UNIVERSITÀ DEGLI STUDI DI NAPOLI
"PARTHENOPE"
ISTITUTO DI STUDI ECONOMICI

IS THE IMPACT OF ECB MONETARY POLICY ON EMU STOCK MARKET RETURNS ASYMMETRIC?

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WORKING PAPER N. 3.2006

MARCH 2006

Redazione:
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La Redazione ottempera agli obblighi previsti dall'Art. 1 del D.L.L. 31.8.1945, n. 660.

Copie della presente pubblicazione possono essere richieste alla segreteria dell'Istituto.

Università degli studi di Napoli
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Is the Impact of ECB Monetary Policy on EMU Stock Market Returns asymmetric?

Oreste Napolitano*

Abstract: This paper investigates whether monetary policy has asymmetric effects on stock returns of the EUM countries at aggregate levels and, for six industry portfolios in France, Italy, Germany, Belgium and Netherlands respectively. In this work, a different measures of monetary policy innovation is adopted. The empirical results, in line with results from previous studies, indicate that for the EUM stock markets there is statistically significant relationship between policy innovations and stock markets returns. This finding is consistent with the hypothesis that positive monetary policy shock (e.g. contractionary policy) is an event that decrease future cash flow. Moreover, the finding from country size and industry portfolios indicate that monetary policy have larger asymmetric effect in industry portfolios of big countries (Italy, France and Germany) compared to the same industry portfolios of small countries (Netherlands and Belgium). However, the sign of the impact is for both groups the same. The policy implications of the analysis can be summarized as follows: if the ECB follows a contractionary monetary policy then the effect on the stock market returns will be lengthier and larger in bear markets. On the other hand, following the same policy, the effect of the ECB actions on the EMU stock markets returns will be smaller in bull markets. The results suggest that monetary policy is not neutral, at least in the short run and, moreover, that there is some role for anticipated ECB monetary policy to affect the stock market but that this role will also have asymmetric impacts on each single EMU country’s stock market.

Keywords: Monetary Policy, Markov-switching, Stock returns .

JEL Classification: E52, E32, G10

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Contents

1 Introduction

The last two decades have witnessed the primacy of monetary policy as the main tool used by policymakers in the stabilisation of inflation and output. Concurrently, commentators and analysts pay close attention to changes in policy rates in the belief that such changes, particularly unexpected changes, can influence stock market returns. Moreover, with increasingly integrated global markets, attention is paid not only to domestic policy changes but also to how foreign policy and foreign economic conditions can affect the domestic economy. Reflecting these issues, greater attention has been paid to the qualitative and quantitative impact of monetary policy changes on stock returns. It sheds some light on the more general debate on the impact of monetary policy shocks on stock market returns.

"In principle, it is acknowledged that there are two main channels through which a central bank can influence asset prices. First, the central bank is able to determine short-term interest rates, which act as a benchmark for short-term returns and are used for discounting the assets' future income streams. Thus, the central bank is able to affect asset prices via agents' expectations about the future path of money market rates (short-run impact).

Second, the long-run perspective about future inflation has an impact on the current prices of long-term assets, since nominal long-term returns usually contain an inflation premium. Given that monetary policy determines inflation in the long run, it has a strong impact on asset prices via inflation expectations (long-run impact)", (Belke and Pollet, 2005).

Which policy implications would emerge from the finding of a significant and stable relationship between monetary policy and stock market returns? In our view, there are at least two clear implications. First, by letting short-term rates deviate from a certain level of equilibrium, the central bank may have a significant impact on asset prices. Second, in principle the central bank is able to reduce stock price volatility by diminishing the uncertainty of future rate changes, hence volatility spillovers to other financial markets could be avoided and the option value of waiting with investment decisions would be reduced.

Moreover, monetary policy exerts a significant impact on financial markets and this is reflected by the appreciable attention that the ECB receives in the financial markets. Estimates of the responsiveness of stock market returns to changes in monetary policy will most likely contribute to effective investment and risk management decisions (Rigobon and Sack, 2004).

In this study we explore the possibility of a non-linear relationship between EUM stock returns and ECB's monetary policy innovations. The non-linearity is modelled using different Markov-switching (MS) regime autoregressive models. We intend to investigate the empirical performance of the univariate MS models used to describe the switches between different economic regimes for the 11 EUM countries' stock markets and, furthermore, extending these models to verify if the inclusion of monetary policy shock as an exogenous variable improves the ability of each specification to identify. Moreover, we investigate if the shocks are both, symmetric or asymmetric throughout the EUM countries and at level of industry portfolio inside each single country. Hence, we study asymmetries using an extension of the Markov switching model described by Hamilton (1989) estimated over the period 1992-2005.

It is commonly thought that the final goals of monetary policy generally are expressed in terms of macroeconomic variables (e.g. inflation, unemployment, output, etc..). However, the most direct and immediate effects of monetary policy actions are on the financial markets. In fact, by affecting asset prices and returns, monetary authorities should try to modify economic behaviour in ways that should help to achieve their ultimate objectives. In this way, changes in monetary policy are transmitted through the stock markets via changes in the values of private portfolios, changes in the cost of capital, and by other mechanisms presented above. For these reasons, it will be useful to try to obtain quantitative estimates of the links between monetary policy innovations and stock prices.

Following the wide literature on this topic, we have considered a different definition of monetary policy shock. This new measure of innovation in monetary policy comes directly from the results we have obtained in a previous work (Montagnoli and Napolitano, 2005). The empirical results showed that only for three out of four countries Taylor's rule the FCI was found with the right sign and significant while, for the EU Taylor rule, it was statistically not significant. Our explanation of that result was basically concentrate on the composition of the EU financial markets and, for some extend, on the different degree of integration of these markets among them. In this work we focus our attention on the relationship on one specific EU asset market, the stock market, and try to investigate if the monetary policy shocks are asymmetric among the EUM countries and also, the impact of a policy innovation among the different sectors of the single country. In doing so, the residuals of the estimated Taylor rule can be used as proxy of the monetary shock.

We measure the persistence of each economic regime, as well as the ability of each MS model to detect the impact of monetary policy on EUM stock markets. Our empirical findings can be summarized as follows. First, the null hypothesis of linearity against the alternative of a MS specification is always rejected by the data. This suggests that regime-dependent models should be used if a researcher is interested in obtaining statistically adequate representations of the output growth process. Second, the introduction of this different monetary shock specifications is never rejected. Third, it contribute to a better description of the impact of monetary policy on stock markets. Finally, models with exogenous shocks variables generally outperform the corresponding univariate specifications which exclude shocks from the analysis.

Starting with the work of Hamilton (1989), the Markov-switching (MS) autoregressive time series models have emerged as an interesting alternative to describe specific features of economic series. As an example, a relevant number of empirical regime-switching models have been proved to be able to capture nonlinearities and asymmetries which are present in many macroeconomic variables (Krolzig, 1997; Clements and Krolzig, 2001, 2002, Shiu-Sheng Chen, 2005). Since policy shocks are generally acknowledged to have important effects on both economic activity and macroeconomic policy, our study concentrates on the analysis of the dynamic relationship between these shocks and the conditions on stock markets for the EUM countries. Our investigation of how monetary innovation affect the stock returns in the EU markets is based on the comparison of alternative MS models.

Our model selection strategy comprises the following criteria: i) model fit, as summarized by the standard error of the residuals; ii) value of the log-likelihood function; iii) values of means and/or intercepts estimated in the different economic regimes; iv) relation between the probability of regime switching and the monetary policy shock.

In particular, asymmetries are supposed to exist where the estimated parameters of the alternative MS specifications are indicative of different regime-dependent responses of stock market. Most of the empirical studies which use an MS modelling approach focus almost exclusively on univariate models. A novelty of this paper is that we explicitly assess the dynamic impact of exogenous monetary shocks on the movements of European stock returns in both cases: under high return stable and low return volatile states, that is when there are bull markets and bear markets, respectively. In this respect, our work can be regarded as an extension of the studies by Thorbecke (1997), Peersman and Smets (2001), Goto and valcknov (2002) and Garcia and Schaller (2002).

This paper has two main objectives. First, we try to measure and analyse in some detail the stock market's response to monetary policy actions, both at the aggregate level for the EUM countries and, at level of industry for five European countries. Second, we try to gain some insights into the reasons for the European stock market's response. An additional innovative feature of our study is that it provides a comparison of the ability of our definitions of policy innovation to detect asymmetries in the EUM stock markets.

The work is structured as follows. Section 4.2 reviews the empirical literature on the macroeconomic effects of monetary innovations. Section 4.3 presents the data. Section 4.4 describes the MS framework and our model selection strategy. Section 4.5 introduces the MS specifications which are relevant to the empirical analysis. In Section 4.6 we present and discuss the empirical findings obtained by using MS models. Section 4.7 concludes.

2 Review of Literature

There is an extant literature on the relationship between stock market returns and monetary policy which, in general, centres on issue of whether monetary policy has an impact on stock returns and, whether this impact is asymmetric in bear and bull markets. We focus on three main aspects of the literature: 1) the relationship between monetary policy shock and stock returns; 2) the asymmetric effects of monetary policy innovation on stock returns; 3) the impact of ECB's monetary policy on EUM stock market returns. Researchers who have investigated long-run relationships between macroeconomic variables and stock market indices focused their attention on determining the dynamic relationships between *a priori* variables and a representative stock market index [Mukherjee and Naka (1995), Kwan and Shin (1999), Maysami and Koh (2000), Hondroyiannis and Papapetrou (2001), Shamsuddin and Kim (2003)]. The proxy variables chosen by these researchers varied from one stock market to another. Also, the analytical methods varied noticeably.

It is clear that the relationship between stock prices and returns in particular countries and economic variables has received great attention over recent years. For example, Mukherjee and Naka (1995) in a study that investigated the Japanese stock market returns found, using a better performing vector error correction model (VECM) compared to the vector autoregressive model (VAR) model, that the Japanese stock market was cointegrated with a group of six macroeconomic variables. Their findings were robust to different combinations of macroeconomic variables in six-dimension systems. Kwan and Shin (1999) utilised a VECM to find that the Korean stock price indices were cointegrated with a set of macroeconomic variables, which included exchange rates and money supply, and that the set of variables provided a direct long-run equilibrium relationship with each stock price index. They also found that stock price indices were not a leading indicator for the macroeconomic variables.

Maysami and Koh (2000) when investigating the long-term equilibrium relationships between the Singapore stock index and selected macroeconomic variables and Singaporean stock returns found, using a VECM, that the Singapore stock market is interest and exchange rate sensitive. They also found that the Singapore stock market was significantly and positively cointegrated with the stock markets of Japan and the USA.

Hondroyiannis and Papapetrou (2001) examined macroeconomic influences on the stock market for Greece. Among the macroeconomic variables investigated were interest rates and exchange rates. They too found that stock prices do not lead changes in real economic activity but that the macroeconomic activity and foreign stock market changes only partially explained Greek stock price movements. They found that oil price changes did explain Greek stock price movements and had a negative impact on economic activity.

Numerous statements made by central banks' chairmen, for instance Mr. Greenspan, indicate that governors believe that soaring stock prices create imbalances in the economy that threaten long-run economic growth. Hence, the natural question is if these concerns have been activated into monetary policy decisions. The academic literature does not offer a decisive answer to this question. Mishkin (2000) acknowledges that the most serious economic downturns are often associated with financial instability but does not discuss specifically the impact of a stock market crash on the economy. Bernanke and Gertler (1999) argue that a central bank dedicated to a policy of flexible inflation targeting should pay little attention to asset inflation because a proper setting of interest rates to achieve the desired inflation target will also stabilize asset prices. Cogley (1999) argues that deliberate attempts to puncture asset price bubbles may destabilize the economy.

Bordo and Jeanne (2001) re-evaluate the model of Bernanke and Gertler (1999) and argue that asset price reversals can be very costly in terms of declining output, such as in the case of Japan. They go further to argue that traditional monetary policy may be unable to correct asset price disturbances. Fair (2000) uses a macroeconomic model to offer quantitative evidence of the Bordo and Jeanne (2001) claim that the Fed may be unable to correct asset price disturbances. Fair shows that the negative effects from the loss of wealth following a stock market crash dominate the positive effects from the Fed lowering interest rates immediately after such a crash. Cecchetti (1998) discusses that the policymaker must often trade off variability in output for variability in prices because it is generally not possible to stabilize both. More specifically, Cecchetti, Genberg, Lipsky and Wadhwami (2000) argue that central bankers can improve economic performance by paying attention to asset prices. Cecchetti and Krause (2000) examine in detail the connection between the dramatic changes in the financial structure (a concept much more general than stable asset prices) of numerous countries and conclude that these changes contributed to the stability of both economic growth and low inflation. Tarhan (1995) finds evidence that the Fed affects asset prices.

Filardo (2000) reviews carefully the literature on including asset prices in inflation measures and finds little evidence that paying attention by the Fed to asset prices would reliably improve economic stability. However, it is important to highlight that in many cases a severe tightening in monetary policy during stock market bubbles was associated with the burst of the bubble and a crash. A good example was the 1929 Crash of New York Stock Exchange, which followed a tight monetary policy by the Federal Reserve at that time by increasing the rediscount rate from 5% to 6%. Also, in Japan, the rise of discount interest rate from 2.5% to 6% -to stabilize the financial market after the peak during 1989 and 1990- played a role in the stock market crash and in the severe recession.

The result of the above statements is that monetary non-neutrality generate responses of stock market returns to monetary policy shocks that are consistent with the data. And second, the model replicates the heterogeneous responses of the returns on small and large firms documented in the empirical literature, where firm size is usually interpreted as a proxy for financial market access. Gertler and Gilchrist (1994) argue that small firms are more strongly affected by monetary policy shocks since they are likely to be relatively more constrained in financial markets. Ehrmann and Fratzscher (2004), Perez- Quiros and Timmermann (2000) and Thorbecke (1997) show that monetary policy exerts a more important effect on the returns of small firms. These results are interpreted as evidence in favour of the hypothesis that financial market imperfections and in particular the access to credit are important elements of the monetary transmission mechanism. Macroeconomic theory offers basically two complementary views on how financial factors influence the business cycle, namely the bank lending channel and the credit channel. The credit channel emphasizes borrower's balance sheet positions and net worth, whereas the bank lending channel focuses on the special role of the banking sector.

Hence, there has been ample evidence that firm size matters with respect to response towards monetary policy shocks. It has been observed that small firms including tradable ones tend to be more dependent on bank financing compared to large firms. This is because the former has limited access to capital markets. For example interest rate changes will affect the creditworthiness of the small firms. Thus, small firms response to monetary policy shocks is more significant compared to that of large firms, especially in adverse economic conditions. Researches suggested that the effect of asset price changes on the economy is transmitted through the balance sheets of households, firms and financial intermediaries as it affects their ability to borrow or lend. This is known as “the balance sheet channel”. The deterioration in balance sheets would be magnified on the long run in the form of declining sales and employment implying further weakening in cash flows and spending. This is known as “financial accelerator” effect. However, recently, the significance of these findings has been declining in few markets. This is due to the continuous financial innovation, which reduce the extent of firms to be bank-dependent. A new financial innovation that is getting to be a known practice is asset securitization techniques in which firm size and asset mix are no longer constraints to access debt markets.

Various studies mostly examined different stock markets, provided evidence consistent with the above theoretical background. Hess and Lee (1999), based on pre- and post-war periods in USA, UK, Japan, and Germany, showed that the response of stock returns to inflation varies over time and depending on whether it is a money supply or demand shock. Evidence showed that supply shocks result in a negative contemporaneous relationship between stock returns and inflation. Demand shock generates a temporary positive contemporaneous relation between stock returns and inflation, which is followed by negative relation. Thorbecke (1997) examined the relation between monetary policy and stock returns. He conducted the empirical estimation using impulse-response functions and variance decompositions from a VAR model depending on US monetary and stock market data. He showed that expansionary monetary policy increases stock returns. Booth and Booth (1997) using Federal funds rate and discount rate have confirmed these results. They showed also, that a restrictive monetary policy stance lowers monthly returns of both large and small stock portfolio. They concluded that monetary policy has explanatory power in forecasting stock portfolio returns. Patelis (1998) confirmed these findings by estimating a VAR model to examine the impact of the Federal Reserve monetary policy on US markets.

McQueen and Roley (1993) examined the stock market responses to macroeconomic news across different economic states. They used monthly time series of unemployment rate, money supply (M1) announcements, inflation rate and discount rate. The authors provided evidence that the stock market’s response to macroeconomic news depends on the state of the economy. These results had been confirmed by Li and Hu (1998) showing that stock market responses to macroeconomic shocks varies across different stages of the business cycle. Furthermore, the authors provided evidence that the size of the firm matters. They showed that during restrictive monetary policy periods small caps tend to perform poorer compared to the large caps.

Due to the increasing evidence that monetary policy contributes in the predictability of stock returns. Chami *et al* (1999) examined the possibility that the stock market could be one of the monetary policy transmission channels in addition to the money and credit channels.

Using US monetary data, the authors confirmed that there is a degree of predictability of stock returns from monetary indicators and concluding that the stock market is a channel for transmitting monetary policy.

Another important aspect of the literature is related to the asymmetric effects of monetary policy innovation on small and large firms' stock returns. Bernanke and Gertler (1989), Gertler and Gilchrist (1994), Kiyotaki and Moore (1997), studying theories about the imperfect capital market, predict the presence of asymmetries in the variation of small and large firms' risk over the economic cycle. Small firms with little collateral should be more strongly affected by tighter credit market conditions in a recession state than large, better collateralized ones. Such theories do not simply have the cross-sectional implication that small firms' risk will be more strongly affected by tighter credit markets in all economic states. Based on the idea that a decline in a borrower's net worth raises the agency cost on external finance, the theories identify asymmetries in the effect of tighter credit market conditions on risk during recessions and expansions. In a recession, small firms' net worth, and hence their collateral, will be lower than usual and tighter credit markets will be associated with stronger adverse effects than during an expansion when these firms' collateral is higher. Large firms are less likely to experience similarly strong asymmetries over time since they have uniformly higher collateral across economic states.

Therefore, as Bernanke and Gertler (1989) pointed out, a recession may result in a flight to quality[1], causing investors to stay away from the high-risk small firms and switch towards better collateralized, and hence safer, large firms.

Gertler and Gilchrist (1994), for example, argue that the informational asymmetries that increase firms' cost of external capital are most important to young firms, firms exposed to large idiosyncratic risks, and firms that are poorly collateralized, all of which tend to be smaller firms. Since small and large firms use very different sources of financing and have very different degrees of access to credit markets, they ought to be differently affected by credit constraints. Combining this with the finding that credit constraints are time-varying and bind most during recessions leads to the conclusion that small firms should be more adversely affected by worsening credit market conditions during a recession state.

The clearest direct link between firm size and asymmetries in the effect of monetary shocks on firm profitability has perhaps been provided by Cooley and Quadrini (2001, 2006). These authors present a general equilibrium model in which firm size is the key source of

[1] Flow of funds from riskier to safer investments in times of marketplace uncertainty or fear. For example, the flow could be from risky investments to safer investments within a given country, or from higher-risk countries to lower-risk countries.

heterogeneity. Firms borrow from financial intermediaries to establish working capital, using cumulated equity as collateral. Since the probability of firm failure is the main source of risk, both the amount of capital a firm can borrow and its borrowing rate are determined by the firm's collateral. Small firms' marginal profits are most sensitive to shocks as a result of their operating on a smaller scale. Since collateral is universally lower in a recession state, their model implies that small firms' risk and the expected profit per unit of borrowed funds should be relatively higher in this economic state. The higher sensitivity of small firms' profits and asset values with respect to credit market shocks and their higher probability of becoming credit constrained or of defaulting means that small firms' relative risk should increase around recessions.

When the economy is hit by monetary shocks, the response of small and large firms differs substantially, with small firms responding more than big firms. As a result of the financial decisions of firms, monetary shocks have a persistent impact on output. Finally, they found that monetary shocks lead to considerable volatility in stock market returns.

Chen (2005) investigates whether monetary policy has asymmetric effects on stock returns using different measures of monetary policy stance. Empirical evidence suggests that monetary policy has larger effects on stock returns in bear markets.

Finally, the introduction of the Euro has been a significant event in the globalisation of financial markets. It is intended to create broader, deeper and more liquid financial markets in Europe, and thus its main purpose is to improve the European economy. A significant part of past research, such as Corhay *et al.* (1993), Choudhry (1996), Serletis and King (1997), Steely and Steely (1999), Gerrits and Yuce (1999), Dickinson (2000), Billio *et al.* (2001) and Yang *et al.* (2003) among others, focuses on major European stock markets.

Ehramann and Fratzscher (2003) model the degree of interdependence of the U.S. and European interest rate markets by focusing on the reaction of these markets to macroeconomic news and monetary policy announcements. They show that the connection of the Euro area and the U.S. money markets has steadily increased over time, with the spillover effects from the U.S. to the Euro area being somewhat stronger than in the opposite direction.

3 Review of econometric studies

In the research of economics time series, especially the macroeconomic and financial series, the conventional framework with a fixed density function or a single set of parameters may not be suitable and it is necessary to include the possible structural change in the analysis (Chang-Jin Kim, 2003). Since the early 1980s, models based on economic fundamentals have been poor at explaining the movements, for instance, in the exchange rate markets (Messe 1990). This has exploded a blast of interest in time-varying parameter models. One notable set of models are switching regressions with latent state variables, in which parameters move discretely between a fixed number of regimes, with the switching controlled by an unobserved state variable. Switching regressions have a rich history in econometrics, dating back to at least Quandt (1958). Goldfeld and Quandt (1973) introduced a particularly useful version of these models, referred to in the following as a Markov-switching model, in which the latent state variable controlling the regime shifts follows a Markov-chain, and is thus serially dependent. In an influential article, Hamilton (1989) extended Markov-switching models to the case of dependent data, specifically an autoregression (Chang-Jin Kim, 2003).

Since the publication of James Hamilton's seminal 1989 *Econometrica* paper many authors have employed Markov-switching to model regime change in economic time series. A recent search yielded more than 250 citations of Hamilton's paper, many investigating some sort of Markov regime change in an empirical model. Examples include investigations of business cycle asymmetry (Hamilton, 1989; Lam, 1990), heteroskedasticity in time series of asset prices (Schwert , 1989b and 1996; Garcia and Perron, 1996), the effects of inflation on UK commercial property values (Barber, Robertson, and Scott, 1977), the effects of oil prices on U.S. GDP growth (Raymond and Rich, 1997), labor market recruitment (Storer, 1996), the dividend process (Driffill and Sola, 1998), government expenditure (Rugemurcia, 1995), and the level of merger and acquisition activity (Town, 1992).(Charles R. Nelson, 2003)

A Markov regime-switching model enhances traditional performance measures by allowing an assessment of the investment strategy to dynamic factor exposure through time. The regime-switching model combines several sets of model parameters (coefficients) into one system, and which set of parameters should be applied depends on the regime the system is likely in at certain time. For instance, a two-regime model:

$$Y(t) = \begin{cases} = X(t) \times b_1, S(t) = 1, \\ = X(t) \times b_2, S(t) = 0. \end{cases}$$

S (t) is the state variable which changes through time and cannot be observed by investors. *S (t)* is determined by Markov chain:

$P(S_{t+1} = j \mid S_t = i) = p_{ji}$

Markov regime-switching model has been applied in a variety of fields including speech recognition (Juang and Rabiner 1990), DNA composition (Churchill 1989), ion channels (Chung et al. 1990, Fredkin and Rice 1992), analysis of business cycles (Hamilton 1989, 1990) and modeling stock market and asset returns (Turner, Startz, and Nelson 1990).(Ramaprasad Bhar, 2000)

In terms of the structure of the remaining work, following an overview of the relevant methodologies employed by the existing studies of the impact of monetary innovations on stock markets, this work argues for Markov Switching Modelling as an alternative methodological approach to the issue of analysing the above mentioned impact on European financial markets. A prototype Markov Switching Model is then applied to the case of and its empirical results are then presented.

There is mounting evidence that empirical models of many economic time series, particularly macroeconomic and financial series, are characterized by parameter instability. This has sparked an explosion of interest in time-varying parameter models. One notable set of models are switching regressions with unknown sample separation, in which parameters move discretely between a fixed number of regimes, with the switching controlled by an unobserved state variable.

As pointed out in the previous section, in this paper we work with switching regressions of the type considered by Hamilton (1989) and various extensions, but relax the exogenous switching assumption. We show that the empirical results from monthly returns on the 11 EMU stock markets indices suggest that, measuring monetary policy innovation as residuals from the Taylor's rule, a contractionary monetary shock strongly lowers stock returns in both bull and bear markets. Furthermore, monetary policy has larger effects on returns in the bear-market regime. This result may provide evidence supporting models which emphasize the important role of finance constraints.

Finally, it has been shown that contractionary monetary policy leads to a higher probability of switching to a bear-market regime. Thus, a tightening monetary policy may depress stock returns in two different ways: it lowers the returns directly and makes the returns more likely to shift to low-return regimes (bear markets).

For both of these estimation techniques, we show that for serially dependent state processes, such as a Markov-switching state process, the lagged state can provide information necessary for identification, providing it is uncorrelated with the current regression error. This is true even though the lagged state is unobserved. Additional information is obtained when the transition probabilities of the switching process are influenced by exogenous variables, as in the so called "time-varying transition probability" case.

Why are we motivated to investigate Markov-switching regressions with endogenous switching? Many of the model's applications are in macroeconomics or finance in situations where it would be natural to assume that the state is endogenous. As an example, in many models the estimated state variable has a strong business cycle correlation, often corresponding with recessions. This can be seen in recent applications of the regime-switching model to identified monetary VARs, such as Sims and Zha (2002) and Owyang (2002). It is not hard to imagine that the shocks to the regression, such as the macroeconomic shocks to the VAR, would be correlated with recessions. As another example, some applications of the model contain parameters that represent the reaction of agents to realization of the state (see for example Turner, Startz and Nelson (1989)). However, it is likely that agents do not observe the state, but instead draw inference based on some information set, the contents of which are unknown to the econometrician. Use of the actual state to proxy for this inference leads to a regression with measurement error in the explanatory variables, and thus endogeneity.

In the next section we examines the asymmetric effects of monetary policy using a modified version of the Markov-switching model developed by Hamilton (1989). The effects of monetary policy are investigated in two different perspectives. First, we assume that monetary policy may affect stock returns directly in a fixed-transition-probability (FTP) Markov-switching model where the transition probabilities are fixed over time.

4 Methodology

The switching process is nowadays frequently used in finance and economics. This kind of process takes into account the changes of state of a time series. In finance for instance, it is well known that the volatility of a time series could change, because of a depression, for example. One of the most popular models is the Markov-switching process introduced and developed by Hamilton (1989, 1990). A large literature exists concerning this model. One of its properties is that the change of state has an unique probability. This is due to the Markov definition of the model. Unfortunately, a consequence of this is that it is difficult to control the changes of state. Here we propose a new model built differently from the Markov-switching process. It will allow better control of the state changes.

In this respect, our work can be regarded as an extension of the studies Maheu and McCurdy (2000) and in Perez-Quiros and Timmermann (2000), Akifumi Isogai *et* al (2004), and Shiu-Sheng Chen (2005). An additional innovative feature of our study is that it provides a new definition of monetary policy shocks to detect asymmetries in the stock markets returns.

4.1 Monetary policy innovation, stock market returns within a Regime-Switching model

As mentioned in paragraph 4.2, the empirical relationship between central bank policy and stock market returns can be relevant under two critical topics that is, in financial and monetary economics. Several proposed monetary transmission mechanisms link changes in central bank policy to the stock market, which in turn affects output via consumer expenditure as well as investment spending. With respect to the former, a decrease in interest rates should boosts stock prices and therefore financial wealth, which should raises consumption through the wealth effect too (Modigliani 1971).
In this section we describe a general econometric framework which allows for regime switching in the dynamics of stock markets returns. We investigate the ability of Markov Switching model to capture asymmetric reactions of stock markets returns to monetary policy shocks under different states of the stock markets. The first specification is:

$$X_{i,t} = \phi_0 s_t + \phi_i s_t X_{i,t-n} + \mu_t \qquad (1.1)$$

Where s_t is governed by an unobservable, discrete, first order Markov chain that can assume *k* values (states), $\mu_t \sim i.i.d.\mathrm{N}(0,\sigma^2_{s_t})$. and i=1,2,3,…n indexes returns on European Stock markets.
The second specification is given by:

$$X_{i,t} = \phi_0 s_t + \phi_{i,} s_t X_{i,t-n} + \phi_{r,} s_t r_t + \varepsilon_t \qquad (1.2)$$

Where s_t is governed by an unobservable, discrete, first order Markov chain that can assume *k* values (states), $\varepsilon_t \sim i.i.d.\mathrm{N}(0,\sigma^2_{s_t})$., r_t is the innovation in monetary policy and i=1,2,3,…n indexes returns on European Stock markets.
In what follows, we assume that the ECB's systematic policy is specified by a Taylor rule. A contractionary policy shock is captured by a positive innovation, ω_t. The effects of this

policy shock on stock returns has been categorized into two main channels: the money channel and bank leading channel. However, in our study, we are not focusing on identifying those channels. Our aim is to establish that a tighter monetary policy ultimately results in a decrease of stock returns and, as final remark, that the effects of monetary policy on stock returns can be asymmetric. That is, a monetary policy can have different impact in bull and bear markets.

The introduction of Markov switching allows the coefficients ϕ_i in equations (1.1) and (1.2) and ϕ_r to switch between the two different states $S_t = 0$ and $S_t = 1$. If our conjecture that stock markets returns at times has specific effects is correct, the unobserved state variable St is a latent dummy variable equaling either 0 or 1, which indicates bull/bear markets.

Nevertheless, we do not impose neither different signs on the coefficients a priori nor force the process to switch into the other regime at a certain time. The only restriction we impose is that there are two different regimes, while everything else is determined from the data in the estimation.

The series S_t, $t = 1, 2, \ldots, T$ provides information about the regime the economy is in at date t. If S_t were known before estimating the model, we could apply a dummy variable approach. In the Markov-switching approach, however, we assume S_t to be not observed, and we estimate the evolution of the regimes endogenously from the data. It is assumed that the transition between the two states is governed by a first order Markov process with the transition probabilities p and q, which can be summarised in form of a transition matrix P:

$$\begin{bmatrix} p & 1-q \\ 1-p & q \end{bmatrix}$$

The transition probabilities are defined as follows:

$$\begin{aligned} p &= \Pr\left[S_t = 1 \middle| S_{t-1} = 1\right] \\ 1-p &= \Pr\left[S_t = 0 \middle| S_{t-1} = 1\right] \\ q &= \Pr\left[S_t = 0 \middle| S_{t-1} = 0\right] \\ 1-q &= \Pr\left[S_t = 1 \middle| S_{t-1} = 0\right] \end{aligned}$$

Here we assume a first order Markov process, i.e., the probability of being in a particular state in period t only depends on the state in period t - 1. To force p and q to lie between 0 and 1, and to keep the model set-up for the constant transition probabilities similar to the case of the time-varying transition probabilities, we employ the following specification in the estimation:

$$p = \frac{\exp(p_1)}{1 + \exp(p_1)} \text{ and } q = \frac{\exp(q_1)}{1 + \exp(q_1)}$$

The model can be estimated using an iterative Maximum Likelihood procedure maximising the following likelihood function[2]:

$$\ln L = \sum_{t=1}^{T} \ln \sum_{t=0}^{1} \Pr\left[S_t = i \middle| \Psi_{t-1}\right] \frac{1}{\sqrt{2\pi\sigma(S_t)}} \exp \frac{-\mu^2(S_t)}{2\sigma^2(S_t)}$$

with $\Pr = \left[S_t = i \middle| \Psi_{t-1}\right]$ denoting the probability of being in state 0 or 1 in period t and ψ_{t-1} denoting all available information up to period $t - 1$.

In general, equation (4.1) is called a MS-AR(k) model.

4.2 Description of the Data.

The data in this work largely follow previous studies on EUM and therefore cover 11 countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Spain and Portugal, respectively. The sample period is January 1992 through September 2005, thus the number of observation is 164. The data set also comprises the monthly stock markets at level of industry portfolio for five single countries, two small, Belgium and Netherlands, and three big countries, France, Germany and Italy in order to check if the magnitude of the impact and/or the timing of been in a specific state could change from country to country and from sector to sector. The Stock markets data aggregate for countries and for industry portfolios are from Datastream. Most of the macroeconomic data we used for the Taylor rules are from the International Financial Statistics databases (IFS), while the sources for the interests rates are from each single Central Bank database.

[2] See Appendix 1 for more details about the likelihood function.

The data are as following.

Figure 4.1 and table 4.1 presents the monetary policy shocks of the EUM countries generated from the residuals of the baseline Taylor rules. Results of the estimated Taylor rules before and after the Monetary Union are presented in appendix 2, table A..

Moreover, we work with 11 stock aggregate stock markets returns available at monthly frequency. The first letter of the variables' name identify the country[3], while for the industry portfolios we restrict the number of countries to five (Belgium, France, Germany, Italy and Netherlands) and consider six basic common portfolios industry: chemical (CH), industrial (IND), insurance (INS), oil (OIL), technology (TEC) and pharmacy (PH). For three countries (France, Germany and Italy) we look at other two additional industry portfolios: automobile (AU) and telecommunication (TEL).

Figure 4.2a and figure 4.2b show the plots of the 11 aggregate EUM stock markets and stock returns and table 4.2a and 4.2b the relative descriptive statistics.

Figure 4.3 - 4.7 show the plot of the industry portfolio returns for each single country, while table 4.2 – 4.6 the corresponding descriptive statistics.

Finally, as preliminary analysis for the next paragraph we created for the five EU countries series reflecting an upswing or downswing of the economies. There series are generated in order to describe the stage of the business cycle and therefore, they will be used to describe whether the output gap is increasing or decreasing. They will be constructed using the differences of the smoothed output gap[4].

[3] O for Austria, B for Belgium, Fn for Finland, F for France, G for Germany, Gr for Greece, Ir for Ireland, I for Italy, N for Netherlands, P for Portugal and E for Spain.

[4] For the smoothed output gap we have chosen the Hodrick-Prescott filter with a relative small λ =1000 because the objective was to filter out only the short-term movement of the output gap.

Figure 4.7a Business cycles of 5 EUM countries

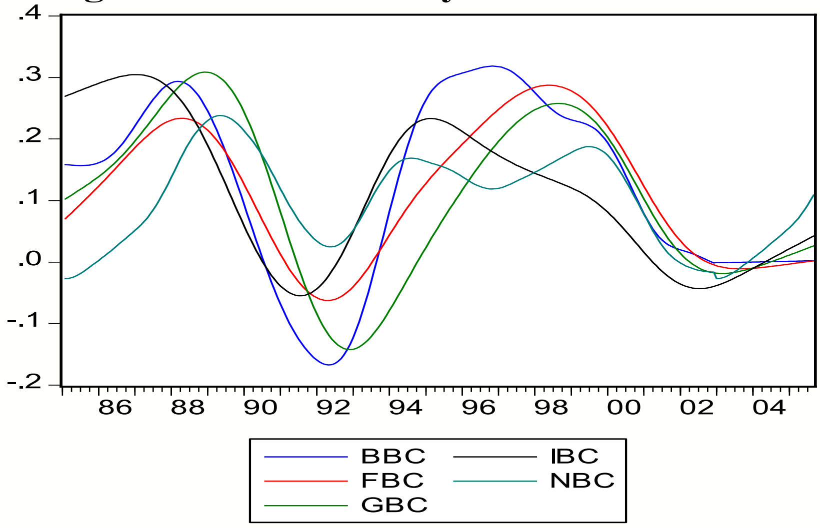

Figure 4.7a plots the paths of the series from 1985 to 2005. The figure shows that overall the countries follow similar business cycle and, most important result for the next section analysis, the convergence process of the business cycle among the countries has increased with the launch of the euro.

5 The Empirical Findings

In this section we present an empirical procedure aimed to compare alternative Markov Switching models. It is worth noting that the empirical approach applied here is open-ended. Any kind of results is possible. For instance, we may find evidence that monetary policy innovation has little impact on stock returns in bull markets, in bear markets or both. From another point of view, it may be evident that monetary policy shock has similarly strong effects in both bull and bear markets.

The starting point is to test for the presence of nonlinearities in the data. Unfortunately, testing for the number of regimes in an MS model is difficult. The main problem arises from the presence of unidentified nuisance parameters under the null of linearity, which invalidates the conventional testing procedures. (Krolzig, 1997).

The nuisance parameters give the likelihood surface sufficient freedom so that one cannot reject the possibility that the apparently significant parameters could simply be due to sampling variation. The scores associated with parameters of interest under the alternative may be identically zero under the null.

Davies (1977, 1987) derived an upper bound for the significance level of the likelihood ratio test statistic under nuisance parameters. Formal tests of the Markov switching model against the linear alternative employing a standardized likelihood ratio test designed to deliver (asymptotically) valid inference have been proposed by Hansen (1992, 1996a), Garcia (1998), but are computationally demanding.

Alternatively one may use the results of Ang and Bekaert (1998) which indicate that critical values of the $\chi^2_{\cdot}$ (*r*+*n*) distribution can be used to approximate the LR test, where *r* is the number of restricted parameters and *n* is the number of nuisance parameters. In this work the null hypothesis of linearity against the alternative of a Markov switching will be tested using the Hansen test (linearity versus two-states Markov switching model). It represents standardised likelihood ratio statistics for the model of each country. The p-value is calculated according to the method described in Hansen (1992, 1996), using Rats procedures based on 1,000 random draws from the relevant limiting Gaussian processes[5].

The switching process is nowadays frequently used in finance and economics. In finance for instance, it is well known that the volatility of a time series could change, because of a depression, for example generating the so called "bull" and "bear" effects on stock markets. A large literature concerning the Markov-switching process exists. One of its properties is that the change of state has an unique probability. This is due to the Markov definition of the model. Unfortunately, a consequence of this is that it is difficult to control the changes of state. More formally, we test the null hypothesis of a single-regime model ($\mu 1 = \mu 2$), against the regime switching model of eq. (1.1) and (1.2). Testing the null restriction $\mu 1 = \mu 2$ is not straightforward. For instance, under the null there is in fact only one regime that governs the exchange rate, so that the regime staying probabilities p11 and p22 are not identified. This makes the asymptotic distribution of the usual tests (likelihood ratio, Wald and Lagrange multiplier) no longer $\chi 2$ (Hansen (1992))[6].

EMU countries' results

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[5] See Hansen, 1992 for details.

[6] A generally applicable solution for the testing problems mentioned above is given by Hansen (1992, 1996). His approach can be summarized as follows. The null restriction is equivalent to $\mu 2 \ \mu 1 = 0$. Under this null, p11 and p22 are not identified. Hansen proposes to consider a fixed value for ($\mu 2 \ \mu 1$, p11, p22). For this point, maximize the log-likelihood across the other parameters. Subtracting the log-likelihood under the null and dividing this difference by its standard deviation yields the standardized likelihood ratio for the ($\mu 2 \ \mu 1$, p11, p22) under consideration. Hansen's test statistic LR is the supremum of these standardized likelihood ratios over all parameter combinations ($\mu 2 \ \mu 1$, p11, p22) that are possible under the alternative.

In practice Hansen suggests to take the supremum over a finite grid of parameter combinations. The asymptotic p-value of LR is not known by itself, but Hansen shows that it is smaller than or equal to the asymptotic p-value using the distribution of another variable. He advises to use this upper bound, though it makes the test conservative (too few rejections of the null). He also explains how the bound can be approximated via simulation. Finally, the p-value bound depends on a bandwidth number M, and Hansen suggests to compute the p-value for different M (see Hansen (1996) for details). In this paper we follow Hansen's method.

We first estimate the model without multiple equilibria using ordinary least squares, in order to test a purely linear model. The parameters estimates, together with associated p-values, likelihood function values and diagnostic statistics of eq. 1.1 are reported in table A1 (appendix 2). The results provide strong evidence in favour of a two state regime-switching specification. The explanatory power of the linear models seem to be poor. Some coefficients do not have the expected signs and are statistically not significant. As shown in Table A1, the relation improves when the model is estimated taking into account an additional state. The fits of the models are considerably better, as evidenced by a lower σ^2_u and a higher log likelihood. Moreover, the plot in figure 4.8 shows that the models with multiple equilibria seem to capture well the episode of sharp movements in the EUM stock markets returns.

The second relevant issue is how to determine the number of states required by each model to be an adequate characterisation of the observed data. Our empirical procedure follows Psaradakis and Spagnolo (2003), who suggest to select the number of regimes using Akaike Information Criterion (AIC hereafter). Using Monte Carlo experiments they show that selection procedures based on the AIC are generally successful in choosing the correct dimension, provided that the sample size and parameter changes are not small. We compute the value of the Akaike information criterion for the linear models and the corresponding Markov switching models in tables A1-A2 . The values reported indicate that a switching model is favourite for all the EMU countries. Moreover, the two regime models outperform the corresponding single regime models in terms of the residuals diagnostic for linear and non linear dependence.

The coefficients $\phi_{r,1}$ indicate how the stock returns respond to the impact of monetary policy innovation in bull markets. On the other hand, the coefficients $\phi_{r,2}$ can be interpreted as the monetary policy effect on stock returns in bear markets. Now we have to specify how to interpret a monetary policy shock when it is generated as residuals from the Taylor rule. By specifying the ECB policy function as a Taylor rule, we assume that the European Central bank uses the interest rate (the interest rate on the main refinancing operations) as its main monetary policy instrument. In other words, this interest rate is not a state variable, but rather it is the main control variable of the European Central Bank. From this perspective, an unanticipated positive shock to the Taylor rule equation (tighter monetary policy) may results in lower future, expected and realized inflation and, consequently lower stock returns[7]. Looking at table A2, the coefficients show that a contractionary monetary policy leads, in most cases, to a decrease in stock return, no matter if the stock market is in bull or bear regime. The two countries with a higher stock returns reaction, as a result of a positive monetary policy innovation, are Italy and Portugal, both for the bear markets. For these two countries, higher stock returns can be explained as a sort of "price puzzle" effect [Sims (1992)]. To the extend that not all the capital market is immediately adjustable to changes of monetary policy, a portion of higher borrowing costs will be passed on to consumers and thereby will result in higher price level at short horizons. In this way, can be plausible to consider adjustment of private portfolio choice that, in the short run, can determine a positive stock return reaction to monetary policy shock. Barth and Ramey (2001) labelled this mechanism as the "cost channel".

Figure 4.8 plots the smoothing probability of state 1 (bull market), the high return state, using estimation of equation 4.3. Simply taking 0.5 as the cut-off value for State 1 or 2, we use the smoothing probability to infer the bull and bear markets. Hence, the period with smoothing probabilities greater than 0.5 are associated to a bear market while, periods with smoothing probabilities less than 0.5 are related to bull markets. In most cases, the smoothing probabilities estimated from nominal returns (figure 4.8) infer consistent periods of bull and bear market.

The smoothed probabilities are conditional on all available returns and the same maximum likelihood estimates. The main thing to notice about the probabilities is that, for Germany, France, Finland, Greece, Belgium, Austria and Netherlands stock markets returns, there are seemingly periodic 3–6-year regime shifts (state 1 or 2) during the period 1991 - 2005. While for the rest of the EUM countries there are also regime shifts (state 1 or 2) in the same period but they come at much less regular intervals 1-3 years.

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[7] According to the generalized Fisher hypothesis, equity stocks, which represent claims against the real assets of a business, may serve as a hedge against inflation. Consequently, investors would sell financial assets in exchange for real assets when expected inflation is pronounced. In such a case, stock prices in nominal terms should fully reflect expected inflation and the relationship between these two variables should be found positively correlated ex ante. The literature. Empirical evidence is rather mixed and could be classified into the following three categories: a) Research findings which provide support in favour of a positive relationship between inflation and stock market returns; b) Studies which provide evidence of a negative relationship between the inflation rate and the stock market returns. [Fama, 1981], suggests that there is a negative correlation between stock returns and the level of inflation. The negative relationship exists due to the correlation between inflation and future output. In particular, since stock prices reflect firms' future potential earnings, an economic downturn predicted by a rise in inflation will depress stock prices; c) Studies which provide mixed results. Usually these studies report negative correlations between stock prices and inflation in the short run which are followed by positive correlations in the long run.

This historical pattern of regime changes suggests that bull and bear regime from 1991 till 2005 for the EMU countries can be substantially divided into two main groups each one related to the duration of the single regime. As we'll explain in more details farther in this section, regime durations can play important rule for central bank monetary policy implications.

Furthermore, for the majority of the countries analyzed the results show that a positive monetary policy innovation lowers stock returns. An economic interpretation of this statement could be that when central bank rises short term interest rate, bonds and money market mutual funds look more attractive relative to stocks. In this situation firms have to pay higher rates on their borrowing, which reduces firms earnings. Both of which should, in theory, bring stock markets returns down. However, table A2 shows different signs of $\phi_{r,1}$ and $\phi_{r,2}$ for Italy and Finland. The former country presents a positive sign for the regime 2 (bear market) with a p-value of 0.045 while the latter shows a positive sign for regime 1 (bull market) but with a p-value of 0.036. The variance of the two states (σ^2_{S1} and σ^2_{S2}) changes from country to country. In particular, for Italy, France, Netherlands, Austria, Greece and Finland the variance of state 1 is smaller than the variance of state 2.

Finally, we have to look at the possible asymmetric effects of policy innovation on the aggregate EMU stock returns. The asymmetric effects of monetary policy come out in the estimations since we have $|\phi_{r,2}| \succ |\phi_{r,1}|$. From table A2 it is also discernible that the asymmetric effect ,$|\phi_{r,2}| \succ |\phi_{r,1}|$, holds in most cases (Germany, Italy, France, Belgium, Netherlands, Portugal Ireland Greece and Finland, respectively) implying that changes in monetary policy instrument have a stronger impact during bear markets.

This is in line with results from other empirical studies. In particular, Pagan and Sossounov (2003), Edwards et al. (2003) and Chen (2005). The latter found similar results for the United Stated using monthly returns on the Standard & Poor's S&P 500. He also find that monetary policy has larger effect on stock returns in bear markets.

Five EMU countries industry portfolios results

This section is devoted to the presentation and discussion of our empirical findings for five countries industry portfolios returns: France, Germany, Italy that we define big countries and Belgium and Netherlands that we assume as small countries. As explained in section 4.4.2, for all five countries industry sectors, we consider six basic common portfolios industry:

chemical (CH), industrial (IND), insurance (INS), oil (OIL), technology (TEC) and pharmacy (PH). For the three big countries (France, Germany and Italy) we look at other two additional industry portfolios: automobile (AU) and telecommunication (TEL).

Table A3 presents the estimates of regime switching model for the selected countries industry portfolios and monetary policy innovations. Overall, we can asserts that the signs of the coefficients and the asymmetric impact of monetary policy is, in general, similar to the results obtained above for the aggregate stock markets returns.

Germany

According to the estimates smoothed probabilities, regime 1 and 2 are presented in appendix 2, fig 4.13. The main thing to notice about the probabilities is that, for pharmacy, insurance, chemical and telecommunication industry sectors, there are long period about 6–8-years regime 1 from 1991 to 2005 while for the rest of the industry sectors there are also regime shifts (state 1 or 2) in the same period but they come at much less regular intervals 1-5 years. This historical patterns of regime changes suggest that bull markets (state 1) is the prevailing regime from 1991 till 1999 for most of the German industry sectors.

Furthermore, for all the industry sectors analyzed the results show that a positive monetary policy innovation lowers stock returns. Hence, when ECB rises short term interest rate, bonds and money market mutual funds look more attractive relative to stocks and, in theory, bring stock markets returns down. The variance of the two states (σ^2_{S1} and σ^2_{S2}) changes from sector to sector. In particular, for chemical, industrial, technology, automobile and telecommunication the variance of state 1 is greater than the variance of state 2.

Finally, we have to look at the possible asymmetric effects of policy innovation on the sector returns. The asymmetric effects of monetary policy come out in the estimations since we can have $|\Gamma_{r,2}| \underset{\prec}{\succ} |\Gamma_{r,1}|$. From table A3 it is also evident that the asymmetric effect, $|\Gamma_{r,2}| \succ |\Gamma_{r,1}|$, holds in all cases implying that changes in European monetary policy instrument can have stronger impact in Germany during bear markets.

France

The plot of the estimates smoothed probabilities of regime 1 and 2 are presented in appendix 2, fig 4.11. It is worth pointing out that, there are long period about 4–6 years regimes 1 or 2 from 1991 to 2005 only for oil, chemical, pharmacy and telecommunication sectors, while for the rest of the industry sectors there are also regime shifts (state 1 or 2) in the same period but they come at much less regular intervals 1-3 years.

Figure 4.11 shows that even for France, bear markets (state 2) is the prevailing regime from 1991 till 1999 for most of the industry sectors.

Moreover, for all the industry sectors analyzed the results show that a positive monetary policy innovation lowers stock returns. Hence, a monetary policy shock that rises short term interest rate bring France industry portfolios returns down. The data available for France indicates that the variance of the two states (σ^2_{S1} and σ^2_{S2}) changes from sector to sector. In particular, for pharmacy and automobile the variance of state 1 is greater than the variance of state 2.

Hence, we have to look at the asymmetric effects of monetary policy shock on the sector returns. As above, the asymmetric effects of monetary policy come out in the estimations since we can have $|\Gamma_{r,2}| \overset{\succ}{\underset{\prec}{=}} |\Gamma_{r,1}|$. From table A3 it is also patent that the asymmetric effect ,$|\Gamma_{r,2}| \succ |\Gamma_{r,1}|$, holds in all cases except for the pharmacy sector implying that changes in European monetary policy instrument can have stronger impact in France during bear markets.

Italy

The results obtained for the Italian sectors are, however, similar to the ones above mentioned for the other two big countries. Fig 4.12 in appendix 2 presents the estimates smoothed probabilities of regime 1 and 2. More precisely, it is worth noting how these probabilities for pharmacy, oil, chemical, technology and telecommunication industry sectors last for long period about 6–8-years regime 1or 2 from 1991 to 2005. While for the rest of the industry sectors there are also regime shifts (state 1 or 2) in the same period but they come at much less regular intervals from 6-12 months to 4 years.

The historical patterns of regime changes for industry sectors suggests that bull markets (state 1) is the prevailing regime for pharmacy (1995-2004), chemical telecommunication from 1991 till 1999, while regime 2 dominates for most of the other industry sectors.

Furthermore, the results of all the industry sectors analyzed, except the oil sector, show that a positive monetary policy innovation lowers stock returns. Hence, when ECB rises short term interest rate it bring stock markets returns down. According to the results obtained for the oil sector, the impact of monetary shocks should have an opposite effects since we found a positive sign for regime 2 (bear market) with a p-value of 0.045. The variance of the two states (σ^2_{S1} and σ^2_{S2}) changes from sector to sector. In particular, for chemical, technology and telecommunication the variance of state 1 is greater than the variance of state 2.

Finally, it is worth pointing out that, looking at the possible asymmetric effects of policy innovation on the sector returns, table A3 indicate that the asymmetric effect , that is $\left|\Gamma_{r,2}\right| \succ \left|\Gamma_{r,1}\right|$, holds in all cases except for the industry sector implying that changes in European monetary policy instrument can have stronger impact in Italy during bear markets.

Belgium

This is the first of the two small countries we have considered for our empirical analysis. According to the estimates smoothed probabilities, regime 1 and 2 are presented in appendix 2, fig 4.9. The main thing to notice about the probabilities is that, pharmacy and chemical sectors exhibit the longest period about 8–10-years regime 1 from 1991 to 2005. On the contrary, industry and technology sectors present quite long period of regime 2 at regular intervals 2-8 years from 1997 to 2005.

Furthermore, for all the industry sectors analyzed the results show that a positive monetary policy innovation lowers stock returns. Hence, a monetary policy shock that rises short term interest rate bring Belgian industry portfolios returns down. The variance of the two states (σ^2_{S1} and σ^2_{S2}) changes from sector to sector. In particular, for chemical, pharmacy, industrial and technology the variance of state 1 is greater than the variance of state 2.

Finally, we look at the asymmetric effects of ECB policy innovation on the sector returns. From table A3 it is also discernible that the asymmetric effect , $\left|\Gamma_{r,2}\right| \succ \left|\Gamma_{r,1}\right|$, holds in all cases implying that changes in European monetary policy instrument can have stronger impact in Belgian industry sectors returns during bear markets.

Netherlands

The empirical results of the last country for the period 1991- 2005 are presented in appendix 2 table A3. In addition, according to the estimates smoothed probabilities, regime 1 and 2 are presented in appendix 2, fig 4.10. The main thing to notice about the probabilities is that, chemical, industry and insurance sectors follow a similar paths and that for them the switch from regime 1 to 2 started in about 1997. Overall, there are long period about 2–6-years regimes 1or 2 from 1991 to 2005. This historical patterns of regime changes give mixed results suggesting that bull and bear markets alternate from 1991 till 2005 for most of the Dutch industry sectors.

Furthermore, for all the industry sectors analyzed, except for chemical and oil sectors, the results show that a positive monetary policy innovation lowers stock returns. Hence, when ECB rises short term interest rate it brings Dutch stock returns down both in bull and bear markets. However, according to the results obtained for the oil and chemical sectors, the impact of monetary shocks should have an opposite effects since we found positive signs for regime 1 (bull market) with a p-value of 0.05 and 0.056 respectively. The variance of the two states (σ^2_{S1} and σ^2_{S2}) for chemical, industrial and insurance sectors of state 1 is greater than the variance of state 2.

Finally, looking at the asymmetric effects of policy shocks on the sector returns, table A3 shows that the asymmetric effect , $|\Gamma_{r,2}| \succ |\Gamma_{r,1}|$, holds in all cases implying that changes in European monetary policy instrument can have stronger impact in Dutch industries sectors during bear markets.

The expected duration of "bull" and "bear" markets

Finally, tables A4-A6 present the conditional of being in state one or two that is, the expected duration of a typical "bull" and "bear" market in Industry portfolios. The results show a longer duration for the three big countries in bear markets and a substantial similar duration an average (bull 24 months, bear 23 months) for EUM aggregate stock markets returns. In particular, the bear state dominates for six out of eleven EMU countries. More precisely, it is worth noting that different duration implies different impact of monetary policy shock on each single EUM stock market. For instance, tables A2 and A5 show for Netherlands a value of the coefficient $\Gamma_{r,1}$ of -0.081 with a duration of bull market of 18.51 months while for Finland the same coefficient has a positive sign of 0.059 (p-value 0.036) and a duration of 43.47. Clearly, since the EMU countries have common currency and common monetary policy, the same shock tends to move the two stock markets apart in opposite directions. Table A6 extends the analysis to the industry portfolio of the five EMU countries. The following results may be drawn. First of all, oil, insurance and technology sectors present a situation where duration of bull market is grater than bear market for four out of five countries analyzed (except Netherlands for oil, except Belgium for insurance and except Italy for technology). Secondly, analysing pharmacy and chemical sectors we note that duration of bull market is greater than bear market only for two out of five countries. Finally, automobile sector has a duration of bull market greater than bear market only for two out of three countries (except Germany) while telecommunication only for one out of three countries (except Italy and Germany).

Policy implication

The policy implications of the above analysis can be summarized as follows. The result that systematic portion of monetary policy shock has significant impact on stock returns has important policy implications. Investors should be concerned with the unanticipated monetary policy because they will be surprised and the immediate effect of monetary policy shock will be large. Moreover, our findings show that these effects will be larger with bear stock markets. The outcomes observed in this work are consistent with the claim by Edwards et al. (2003), Lunde and Timmermann (2004), and Chen (2005).

An interesting feature of the results in Figures 4.8 -4.13 is that, at a first glance, it appears that aggregate stock markets seem to have faced the effects of the launch of the Euro in 1999. On the contrary, single country industry portfolios show that the smooth probability of change in regimes due to the new currency is less pronounced and affect only some industries.

This finding is consistent with the hypothesis that positive monetary policy shock (e.g. contractionary policy) is an event that decrease future cash flow. Moreover, the finding from country size and industry portfolios indicate that monetary policy have larger asymmetric effect in industry portfolios of big countries (Italy, France and Germany) compared to the same industry portfolios of small countries (Netherlands and Belgium). However, the sign of the impact is for both groups the same.

Moreover, if the ECB follows a contractionary monetary policy then the effect on the stock market returns will be lengthier and larger in bear markets. On the other hand, following the same policy, the effect of the ECB policy on the EMU stock markets returns will be smaller in bull markets. The results suggest that monetary policy is not neutral, at least in the short run and, there is some role for anticipated ECB monetary policy to affect the stock market but that this role will also have asymmetric impacts on each single EMU country's stock market.

6 Conclusions

This paper has explored, using Markov switching models, the dynamic relationship between stock market returns and the monetary policy innovation in 11 EUM countries and, in particular, for five countries at each single industry portfolios. Presumably, stock market movements reflect positions taken by market participants based on their assessment about the current state of the economy. Given the forward-looking behaviour of stock market investors, this study has explored the possibility of asymmetric effects of centralised monetary policy (ECB) when stock markets are not fully integrated. Stock market returns were represented by nonlinear dynamic factors at the monthly frequency. In the analysis undertaken here, the following important conclusions may be drawn. The findings, in line with results from previous empirical studies, indicate that for the EUM stock markets there is statistically significant relationship between policy innovations and stock markets returns. This finding is consistent with the hypothesis that positive monetary policy shock (e.g. contractionary policy) is an event that decrease future cash flow. Moreover, the finding from country size and industry portfolios indicate that monetary policy have larger asymmetric effect in industry portfolios of big countries (Italy, France and Germany) compared to the same industry portfolios of small countries (Netherlands and Belgium). However, the sign of the impact is for both groups the same.

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Moreover, the finding from country size and industry portfolios indicate that monetary policy have larger asymmetric effect in industry portfolios of big countries (Italy, France and Germany) compared to the same industry portfolios of small countries (Netherlands and Belgium). However, the sign of the impact is for both groups the same.

Hence, if the ECB follows a contractionary monetary policy then the effect on the stock market returns will be lengthier and larger in bear markets. The results suggest that monetary policy is not neutral, at least in the short run and, there is some role for anticipated ECB monetary policy to affect the stock market but that this role will also have asymmetric impacts on each single EMU country's stock market.

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Appendix 1

Table A GMM Estimates of EUM Forward Looking Taylor Rules, 1985:01-2005:09

	Belgium	Italy	France	Germany	Netherlands	Ireland
Coefficients						
α	0.977**	0.973**	0.982***	1.008**	1.021**	0.976***

β	1.523*	1.166***	1.360**	1.352**	1.192**	1.794**
γ	0.770*	0.179**	0.175**	0.818**	0.889***	0.924**
$\sum_{i=1}^{l} \varphi_i$	0.509***	0.928**	0.601**	0.986*	0.916**	0.905**
J-stat	0.192	0.201	0.091	0.114	0.110	0.142
	Greece	**Spain**	**Portugal**	**Finland**	**Austria**	
α	0.983*	0.970***	0.974*	0.972**	0.849**	
β	1.570**	1.789**	1.014*	1.122**	1.754**	
γ	0.252**	0.806**	0.740**	0.305***	0.144*	
$\sum_{i=1}^{l} \varphi_i$	0.845**	0.838***	0.946**	0.901**	0.916**	
J-stat	0.067	0.237	0.155	0.088	0.099	

Note:
1) Estimates are obtained by GMM estimation with correction for MA(12) autocorrelation. Two-stage least squares estimation is employed to obtain the initial estimates of the optimal weighting matrix;
2) In the benchmark model the instruments used are a constant and lags 1 to 6 of the nominal short term interest rate, inflation, output gap, and a world commodity price index (agricultural raw materials);
3) *J*-stat denotes the test statistic for over-identifying restrictions;
4) *, **, *** indicate level of significance of 10%, 5%, and 1% respectively.

Figure 4.1 EUM Monetary Policy Innovations

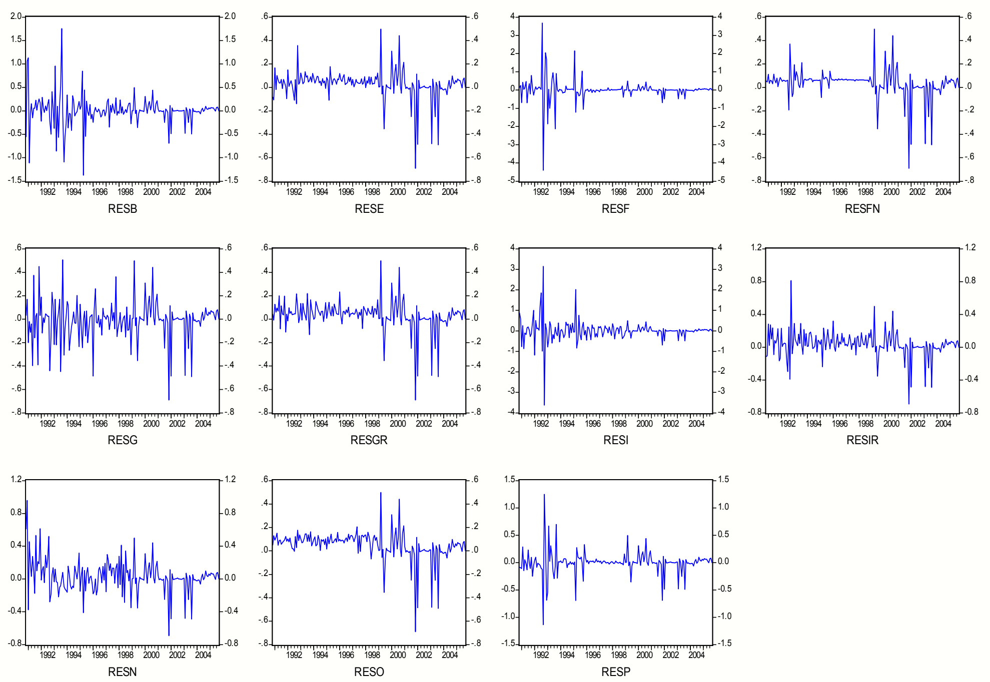

Table 4.1 Descriptive Statistics

	RESB	*RESF*	*RESG*	*RESI*	*RESN*	*RESP*

Mean	0.007234	0.006425	-0.01062	0.013253	0.032798	0.001138
Maximum	1.756936	3.673407	0.507469	3.145871	0.957323	1.250975
Minimum	-1.37516	-4.39936	-0.69083	-3.626	-0.69083	-1.13618
Std. Dev.	0.324252	0.603905	0.169519	0.517224	0.198521	0.218071
Skewness	0.367819	-0.80192	-0.58055	-0.22753	0.44844	-0.06727
Kurtosis	11.2898	27.41001	6.070841	24.40911	6.964946	14.30409
Jarque-Bera	516.5784	4463.223	80.38749	3420.07	123.2504	953.1793
Observations	179	179	179	179	179	179

	RESFN	*RESGR*	*RESIR*	*RESO*	*RESE*
Mean	0.003428	0.003309	0.003753	0.004997	0.002781
Maximum	0.498592	0.498592	0.498592	0.498592	0.498592
Minimum	-0.69083	-0.69083	-0.69083	-0.69083	-0.69083
Std. Dev.	0.111738	0.111755	0.112176	0.111759	0.111743
Skewness	-2.0191	-2.01495	-2.00245	-2.06014	-2.00142
Kurtosis	19.51745	19.49642	19.23867	19.61722	19.46694
Jarque-Bera	2156.451	2150.774	2086.347	2186.102	2141.905
Observations	179	179	179	179	179

Figure 4.2a EUM stock markets

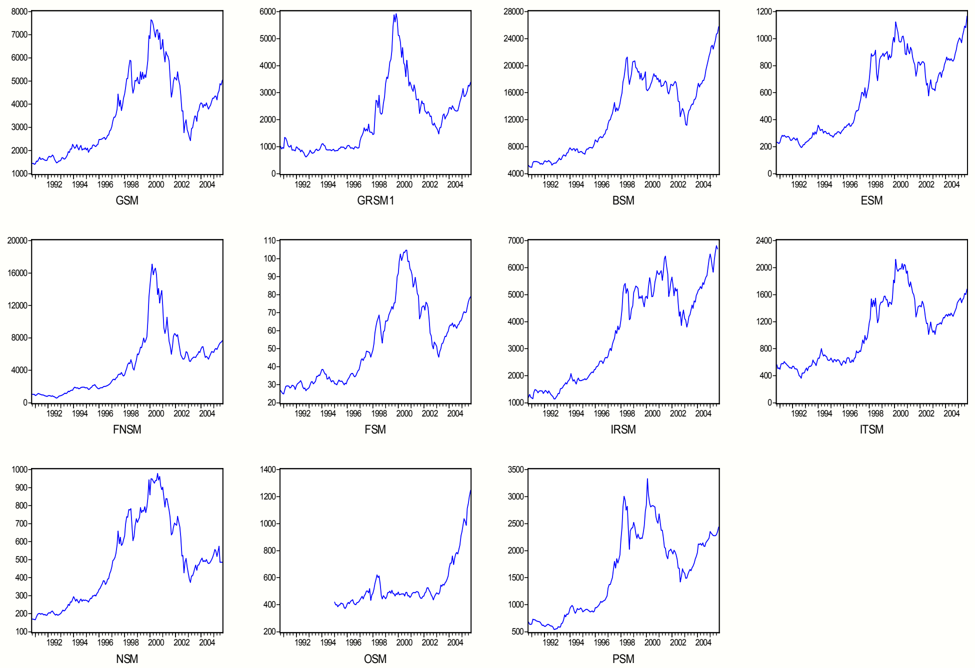

Table 4.2.a	BSM	ESM	FNSM	FSM	GRSM1	GSM
Mean	15494.13	727.1649	6177.352	61.22305	2432.627	4300.214
Maximum	24829.78	1123.75	17092	104.62	5921.98	7644.5
Minimum	6859.35	268.85	1648	29.89	833.01	1922.6
Std. Dev.	4352.891	234.4982	3668.544	20.14986	1223.187	1469.295
Skewness	-0.286502	-0.580279	1.160491	0.311682	0.884933	0.340245
Kurtosis	2.37914	2.197354	4.124626	2.417572	3.46556	2.354426

Jarque-Bera	3.806935	10.61939	35.47597	3.881623	17.86225	4.692435
Observations	128	128	128	128	128	128

	IRSM	ITSM	NSM	OSM	PSM
Mean	4455.622	1254.327	589.6066	537.9906	1926.103
Maximum	6810.94	2124.43	978.54	1200.8	3332.3
Minimum	1849.48	552.77	264.71	372.9	863.3
Std. Dev.	1338.828	422.2817	194.7748	168.4807	610.4763
Skewness	-0.529403	-0.055399	0.251157	2.147047	-0.19859
Kurtosis	2.20288	2.170524	2.045031	7.169113	2.224132
Jarque-Bera	9.367845	3.734968	6.209524	191.044	4.051857
Observations	128	128	128	128	128

Figure 4.2b EUM stock market returns

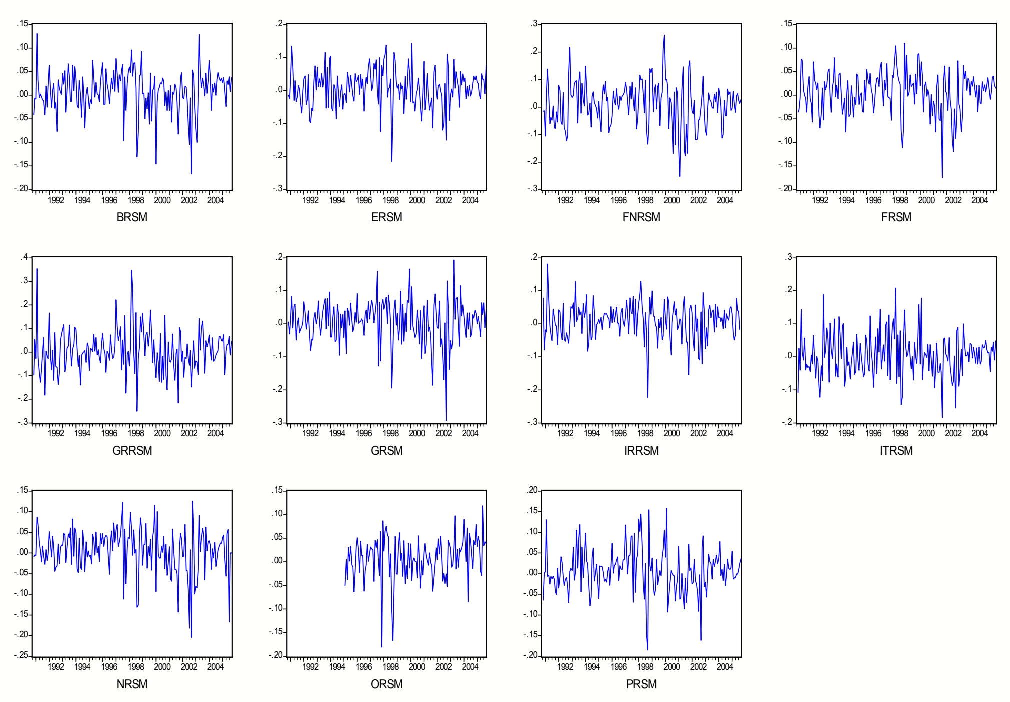

Table 4.2.b	BRSM	ERSM	FNRSM	FRSM	GRRSM	GRSM
Mean	0.009917	0.010592	0.010898	0.007322	0.010674	0.006859
Maximum	0.12895	0.142338	0.261512	0.110146	0.345946	0.193712
Minimum	-0.166222	-0.215142	-0.252379	-0.175032	-0.251423	-0.293327
Std. Dev.	0.04673	0.057274	0.082455	0.045706	0.088068	0.071515
Skewness	-1.115531	-0.633864	-0.32055	-0.810926	0.344694	-0.860137
Kurtosis	5.278176	4.567498	3.658103	4.659231	4.786899	5.365104
Jarque-Bera	53.80421	21.5063	4.466744	28.48743	19.41124	45.25995
Observations	127	127	127	127	127	127

	IRRSM	ITRSM	NRSM	ORSM	PRSM
Mean	0.010129	0.006978	0.00453	0.00829	0.007861
Maximum	0.129283	0.20825	0.125561	0.118795	0.158557
Minimum	-0.223708	-0.184827	-0.204473	-0.180821	-0.18477
Std. Dev.	0.052757	0.06455	0.059555	0.045592	0.0553
Skewness	-1.138054	0.187189	-0.956964	-0.973851	-0.183155
Kurtosis	5.720889	3.85522	4.408987	5.746347	4.72238
Jarque-Bera	66.58984	4.612002	29.88927	59.98617	16.40828
Observations	127	127	127	127	127

Figure 4.3 Belgium Industry portfolios

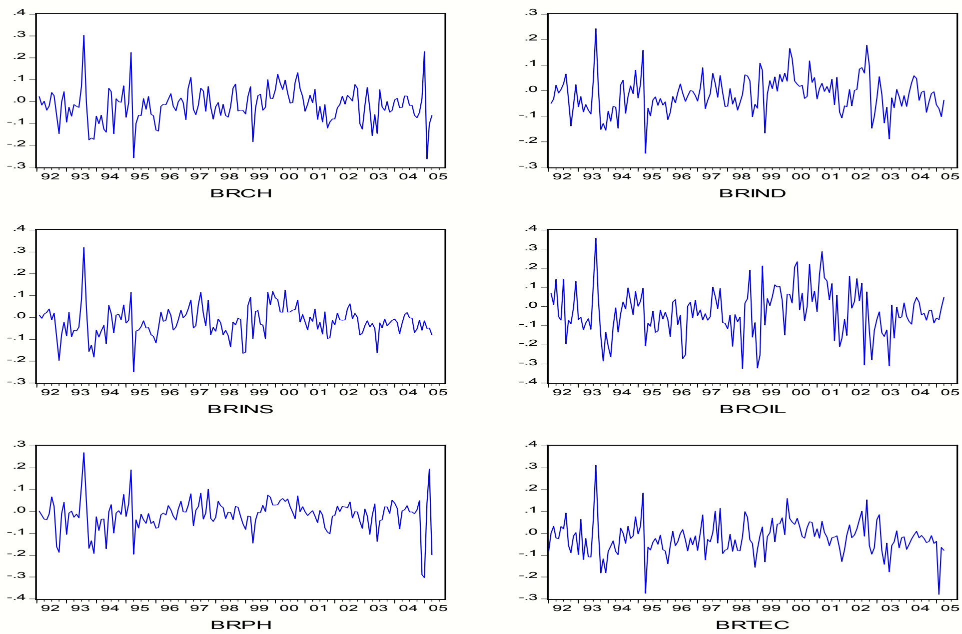

Table 4. 3	BRCH	BRIND	BRINS	BROIL	BRPH	BRTEC
Mean	-0.017412	-0.015464	-0.019222	-0.029575	-0.014361	-0.020977
Maximum	0.303066	0.242961	0.319522	0.358082	0.269138	0.311411
Minimum	-0.261981	-0.245243	-0.248256	-0.323542	-0.302397	-0.27932
Std. Dev.	0.078599	0.071047	0.068491	0.121378	0.072961	0.075433
Skewness	0.254573	0.207847	0.417339	0.035417	-0.589561	0.231564
Kurtosis	5.398965	4.240589	6.660879	3.464403	6.91801	5.992061
Jarque-Bera	39.8445	11.34108	93.40403	1.462054	110.91	60.73082
Observations	159	159	159	159	159	159

Figure 4.4 France Industry portfolios

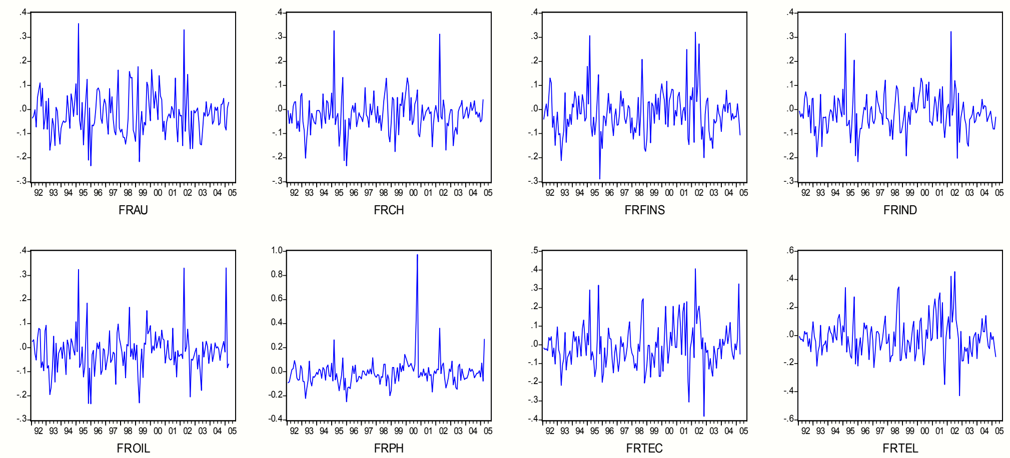

Table 4. 4	FRAU	FRCH	FRFINS	FRIND	FROIL	FRPH	FRTEC	FRTEL
Mean	-0.017438	-0.019247	-0.013494	-0.015475	-0.016441	-0.011559	-0.00705	-0.00837
Maximum	0.356199	0.326519	0.320757	0.323368	0.33072	0.9726	0.406546	0.454317
Minimum	-0.234473	-0.234396	-0.28894	-0.217324	-0.233647	-0.250105	-0.38145	-0.42807
Std. Dev.	0.090861	0.07426	0.091041	0.080126	0.085705	0.116447	0.11649	0.134647
Skewness	0.792515	0.822405	0.653462	0.743927	0.887723	4.303758	0.530068	0.598803
Kurtosis	5.101682	7.784851	5.129369	6.095479	7.068856	35.35974	4.52386	4.52699
Jarque-Bera	45.61846	168.5346	41.0949	77.65503	129.743	7381.508	22.68643	24.79258
Observations	158	158	158	158	158	158	158	158

Figure 4.5 Germany Industry portfolios

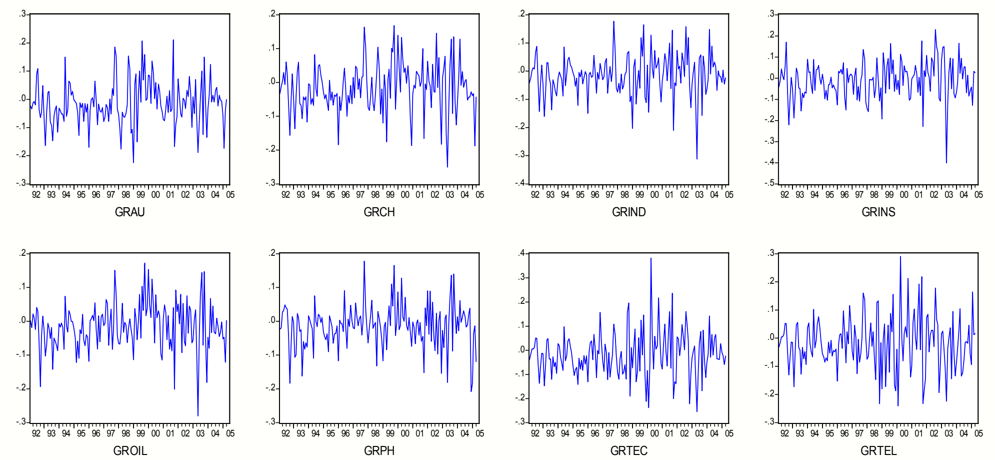

Table 4. 5	GRAU	GRCH	GRIND	GRINS	GROIL	GRPH	GRTEC	GRTEL
Mean	-0.013979	-0.016489	-0.014381	-0.009882	-0.015145	-0.013875	-0.01738	-0.01752
Maximum	0.211476	0.167807	0.177056	0.229835	0.171709	0.177913	0.381253	0.290312
Minimum	-0.224669	-0.250841	-0.311751	-0.400582	-0.280174	-0.208208	-0.25417	-0.24019
Std. Dev.	0.077549	0.072326	0.071942	0.087786	0.067669	0.063565	0.092119	0.092126
Skewness	0.33295	-0.120948	-0.351919	-0.441804	-0.200165	-0.197849	0.591741	0.19137
Kurtosis	3.697705	3.733257	4.838248	4.883882	4.547679	4.350743	4.962403	3.64276
Jarque-Bera	6.162679	3.949694	25.66885	28.68475	16.93068	13.12468	34.79224	3.707554
Observations	159	159	159	159	159	159	159	159

Figure 4.6 Italy Industry portfolios

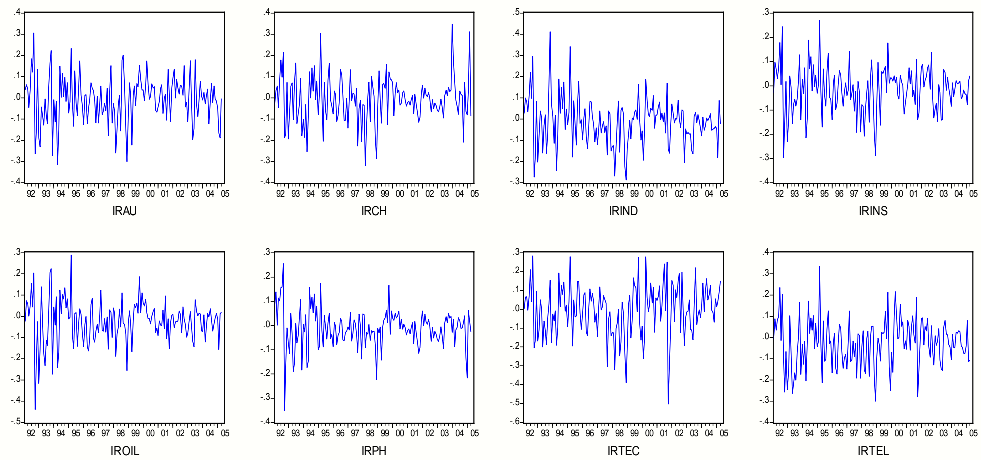

Table 4. 6	IRAU	IRCH	IRIND	IRINS	IROIL	IRPH	IRTEC	IRTEL
Mean	-0.006359	-0.006739	-0.012048	-0.015846	-0.023564	-0.01144	-0.00451	-0.02588
Maximum	0.305898	0.347689	0.412445	0.268807	0.289575	0.255082	0.283929	0.335031
Minimum	-0.313488	-0.320284	-0.287141	-0.297088	-0.438733	-0.352417	-0.50316	-0.30078
Std. Dev.	0.108877	0.104962	0.109035	0.093262	0.100992	0.079651	0.133889	0.110692
Skewness	-0.239661	0.101487	0.374228	-0.176032	-0.450445	-0.400638	-0.46137	0.045305
Kurtosis	3.41567	4.314768	4.665008	3.784427	5.021118	5.505607	3.762692	3.237734
Jarque-Bera	2.666773	11.72502	22.0774	4.897695	32.43946	45.84575	9.49457	0.428821
Observations	159	159	159	159	159	159	159	159

Figure 4. 7 Netherlands Industry portfolios

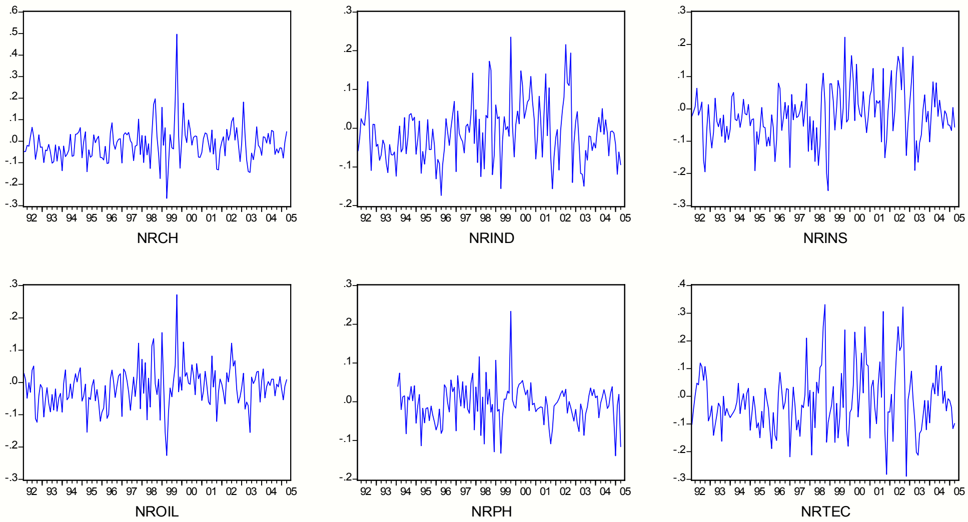

Table 4. 7	NRCH	NRIND	NRINS	NROIL	NRPH	NRTEC
Mean	-0.007302	-0.008704	-0.014302	-0.011144	-0.006478	-0.014297
Maximum	0.497245	0.235593	0.221758	0.271802	0.233673	0.33096
Minimum	-0.266657	-0.173929	-0.253623	-0.226727	-0.139719	-0.289963
Std. Dev.	0.085733	0.077462	0.085199	0.064869	0.051691	0.117445
Skewness	1.525559	0.544815	0.025067	0.365946	0.329941	0.60442
Kurtosis	11.31103	3.573919	3.266119	5.812789	5.954503	3.719965
Jarque-Bera	440.9022	8.531296	0.412496	47.51689	51.55048	11.1355
Observations	158	158	158	158	135	158

Table A1

Estimates of Regime Switching Model for European Stock Markets Returns

This table reports estimation results for the model

$$X_{i,t} = \phi_{0,s_t} + \phi_i X_{i,t-n} + \mu_t$$

Where s_t is governed by an unobservable, discrete, first order Markov chain that can assume *k* values (states), $\mu_t \sim i.i.d.\mathrm{N}(0,\sigma^2_{st})$. and i=1,2,3,…n indexes returns on European Stock markets. Data are monthly and obtained from Datastream, IMF - Financial Statistics and National Central Banks datasets. The sample period is 1991:01 – 2005:09. P-values are reported in parentheses.

	Italy		***Germany***		***France***		***Spain***	
Parameter	Linear	Markov	Linear	Markov	Linear	Markov	Linear	Markov
$\phi_{0,1}$	0.007 (0.148)	0.006 (0.000)	0.007 (0.150)	0.0358 (0.000)	0.004 (0.162)	0.005 (0.000)	0.008 (0.049)	0.009 (0.000)
$\phi_{0,2}$		0.059 (0.003)		0.023 (0.016)		0.034 (0.000)		0.021 (0.001)

ϕ_i	-0.049 (0.509)	-0.021 (0.001)	-0.006 (0.963)	0.042 (0.002)	0.307 (0.000)	0.345 (0.001)	0.075 (0.318)	0.078 (0.085)
p_{11}		0.909		0.980		0.977		0.902
p_{22}		0.943		0.990		0.943		0.886
σ^2_u	0.0041	0.004	0.0043	0.004	0.0027	0.0019	0.0035	0.003
σ^2_{S1}		0.034		0.0854		0.035		0.071)
σ^2_{S2}		0.078		0.0421		0.059		0.036
Log-likelihood	235.59	246.76	294.21	296.39	258.66	261.36	259.28	259.40
AIC	-2.62	-2.73	-2.61	-2.65	-3.57	-3.77	-2.89	-2.88
LR test	9.54 (0.068)		15.89 (0.013)		21.73 (0.012)		17.40 (0.063)	

The bottom row concerns the Hansen test (linearity versus two-states Markov switching model). It represents standardised likelihood ratio statistics for the model of each country. The asymptotic p-values are calculated according to the Hansen (1992)'s method. The p-value is calculated according to the method described in Hansen (1992, 1996), using Rats procedures based on 1,000 random draws from the relevant limiting Gaussian processes (see Hansen, 1992 for details).

	Belgium		***Netherlands***		***Austria***		***Portugal***	
Parameter	Linear	Markov	Linear	Markov	Linear	Markov	Linear	Markov
$\phi_{0,1}$	0.008 (0.020)	0.021 (0.000)	0.006 (0.163)	0.121 (0.000)	0.002 (0.000)	0.019 (0.112)	0.006 (0.114)	0.016 (0.000)
$\phi_{0,2}$		0.033 (0.005)		0.063 (0.003)		0.054 (0.010)		0.008 (0.001)
ϕ_i	0.164 (0.027)	0.147 (0.000)	0.044 (0.562)	0.040 (0.000)	-0.126 (0.000)	0.036 (0.000)	0.186 (0.012)	0.092 (0.005)
p_{11}		0.892		0.944		0.972		0.89
p_{22}		0.958		0.904		0.945		0.92
σ^2_u	0.002	0.0015	0.0029	0.022	0.009	0.002	0.003	0.002
σ^2_{S1}		0.065		0.033		0.033		0.074
σ^2_{S2}		0.033		0.075		0.065		0.029
Log-likelihood	306.37	310.89	238.90	239.24	253.54	255.72	287.75	288.97
AIC	-3.41	-3.45	-2.99	-3.28	-1.82	-2.63	-3.06	-3.37
LR test	12.77 (0.052)		18.59 (0.047)		15.26 (0.096)		9.91 (0.061)	

The bottom row concerns the Hansen test (linearity versus two-states Markov switching model). It represents standardised likelihood ratio statistics for the model of each country. The asymptotic p-values are calculated according to the Hansen (1992)'s method. The p-value is calculated according to the method described in Hansen (1992, 1996), using Rats procedures based on 1,000 random draws from the relevant limiting Gaussian processes (see Hansen, 1992 for details).

	Ireland		***Greece***		***Finland***		
Parameter	Linear	Markov	Linear	Markov	Linear	Markov	
$\phi_{0,1}$	0.008	0.029	0.006	0.082	0.007	0.055	

	(0.035)	(0.010)	(0.300)	(0.000)	(0.202)	(0.000)	
$\phi_{0,2}$		0.014 (0.000)		0.018 (0.000)		0.017 (0.000)	
ϕ_i	0.092 (0.218)	0.079 (0.000)	0.067 (0.369)	0.028 (0.013)	0.368 (0.000)	0.104 (0.001)	
p_{11}		0.921		0.963		0.977	
p_{22}		0.947		0.977		0.964	
σ^2_u	0.003	0.002	0.008	0.004	0.008	0.006	
σ^2_{S1}		0.069		0.049		0.055	
σ^2_{S2}		0.041		0.104		0.105	
Log-likelihood	324.47	326.56	180.11	180.94	223.06	235.37	
AIC	-3.03	-3.51	-2.01	-1.99	-2.34	-2.63	
LR test	15.02 (0.014)		10.23 (0.036)		10.87 (0.051)		

The bottom row concerns the Hansen test (linearity versus two-states Markov switching model). It represents standardised likelihood ratio statistics for the model of each country. The asymptotic p-values are calculated according to the Hansen (1992)'s method. The p-value is calculated according to the method described in Hansen (1992, 1996), using Rats procedures based on 1,000 random draws from the relevant limiting Gaussian processes (see Hansen, 1992 for details).

Table A2

Estimates of Regime Switching Model for European Stock Markets Returns and Monetary Policy Innovations

This table reports estimation results for the model

$$X_{i,t} = \phi_0 s_t + \phi_i X_{i,t-n} + \phi_r s_t r_t + \mu_t$$

Where s_t is governed by an unobservable, discrete, first order Markov chain that can assume *k* values (states), $\mu_t \sim i.i.d.\mathrm{N}(0, \sigma^2_{st})$. , r_t is the innovation in monetary policy and i=1,2,3,…n indexes returns on European Stock markets. Data are monthly and obtained from Datastream, IMF - Financial Statistics and National Central Banks dataset. The sample period is 1991:01 – 2005:09. P-values are reported in parentheses.

	Italy		***Germany***		***France***		***Spain***	
Parameter	Linear	Markov	Linear	Markov	Linear	Markov	Linear	Markov
$\phi_{0,1}$	0.007 (0.104)	0.041 (0.005)	0.007 (0.178)	0.0321 (0.001)	0.004 (0.157)	0.051 (0.026)	0.008 (0.048)	0.012 (0.011)
$\phi_{0,2}$		0.007 (0.000)		0.0065 (0.000)		0.0607 (0.000)		0.025 (0.000)
ϕ_i	-0.062 (0.380)	0.076 (0.001)	-0.005 (0.945)	0.0056 (0.000)	0.304 (0.000)	0.047 (0.000)	0.073 (0.333)	0.036 (0.000)
$\phi_{r,1}$	-0.043 (0.000)	-0.044 (0.005)	-0.043 (0.134)	-0.037 (0.015)	-0.005 (0.297)	-0.0117 (0.005)	-0.018 (0.635)	-0.0223 (0.003)
$\phi_{r,2}$		0.0726 (0.045)		-0.0796 (0.000)		-0.0921 (0.000)		-0.0176 (0.065)
p_{11}		0.916		0.978		0.977		0.901
p_{22}		0.929		0.981		0.943		0.887
σ^2_u	0.004	0.003	0.005	0.004	0.0024	0.0018	0.0036	0.0031
σ^2_{S1}		0.035		0.084		0.035		0.070
σ^2_{S2}		0.076		0.041		0.059		0.034

Log-likelihood	246.77	255.75	236.06	251.73	314.75	325.02	259.40	263.60
AIC	-2.72	-2.80	-2.60	-2.76	-3.48	-3.57	-2.86	-2.89
LR test	11.40 (0.043)		14.34 (0.017)		22.13 (0.005)		12.92 (0.028)	

The bottom row concerns the Hansen test (linearity versus two-states Markov switching model). It represents standardised likelihood ratio statistics for the model of each country. The asymptotic p-values are calculated according to the Hansen (1992)'s method. The p-value is calculated according to the method described in Hansen (1992, 1996), using Rats procedures based on 1,000 random draws from the relevant limiting Gaussian processes (see Hansen, 1992 for details).

	Belgium		***Netherlands***		***Austria***		***Portugal***	
Parameter	Linear	Markov	Linear	Markov	Linear	Markov	Linear	Markov
$\phi_{0,1}$	0.007 (0.015)	0.025 (0.000)	0.006 (0.134)	0.006 (0.005)	0.002 (0.000)	0.009 (0.014)	0.006 (0.114)	0.008 (0.001)
$\phi_{0,2}$	(0.000)	0.033 (0.000)		0.012 (0.000)		0.045 (0.000)		0.189 (0.000)
ϕ_i	0.175 (0.016)	0.032 (0.000)	0.045 (0.549)	0.027 (0.041)	-0.125 (0.000)	0.081 (0.036)	0.185 (0.013)	0.081 (0.000)
$\phi_{r,1}$	-0.03 (0.002)	-0.037 (0.000)	-0.017 (0.410)	-0.081 (0.000)	0.026 (0.000)	-0.306 (0.000)	-0.005 (0.763)	-0.056 (0.005)
$\phi_{r,2}$		-0.043 (0.001)		-0.108 (0.045)		-0.0287 (0.138)		0.0611 (0.112)
p_{11}		0.911		0.946		0.973		0.895
p_{22}		0.968		0.900		0.946		0.925
σ^2_u	0.002	0.0011	0.003	0.002	0.009	0.002	0.0032	0.0024
σ^2_{S1}		0.065		0.035		0.034		0.074
σ^2_{S2}		0.034		0.077		0.035		0.029
Log-likelihood	310.89	316.98	269.12	282.32	164.48	219.19	274.63	288.75
AIC	-3.44	-3.48	-2.89	-3.09	-1.80	-2.39	-3.03	-3.17
LR test	12.01 (0.039)		22.04 (0.004)		16.41 (0.091)		11.87 (0.041)	

The bottom row concerns the Hansen test (linearity versus two-states Markov switching model). It represents standardised likelihood ratio statistics for the model of each country. The asymptotic p-values are calculated according to the Hansen (1992)'s method. The p-value is calculated according to the method described in Hansen (1992, 1996), using Rats procedures based on 1,000 random draws from the relevant limiting Gaussian processes (see Hansen, 1992 for details).

	Ireland		***Greece***		***Finland***	
Parameter	Linear	Markov	Linear	Markov	Linear	Markov
$\phi_{0,1}$	0.008 (0.035)	0.009 (0.000)	0.007 (0.277)	0.0015 (0.025)	0.007 (0.199)	0.005 (0.000)
$\phi_{0,2}$		0.025 (0.018)		0.0308 (0.000)		0.003 (0.000)
ϕ_i	0.097 (0.201)	0.101 (0.000)	0.056 (0.451)	0.002 (0.035)	0.367 (0.000)	0.035 (0.000)
$\phi_{r,1}$	-0.016 (0.660)	-0.010 (0.005)	-0.076 (0.201)	-0.064 (0.133)	-0.017 (0.733)	0.059 (0.036)
$\phi_{r,2}$		-0.0385 (0.045)		-0.0847 (0.000)		-0.129 (0.086)
p_{11}		0.920		0.965		0.977
p_{22}		0.947		0.978		0.964
σ^2_u	0.006	0.003	0.008	0.006	0.006	0.004
σ^2_{S1}		0.069		0.049		0.055

σ^2_{S2}		0.040		0.104		0.114	
Log-likelihood	271.80	282.10	180.94	190.73	210.45	217.65	
AIC	-3.00	-3.09	-1.99	-2.07	-2.31	-2.37	
LR test	10.08 (0.000)		20.60 (0.016)		9.39 (0.067)		

The bottom row concerns the Hansen test (linearity versus two-states Markov switching model). It represents standardised likelihood ratio statistics for the model of each country. The asymptotic p-values are calculated according to the Hansen (1992)'s method. The p-value is calculated according to the method described in Hansen (1992, 1996), using Rats procedures based on 1,000 random draws from the relevant limiting Gaussian processes (see Hansen, 1992 for details).

Table A3

Estimates of Regime Switching Model for Industry portfolios in five European countries and Monetary Policy Innovations

This table reports estimation results for the model

$$y_{i,t} = \Gamma_0 s_t + \Gamma_i y_{i,t-n} + \Gamma_r s_t r_t + \varepsilon_t$$

Where s_t is governed by an unobservable, discrete, first order Markov chain that can assume *k* values (states), $\varepsilon_t \sim i.i.d.\mathrm{N}(0,\sigma^2_{s_t})$., r_t is the innovation in monetary policy and i=1,2,3,…n indexes returns on single country industry portfolios. Data are monthly and obtained from Datastream, IMF - Financial Statistics and National Central Banks dataset. The sample period is 1991:01 – 2005:09. P-values are reported in parentheses.

ITALY	***CH***	***PH***	***IND***	***INS***	***OIL***	***TEC***	***AU***	***TEL***
Parameter								
$\Gamma_{0,1}$	-0.0048 (0.016)	0.055 (0.005)	0.035 (0.006)	0.0983 (0.000)	0.0047 (0.022)	0.0164 (0.000)	0.0552 (0.000)	0.014 (0.001)
$\Gamma_{0,2}$	-0.0059 (0.009)	0.0134 (0.000)	0.0112 (0.000)	0.0016 (0.000)	0.0308 (0.005)	-0.0291 (0.001)	0.0114 (0.000)	0.0065 (0.005)
Γ_i	0.193 (0.007)	0.066 (0.001)	0.071 (0.000)	0.076 (0.001)	0.0204 (0.035)	-0.0081 (0.097)	0.0263 (0.054)	0.064 (0.027)
$\Gamma_{r,0,1}$	-0.021 (0.000)	-0.020 (0.018)	-0.054 (0.004)	-0.043 (0.000)	-0.039 (0.000)	-0.072 (0.052)	-0.043 (0.000)	-0.057 (0.000)
$\Gamma_{r,0,2}$	-0.034 (0.000)	-0.019 (0.005)	-0.061 (0.000)	-0.047 (0.000)	0.0046 (0.045)	-0.103 (0.024)	-0.066 (0.000)	-0.116 (0.001)
p_{11}	0.979	0.952	0.807	0.895	0.991	0.975	0.931	0.832
p_{22}	0.949	0.985	0.847	0.845	0.954	0.989	0.923	0.955
σ^2_u	0.006	0.007	0.007	0.003	0.005	0.012	0.007	0.007
σ^2_{S1}	0.090	0.018	0.036	0.041	0.047	0.014	0.055	0.134
σ^2_{S2}	0.017	0.093	0.115	0.082	0.127	0.008	0.115	0.062
Log-likelihood	201.52	208.55	186.36	235.35	340.70	132.93	173.01	179.00
AIC	-2.20	-2.27	-2.03	-2.57	-3.75	-1.43	-1.88	-1.94

FRANCE	***CH***	***PH***	***IND***	***INS***	***OIL***	***TEC***	***AU***	***TEL***
Parameter								
$\Gamma_{0,1}$	-0.091 (0.054)	0.063 (0.005)	0.036 (0.000)	0.0151 (0.001)	0.0077 (0.018)	0.0221 (0.006)	0.0257 (0.000)	0.006 (0.000)
$\Gamma_{0,2}$	0.0106 (0.011)	0.083 (0.022)	0.0954 (0.020)	0.0065 (0.000)	0.0362 (0.005)	0.0614 (0.001)	0.0154 (0.000)	0.0183 (0.000)

Γ_i	0.1306 (0.005)	0.095 (0.001)	0.0241 (0.000)	0.0198 (0.010)	0.0417 (0.000)	0.0296 (0.000)	0.0170 (0.005)	0.0301 (0.000)
$\Gamma_{r,0,1}$	-0.084 (0.033)	-0.086 (0.001)	-0.069 (0.005)	-0.014 (0.005)	-0.011 (0.014)	-0.061 (0.040)	-0.081 (0.034)	-0.0094 (0.015)
$\Gamma_{r,0,2}$	-0.089 (0.005)	-0.085 (0.047)	-0.074 (0.000)	-0.052 (0.085)	-0.046 (0.105)	-0.079 (0.000)	-0.088 (0.001)	-0.017 (0.015)
p_{11}	0.833	0.888	0.834	0.833	0.987	0.988	0.833	0.984
p_{22}	0.829	0.985	0.822	0.821	0.952	0.955	0.823	0.920
σ^2_u	0.004	0.009	0.003	0.003	0.002	0.002	0.005	0.002
σ^2_{S1}	0.031	0.682	0.034	0.044	0.041	0.040	0.080	0.044
σ^2_{S2}	0.054	0.048	0.065	0.098	0.067	0.068	0.053	0.071
Log-likelihood	273.53	243.41	252.25	206.99	261.36	258.66	202.03	269.72
AIC	-3.00	-2.66	-2.76	-2.26	-2.86	-2.83	-2.20	-2.96

GERMANY	***CH***	***PH***	***IND***	***INS***	***OIL***	***TEC***	***AU***	***TEL***
Parameter								
$\Gamma_{0,1}$	0.0152 (0.000)	0.0011 (0.000)	0.0061 (0.000)	0.0128 (0.005)	0.0275 (0.000)	0.0746 (0.000)	0.0117 (0.005)	0.0712 (0.000)
$\Gamma_{0,2}$	-0.098 (0.000)	0.0268 (0.003)	0.0712 (0.000)	-0.178 (0.000)	-0.0217 (0.001)	0.0422 (0.000)	-0.0145 (0.011)	0.0318 (0.005)
Γ_i	0.102 (0.086)	0.0904 (0.001)	0.0309 (0.000)	0.0925 (0.005)	0.0488 (0.000)	0.0223 (0.049)	0.0152 (0.000)	0.0173 (0.093)
$\Gamma_{r,0,1}$	-0.0177 (0.005)	-0.092 (0.000)	-0.015 (0.037)	-0.0189 (0.035)	-0.0367 (0.000)	-0.005 (0.000)	-0.022 (0.024)	-0.014 (0.000)
$\Gamma_{r,0,2}$	-0.023 (0.035)	-0.118 (0.005)	-0.037 (0.000)	-0.051 (0.000)	-0.039 (0.015)	-0.026 (0.001)	-0.047 (0.000)	-0.021 (0.000)
p_{11}	0.916	0.982	0.954	0.678	0.986	0.976	0.920	0.990
p_{22}	0.916	0.982	0.954	0.978	0.986	0.976	0.92	0.985
σ^2_u	0.972	0.943	0.963	0.971	0.984	0.952	0.966	0.986
σ^2_{S1}	0.073	0.018	0.072	0.045	0.039	0.107	0.099	0.112
σ^2_{S2}	0.040	0.066	0.031	0.098	0.058	0.041	0.044	0.043
Log-likelihood	252.57	363.62	253.75	212.06	167.82	197.73	222.97	178.50
AIC	-2.77	-4.01	-2.78	-2.31	-1.82	-2.15	-2.43	-1.94

NETHERLANDS	***CH***	***PH***	***IND***	***INS***	***OIL***	***TEC***
Parameter						
$\Gamma_{0,1}$	0.0312 (0.005)	0.0141 (0.007)	0.0092 (0.038)	0.0269 (0.011)	0.0176 (0.001)	0.0139 (0.005)
$\Gamma_{0,2}$	0.0193 (0.000)	0.0169 (0.000)	0.0704 (0.001)	0.0122 (0.000)	0.0288 (0.005)	0.0677 (0.000)
Γ_i	0.0242 (0.001)	0.0186 (0.000)	0.0284 (0.001)	0.0302 (0.001)	0.0424 (0.000)	0.0254 (0.001)
$\Gamma_{r,0,1}$	0.0096 (0.056)	-0.0012 (0.005)	-0.036 (0.005)	-0.0097 (0.000)	0.0013 (0.052)	-0.031 (0.006)
$\Gamma_{r,0,2}$	-0.098 (0.020)	-0.027 (0.000)	-0.075 (0.000)	-0.0179 (0.005)	-0.0109 (0.104)	-0.055 (0.000)
p_{11}	0.919	0.932	0.916	0.932	0.932	0.988
p_{22}	0.979	0.927	0.974	0.974	0.927	0.981
σ^2_u	0.004	0.002	0.004	0.005	0.002	0.011
σ^2_{S1}	0.103	0.029	0.102	0.105	0.029	0.068
σ^2_{S2}	0.043	0.051	0.044	0.051	0.052	0.132
Log-likelihood	233.92	324.48	230.80	203.36	279.91	315.02
AIC	-2.56	-3.57	-2.52	-2.22	-3.07	-3.46

BELGIUM	***CH***	***PH***	***IND***	***INS***	***OIL***	***TEC***
Parameter						
$\Gamma_{0,1}$	0.0177 (0.000)	0.0044 (0.001)	0.0022 (0.000)	0.0134 (0.002)	0.0064 (0.000)	0.0092 (0.015)
$\Gamma_{0,2}$	0.0148 (0.008)	0.0352 (0.000)	0.0926 (0.024)	0.0582 (0.004)	0.0078 (0.001)	0.0130 (0.000)
Γ_i	0.0200 (0.014)	0.0361 (0.000)	0.0106 (0.005)	0.0281 (0.045)	0.0186 (0.000)	0.0197 (0.005)

$\Gamma_{r,0,1}$	-0.032 (0.000)	-0.0101 (0.005)	-0.0105 (0.022)	-0.065 (0.005)	-0.0029 (0.000)	-0.0168 (0.005)
$\Gamma_{r,0,2}$	-0.036 (0.000)	-0.047 (0.005)	-0.016 (0.000)	-0.066 (0.085)	-0.0107 (0.000)	-0.0291 (0.000)
p_{11}	0.544	0.865	0.988	0.989	0.897	0.867
p_{22}	0.987	0.982	0.967	0.974	0.902	0.754
σ^2_u	0.003	0.014	0.002	0.004	0.002	0.010
σ^2_{S1}	0.148	0.392	0.055	0.062	0.026	0.125
σ^2_{S2}	0.045	0.021	0.027	0.079	0.055	0.046
Log-likelihood	255.72	333.46	264.21	146.66	158.22	143.64
AIC	-2.80	-3.67	-2.90	-1.58	-1.71	-1.50

Table A4

Conditional of being in state one or two, the expected duration of a typical "bull" and "bear" market in European Stock Markets Returns

This table reports duration results for the model

$$X_{i,t} = \phi_0 s_t + \phi_i X_{i,t-n} + \mu_t$$

	Italy	*Belgium*	*Germany*	*Portugal*	*France*	*Austria*	*Spain*	*Greece*
Duration								
Bull State 1 [1/(1- p_{11})]	10.989	9.259	35.714	9.090	43.478	35.714	10.204	27.027
Bear State 2 [1/(1- p_{22})]	17.543	23.809	55.555	12.5	17.543	18.181	8.7719	43.478
	Ireland	*Finland*	*Netherlands*	**Average Duration**				
Bull State 1 [1/(1- p_{11})]	12.658	43.478	17.857	23.224				
Bear State 2 [1/(1- p_{22})]	18.867	27.777	10.416	23.131				

Table A5

Conditional of being in state one or two, the expected duration of a typical "bull" and "bear" market in European Stock Markets Returns

This table reports duration results for the model

$$X_{i,t} = \phi_0 s_t + \phi_i X_{i,t-n} + \phi_r s_t r_t + \varepsilon_t$$

	Italy	*Belgium*	*Germany*	*Portugal*	*France*	*Austria*	*Spain*	*Greece*
Duration								

Bull State 1 [1/(1- p_{11})]	11.904	11.235	41.667	9.524	43.478	37.037	10.101	28.571
Bear State 2 [1/(1- p_{22})]	14.084	31.250	52.631	13.334	17.543	18.518	8.849	45.454
	Ireland	***Finland***	***Netherlands***	**Average Duration**				
Bull State 1 [1/(1- p_{11})]	12.50	43.478	18.518	24.3648				
Bear State 2 [1/(1- p_{22})]	18.867	27.778	10.0	23.482545				

Table A6

Conditional of being in state one or two, the expected duration of a typical "bull" and "bear" market in Industry portfolios

This table reports duration results for the model

$$y_{i,t} = \Gamma_0 s_t + \Gamma_i y_{i,t-n} + \Gamma_r s_t r_t + \mu_t$$

Italy	***CH***	***PH***	***IND***	***INS***	***OIL***	***TEC***	***AU***	***TEL***	**Average Duration**
Duration									
Bull State 1 [1/(1-p_{11})]	47.619	20.834	5.181	9.523	111.11	40.0	14.492	5.952	31.839
Bear State 2 [1/(1-p_{22})]	19.607	66.667	6.5359	6.451	21.739	90.909	12.987	22.223	30.889

France	***CH***	***PH***	***IND***	***INS***	***OIL***	***TEC***	***AU***	***TEL***	**Average Duration**
Duration									
Bull State 1 [1/(1-p_{11})]	5.988	8.928	6.024	5.988	76.923	77.923	5.988	62.5	33.176
Bear State 2 [1/(1-p_{22})]	5.847	66.667	5.617	5.586	20.833	22.223	5.649	12.5	25.407

Germany	***CH***	***PH***	***IND***	***INS***	***OIL***	***TEC***	***AU***	***TEL***	**Average Duration**
Duration									
Bull State 1 [1/(1-p_{11})]	11.905	55.556	21.739	45.455	71.429	41.667	12.500	66.667	40.864
Bear State 2 [1/(1-p_{22})]	35.714	17.544	27.027	34.483	62.500	20.833	29.412	71.429	37.368

Belgium	***CH***	***PH***	***IND***	***INS***	***OIL***	***TEC***	**Average Duration**
Duration							
Bull State 1 [1/(1-p_{11})]	12.346	14.706	11.905	14.706	14.706	83.333	25.284
Bear State 2 [1/(1-p_{22})]	47.619	13.699	38.462	38.462	13.699	52.632	34.095

Netherland	***CH***	***PH***	***IND***	***INS***	***OIL***	***TEC***	**Average Duration**
Duration							
Bull State 1 [1/(1-p_{11})]	2.193	7.407	83.333	90.909	9.709	7.519	33.512
Bear State 2 [1/(1-p_{22})]	76.923	55.556	30.303	38.462	10.204	4.065	35.919

Figure 4.8 Smoothed Probabilities EUM Stock Markets Returns

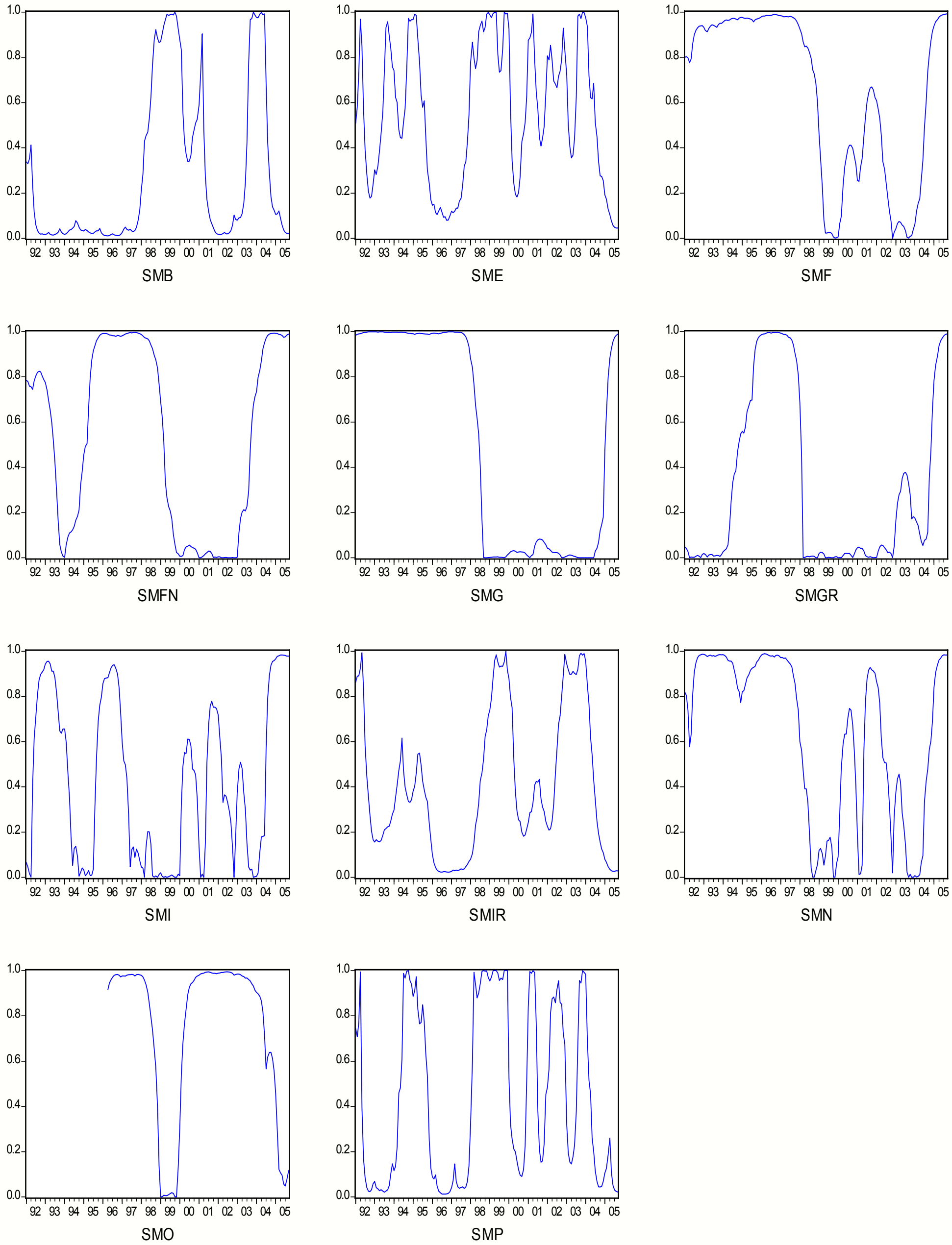

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Figure 4.9 Smoothed Probabilities Belgium Industry Portfolios

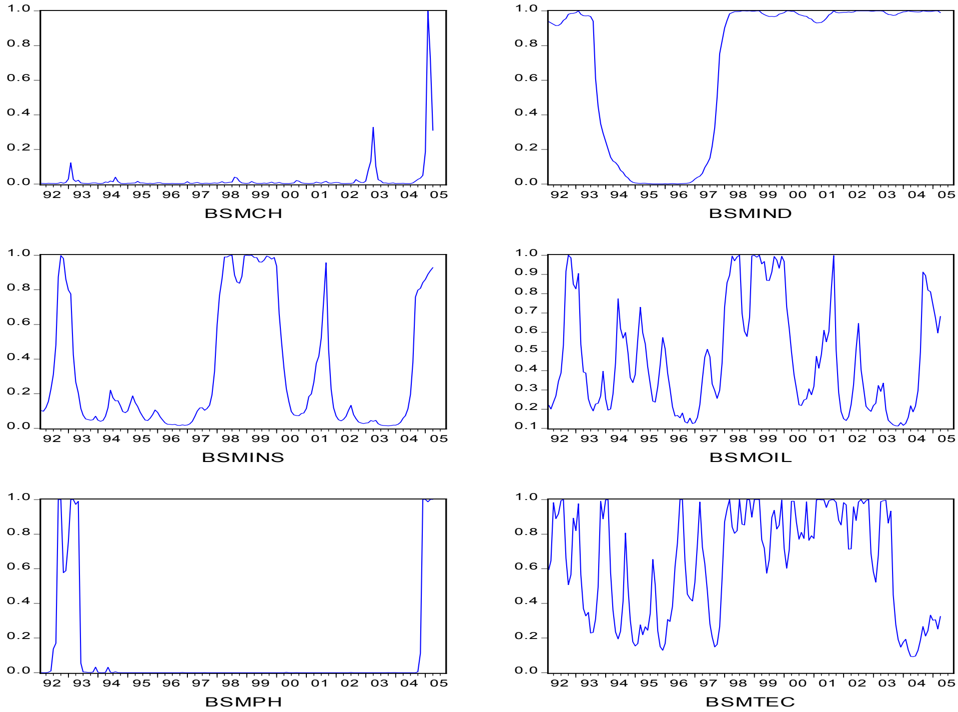


Figure 4.10 Smoothed Probabilities Netherlands Industry Portfolios

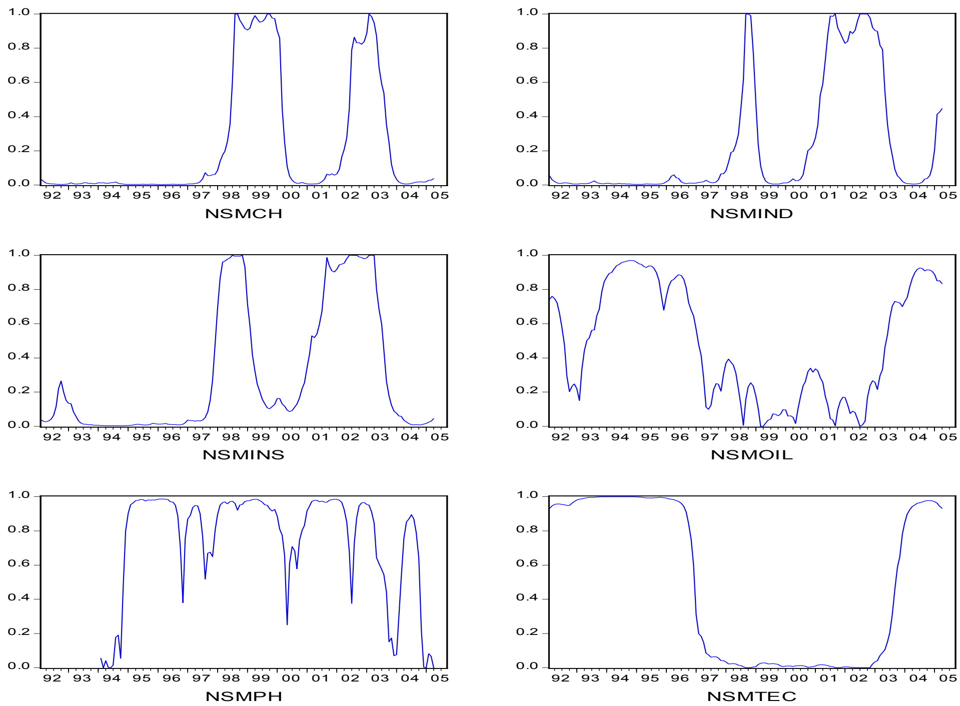


Figure 4.11 Smoothed Probabilities France Industry Portfolios

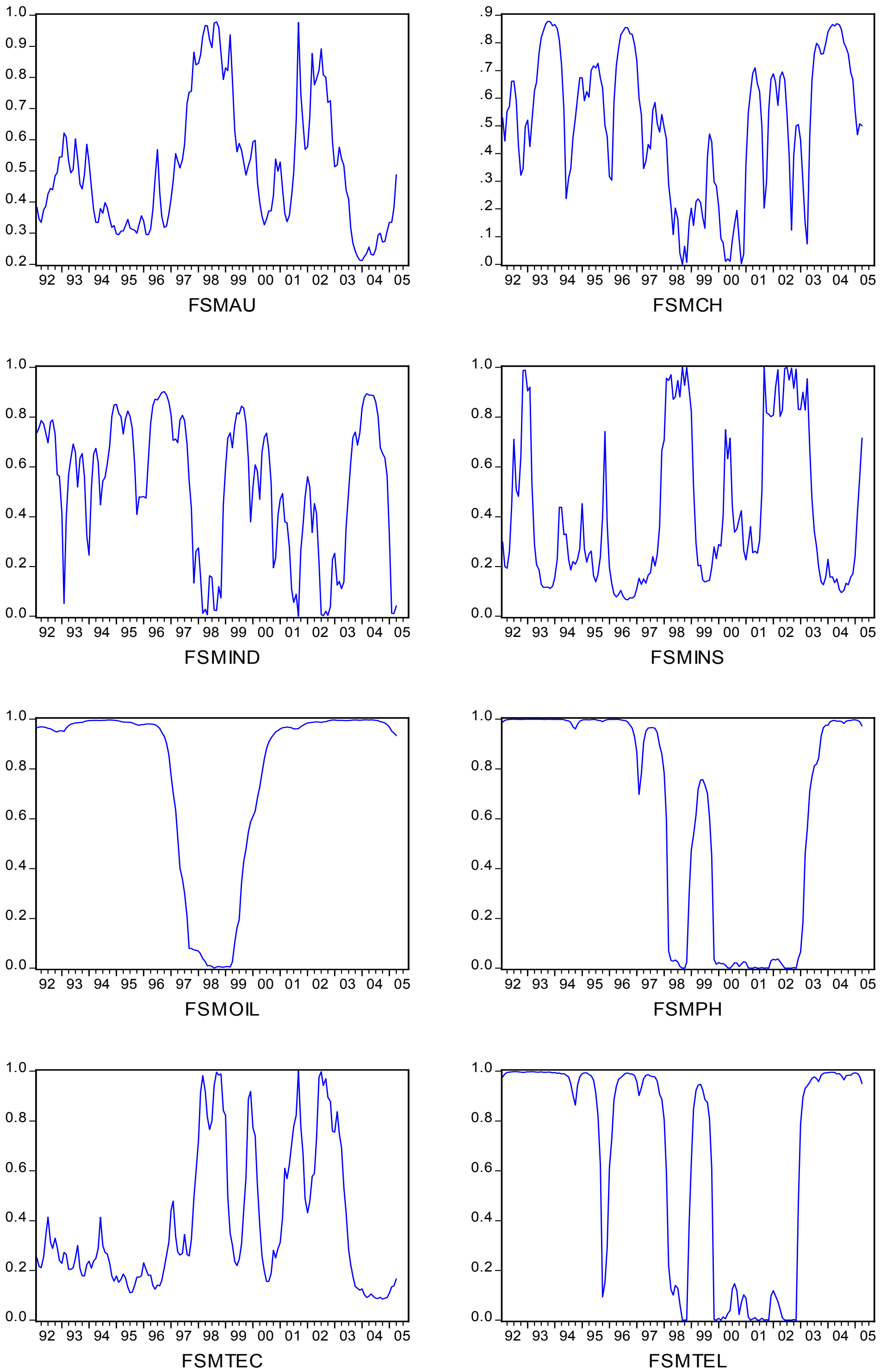


Figure 4.12 Smoothed Probabilities Italy Industry Portfolios

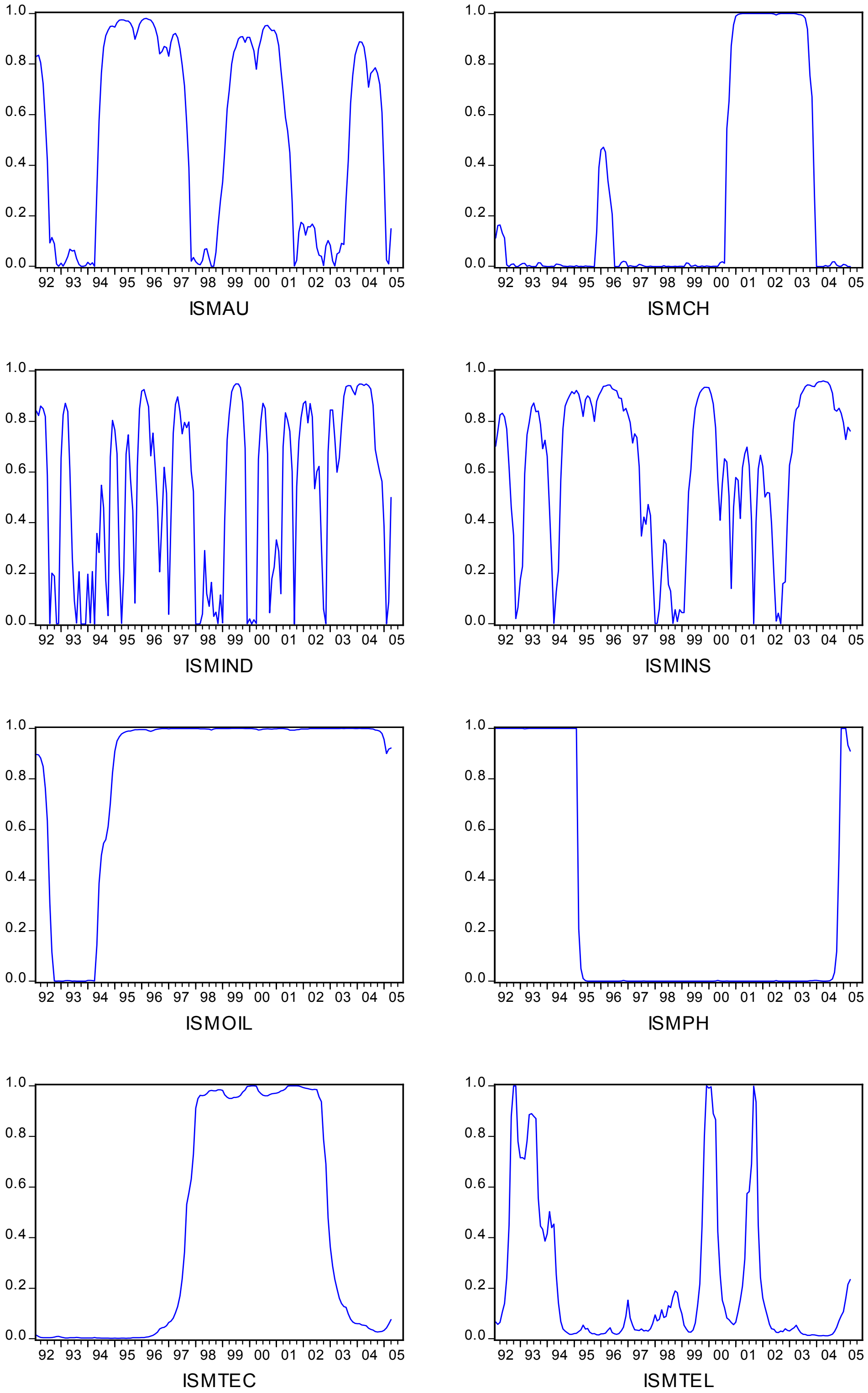
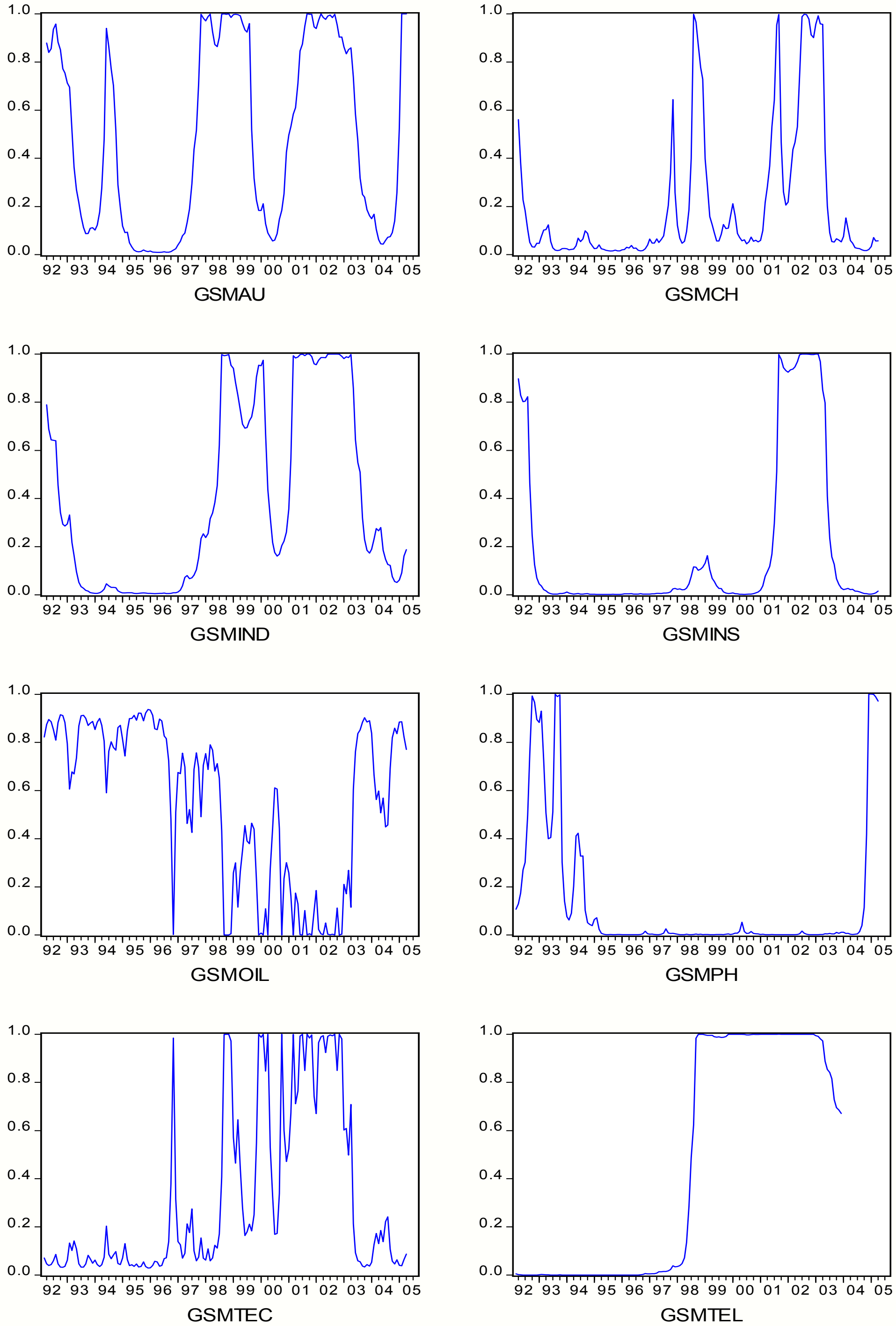


Figure 4.13 Smoothed Probabilities Germany Industry Portfolios



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References

Akifumi Isogai, Satoru Kanoh, and Toshifumi Tokunaga, 2004, An Extension of the Markov-Switching Model with Time-Varying Transition Probabilities: Bull-Bear Analysis of the Japanese Stock Market, Institute of Economic Research Hitotsubashi University, Discussion paper, No.43, November.

Ammer, John and Jianping Mei, 1996, Measuring International Economic Linkages with Stock Market Data, *Journal of Finance* 51, 1743-1763.

Ball L. 1997, “Efficient rules for monetary policy”, *Reserve Bank of New Zealand Discussion Paper* G97/3.

Batini N. and A. Haldane, 1998, “Forward looking for monetary policy”, paper presented at the NBER conference on “Monetary policy rules” held on 15-17 January 1998.

Bauer, Gregory H. and Clara Vega, 2005, The Monetary Origins of Asymmetric Information in International Equity Markets, Working Paper University of Rochester’s the William E. Simon School of Business.

Bernanke B. and I. Mihov 1997, “What does the Bundesbank target?”, *European Economic Review* 41, p 1025-1054.

Bernanke, Ben S. and Kenneth Kuttner, 2005, What Explains the Stock Market’s Reaction to Federal Reserve Policy?, *Journal of Finance* 60, 1221-1257.

Bullard, J. B., and Schaling, E., 2002, Why the FED should ignore the stock market, The Federal Bank of St. Louis review, March/April.

Chen, Shiu-Sheng *2006, Does Monetary Policy Have Asymmetric Effects on Stock Returns?,* Journal of Money, Credit, and Banking forthcoming.

Clarida R, Galí J. and M. Gertler 1998, “Monetary policy rules in practice: some international evidence”, *European Economic Review*, 42, 1033-1068.

Dornbusch R, Favero C. and F. Giavazzi 1998, “Immediate challenges for the European Central Bank”, *Economic Policy*, 26, April 1998.

Campbell, John Y., 1991, A Variance Decomposition for Stock Returns, *Economic Journal* 101, 157-179.

Diebold, F., Lee. J-H and G. Weinbach, 1994, Regime Switching with Time-Varying Transition Probabilities, *Non-stationary Time Series Analysis and Cointegration,* ed. C. Hargreaves, Oxford University Press, Oxford, U.K.

Driffill, J., Sola, M., 1998, Intrinsic Bubbles and Regime Switching, *Journal of Monetary Economics 42, 1998.*

Durham, J. Benson, 2001, The Effect of Monetary Policy on Monthly and Quarterly Stock Market Returns: Cross-Country Evidence and Sensitivity Analyses, Board of Governors of the Federal Reserve System Finance and Economics Discussion Paper No. 2001-42.

Ehrmann, Michael and Marcel Fratzscher, 2002, Interdependence between the Euro Area and the US: What Role for EMU?, European Central Bank Working Paper No. 200.

Engel, C., 1994, Can the Markov Switching Model Forecast Exchange Rates?, *Journal of International Economics, 36.*

Gürkaynak, Refet, Brian Sack, and Eric Swanson, 2004, Do Actions Speak Louder than Words? The Response of Asset Prices to Monetary Policy Actions and Statements, Board of Governors of the Federal Reserve System Finance and Economics Discussion Paper No. 2004-66.

Hamilton, James D, 1989, A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle, *Econometrica, Vol. 57 2.*

Hamilton, James D. 1994, *Time Series Analysis*. Princeton University Press. Princeton.

Hansen, B., 1996, Inference When a Nuisance Parameter is Not Identified Under the Null Hypothesis, Econometrica, vol 64, no. 2, pp 413-430.

Madhu Kalimipalli and Raul Susmel, Regime-Switching Stochastic Volatility and Short-term Interest Rates, *Journal of Empirical Finance.*

Mills, Terence C., 2002, The Econometric Modelling of Financial Time Series, Second Chang-Jin Kim, Jeremy M. Piger and Richard Startz, 2003, Estimation of Markov Regime-Switching Regression Models with Endogenous Switching, *Economic Research, Federal Reserve Bank of St.Louis.*

Montagnoli A., Napolitano O., 2005, Financial Condition Index and interest rate settings: a comparative analysis, Dipartimento di Studi Economici, working paper, n.8 December 2005.

Nelson, Charles R. Piger, Jeremy and Eric Zivot, 2000, Markov Regime-Switching And Unit Root Tests, *International Finance Discussion Papers, Number 683, Board of Governors of the Federal Reserve System.*

Raymond, J. E.. and R. W. Rich, 1997, Oil and the Macroeconomy: A Markov State-Switching Approach, *Journal of Money, Credit and Banking, 292, May.*

Schwert, G. William, Markup Pricing in Mergers and Acquisitions, *Journal of Financial Economics 41 1996 153-192*

Rugemurcia, F. J., 1995, Credibility and Changes in Policy Regime, *Journal of Political Economy, 103.*

Patelis, Alex D., 1997, Stock Return Predictability and The Role of Monetary Policy, *Journal of Finance* 52, 1951-1972.

Rigobon, Roberto and Brian Sack, 2004, The Impact of Monetary Policy on Asset Prices, *Journal of Monetary Economics* 51, 1553-1575.

Thorbecke, Willem, 1997, On Stock Market Returns and Monetary Policy, *Journal of Finance* 52, 635-654.

R. Vigfusson, Switching Between Chartists and Fundamentalists: A Markov Regime-Switching Approach, *Economic Working Papers, ewp-test/9602002.*

Wongswan, J., 2005, The Response of Global Equity Indexes to U.S. Monetary Policy Announcements, *Board of Governors of the Federal Reserve System, International Finance Discussion Papers,* Number 844, October.

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a cura della
Liaprint Service s.a.s.
Pozzuoli (NA)
tel. e fax 081 526 79 05

FINITO DI STAMPARE NEL MARZO 2006