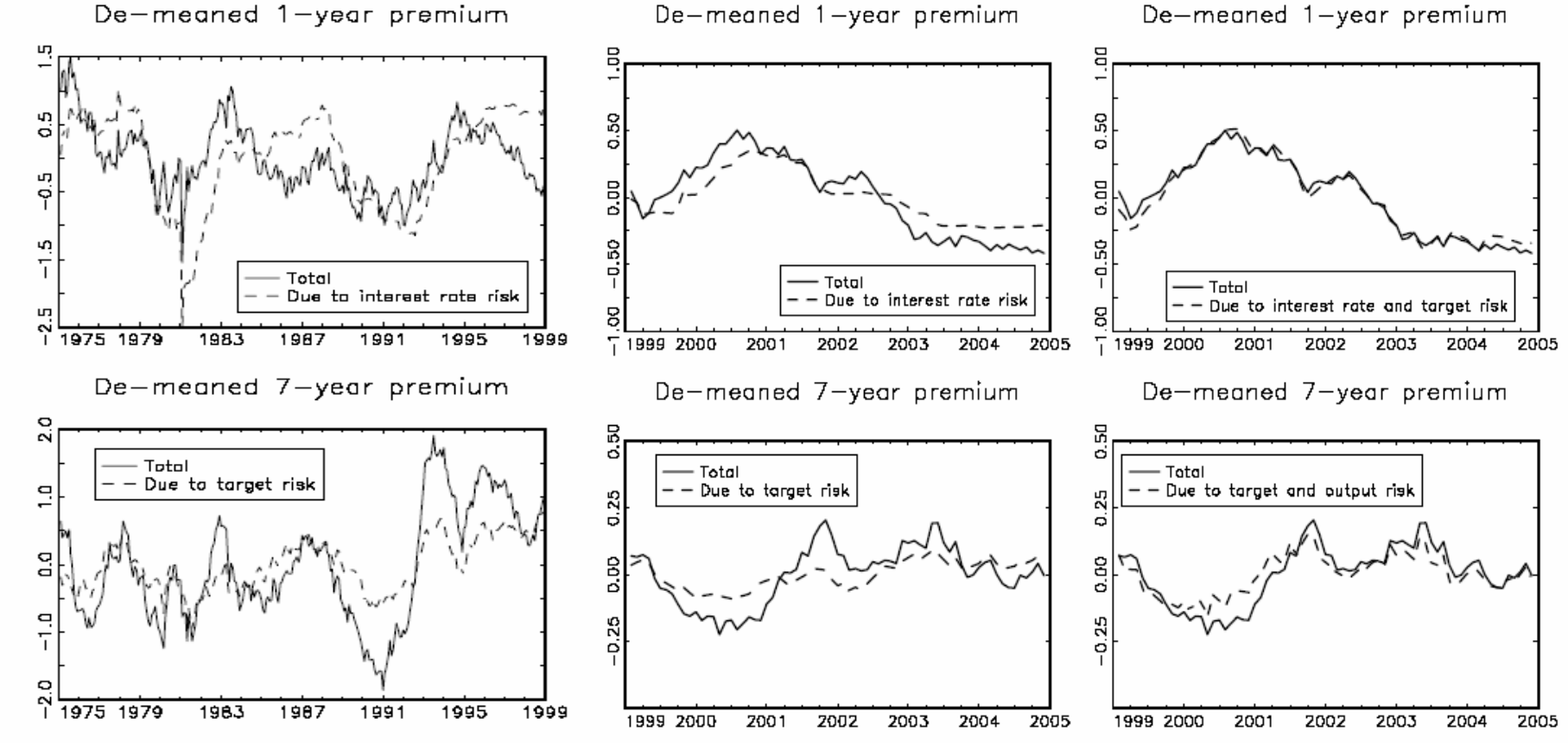
# Impact of the euro on risk premia

Initial response of risk premia to a monetary policy shock



# Impact of the euro on risk premia

## Estimated risk premia and components of premia



# Conclusions

- Paper combined a micro-financial and a macro-financial perspective on the effects of the euro
- Micro: Financial integration
  - Reduced bond market volatility but not stock markets
  - Significantly increased stock market return correlations among large but not small euro area countries
  - But also some increase with the US, but not global
  - Increased bond market correlations, also several small
  - Co-movements of stock and bond markets signal significant progress in integration
  - Catalyst effect of the euro
  - Benefits sovereigns, investors and corporations
  - Financial integration a relatively successful program under the Lisbon Agenda
  - Other areas: Banking, retail etc.

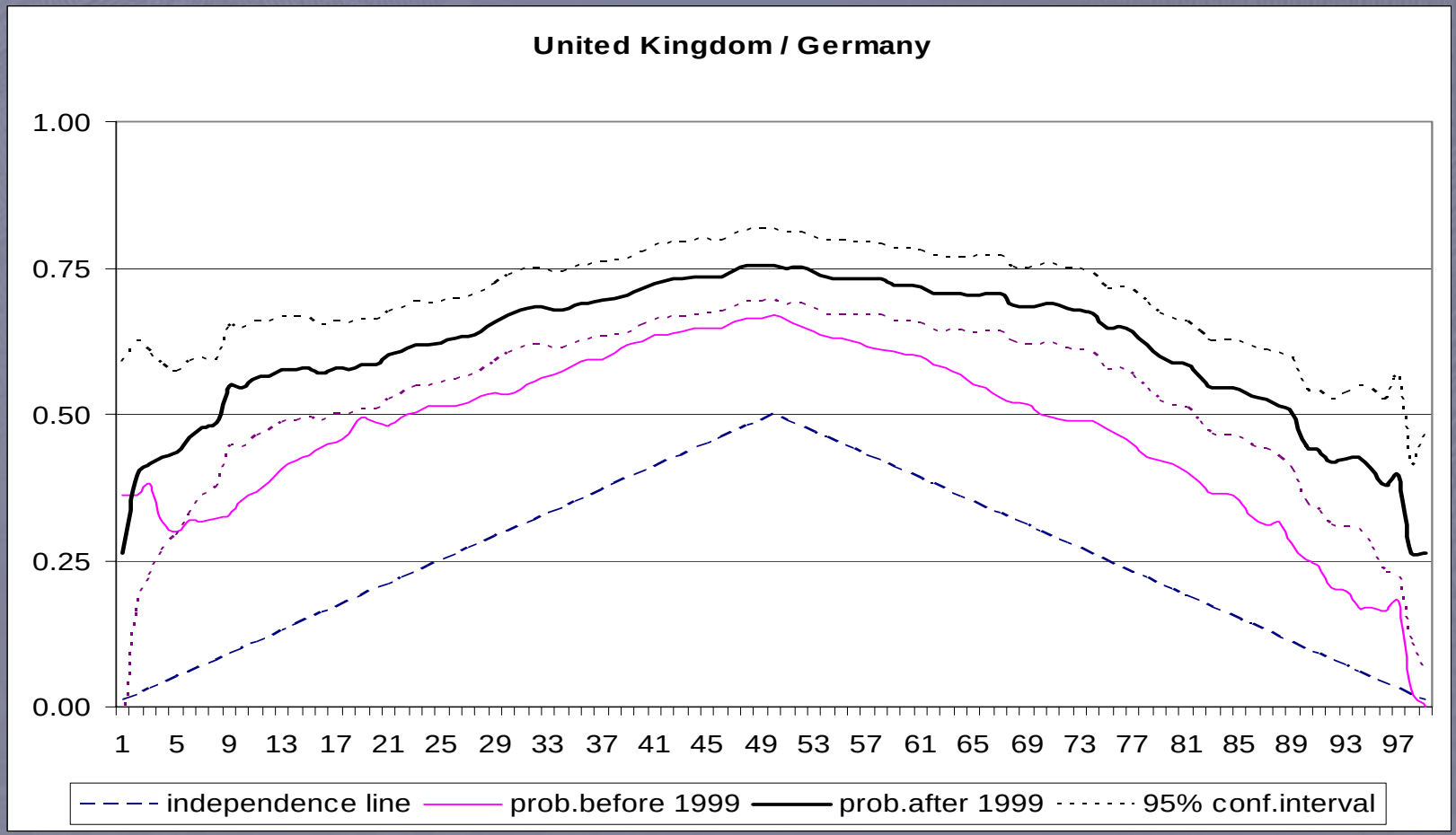
# Conclusions

- Macro: Term structure and monetary policy
  - Variability of risk premia has decreased with EMU, related to a reduction in macroeconomic volatility
  - On average, however, they are similar to before
  - Increases in the market prices of risk have offset the reduction in macroeconomic volatility
  - Fundamental drivers of risk premia have not changed
  - Hence, the central bank can extract rate expectations from the yield curve equally well as before EMU
  - It can even be more confident in the accuracy of its analysis due to the reduced variability of premia
  - Communication with the market may be more effective
- Euro had significant positive effects on markets, although also other factors may have played a role

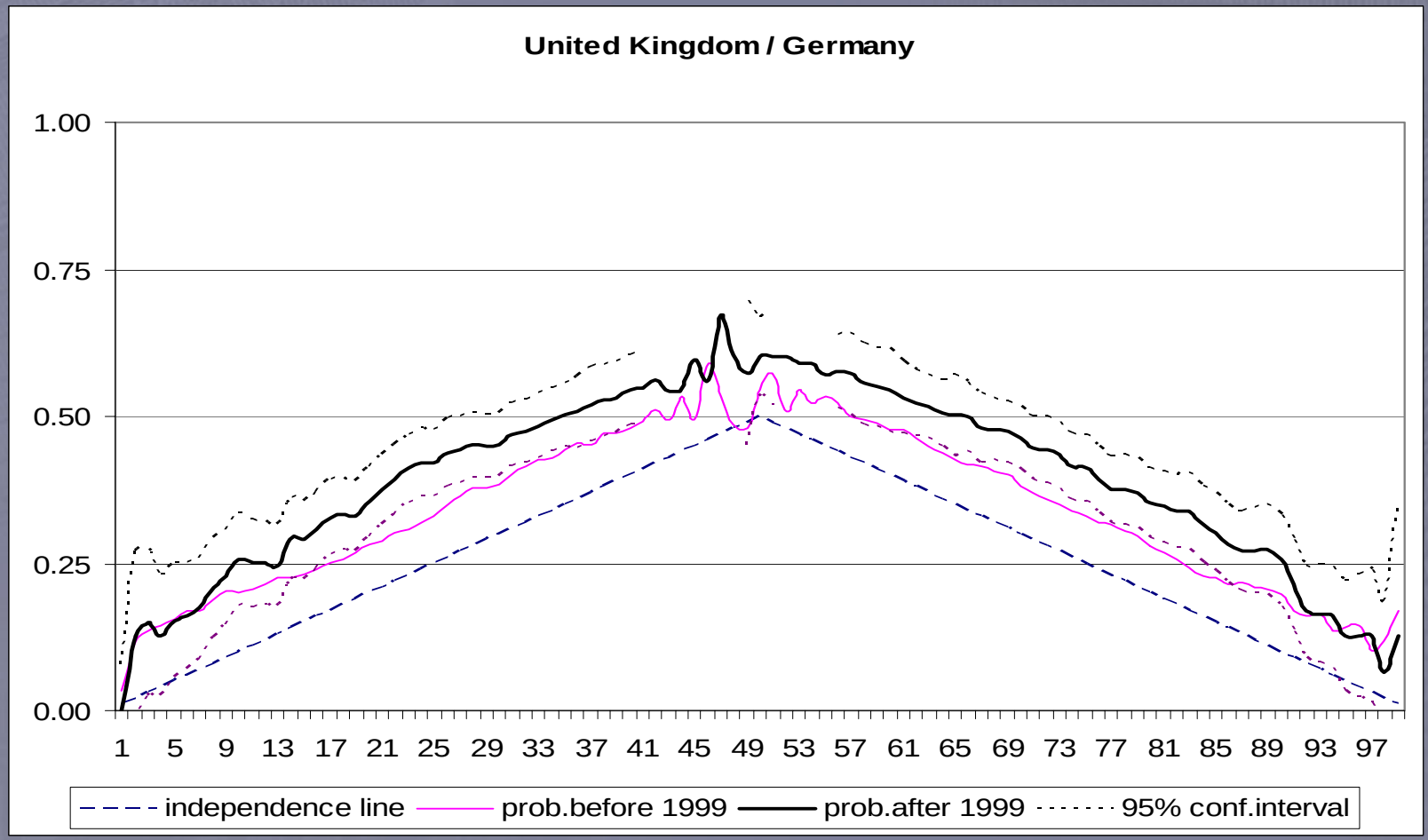
# Annex

## Further charts

# Equity market integration



# Government bond market integration



# Impact of the euro on risk premia

Impulse response of inflation to a monetary policy shock