LIÈGE université Library

https://lib.uliege.be https://matheo.uliege.be

Research-Thesis: How does the sensitivity of european stock markets to FED decisions vary across monetary regimes (pre/post 2008) ?

Auteur : Claessens, Vincent
Promoteur(s) : Hambuckers, Julien
Faculté : HEC-Ecole de gestion de l'Université de Liège
Diplôme : Master en sciences économiques, orientation générale, à finalité spécialisée en macroeconomics and finance
Année académique : 2025-2026
URI/URL : http://hdl.handle.net/2268.2/27460

Avertissement à l'attention des usagers :

Tous les documents placés en accès ouvert sur le site le site MatheO sont protégés par le droit d'auteur. Conformément aux principes énoncés par la "Budapest Open Access Initiative"(BOAI, 2002), l'utilisateur du site peut lire, télécharger, copier, transmettre, imprimer, chercher ou faire un lien vers le texte intégral de ces documents, les disséquer pour les indexer, s'en servir de données pour un logiciel, ou s'en servir à toute autre fin légale (ou prévue par la réglementation relative au droit d'auteur). Toute utilisation du document à des fins commerciales est strictement interdite.

Par ailleurs, l'utilisateur s'engage à respecter les droits moraux de l'auteur, principalement le droit à l'intégrité de l'oeuvre et le droit de paternité et ce dans toute utilisation que l'utilisateur entreprend. Ainsi, à titre d'exemple, lorsqu'il reproduira un document par extrait ou dans son intégralité, l'utilisateur citera de manière complète les sources telles que mentionnées ci-dessus. Toute utilisation non explicitement autorisée ci-avant (telle que par exemple, la modification du document ou son résumé) nécessite l'autorisation préalable et expresse des auteurs ou de leurs ayants droit.

HEC LIÈGE
Management School - Liège Université

HOW DOES THE SENSITIVITY OF EUROPEAN STOCK MARKETS TO FED DECISIONS VARY ACROSS MONETARY REGIMES (PRE/POST 2008)?

Supervisor:
Julien HAMBUCKERS

Reader(s):
Lionel ARTIGE
Pierrick CLERC

Master thesis presented by
Vincent CLAESSENS

To obtain the degree of
MASTER IN ECONOMICS

with a specialization in
Macroeconomics and Finance

Academic year 2025 / 2026

Ecole de Gestion de l'Université de Liège

Acknowledgements

First, I would like to express my sincere gratitude to my thesis supervisor, Prof. Julien Hambuckers, for allowing me to complete this Master's Thesis under his supervision on a topic we both share an interest in. His guidance, availability, and expertise have been precious for this project, and his insightful feedback played a major role in shaping both the direction and the quality of this work.

I would also like to warmly thank Romain Crucil, who provided invaluable support in launching this thesis. His help in building the literature review was instrumental in giving this project a solid foundation.

My sincere thanks go as well to my readers, Prof. Lionel Artige and Prof. Pierrick Clerc, for their time, their careful reading of this work, and their constructive feedback. I am also grateful to all members of the jury for their interest in this research and for taking part in the evaluation of this thesis.

Beyond my academic supervisors, I am deeply grateful to my parents, my in-laws, my brother and sisters whose constant support and encouragement have been a source of strength throughout this challenging period.

I would also like to thank my friends, both from HEC Liège and beyond, for the unforgettable moments we have shared during these years. The memories we built along the way have made this journey all the more memorable.

Finally, and most importantly, I extend my sincerest thanks to my partner, Jessica, whom I met during my studies at HEC Liège, for her support and patience throughout the completion of this thesis.

During the writing of this master's thesis, artificial intelligence tools (such as Gemini and Claude) were utilized as an help to improve the syntax and overall quality of the English text. The entirety of the research, the economic and financial analyses, and the conclusions presented in this work remain the exclusive product of my own reflection.

Contents

Acknowledgements **1**

List of Tables **4**

List of Figures **5**

List of Abbreviations **6**

1 Introduction **7**
1.1 Dollar Hegemony and Global Financial Interdependence . . . 7
1.2 The Global Financial Cycle and the Loss of Monetary Autonomy . . . 7
1.3 The Pre-Crisis Consensus: Ehrmann and Fratzscher (2009) . . . 7
1.4 The Structural Break: 2008 and the Rise of Unconventional Monetary Policy . . . 8
1.5 Motivations and Research Question Framing . . . 8
1.6 Research Question and Contribution . . . 9
1.7 Structure of the thesis . . . 10

2 Literature Review **11**
2.1 Channels of Monetary Policy Transmission . . . 11
2.2 The Global Financial Cycle . . . 12
2.3 Empirical Studies on Fed Spillover Effects to Equity Markets . . . 12

3 Methodology **16**
3.1 Hypothesis Development . . . 16
3.2 Identification of Monetary Policy Shocks . . . 16
3.3 Econometric Framework . . . 17
3.3.1 Baseline OLS Model (Ehrmann, 2009) . . . 17
3.3.2 The Local Projections Approach (Jordà, 2005) . . . 18
3.3.3 Structural Break Test (Chow, 1960) . . . 19
3.3.4 Multiple Break Test (Bai & Perron, 1998) . . . 19
3.3.5 Variable Definitions . . . 20

4 Empirical Analysis **21**
4.1 Data Description . . . 21
4.1.1 Data Sources and Sample . . . 21
4.1.2 Descriptive Statistics . . . 22
4.1.3 Stylized Facts . . . 23
4.2 Preliminary Analysis . . . 24
4.2.1 Shock Visualisation . . . 24
4.3 Main Results . . . 24
4.3.1 Structural Break: Chow Test . . . 24
4.3.2 Multiple Breaks: Bai-Perron Test . . . 25
4.3.3 Baseline OLS Results (Full Sample) . . . 25
4.3.4 Diagnostic Tests . . . 27
4.3.5 Regime-Specific Results: Local Projections (LP) . . . 27
4.3.6 Discussion of Main Results . . . 29
4.4 Secondary Results . . . 30

4.4.1 Analysis by National Indices (CAC 40, DAX, FTSE 100) 30
4.4.2 Sub-Analyses 32
4.4.3 Robustness Checks 37

5 Conclusion **40**
5.1 Summary of Results 40
5.2 Policy Implications 40
5.3 Limitations and Future Research 41

A Appendices **43**
A.1 Full LP Numerical Tables 43

List of Resource Persons **44**

Bibliography and References **45**

Executive Summary **46**

List of Tables

2.1 Position Relative to the Literature 15

3.1 Variable Definitions and Sources 20

4.1 Sample Comparison in the Reference Literature 22
4.2 Descriptive Statistics – FOMC Meeting Days 22
4.3 Break Number Selection — BIC Criterion (Bai-Perron, 1998) 25
4.4 Break Dates by Forced Solution — Bai-Perron (1998) 25
4.5 OLS Results — Euro Stoxx 50 Sensitivity 26
4.6 LP by National Index — $\hat{\beta}(0)$ and $\hat{\beta}(5)$ 31
4.7 Sub-Analysis 1: Monetary Policy Surprise Asymmetry 32
4.8 Sub-Analysis 2: Sub-Periods of the Post 2008 Regime 33
4.9 Sub-Analysis 3: LP by Fed Communication Regime 35
4.10 Summary of Robustness Checks 39

A.1 LP Pre 2008: Numerical Results 43
A.2 LP Post 2008: Numerical Results 43

List of Figures

4.1 Euro Stoxx 50 Return as a Function of the Kuttner Surprise, by Regime 24
4.2 LP Impulse Response Function — Full Sample (2000–2023) 28
4.3 LP Impulse Response Functions — Pre 2008 vs. Post 2008 28
4.4 Post 2008 LP Impulse Response Functions by European Index 31
4.5 LP by Sub-Period of the Post 2008 Regime 34
4.6 LP by Fed Communication Regime 35
4.7 Rolling Sensitivity of the Euro Stoxx 50 — Rolling LP $\hat{\beta}(h{=}1)$ 36
4.8 Robustness 3: Post 2008 LP : Kuttner vs. 2-Year Treasury Yield Change (ΔDGS2) . . 38

List of Abbreviations

CBOT	Chicago Board of Trade
CBOE	Chicago Board Options Exchange
ECB	European Central Bank
Fed	US Federal Reserve
FOMC	Federal Open Market Committee
GFC	Global Financial Crisis (2007–2009)
HC3	Heteroskedasticity Consistent Covariance Estimator, Type 3
IRF	Impulse Response Function
LP	Local Projections
OLS	Ordinary Least Squares
QE	Quantitative Easing
RSS	Residual Sum of Squares
VIX	CBOE Volatility Index
ZLB	Zero Lower Bound

Chapter 1

Introduction

1.1 Dollar Hegemony and Global Financial Interdependence

The architecture of the modern international financial system has its roots after the Second World War. Under the Bretton Woods agreements, almost all world currencies were pegged to the US dollar, which was itself convertible into gold. This arrangement cemented the dollar's role as the center of the global economy. Although this system was abolished by President Richard Nixon in 1971, the US currency did not lose its dominance. On the contrary, the dollar remains the world's leading reserve currency today.

The US dollar is the primary currency of the international financial system. It is the currency in which strategic commodities such as oil are priced, in which international trade is invoiced, and in which the vast majority of central bank foreign exchange reserves are held. Because of this privilege, the dollar features in portfolios across the entire world.

As a result, the institution that controls the supply and price of the dollar, the US Federal Reserve (Fed), exerts an influence that extends far beyond the borders of the United States. When the Fed changes its interest rates, the value of the dollar shifts, triggering immediate repercussions on global financial markets. This unique position leads to a fundamental observation: a monetary policy decision taken in Washington can determine financial conditions in Paris, Frankfurt or London.

1.2 The Global Financial Cycle and the Loss of Monetary Autonomy

This dependence challenges the traditional view of monetary policy independence. As said by Rey (2013), the global economy is governed by a "*Global Financial Cycle*" that manifests itself in asset prices, capital flows and leverage. This cycle is strongly correlated with the VIX index and, above all, is driven by US monetary policy.

Rey's hypothesis suggests a "dilemma" rather than the traditional "trilemma": an independent monetary policy is only possible if the capital account is managed. In a world of free capital flows, even major central banks such as the European Central Bank (ECB) face constraints. Despite the existence of the euro, European markets cannot fully decouple from the US financial cycle. When the Fed tightens policy, global liquidity contracts, often forcing other nations to follow or to suffer capital outflows and currency depreciation. This dynamic is the main motivation of this thesis: to analyse precisely how Fed decisions transmit to Europe and affect European stock markets.

1.3 The Pre-Crisis Consensus: Ehrmann and Fratzscher (2009)

The transmission of US shocks to Europe is not a new topic. Ehrmann and Fratzscher (2009) provided an in-depth analysis of this phenomenon, focusing on the period preceding the crisis. They showed that US monetary policy is a significant determinant of global equity returns. As they noted:

> *"We show that there is substantial cross-country heterogeneity in the reactions of 50 global equity markets, with returns falling on average by approximately 2.7% in response to a 100 basis point tightening of US monetary policy, but ranging from a zero reaction in some countries to a reaction of 5% in others. We find that countries' degree of global financial*

> *integration — and not their bilateral integration with the United States — is a key determinant of the transmission process."* (Ehrmann & Fratzscher, 2009)

Their work established a key foundation: financial integration amplifies spillover effects. However, their study ends at the beginning of 2008. It captures a world that no longer exists; one in which monetary policy was conducted almost exclusively through conventional interest rate adjustments.

1.4 The Structural Break: 2008 and the Rise of Unconventional Monetary Policy

The financial landscape shifted in the summer of 2007, when the Fed began raising rates. On 15 September 2008, with the collapse of Lehman Brothers, the global financial system entered a period of chaos.

To prevent a complete economic collapse, the Federal Reserve was forced to innovate rapidly. Traditional tools proved insufficient; cutting the federal funds rate to zero (the *zero lower bound*, or ZLB) was not enough to restart the economy. In November 2008, the Fed announced a historic shift towards **unconventional monetary policy**, in particular quantitative easing (QE).

Quantitative easing is a policy by which a central bank purchases government securities or other financial assets on the markets in order to lower long-term interest rates and expand the money supply. The objective is twofold : to inject large amounts of liquidity into the banking system to avoid deflation, and to compress long-term yields to stimulate investment.

1.5 Motivations and Research Question Framing

Motivations and Research Gap.

The motivation for this thesis is grounded in both economic theory and empirical portfolio management. On the academic side, the question of the international transmission of US monetary policy is at the heart of contemporary macroeconomic debate. Since the Global Financial Crisis, central banks have profoundly reconfigured their policy toolkits, and the empirical literature has not yet fully measured the consequences of this reconfiguration on the sensitivity of foreign stock markets. There is thus a documented gap between the abundant pre 2008 literature and the rare studies covering the entirety of the post-QE era up to 2023.

For financial practitioners and portfolio managers, the question of whether Federal Reserve decisions affect European equity portfolios more today than before 2008 is of direct and concrete relevance. Each FOMC announcement is a global market event that European investors cannot ignore: understanding whether sensitivity has increased, decreased or changed in nature since the financial crisis is information that is directly useful for risk management and portfolio construction.

The European Market as an Optimal Case Study.

The choice to focus on European stock markets, represented by the Euro Stoxx 50 index, rests on several complementary justifications. First, the euro area constitutes the world's second-largest economy and its stock market is among the deepest and most liquid in the world, with a capitalisation of several trillion euros. Its representativeness is therefore undeniable. Second, Europe has an extremely high degree of financial integration with the United States: major European banks operate extensively in dollars, multinationals listed on the Euro Stoxx 50 earn a significant share of their revenues in the US, and European institutional investors hold large portfolios of dollar-denominated

assets. This degree of integration makes it an ideal case study for international transmission.

Third, Europe has its own central bank, the ECB, whose mandate is independent of the Fed's. This institutional configuration allows the effect of US decisions to be identified more cleanly, since any Euro Stoxx reaction cannot be attributed to a mechanical European monetary policy response. Europe is in some sense the "pure receiver" of US monetary policy shocks, without the noise of a domestic central bank mechanically following the Fed.

September 2008: A Structural Break in Monetary Policy

The choice of September 2008 as the segmentation point is not arbitrary: it corresponds to the bankruptcy of Lehman Brothers, the triggering event of the Global Financial Crisis and the date from which the Fed definitively shifted towards unconventional monetary policy. This date is at once an institutional landmark (the first QE programme was announced in November 2008), a market landmark (the VIX index reached its historic peak in late October 2008) and an academic landmark (most studies on unconventional policy use this period as a demarcation point).

Economically, 2008 also marks a qualitative break in the very nature of the information conveyed by FOMC announcements. Before the crisis, an FOMC meeting essentially communicated a decision on the policy rate; after 2008, announcements also include forward guidance commitments, economic projections (*dot plots*), information on asset purchase programmes and signals about the normalisation timeline. This increased informational richness is likely to amplify market reactions to each announcement, and constitutes a central hypothesis that this thesis tests empirically.

1.6 Research Question and Contribution

This structural break reveals an important gap in the literature. The Ehrmann and Fratzscher analysis stops precisely at the moment when these new tools were deployed. Consequently, we do not know whether the transmission mechanisms identified in the "conventional" era remain valid in the QE and ZLB era.

This thesis aims to fill this gap. By extending the observation window from January 2000 to December 2023, we cover the full spectrum of modern monetary history: the conventional pre-crisis period, the Global Financial Crisis, the decade of QE, the COVID-19 pandemic and the return of inflation in 2022.

Our central objective is to compare the impact of Fed decisions on European stock markets across these two distinct regimes (pre- and post 2008). More specifically, this thesis bridges two strands of the literature. On the **conceptual** side, we adopt the international transmission framework of Ehrmann and Fratzscher (2009), extending it to the post 2008 era to explicitly test the stability of the transmission regime. On the **methodological** side, we employ the high-frequency identification strategy of Kuttner (2001) to isolate the exogenous component of Fed decisions and correct the endogeneity bias in monetary policy event studies.

The risk-taking channel serves as the core transmission mechanism in this framework, effectively connecting macro-financial theory with high-frequency event studies. Rey (2013) traditionally links the Global Financial Cycle to long-term capital flows and credit aggregates; however, at a daily frequency, this cycle materializes through shifts in global risk premiums. Consequently, this research integrates the monetary surprise methodology of Kuttner (2001) with the equity framework developed by Ehrmann and Fratzscher (2009). This combination allows for the tracking of immediate adjustments in international investors' risk appetite and cross-border portfolio allocations follow-

ing US monetary announcements.

This thesis makes three main contributions to the literature. **First**, it extends the analysis to the past fifteen years (post 2008), covering critical events such as the European sovereign debt crisis, the COVID-19 crisis and the aggressive tightening cycle of 2022, thereby filling the gap left by earlier studies. **Second**, it formally tests for structural breaks between "conventional" and "unconventional" (QE) policy, evaluating whether the "Fed put" has modified the sensitivity of European assets. **Third**, it combines high-frequency identification via Fed Funds futures with local projections (LP), providing a more precise causal estimate and a dynamic picture of the market response that traditional monthly studies cannot offer.

1.7 Structure of the thesis

To address these research questions, the subsequent chapters proceed as follows. Chapter 2 establishes the theoretical foundation by examining the literature on monetary transmission and the global financial cycle. Building on these concepts, Chapter 3 outlines the empirical design. It specifies the data compilation process, the derivation of Kuttner surprises, and the application of the local projections framework. Chapter 4 presents the empirical results and cross-regime comparisons. Chapter 5 discusses the implications for European financial stability and concludes.

Chapter 2

Literature Review

This chapter presents the theoretical and empirical foundations that structure our analysis of the transmission of US monetary policy to European stock markets. We first identify the four channels through which this transmission operates and discuss their relative relevance for our research question. We then develop the global financial cycle framework (Rey, 2013), which constitutes the central theoretical backbone of this thesis. Finally, we review the key empirical studies, in particular those of Kuttner (2001), Ehrmann and Fratzscher (2009) and Bekaert et al. (2023) and position this thesis within the literature through a comparative table.

2.1 Channels of Monetary Policy Transmission

Understanding how Federal Reserve decisions affect European stock markets requires identifying the channels through which monetary policy propagates beyond US borders. The literature identifies four main channels.

Often considered the most fundamental mechanism, the **interest rate channel** dictates that restrictive monetary shifts push the federal funds rate upward, thereby steepening borrowing costs across the yield curve. Consequently, this upward pressure on discount rates structurally depresses the present value of expected corporate cash flows, dragging down overall equity valuations. While initially operating as a domestic constraint, these effects inevitably spill over globally as international portfolios rebalance their dollar-denominated holdings.

The **credit channel**, formalised by Bernanke and Gertler (1995), operates through the balance sheets of firms and financial intermediaries. A monetary tightening reduces borrowers' net worth, tightens credit conditions and contracts the supply of financing. Miranda-Agrippino and Rey (2020) document that US monetary contractions lead to significant deleveraging by global financial intermediaries and a sharp decline in international credit flows, confirming that this channel operates on a global scale.

The **exchange rate channel** links US policy to European markets through currency movements. A Fed tightening generally appreciates the dollar, which affects the competitiveness of European exporters, the valuation of dollar-denominated assets held by European investors, and the cost of dollar funding for European banks.

Finally, the **risk-taking channel** has attracted growing attention since the Global Financial Crisis. As demonstrated by Miranda-Agrippino and Rey (2020), this channel operates fundamentally through the compression of risk premia during accommodative cycles, thereby fueling yield-seeking behavior across global markets. When confronted with an unexpected monetary tightening, this dynamic abruptly reverses. Portfolios undergo a synchronized repricing of risk, typically observable through sudden spikes in implied volatility (the VIX) and widespread depreciations in risky asset valuations. Furthermore, the prominence of this mechanism has expanded considerably in the post 2008 landscape, as the Federal Reserve's unconventional balance sheet interventions began directly targeting these long-term risk premia.

Among these four channels, the interest rate and risk-taking channels are the most directly relevant for analyzing the daily response of European equity indices to FOMC announcements.

2.2 The Global Financial Cycle

The concept of *Global Financial Cycle*, developed by Rey (2013), provides the theoretical foundation for understanding why domestic US monetary policy decisions have such powerful international repercussions. Rey demonstrates that a single global factor drives co-movements in capital flows, asset prices and credit across countries, and that this factor is strongly correlated with the VIX index and essentially driven by US monetary policy.

This observation has profound implications. The traditional "trilemma" of international finance states that a country can independently choose two of the following three elements: a fixed exchange rate, free capital flows and an autonomous monetary policy. Rey's contribution is to show that in practice, even countries with floating exchange rates lose significant monetary autonomy when they maintain open capital accounts. The trilemma is reduced to a "dilemma": independent monetary policy requires capital controls.

This conclusion applies directly to the European case. Despite the euro and the ECB's independent mandate, European financial conditions cannot fully decouple from the US financial cycle. When the Fed tightens policy, global liquidity contracts, risk appetite falls and European markets are sent lower alongside their US counterparts.

Miranda-Agrippino and Rey (2020) provide the most rigorous empirical validation of this hypothesis. Using a global Bayesian VAR identified with high-frequency monetary policy instruments, constructed from changes in Fed Funds futures prices around FOMC announcements, they document that US monetary policy shocks generate a single global factor explaining more than 20% of the variance of risky asset prices worldwide. Their analysis also shows that floating exchange rate countries face financial spillovers similar to those of fixed exchange rate countries, reinforcing Rey's dilemma. This paper is methodologically close to ours: both rely on high-frequency identification via futures to isolate exogenous monetary policy surprises.

2.3 Empirical Studies on Fed Spillover Effects to Equity Markets

High-Frequency Identification: Kuttner (2001)

Measuring monetary policy surprises is a fundamental methodological challenge. Estimating market sensitivity by directly regressing equity returns on absolute changes in the federal funds rate introduces a fundamental identification problem. Because financial markets continuously price in expected policy trajectories, a fully anticipated rate adjustment carries no novel information and is already reflected in asset valuations prior to the FOMC announcement. Consequently, failing to isolate the purely exogenous, unpriced component of the policy decision leads to a severe attenuation bias. Such regressions systematically drive the estimated coefficients toward zero, artificially dampening the true responsiveness of equities to monetary shocks.

Kuttner (2001) solves this identification problem by exploiting the information contained in 30-day Fed Funds futures contracts (*Fed Funds Futures*). These contracts settle on the monthly average of the federal funds rate. The monetary surprise is extracted as the change in the implied rate of the current-month contract, between the day before and the day of the FOMC meeting, corrected by a scaling factor accounting for the number of days remaining in the month:

$$S_t = \frac{D}{D-d}\left(f_t^0 - f_{t-1}^0\right)$$

where D is the total number of days in the month, d is the day of the meeting and f_t^0 is the con-

tract's implied rate. Because Fed Funds futures settle on the effective monthly average, a policy shift enacted on day d impacts only the final $D - d$ days of the month. The equation introduces a multiplicative scaling factor to adjust for this exact timing. Consequently, this transformation isolates an exogenous monetary shock, strictly orthogonal to prior market pricing, which Kuttner (2001) confirms as an unbiased estimator of future rate trajectories.

Over a sample covering 1989–2000, Kuttner (2001) demonstrates that the surprise component of a change in the federal funds rate has an effect on bond returns up to ten times larger than that of the anticipated component. In particular, the expected change is statistically indistinguishable from zero for all maturities tested, consistent with market efficiency, while the surprise component has a significant and declining effect along the yield curve. This result establishes the legitimacy of the expected/unexpected separation as an identification strategy: the information relevant to asset prices lies entirely in the surprise.

Bernanke and Kuttner (2005) apply this methodology to the US stock market over 1989–2002 and find that an unexpected 25 basis point cut in the federal funds rate is associated with an approximately 1% increase in major US indices on the same day. They decompose this effect into three components: revisions to expected future dividends, revisions to the risk-free rate, and revisions to future risk premia. Their central finding is that the bulk of the equity reaction (approximately 60%) is explained by revisions to expected risk premia rather than changes in dividends or risk-free rates. This result highlights the importance of the risk premium channel and justifies controlling for global market volatility (such as the VIX) when evaluating monetary spillovers.

Gürkaynak et al. (2005) extend this approach by showing that FOMC communication actually generates *two* distinct surprise factors. The first is the "target surprise", which measures the gap between the immediate rate decision and expectations: this is essentially the Kuttner measure. The second is the "path surprise", which captures the revision of expectations about *future* monetary policy induced by FOMC statements and projections. This second factor, identified via longer-dated futures, has a considerable effect on long-term yields and term premia, even in the absence of a surprise on the immediate decision. This decomposition is particularly relevant for analyzing the post 2008 era, as FOMC announcements progressively shifted the centre of gravity of information from target surprises (near-zero at the ZLB) towards path surprises, transmitted through forward guidance, dot plots and QE programme timelines.

International Transmission: Ehrmann and Fratzscher (2009)

The most direct precursor of this thesis is Ehrmann and Fratzscher (2009), who study the international transmission of US monetary policy shocks to the equity markets of 50 countries over 1989–2007. Their contribution is important in two aspects: they provide the first systematic large-scale analysis of Fed equity spillovers; and they identify the structural determinants of cross-country heterogeneity, beyond simply documenting an average effect.

Methodologically, Ehrmann and Fratzscher (2009) adopt a two-step approach. First, they regress daily equity returns on the day after each FOMC meeting on the Kuttner surprise, controlling for domestic monetary policy surprises, bilateral exchange rate changes with the dollar, and the same-day US market return. This control aims to isolate the Fed surprise effect from the concurrent US market response. Second, they regress the estimated country-by-country sensitivities on a set of structural variables: degree of financial integration with the US, bilateral trade intensity, exchange rate regime and banking sector size.

Their central finding is that an unexpected 100 basis point tightening reduces equity returns by 2.7% on average globally. This figure masks considerable heterogeneity: countries highly finan-

cially integrated with the US record reactions two to three times above the average, while countries with limited financial integration are almost unresponsive, even when they maintain close trade links with the US. This result implies that the euro area, as a region with high global financial integration, represents an optimal case study for examining post-crisis market reactivity to FOMC decisions.

Empirically, Ehrmann and Fratzscher (2009) identify three channels through which transmission operates. The direct asset holding channel reflects the fact that US investors hold foreign equity portfolios and adjust their positions around monetary announcements. The cross-border banking channel works through the international subsidiaries and branches of large US banks, which transmit domestic funding conditions abroad. Finally, the information channel operates through the revision of global growth expectations signalled by Fed decisions: an unexpected tightening is interpreted by global markets as a signal of future economic slowdown in the US, which contaminates the earnings outlook of European exporting firms.

The main limitation of Ehrmann and Fratzscher (2009) lies in the temporal boundary of their sample, which ends before the Global Financial Crisis and the subsequent adoption of quantitative easing and forward guidance. Consequently, whether the transmission coefficient remained stable in the post 2008 era remains an open empirical question, motivating a reassessment of cross-border monetary transmission under unconventional policy regimes.

Unconventional Monetary Policy and International Financial Transmission

The 2008 Global Financial Crisis forced the Federal Reserve to exceed the zero lower bound (*Zero Lower Bound*, ZLB) and to deploy unprecedented instruments. The adoption of quantitative easing (QE) from November 2008 transformed the mechanisms of US monetary policy transmission: while the short-term policy rate channel was paralysed by the ZLB, the Fed wanted to act directly on long-term rates and term premia through massive purchases of government securities and mortgage-backed securities (MBS). Over 2008–2014, the Fed deployed three successive waves of QE, expanding its balance sheet from $900 billion to over $4,500 billion, radically transforming the global financial transmission environment. This structural shift represents a core analytical focus, suggesting that the transmission channels to European stock markets may have changed between the two regimes.

Miranda-Agrippino and Rey (2020) provide the analysis most directly relevant for examining international risk spillovers. By constructing a global US monetary policy factor from high-frequency surprises (identified in narrow windows surrounding FOMC announcements) they show that US monetary policy shocks generate spillovers to global risky asset prices, with a single factor explaining more than 20% of the common variance of international asset prices. Their global Bayesian VAR framework identifies two complementary mechanisms: a direct effect on global risk premia through the risk appetite channel; and an indirect effect through global financial intermediaries, whose balance sheets contract significantly after a restrictive US monetary shock. Their result is consistent with the hypothesis that QE programmes, by compressing term premia and reallocating global savings towards risky assets, strengthened cross-border transmission channels beyond their pre-crisis level.

In addition to QE, the Fed developed forward guidance as an autonomous monetary policy tool, the explicit commitment to keep rates low for an extended period or until certain macroeconomic conditions are met. Gürkaynak et al. (2005) had already shown, before the crisis, that FOMC communication generated a "path factor" distinct from the target surprise, acting primarily on long-term rates. After 2008, this path factor became the dominant tool: markets react less to the rate decision (often kept at zero) than to signals about the duration of the accommodative regime, the pace of gradual reduction of asset purchases or the projections of FOMC members published in the *Summary of*

Economic Projections (*dot plot*). A direct implication is that the Kuttner (2001) measure captures qualitatively different information before and after 2008, and that the magnitude of measured surprises reflects a richer informational content inherent to unconventional monetary policy regimes.

Communication and Information Shocks: Bekaert, Hoerova and Xu (2023)

Recent research suggests that not all monetary surprises are the same. FOMC announcements actually provide two different types of information. The first is the *pure monetary policy surprise*: the unexpected change in the policy rate, as in the Kuttner measure. The second is the *central bank information shock*: the signal about the state of the economy contained in FOMC communication, distinct from the rate decision itself. A rate hike accompanied by a very optimistic speech about the economy thus constitutes a positive rate surprise but a positive information shock; if markets react little despite the rate rise, it is because the favourable economic signal partially offsets the tightening effect (Jarociński & Karadi, 2020).

Bekaert et al. (2023) study this decomposition for the US, the euro area and Japan over 2000–2017. Their main methodological contribution is to decompose VIX variance into a realised variance component (actual risk) and a variance risk premium (risk appetite), and to study how the two types of FOMC shocks affect these two components differently. They find that US communication shocks (the informational content of FOMC statements beyond the rate decision) transmit strongly to risk premia in the euro area, via a significant reduction in the variance risk premium. By contrast, traditional rate surprises have more limited cross-border effects on risk premia, acting more on the realised variance component.

This result provides a theoretical foundation for examining post-crisis dynamics. If the spillovers to the euro area are primarily carried by the communication component rather than rate changes strictly speaking, then the multiplication of communication tools after 2008 (forward guidance, dot plots, more detailed statements) constitutes an amplification mechanism for international transmission, suggesting a strengthened informational channel in the post 2008 environment.

Positioning of This Thesis

Table 2.1 summarises the key differences between this thesis and the closest papers.

Table 2.1: Position Relative to the Literature

	Ehrmann (2009)	**Miranda-Agrippino & Rey (2020)**	**Bekaert et al. (2023)**	**This thesis**
Period	1989- 2008	1980–2012	2000–2017	2000–2023
Frequency	Daily	Monthly	Daily	Daily
Identification	Kuttner	HF Futures	HF Events	HF Event Study (Kuttner)
Target market	50 countries	Global	US/EA/JP	Euro Stoxx 50
Regime test	No	No	No	Yes (Chow)
Post-QE era	No	Partial	Partial	Yes

Note: HF = High Frequency. EA = Euro Area. JP = Japan. *Source:* Own compilation.

The main contribution of this study relative to the existing literature is threefold. First, the sample is extended to December 2023, covering the entirety of the post 2008 era, including the COVID-19 shock and the 2022 tightening cycle. Second, structural breaks in 2008 are formally tested using the Chow test, rather than assuming regime stability. Third, the local projections framework of Jordà (2005) to trace the dynamic impulse response at multiple horizons, offering a richer picture of how sensitivity evolves over time after an FOMC announcement.

Chapter 3

Methodology

This chapter develops the empirical framework tested in the analysis of the following chapter. Section 3.1 formulates the three hypotheses tested, grounded in the literature review of the previous chapter. Section 3.2 describes the construction of the high-frequency monetary surprise measure of Kuttner (2001), the central instrument of our causal identification strategy. Section 3.3 successively presents the OLS model with interaction term (Section 3.3.1), the local projections framework (LP, Section 3.3.2), the Chow structural break test (Section 3.3.3) and the definition of the variables used (Section 3.3.4).

3.1 Hypothesis Development

Drawing on the literature reviewed in Chapter 2, this thesis tests three hypotheses:

H_1 : Negative Sensitivity to Fed Surprises.
In line with Ehrmann and Fratzscher (2009) and Bernanke and Kuttner (2005), an unexpected tightening of US monetary policy should reduce European equity returns, both through the interest rate channel and the risk appetite channel. We therefore expect the Kuttner surprise coefficient to be statistically significant.

H_2 : Structural Break in 2008.
The 2008 financial crisis and the subsequent adoption of unconventional monetary policy tools (forward guidance, zero lower bound, quantitative easing) fundamentally modified the transmission of Fed decisions to global financial markets (Miranda-Agrippino & Rey, 2020). We expect the Chow test to reject parameter stability, confirming a structural break in 2008.

H_3 : Greater Post 2008 Sensitivity.
Following Rey (2013) and Bekaert et al. (2023), the strengthening of the global financial cycle after 2008 implies that US monetary policy shocks transmit more strongly and more persistently to European stock markets in the post-crisis period. We therefore expect the LP impulse response functions to be of larger amplitude and more persistent after 2008.

3.2 Identification of Monetary Policy Shocks

A central challenge in estimating the impact of monetary policy is the endogeneity problem: stock markets do not react to the policy decision itself, but to its unexpected component. To isolate this exogenous shock, we follow the methodology established by Kuttner (2001), which has become the standard in the literature (see also Bernanke & Kuttner, 2005).

Kuttner (2001) demonstrates that changes in the federal funds rate incorporate both expected and unexpected actions. To isolate the surprise component, we use 30-day Fed Funds futures contracts. Since these contracts provide a market-based measure of expectations, any change in their price in a narrow window around the FOMC announcement can be interpreted as a pure monetary policy shock.

Formally, the surprise component ($\Delta\tilde{r}_t^u$) is calculated as:

$$\Delta\tilde{r}_t^u = \frac{m}{m-t}\left(f_{t,s}^0 - f_{t-1,s}^0\right) \tag{3.1}$$

where $f_{t,s}^0$ denotes the implied rate of the futures contract with maturity s at date t, m is the total number of days in the month, and t represents the day of the FOMC announcement. The adjustment factor $\frac{m}{m-t}$ corrects for the fact that the contract settles on the monthly average rate. When an FOMC meeting occurs on the final day of the month ($t = m$), the adjustment factor's denominator becomes zero; following Kuttner (2001), this edge case is handled by utilizing the subsequent month's futures contract ($s + 1$) without the multiplicative scaling factor. This measure serves as the primary independent variable for examining the sensitivity of European indices in the empirical analysis.

3.3 Econometric Framework

3.3.1 Baseline OLS Model (Ehrmann, 2009)

Following Ehrmann and Fratzscher (2009), our baseline specification links the next-day log-return of the Euro Stoxx 50 to the Kuttner surprise:

$$r_{t+1} = \alpha + \beta_1 S_t + \beta_2 D_t^{\text{post}} + \beta_3\left(S_t \times D_t^{\text{post}}\right) + \gamma_1 \text{VIX}_t + \gamma_2 r_t^{SP500} + \varepsilon_t \tag{3.2}$$

where r_{t+1} is the Euro Stoxx 50 log-return on the day after the FOMC announcement (European markets being closed at the time of announcements), S_t is the Kuttner surprise (Equation 3.1), D_t^{post} is a dummy variable equal to 1 for observations after September 2008, VIX_t is the CBOE volatility index, and r_t^{SP500} is the same-day log-return of the S&P 500.

The coefficient of interest is β_3: it captures the *change* in sensitivity between the two regimes. β_1 gives the pre 2008 sensitivity, while $\beta_1 + \beta_3$ gives the post 2008 sensitivity.

All models are estimated with HC3 heteroskedasticity-robust standard errors (White, 1980), as justified by the Breusch–Pagan and White tests reported in Section 4.3.4.

Hypotheses and decision rule. For each coefficient β_j, the significance test is:

$$\begin{aligned} H_0 &: \beta_j = 0 \qquad \text{(no effect)} \\ H_1 &: \beta_j \neq 0 \qquad \text{(effect)} \end{aligned}$$

The test statistic is $t = \hat{\beta}_j \,/\, \widehat{SE}(\hat{\beta}_j)$, where $\widehat{SE}$ is the HC3 robust standard error. Under H_0, this statistic follows a standard normal distribution $\mathcal{N}(0,1)$. We reject H_0 when $|t| > z_{\alpha/2}$, i.e. $|t| > 1.96$ at the 5% level. The 95% confidence interval is:

$$CI_{95\%}(\beta_j) = \left[\,\hat{\beta}_j - 1.96 \cdot \widehat{SE}(\hat{\beta}_j)\;;\; \hat{\beta}_j + 1.96 \cdot \widehat{SE}(\hat{\beta}_j)\,\right]$$

If this interval does not contain zero, H_0 is rejected. The main coefficient of interest is β_3: rejecting it at the conventional level means that the sensitivity of the Euro Stoxx to the Kuttner surprise has significantly changed between the two regimes.

3.3.2 The Local Projections Approach (Jordà, 2005)

To obtain impulse response functions (IRFs) at multiple horizons, we use the local projections of Jordà (2005). The Kuttner surprise S_t is used directly as a regressor. Being constructed from Fed Funds futures prices *before* the FOMC announcement, it captures only the unanticipated component of monetary policy and is exogenous by construction (Bernanke & Kuttner, 2005; Kuttner, 2001): market expectations are already incorporated in the contract price the day before the decision, so that the price change around the announcement reflects only "surprise" information. No additional instrumentation is therefore required.

At each horizon $h = 0, 1, \ldots, H$, we estimate by OLS with robust standard errors:

$$\sum_{k=1}^{h} r_{t+k} = \alpha^{(h)} + \beta^{(h)} S_t + \gamma^{(h)} \mathrm{VIX}_t + \delta^{(h)} r_t^{SP500} + \varepsilon_t^{(h)} \tag{3.3}$$

where S_t is the Kuttner surprise at meeting t, and the dependent variable is the cumulative Euro Stoxx return over the h days following the announcement. The sequence $\{\beta^{(h)}\}_{h=0}^{H}$ traces the dynamic impulse response of the Euro Stoxx to a unit monetary policy shock. As demonstrated by Plagborg-Møller and Wolf (2021), the local projections approach is asymptotically equivalent to VAR identification, with the advantage of being robust to dynamic model misspecification.

Why local projections rather than a SVAR? Structural VAR (SVAR) models are commonly used in macroeconomics to study monetary policy transmission. Three reasons motivate the choice of LP over SVAR here.
First, SVARs require identification restrictions (such as a Cholesky decomposition or sign restrictions) to recover structural shocks from residuals. In our setting, this problem is solved upstream: the Kuttner surprise is an externally identified instrument constructed directly from futures markets, making these restrictions unnecessary.
Secondly, SVAR models describe the joint dynamics of several variables within a continuous time series; however, the structure of our event study—based on non-consecutive observations spaced six to eight weeks apart—does not lend itself to this assumption.
Third, Plagborg-Møller and Wolf (2021) show that LP and VAR are asymptotically equivalent under the same identification scheme: the choice between them is therefore not about the validity of the results, but about specification assumptions. With a modest sample of $N = 192$ observations, the robustness of LP to lag misspecification outweighs the marginal efficiency gain of SVAR.

Hypotheses and confidence intervals. At each horizon h, the significance test is:

$$H_0 : \beta^{(h)} = 0 \qquad \text{(no Euro Stoxx response at horizon } h\text{)}$$
$$H_1 : \beta^{(h)} \neq 0 \qquad \text{(significant response at horizon } h\text{)}$$

The standard errors $\widehat{SE}(\hat{\beta}^{(h)})$ are calculated with the HC3 correction. The local projections literature conventionally uses 90% confidence intervals (Jordà, 2005):

$$CI_{90\%}(\beta^{(h)}) = \left[\hat{\beta}^{(h)} - 1.645 \cdot \widehat{SE}(\hat{\beta}^{(h)}) \; ; \; \hat{\beta}^{(h)} + 1.645 \cdot \widehat{SE}(\hat{\beta}^{(h)}) \right]$$

The impulse response function is statistically significant at horizon h if zero does not belong to this interval, i.e. if the sign of the response is precise enough to exclude the hypothesis of no effect.

3.3.3 Structural Break Test (Chow, 1960)

To formally test whether 2008 constitutes a structural break, we implement the test of Chow (1960). The null hypothesis is that the regression coefficients $(\alpha, \beta_1, \gamma_1, \gamma_2)$ are identical across the two sub-periods. The test statistic is:

$$F = \frac{(RSS_R - RSS_U)/k}{RSS_U/(N-2k)} \tag{3.4}$$

where RSS_R is the residual sum of squares of the constrained model (identical coefficients across sub-periods), $RSS_U = RSS_{\text{pre}} + RSS_{\text{post}}$ is the sum of residuals of the two unconstrained models estimated separately, k is the number of parameters and N the total number of observations.

Hypotheses and decision rule.

$$\begin{aligned} H_0 &: \boldsymbol{\theta}_{\text{pre}} = \boldsymbol{\theta}_{\text{post}} \qquad \text{(no break)} \\ H_1 &: \boldsymbol{\theta}_{\text{pre}} \neq \boldsymbol{\theta}_{\text{post}} \qquad \text{(structural break in 2008)} \end{aligned}$$

where $\boldsymbol{\theta} = (\alpha, \beta_1, \gamma_1, \gamma_2)$ denotes the OLS model parameter vector. Under H_0, the F statistic follows a Fisher distribution $F(k,\ N-2k)$. We reject H_0 at the 5% level when the associated p-value is below 0.05, or equivalently when F exceeds the critical value $F_{5\%}(k, N-2k)$. Rejecting H_0 confirms that a regime change occurred and validates the sample segmentation into two sub-periods for the LP estimation.

3.3.4 Multiple Break Test (Bai & Perron, 1998)

The Chow test assumes that the break date is fixed *a priori* by the researcher. To relax this assumption and let the data themselves identify the number and dates of regime changes, we complement the analysis with the multiple break test of Bai and Perron (1998).

The algorithm estimates the baseline OLS model (Section 3.3.1) over all possible partitions of the sample into $m+1$ segments, and retains the partition that globally minimises the RSS. The optimal number of breaks m^* is selected by the BIC information criterion:

$$\text{BIC}(m) = N \ln\left(\frac{RSS_m}{N}\right) + (m+1)\,(k+1)\,\ln(N) \tag{3.5}$$

where N is the number of observations, k the number of parameters per segment, and RSS_m the minimum residual sum of squares for m breaks. The minimum segment size is set to $h = 15\%$ of observations (approximately 24 FOMC meetings), ensuring that each regime contains enough observations for reliable estimates.

Hypotheses and decision rule.

$$\begin{aligned} H_0 &: \text{no break, stable parameters over the full period } (m^* = 0) \\ H_1 &: \text{at least one break of unknown date in } (t_{\min},\ t_{\max}) \end{aligned}$$

If $m^* \geq 1$, the break dates are estimated simultaneously and their 95% confidence intervals are calculated according to the procedure of Bai and Perron (1998). Unlike the Chow test, this procedure is robust to heteroskedasticity and serial correlation within each segment. If the procedure spontaneously identifies September 2008 as a break, this constitutes external validation of the date chosen a priori in the main analysis.

3.3.5 Variable Definitions

Table 3.1 summarises all variables used in the empirical analysis.

Table 3.1: Variable Definitions and Sources

Variable	Definition	Source (frequency)	Transformation
Dependent variable			
R_{t+1}^{ES50}	Euro Stoxx 50 log-return on the day after the FOMC meeting (D+1). European markets being closed at the time of announcements, the reaction is measured the following day.	Investing.com (daily)	$\ln(P_{t+1}/P_t) \times 100$
Variables of interest			
Kuttner_t	Monetary surprise of Kuttner (2001): unexpected component of the FOMC decision, extracted from 30-day Fed Funds futures with calendar adjustment.	CBOT / Federal Reserve (FOMC meetings)	Basis points (bp)
$\mathbf{1}_{\text{Post2008},t}$	Regime dummy: 0 for Jan. 2000 – Sep. 2008 (71 meetings); 1 for Oct. 2008 – Dec. 2023 (121 meetings).	/	$\{0, 1\}$
Control variables			
R_t^{SP500}	S&P 500 log-return on day of the meeting. Captures the contemporaneous reaction of US markets.	Investing.com (daily)	$\ln(P_t/P_{t-1}) \times 100$
VIX_t	Level of the CBOE implied volatility index on day D. Proxy for global risk aversion.	Investing.com (daily)	Level
$R_t^{\text{EUR/USD}}$	EUR/USD exchange rate log-return on day D. Captures exchange rate effects linked to FOMC announcements.	Investing.com (daily)	$\ln(S_t/S_{t-1}) \times 100$

Note: D denotes the day of the FOMC meeting. The Kuttner surprise is $\frac{D}{D-d}(f_{t,0} - f_{t-1,0})$, where $f_{t,0}$ is the current-month Fed Funds futures price, D the number of days in the month and d the day of the meeting. *Source:* Authors' calculations and sources listed above.

Chapter 4

Empirical Analysis

This chapter presents the empirical results of the thesis. Section 4.1 describes the data, presents descriptive statistics and identifies three stylized facts that motivate the methodological choices. Section 4.2 offers a preliminary graphical analysis of patterns in the sample. Section 4.3, at the heart of the chapter, successively presents the Chow structural break test, the baseline OLS results and the LP impulse response functions, before offering a detailed economic interpretation. Section 4.4 examines secondary results relating to cross-country heterogeneity and robustness of the break date.

4.1 Data Description

4.1.1 Data Sources and Sample

Our dataset covers the period from January 2000 to December 2023, comprising 6,023 daily observations. The sample includes 192 FOMC meetings: 71 in the pre 2008 period (January 2000 – September 2008) and 121 in the post 2008 period (October 2008 – December 2023). Only *scheduled* meetings are retained; inter-meeting decisions (emergency cuts, extraordinary conference calls) are excluded, in line with Nakamura and Steinsson (2018) who note that these announcements have different statistical properties: the surprise is near-total by construction and the market reaction is contaminated by the crisis signal rather than the monetary policy shock alone.

Justification of the 2000–2023 window. The choice of January 2000 as the starting point is motivated by two considerations. On one hand, the liquidity of 30-day Fed Funds futures reaches a sufficient level to construct reliable surprise measures from the early 2000s; data prior to 1999 present episodes of reduced liquidity that weaken the construction of the Kuttner surprise (Kuttner, 2001). On the other hand, Euro Stoxx 50 data and control variables (VIX, S&P 500) are homogeneous and reliable throughout the 2000–2023 period. The choice of December 2023 as the closing date allows us to capture the full aggressive tightening cycle of 2022–2023 (+525 bp in 18 months), an episode that generates large Kuttner surprises and considerably enriches the identification of post 2008 effects.

Comparison with the literature and justification of estimation windows. With 192 FOMC meetings over 24 years, our sample is substantially larger than those of the reference studies in this field.

Kuttner (2001) and Bernanke and Kuttner (2005) both start in **June 1989**, approximately eight months after the launch of Fed Funds futures at the Chicago Board of Trade (October 1988): this delay corresponds to the time needed for this nascent market to reach sufficient liquidity. Ehrmann and Fratzscher (2009) start in **February 1994**, the date from which the FOMC began publicly announcing its policy rate decisions; before this transparency reform, the surprise component was more difficult to cleanly isolate. Nakamura and Steinsson (2018) use **January 1995** as their starting point, conditioned on the availability of *Blue Chip Economic Indicators* consensus forecasts, which are indispensable to their identification strategy. Miranda-Agrippino and Rey (2020) use two windows: **1980–2019** for their monthly global financial factor (long macroeconomic data), but **1989** as the start for the high-frequency part, for consistency with futures availability. Finally, Bekaert et al. (2023) use **2000–2017**, the period for which futures liquidity and detailed VIX decomposition are simultaneously available reliably. Table 4.1 summarises these sample choices.

Table 4.1: Sample Comparison in the Reference Literature

Study	Period	Target market	Shock measure
Kuttner (2001)	1989–1999	US interest rates	Fed Funds futures
Bernanke and Kuttner (2005)	1989–2001	US equities	Fed Funds futures
Ehrmann and Fratzscher (2009)	1994–2003	Euro area / G7	Fed Funds futures
Nakamura and Steinsson (2018)	1995–2014	Rates / income	High frequency
Miranda-Agrippino and Rey (2020)	1989–2019	Global assets	High frequency
Bekaert et al. (2023)	2000–2017	US equities / VIX	Fed Funds futures
This thesis	**2000–2023**	**Euro Stoxx 50**	**Fed Funds futures**

Source: Summary table compiled from the cited references.

Our 2000–2023 window follows this same data-availability logic: it offers homogeneous coverage of all variables (futures, Euro Stoxx 50, S&P 500, VIX), avoids the period of reduced futures liquidity prior to 1999, and extends all cited works by several years to cover the entirety of the post-QE era through the 2022–2023 tightening cycle. With 192 meetings, our sample exceeds that of each of these reference studies, which strengthens the statistical power of the break tests and LP estimates.

The Kuttner surprise is constructed from 30-day Fed Funds futures prices obtained from the CBOT. European equity market returns are measured by the Euro Stoxx 50 log-return. Control variables include the same-day S&P 500 log-return and the daily change in the VIX index. The Kuttner surprise S_t is used directly as a regressor over the full 2000–2023 sample, in line with the original approach of Kuttner (2001) and Bernanke and Kuttner (2005).

The dependent variable is the Euro Stoxx 50 log-return on the *day after* the announcement, as European markets are closed at the time of FOMC announcements (generally between 8:00 pm and 10:00 pm, European time).

4.1.2 Descriptive Statistics

Table 4.2 presents summary statistics for the key variables on FOMC meeting days, separated by regime.

Table 4.2: Descriptive Statistics – FOMC Meeting Days

	Pre 2008		**Post 2008**	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
FOMC Meetings	71		121	
Kuttner Surprise (%)	+0.005	0.063	−0.002	0.039
Euro Stoxx Return D+1 (%)	−0.05	1.54	−0.25	1.59
S&P 500 Return D (%)	+0.05	1.54	−0.25	1.41

Note: Kuttner surprise and returns are expressed in percentage. D denotes the day of the FOMC meeting; D+1 the following trading day. *Source:* Own compilation.

Several observations emerge from Table 4.2. First, the standard deviation of the Kuttner surprise falls from 0.063% before 2008 to 0.039% after 2008, a reduction by a factor of approximately 1.6. This structural compression is primarily driven by the prolonged periods at the Zero Lower Bound (ZLB) post 2008 (such as 2008–2015 and 2020–2022), during which the federal funds rate remained constrained and invariant to incoming news, alongside the adoption of forward guidance and regular press conferences by the Fed, which enabled market participants to better anticipate policy decisions (Ehrmann & Fratzscher, 2009). Second, the average Euro Stoxx returns on FOMC days are

negative in both periods (−0.05% and −0.25% respectively), which is consistent with the expected negative relationship between unexpected rate hikes and equity prices. Third, the standard deviation of the S&P 500 return on FOMC days slightly decreases from 1.54% before 2008 to 1.41% after 2008 (Table 4.2). This result directly addresses the concern that the doubling of the S&P 500 coefficient (0.496 to 0.794, Stylized Fact 2) could reflect a mechanical variance effect rather than genuine financial integration. Since $\hat{\beta}_{SP500} = \rho \times SD(r_{ES50})/SD(r_{SP500})$, a *lower* post-2008 S&P 500 variance combined with a *higher* coefficient implies that the implied correlation between the two indices rose from approximately 0.50 to 0.70, confirming that the strengthening of co-movement is genuine and consistent with the global financial cycle hypothesis (Miranda-Agrippino & Rey, 2020).

4.1.3 Stylized Facts

Examining the raw data and descriptive statistics reveals three fundamental stylized facts. These empirical regularities constitute the primary motivation for the methodological choices developed in Chapter 3 and structure the formal analysis that follows.

Stylized Fact 1: The Fed's communication policy has drastically compressed the variability of monetary surprises since 2008.
The standard deviation of the Kuttner surprise falls from 0.063% in the pre 2008 period to 0.039% in the post 2008 period, a reduction by a factor of 1.6. This phenomenon reflects the communication revolution carried out by the Federal Reserve: the introduction of explicit forward guidance in 2011, dot plots from 2012 and systematic press conferences after every meeting from 2015 have allowed financial markets to anticipate FOMC decisions with far greater precision (Bekaert et al., 2023). Crucially, this variance reduction is also heavily driven by prolonged periods at the Zero Lower Bound (ZLB) post 2008, during which the federal funds rate remained constrained. This lack of dispersion mechanically induces an attenuation bias in post 2008 estimates. While subsequent local projections are employed to trace out the dynamic impulse response path across multiple horizons, they do not overcome underlying data dispersion issues.

Stylized Fact 2: The co-movement between the Euro Stoxx 50 and the S&P 500 on FOMC days has increased substantially since the crisis.
The OLS results by period reveal that the coefficient of the S&P 500 return almost doubles between the two regimes: 0.496 before 2008 ($p = 0.10$, 71 observations) versus 0.794 after 2008 ($p < 0.001$). Even more striking, adding only the S&P 500 as a control variable multiplies the explanatory power of the model by a factor of 40 (R^2 going from 1% to nearly 40%), highlighting that the main transmission channel on FOMC days runs through the US market reaction channel and not the raw rate surprise. This fact directly illustrates the strengthening of the global financial cycle documented by Miranda-Agrippino and Rey (2020): since the Global Financial Crisis, co-movements between global equity markets have intensified, driven by a single US factor.

Stylized Fact 3: The temporal dynamics of the Euro Stoxx response are asymmetric across regimes.
A preliminary graphical inspection of Euro Stoxx returns in the ten days following an FOMC announcement reveals systematically different patterns depending on the monetary regime. In the pre 2008 period, returns show no persistent trend after the announcement: any initial reaction fades quickly and reverses after six days. In the post 2008 period, by contrast, a significant initial reaction progressively amplifies over the following days before stabilising, suggesting a gradual transmission mechanism consistent with progressive international portfolio rebalancing (Miranda-Agrippino & Rey, 2020).

4.2 Preliminary Analysis

4.2.1 Shock Visualisation

Figure 4.1 presents the scatter plot of next-day Euro Stoxx 50 returns against the Kuttner surprise, separately for the pre- and post 2008 periods.

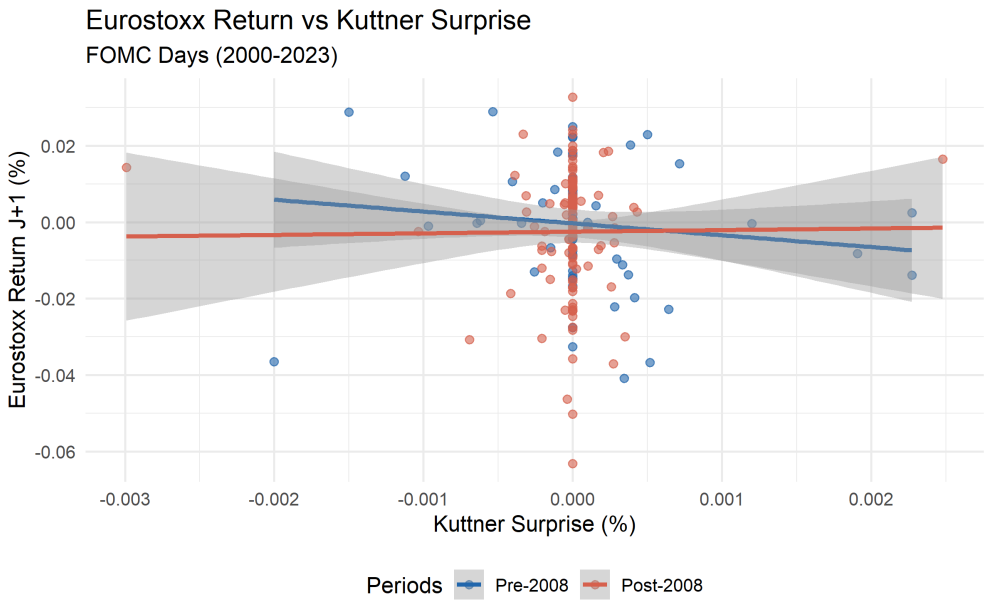

Figure 4.1: Euro Stoxx 50 Return as a Function of the Kuttner Surprise, by Regime

Note: Each point represents an FOMC meeting. Blue = pre 2008; Red = post 2008. Lines are OLS fits with 95% confidence bands. *Source: Author's calculations*

Figure 4.1 reveals two important patterns. First, post 2008 observations (red dots) are almost entirely clustered around zero on the horizontal axis, reflecting the dramatic reduction in Kuttner surprises documented in Table 4.2: the adoption of forward guidance and regular press conferences has compressed the surprise measure towards zero. This lack of variation in the independent variable prevents OLS from precisely identifying the slope : the red line is essentially flat not because there is no effect, but because there is almost no variation to exploit. Second, pre 2008 observations (blue dots) are more dispersed, with some large negative surprises associated with large negative returns. The wide confidence bands in both regimes reflect the high estimation uncertainty inherent to these noisy daily responses. Rather than overcoming data dispersion issues, subsequent local projections are employed to trace out the dynamic impulse response path of European equity returns across multiple horizons.

4.3 Main Results

4.3.1 Structural Break: Chow Test

Before presenting the regression results, we formally test whether 2008 constitutes a structural break using the Chow test described in Section 3.3.3. The unconstrained model allows all coefficients to vary between the two sub-periods, while the constrained model imposes identical coefficients.

The Chow test yields $F(4, 184) = 2.362$, $p = 0.055$. This borderline p-value does not allow us to formally reject the null hypothesis at the conventional 5% threshold, but the null hypothesis of parameter stability is rejected at the 10% significance level. This result, combined with the economic

and institutional motivation for the 2008 date (shift to ZLB, QE, forward guidance), justifies the sub-period segmentation adopted in the main analysis. The Bai-Perron test below provides an additional exploratory confirmation.

4.3.2 Multiple Breaks: Bai-Perron Test

The Bai-Perron test is applied to the baseline OLS model over all 192 available FOMC meetings. Table 4.3 presents the RSS and BIC criteria for $m \in \{0, 1, 2, 3\}$ breaks; the BIC minimum (in bold) determines the optimal number retained by the data.

Table 4.3: Break Number Selection — BIC Criterion (Bai-Perron, 1998)

No. breaks (m)	RSS	BIC
0	0.02936	**−1116.0**
1	0.02724	−1104.0
2	0.02507	−1093.0
3	0.02357	−1079.0

Note: Minimum segment size $h = 15\%$ ($\approx$ 24 meetings). The BIC minimum (optimal model) is in bold. *Source: Author's calculations*

The BIC criterion selects $m^* = 0$ (no break). The forced solutions for $m = 1$ and $m = 2$ are reported in Table 4.4 as an economic reference.

Table 4.4: Break Dates by Forced Solution — Bai-Perron (1998)

m forced	Break 1	Break 2
1	Jun. 2009 (obs. 76/192)	—
2	Nov. 2009 (obs. 79/192)	Sep. 2015 (obs. 126/192)

Note: Dates reconstructed from observation indices in `df_bp`. Since the BIC selects $m^* = 0$, these solutions are presented as reference only and not as statistically validated breaks. *Source: Author's calculations*

The unconstrained Bai-Perron test selects $m^* = 0$ (no structural break) based on the BIC criterion, as the penalty for adding extra parameters outweighs the marginal reduction in residual sum of squares. This outcome reflects the limited statistical power of information criteria in small sample sizes with noisy daily event-study data rather than the absence of structural shifts. To examine the potential timing of structural changes as referenced in the literature, we look at the forced segmentation outputs ($m = 1$ and $m = 2$). When forcing a single break ($m = 1$), the procedure identifies June 2009. If we force two breaks ($m = 2$), the second date points to September 2015, aligning with the Federal Reserve's liftoff period. However, because the formal statistical criteria point to $m^{=}0$, these dates cannot be interpreted as statistically validated endogenous breaks within our sample. Strictly speaking, the empirical evidence for a structural break is tenuous, as the Chow test yields a borderline p-value of 0.055 and the unconstrained Bai-Perron test detects no endogenous breaks. Nevertheless, the profound macroeconomic and institutional upheaval of the 2008 global financial crisis provides a compelling economic justification for segmenting the sample. Instead, relying on prior macroeconomic literature, we maintain September 2008 as the primary structural break date for our empirical investigation.

4.3.3 Baseline OLS Results (Full Sample)

Table 4.5 presents the OLS estimation results for the three specifications described in Section 3.3.1.

Table 4.5: OLS Results — Euro Stoxx 50 Sensitivity to Fed Decisions

	(1) No controls	(2) With controls	(3) Full model
Kuttner Surprise	−3.100	−1.364	−1.288
	(4.501)	(3.313)	(3.333)
Post 2008	−0.002	0.00004	−0.00003
	(0.002)	(0.002)	(0.002)
EUR/USD return (D)			0.065
			(0.142)
VIX		−0.001	−0.001
		(0.001)	(0.001)
S&P 500 return		0.608***	0.604***
		(0.163)	(0.162)
Kuttner × Post 2008	3.522	5.302	5.262
	(8.198)	(3.523)	(3.570)
Constant	−0.0003	−0.001	−0.001
	(0.002)	(0.002)	(0.002)
Observations	192	192	192
R^2	0.010	0.387	0.388
Adjusted R^2	−0.006	0.370	0.368

Note: HC3 robust standard errors (White, 1980) in parentheses. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$. *Source: Author's calculations*

Three findings emerge from Table 4.5.
First, the Kuttner surprise coefficient is positive but statistically non-significant in all three specifications (p-values between 0.19 and 0.55). This should not be interpreted as an absence of effect: with only 192 FOMC observations and substantial noise on meeting days, OLS lacks the statistical power to precisely identify sensitivity. The large standard errors reflect this imprecision and motivate the use of the local projections approach.
Second, the S&P 500 return is consistently significant, with a coefficient of approximately 0.61 ($p < 0.001$ in Models 2 and 3), driving the jump in the R^2 from 1.0% in Model (1) to 38.7% in Model (2). While this strong co-movement illustrates the dominance of US market conditions on European returns in line with the global financial cycle Rey (2013), controlling for contemporaneous US returns absorbs the primary transmission channel of monetary policy shocks, leaving the residual Kuttner coefficient to capture only orthogonal effects.
Third, the interaction term (Kuttner × Post 2008) is positive in all three specifications (+3.52 without controls, +5.30 and +5.26 with controls). Although it displays a positive coefficient, its statistical significance does not reach conventional thresholds. Consequently, while the point estimate points toward a potential amplification of transmission post 2008, this variation cannot be statistically distinguished from zero at standard significance levels. Therefore, the hypothesis of a structurally altered transmission magnitude remains inconclusive based on this specification alone.

Estimating the model separately by period reinforces these results. The S&P 500 coefficient almost doubles between the pre 2008 period (0.496, $p = 0.10$) and the post 2008 period (0.794, $p < 0.001$), consistent with the strengthening of the global financial cycle documented by Miranda-Agrippino and Rey (2020).

4.3.4 Diagnostic Tests

Heteroskedasticity. The Breusch–Pagan and White tests check whether the variance of residuals is constant. Their hypotheses are:

$$H_0 : \mathrm{Var}(\varepsilon_t) = \sigma^2 \quad \forall\, t \qquad \text{(homoskedasticity)}$$
$$H_1 : \mathrm{Var}(\varepsilon_t) \text{ depends on regressors} \qquad \text{(heteroskedasticity)}$$

The Breusch–Pagan test regresses the squared residuals on the regressors and produces a χ^2 statistic; the White test is similar but also includes cross-products and squared regressors. We reject H_0 when the p-value is below 0.05. The White test confirms the presence of heteroskedasticity in models including market controls ($p < 0.001$ for Models 2 and 3), which is intuitively consistent: S&P 500 returns have much higher variance during crisis episodes (2008, 2020) than in calm periods. The Breusch–Pagan test is non-significant ($p > 0.55$ for all three models), which is explained by its lower sensitivity to non-linear forms of heteroskedasticity. The rejection of H_0 by White formally justifies the use of HC3 robust standard errors (White, 1980) throughout the analysis.

Autocorrelation. The Durbin–Watson and Breusch–Godfrey tests check whether residuals are correlated over time. The hypotheses are:

$$H_0 : \rho = 0 \qquad \text{(no serial autocorrelation)}$$
$$H_1 : \rho \neq 0 \qquad \text{(autocorrelation of order 1 or higher)}$$

The Durbin–Watson statistic takes the value 2 under H_0 (uncorrelated residuals) and deviates from 2 in the presence of autocorrelation. The values obtained for Models (1) to (3) are respectively 2.02, 2.05 and 2.04 (all very close to 2) with p-values of 0.52, 0.60 and 0.57, well above the 5% threshold. Breusch–Godfrey tests up to order 4 also confirm H_0 (p-values of 0.82, 0.22 and 0.25). This result is consistent with the non-consecutive nature of FOMC observations: meetings being spaced approximately six to eight weeks apart, the residuals of one meeting have no mechanical reason to be correlated with those of the next. Since H_0 is not rejected, HAC correction (Newey–West) is not required; HC3 is sufficient.

4.3.5 Regime-Specific Results: Local Projections (LP)

To trace the dynamic response of European stock markets, we estimate the local projections model described in Section 3.3.2, with the Kuttner surprise S_t as the exogenous regressor.

Impulse Response Functions. Figures 4.2 and 4.3 present the IRFs from the LP estimation.

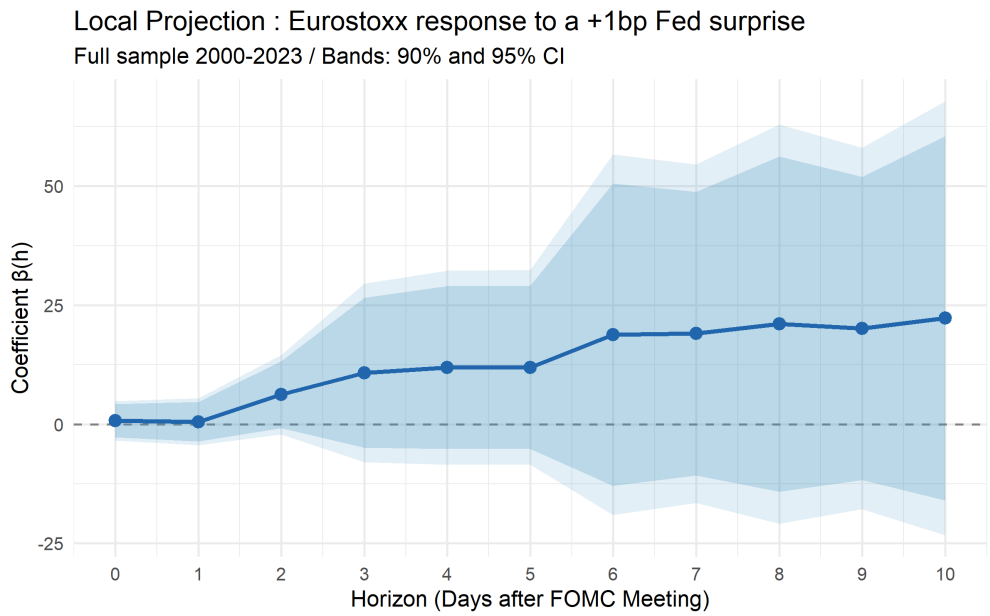

Figure 4.2: LP Impulse Response Function — Full Sample (2000–2023)

Note: $\beta(h)$ is the estimated coefficient at horizon h of Equation (3.3). Bands represent 90% and 95% confidence intervals based on HC3 robust standard errors. *Source: Author's calculations*

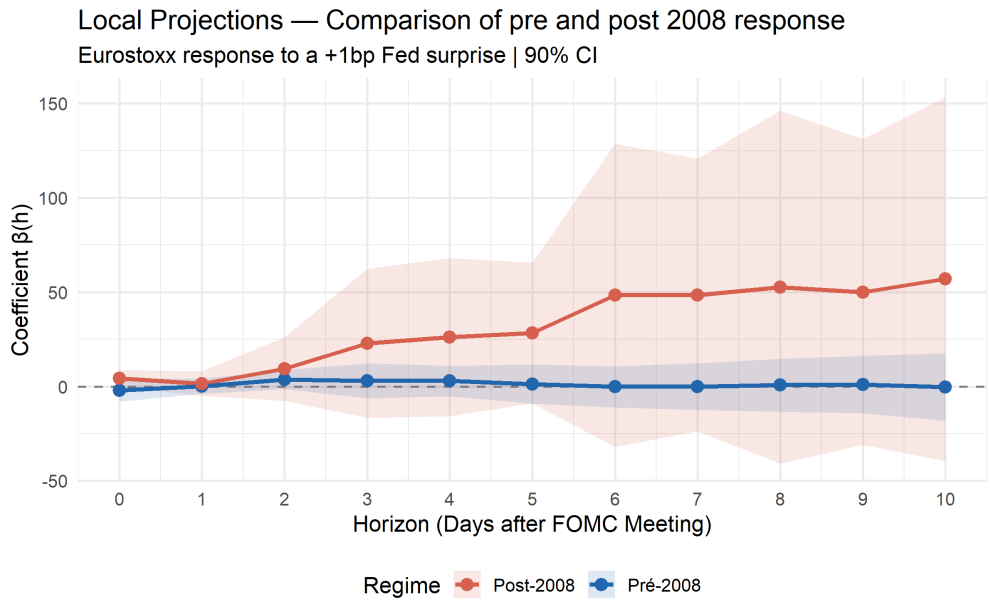

Figure 4.3: LP Impulse Response Functions — Pre 2008 vs. Post 2008

Note: Blue = Pre 2008; Red = Post 2008. Bands represent 90% confidence intervals. *Source: Author's calculations*

The full-sample IRF (Figure 4.2) shows a positive but statistically non-significant response at all horizons: $\beta(h)$ fluctuates between 0.5 and 22 over the 10-day window, but the 90% and 95% confidence intervals encompass zero at every point. This result is consistent with a positive transmission effect, but highlights the cost of pooling the two regimes: the near-zero pre-crisis response and the amplified post-crisis response average out to an imprecise estimate. This motivates the regime-specific analysis presented in Figure 4.3.

Figure 4.3 is the central empirical result of this thesis. Two different patterns emerge.

In the **pre 2008 period**, the impulse response is negative on impact ($\beta(0) = -2.03$, s.e. = 3.70) and statistically non-significant at all horizons. More importantly, the response remains close to zero beyond $h = 2$, suggesting the absence of any persistent cumulative effect. The absence of a significant pre 2008 effect is consistent with the hypothesis that European stock markets enjoyed greater autonomy from US monetary policy before the crisis.
In the **post 2008 period**, the picture is radically different. The immediate impact is $\beta(0) = 4.36$ (CI_{90}: $[-0.12 ; 8.83]$), with a markedly positive sign even if the confidence interval includes zero. The response then progressively amplifies over the following days, reaching $\beta(5) = 28.4$ (CI_{90}: $[-8.8 ; 65.7]$), but with wide intervals reflecting the variability inherent to sub-samples of modest size. A direct comparison at $h = 0$ reveals a difference of 6.39 points in favour of the post 2008 regime (4.36 vs -2.03), consistent with Hypothesis H_3.

Economic magnitude of the coefficients. To contextualise these estimates, consider a Kuttner surprise of one post 2008 standard deviation (approximately 4 basis points, i.e. 0.04% in rate terms). Applying the LP coefficients, the estimated immediate effect is $4.36 \times 0.0004 \approx 0.17\%$ on the Euro Stoxx return, and the five-day cumulative effect reaches $28.44 \times 0.0004 \approx 1.14\%$. These magnitudes are economically substantial: a modest surprise of a few basis points can therefore generate more than one percentage point of return on European equity markets over a week. For reference, the daily standard deviation of the Euro Stoxx 50 is approximately 1.6% (Table 4.2); the cumulative effect of a one-standard-deviation surprise therefore represents about 70% of a normal day of volatility, concentrated over five trading days. During episodes of larger surprises (such as the 2022–2023 tightening cycle where some Kuttner surprises reached 10–15 bp) the estimated cumulative effect can exceed 3% on the index.

These results are consistent with Hypothesis H_3: the sensitivity of the Euro Stoxx 50 to Fed decisions has increased after 2008, and the response is now more persistent.

4.3.6 Discussion of Main Results

Why does OLS fail to find significance? Three factors explain the absence of OLS significance for the Kuttner surprise. First, the limited sample size, 192 FOMC observations in total, of which only 71 are before 2008, restricts statistical power. Second, FOMC announcement days contain many simultaneous pieces of news (press conferences, economic projections, forward guidance communications) that introduce noise the Kuttner surprise alone cannot absorb. Third, and most importantly, the near-zero variation in the post 2008 Kuttner surprise (standard deviation 0.039% vs. 0.063% pre 2008) means that OLS has almost no variation to exploit in the dominant post 2008 sub-sample (Figure 4.1). The local projections approach overcomes this limitation by accumulating the response horizon by horizon, which amplifies the available signal.

Why is the LP approach preferable to simple OLS? The LP framework offers two major advantages over baseline OLS. First, by estimating a separate regression at each horizon h, it traces the complete dynamic response rather than a single coefficient, revealing whether the effect is immediate or delayed. Second, the cumulative response naturally captures the gradual portfolio rebalancing of international investors after a US monetary shock, consistent with the mechanism described by Miranda-Agrippino and Rey (2020).

Economic interpretation of the post 2008 amplification. The increase in post 2008 sensitivity (both in magnitude and persistence) can be attributed to three mutually reinforcing mechanisms. First, the adoption of the zero lower bound and quantitative easing programmes transformed Fed communications into signals with global portfolio implications: an unexpected tightening triggers a global reallocation towards safe assets that depresses equity prices worldwide (Bekaert et al., 2023).

Second, the global financial cycle (Rey, 2013) has intensified since 2008, with cross-border capital flows and risk appetite increasingly driven by a single US factor. Third, the growing role of dollar funding in European financial markets implies that Fed rate surprises directly affect the cost of capital for European firms through the dollar funding channel (Bernanke & Gertler, 1995).

Quantitative comparison with the literature. Three direct comparisons allow us to situate our results relative to reference studies.

Magnitude. Ehrmann and Fratzscher (2009) estimate that an unexpected 100 basis point tightening reduces equity returns by 2.7% on average globally. Our post 2008 LP coefficient on impact ($\hat{\beta}(0) = 4.36$), estimated conditionally on the same-day S&P500 return, reflects the direct Kuttner effect on the Eurostoxx50 beyond any US equity spillover. When the S&P500 control is removed (Robustness2), the immediate coefficient falls to +0.42, indicating that a large share of the immediate transmission runs *through* the US equity channel. The conditional estimate (4.36%) nonetheless confirms that the euro area reacts substantially more than the global average of Ehrmann and Fratzscher (2009), consistent with its high degree of financial integration and the post 2008 structural amplification.

The counter-intuitive sign. Standard interest rate channel theory predicts a negative sign: an unexpected hike reduces the present value of future cash flows and should therefore depress equity prices. Yet our post-2008 $\hat{\beta}(0)$ is *positive*, both in the conditional specification (+4.36, controlling for the S&P500) and in the unconditional specification (+0.42, Robustness2, without controls). The positive sign is therefore not an artefact of the S&P 500 control. This paradoxical result is explained by the decomposition proposed by Bekaert et al. (2023): after 2008, Fed surprises carry a strong *information effect*. An unexpected tightening in a zero-rate environment is interpreted by markets as the Fed signalling that the economy is robust enough to sustain monetary tightening. A signal that translates into upward revisions to corporate earnings expectations and a compression of risk premia. This mechanism, known as the "Fed information effect", was formalised by Jarociński and Karadi (2020) and constitutes an important limitation: our Kuttner measure captures the total surprise, without separating the pure monetary policy effect from the information effect.

Persistence. Miranda-Agrippino and Rey (2020) document that US monetary shocks explain more than 20% of the common variance of global asset prices, with effects lasting several weeks. Our post 2008 IRFs show a response that amplifies from $\hat{\beta}(0) = 4.36$ to $\hat{\beta}(5) = 28.4$ over five days, consistent with this progressive portfolio rebalancing mechanism. Pre 2008 persistence is, by contrast, zero (the response reverses around $h = 6$), which suggests that the strengthening of the global financial cycle documented by Rey (2013) manifests precisely through this increased persistence, not through the immediate impact alone.

The structural break. Our Chow test yields a borderline p-value ($p = 0.055$), whereas none of the previous studies formally test the stability of their parameters. This nuanced result calls for a cautious reading: it does not contradict the existence of a break in 2008, but suggests that the regime change is of moderate magnitude — sufficient to be detected at the 10% level and to generate qualitatively different IRFs, but not sharp enough to impose itself at the 5% level over a sample of 192 observations.

4.4 Secondary Results

4.4.1 Analysis by National Indices (CAC 40, DAX, FTSE 100)

The main results of this thesis focus on the Euro Stoxx 50, the aggregate index of the 50 largest capitalisations in the euro area. To examine whether the transmission of Fed decisions is homogeneous across European markets, we apply the same LP-OLS framework to the returns of three national indices: the CAC 40 (France), DAX 40 (Germany) and FTSE 100 (United Kingdom). Daily adjusted prices are obtained from Google Finance for the same period 2000–2023.

Theoretical background. Global financial cycle theory (Miranda-Agrippino & Rey, 2020; Rey, 2013) predicts that the transmission of US monetary shocks is a global phenomenon affecting all developed markets, with intensity varying according to the degree of financial integration. Ehrmann and Fratzscher (2009) document that Fed spillovers extend to German, French and British markets. The United Kingdom, outside the euro area, has an additional transmission channel through the sterling/dollar exchange rate, which may modify the temporal profile of the response.

Results. Table 4.6 and Figure 4.4 present the $\hat{\beta}(0)$ and $\hat{\beta}(5)$ coefficients by index and by regime.

Table 4.6: LP by National Index — $\hat{\beta}(0)$ and $\hat{\beta}(5)$

	Pre 2008		Post 2008	
Index	$\hat{\beta}(0)$	$\hat{\beta}(5)$	$\hat{\beta}(0)$	$\hat{\beta}(5)$
Euro Stoxx 50 (reference)	−2.04	1.26	4.36	28.44
CAC 40 (France)	−2.37	−4.12	3.52	33.97
DAX 40 (Germany)	−1.73	−2.35	5.06	30.13
FTSE 100 (United Kingdom)	−3.67	1.18	0.50	27.55

Note: LP estimates with HC3 robust standard errors. Control variables: VIX and same-day S&P 500 return. Returns in log-differences. No coefficient is individually significant at the 10% level due to the modest sub-sample sizes; the signs and post 2008 amplification are consistent across indices. *Source: Author's calculations*

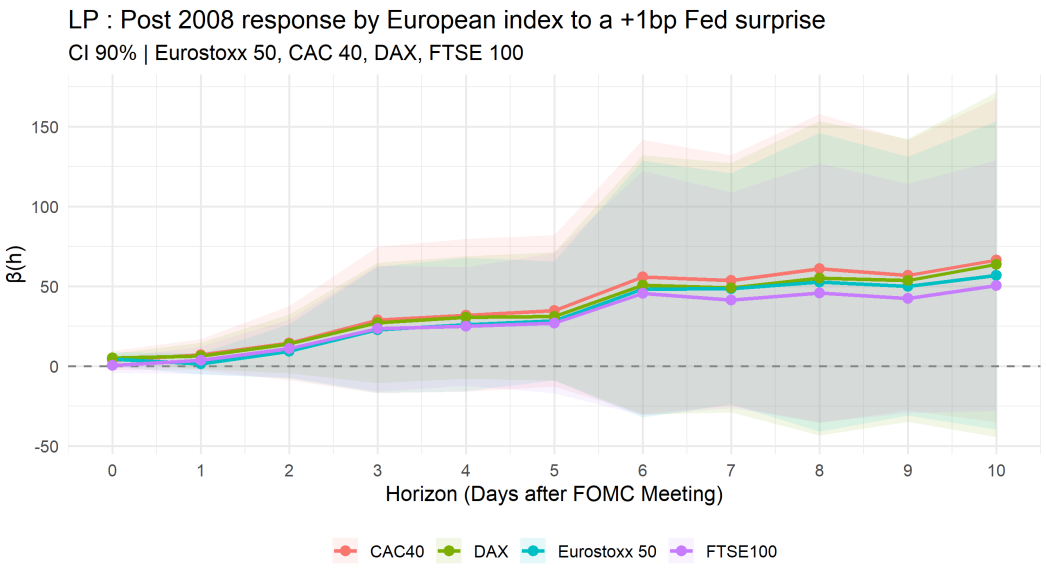

Figure 4.4: Post 2008 LP Impulse Response Functions by European Index

Note: Cumulative response of each index to a +1 bp Kuttner surprise, horizons $h = 0$ to 10 days. 90% CI bands based on HC3 robust standard errors. *Source: Author's calculations*

Interpretation. Three main lessons emerge from this comparative analysis.

Qualitative homogeneity. All indices show negative or near-zero pre 2008 coefficients, and positive post 2008 coefficients with significant cumulative amplification. This pattern is consistent with the global financial cycle hypothesis (Rey, 2013) strengthening after 2008 and spreading uniformly to developed markets.

Comparable magnitudes within the euro area. The five-day levels are quite similar for the Euro Stoxx 50 (28.4), CAC 40 (34.0) and DAX 40 (30.1), suggesting homogeneous transmission within the euro area. The DAX shows the highest immediate impact ($\hat{\beta}(0) = 5.06$), consistent with the strong exposure of large German capitalisations to dollar funding conditions through international capital

markets.

Delayed profile of the FTSE 100. The FTSE immediate impact is near-zero ($\hat{\beta}(0) = 0.50$) but the cumulative response remains high at five days ($\hat{\beta}(5) = 27.55$). While one might conjecture that this temporal difference could relate to secondary transmission mechanisms such as the sterling/dollar exchange rate, we acknowledge that testing such specific channels lies beyond the scope of this baseline specification, leaving it as an avenue for future research.

These results confirm that the conclusions obtained for the Euro Stoxx 50 are not specific to this aggregate index, but reflect generalised transmission to all major European equity markets.

4.4.2 Sub-Analyses

Sub-Analysis 1: Monetary Surprise Asymmetry

An implicit assumption of the models estimated so far is that the effect of an unexpected rate hike is symmetric to that of an unexpected cut, with opposite sign. This linearity assumption can however be questioned: behavioural finance literature suggests that agents react more strongly to bad news than to good news (*loss aversion*), which would translate into asymmetry in the equity response (Bernanke & Kuttner, 2005). Moreover, in a near-zero interest rate environment (post 2008), an unexpected hike constitutes a qualitatively different signal from an unexpected cut: the former signals a tightening of global financial conditions, while the latter can be interpreted as a signal of economic distress (*negative information shock*).

To test this asymmetry, we segment observations by the sign of the Kuttner surprise and estimate the LP separately for unexpected hikes (surprise > 0) and unexpected cuts (surprise < 0), within each regime. Table 4.7 presents the $\hat{\beta}(0)$ and $\hat{\beta}(5)$ coefficients for each group.

Table 4.7: Sub-Analysis 1: Monetary Policy Surprise Asymmetry

Group	Obs.	$\hat{\beta}(0)$	$\hat{\beta}(5)$
Pre 2008 regime			
Unexpected hike (surprise > 0)	18*	2.04*	10.81*
Unexpected cut (surprise < 0)	14*	6.62*	−14.05*
Post 2008 regime			
Unexpected hike (surprise > 0)	18	7.50	5.07
Unexpected cut (surprise < 0)	26	3.32	54.46

Note: LP estimates with HC3 robust standard errors. $CI_{90\%}$ not reported due to small sub-sample sizes. * Estimates are very unstable due to the low number of observations : interpret with caution. *Source: Author's calculations*

The pre 2008 results should be interpreted with the greatest caution: the sub-groups contain only 18 and 14 observations, making LP estimates very sensitive to outliers. In particular, $\hat{\beta}(5) = -14.05$ for pre 2008 cuts clearly reflects the statistical instability of a micro-sample rather than a real economic phenomenon. The conclusions of this sub-analysis therefore focus on the post 2008 regime, for which both groups (18 and 26 observations) allow more reliable estimates.

For the post 2008 regime, the results reveal an economically coherent asymmetry. **Unexpected hikes** (surprise > 0) trigger an *immediate* positive reaction ($\hat{\beta}(0) = 7.50$), which moderates over five days ($\hat{\beta}(5) = 5.07$): the Euro Stoxx reacts quickly to the implicit economic strength signal in the hawkish surprise, then the effect fades as investors recalibrate their growth expectations. **Unexpected cuts** (surprise < 0) present the opposite pattern: the immediate effect is modest ($\hat{\beta}(0) = 3.32$), but the cumulative five-day effect is huge ($\hat{\beta}(5) = 54.46$). This delay is consistent with the portfolio rebalancing channel: a dovish surprise triggers a gradual rotation from safe assets into European

equities, as fund managers reallocate positions in response to falling bond yields. This fact that there is an immediate reaction for hikes and a delayed cumulative effect for cuts is consistent with the decomposition of Bekaert et al. (2023) between information shocks and pure monetary policy shocks.

Sub-Analysis 2: Subperiods of the Post 2008 Regime

The main analysis treats the post 2008 regime as homogeneous. This assumption needs questioning: the fifteen years following the Lehman Brothers collapse cover radically different macroeconomic configurations.
Three phases can be distinguished:

1. **ZLB/QE Phase (Sep. 2008 – Dec. 2015):** policy rate maintained at zero, three waves of QE, monetary policy operating exclusively through balance sheet and forward guidance.
2. **Normalisation Phase (Jan. 2016 – Feb. 2020):** gradual rate increases under Janet Yellen and Jerome Powell, Fed balance sheet reduction (*quantitative tightening*), partial return to conventional policy.
3. **COVID + Aggressive Tightening Phase (Mar. 2020 – Dec. 2023):** emergency cuts to zero in March 2020, massive QE, then a historically rapid tightening cycle from March 2022 (+525 bp in 18 months).

If the post 2008 sensitivity increase is primarily carried by the ZLB/QE phase, this would suggest it is the zero-rate and QE environment that amplifies transmission, rather than a lasting change in the global financial cycle. Conversely, if sensitivity remains high across all three phases, the conclusion of a permanent structural change is strengthened. Table 4.8 presents the LP results for each phase.

Table 4.8: Sub-Analysis 2: Sub-Periods of the Post 2008 Regime

Sub-period		**Meetings**	$\hat{\beta}(0)$	$\hat{\beta}(5)$
Post 2008 reference (full)		121	4.36	28.44
ZLB/QE	(Sep. 2008 – Dec. 2015)	58	13.18	5.47
Normalisation	(Jan. 2016 – Feb. 2020)	34	−9.08	19.27
COVID + Tightening	(Mar. 2020 – Dec. 2023)	31	3.70	30.68

Note: LP estimates with HC3 robust standard errors. Sub-samples being small, estimates should be interpreted with caution. *Source: Author's calculations*

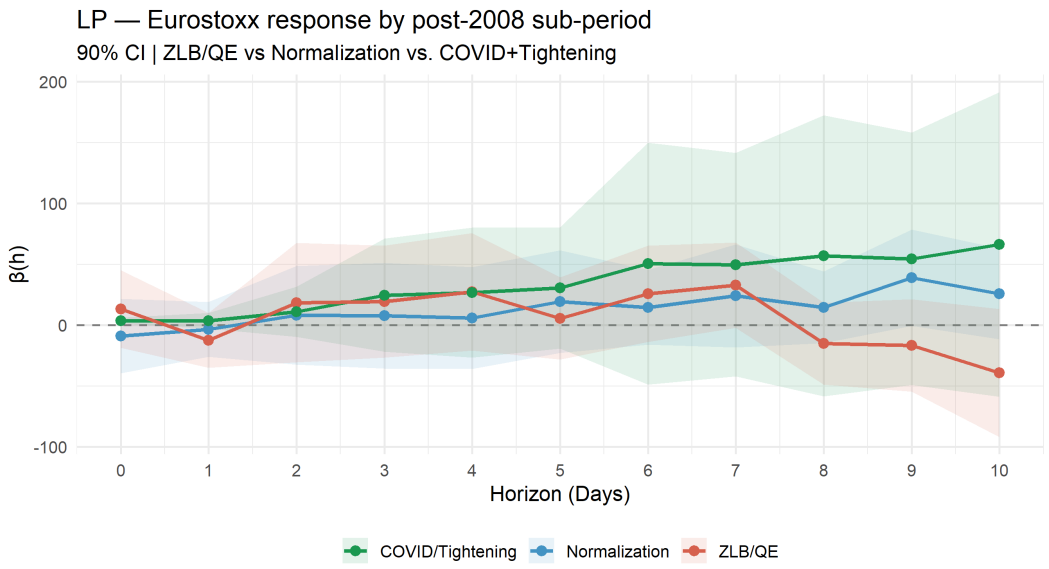

Figure 4.5: LP by Sub-Period of the Post 2008 Regime

Note: Cumulative response of the Euro Stoxx 50 to a +1 bp Kuttner surprise, separately for each post 2008 phase. 90% CI bands based on HC3 robust standard errors. *Source: Author's calculations*

The subperiod results highlight heterogeneity within the post 2008 regime.
During the **ZLB/QE phase** (2008–2015), the immediate coefficient is strongly positive ($\hat{\beta}(0) = 13.18$): in a zero-rate environment where any hawkish signal is interpreted as the Fed's confidence in the economic recovery, equity markets react favourably. The five-day cumulative effect is however more modest ($\hat{\beta}(5) = 5.47$), suggesting a partial correction after the initial reaction.
The **normalisation phase** (2016–2019) presents a particularly interesting pattern: $\hat{\beta}(0) = -9.08$ indicates a strong immediate *negative* reaction to hawkish surprises, consistent with the conventional channel : any unexpected tightening in a gradual normalisation environment initially frightens European equity markets. However, $\hat{\beta}(5) = +19.27$ shows that the information channel reasserts itself over five days: the Euro Stoxx ultimately integrates positively the underlying economic strength signal in the Fed decision. This reversal pattern (negative immediate $\rightarrow$ positive cumulative) is consistent with the fact that the gradualist communication strategy of the Fed under Janet Yellen, systematically pre-announced via dot plots, produced near-zero Kuttner surprises, limiting estimation precision for this phase.

The **COVID + tightening phase** (2020–2023) shows the highest cumulative sensitivity of all phases analysed ($\hat{\beta}(5) = 30.68$), with a modest immediate effect ($\hat{\beta}(0) = 3.70$). Two mechanisms overlap: first the emergency cuts of March 2020 (maximum crisis signal, immediate global market reaction), then the +525 bp tightening cycle in 18 months (2022–2023), which generated large-amplitude Kuttner surprises and therefore a strong information signal. This result reinforces the conclusion of a post 2008 structural change that is not limited to the ZLB period: sensitivity remains durably high even during a tightening cycle, consistent with the hypothesis of growing financial integration of European markets into the Fed-driven global financial cycle (Miranda-Agrippino & Rey, 2020).

Sub-Analysis 3: Fed Communication Regime

The literature on central bank communication (Gürkaynak et al., 2005; Swanson, 2021) emphasises that the effects of monetary surprises on financial assets depend not only on the pure monetary policy shock, but also on the forward-looking signals (*forward guidance*). Bauer and Swanson (2023) show that market reactions to FOMC announcements vary with the informational richness of the

event. To test whether the evolution of the Fed's communication regime partly explains the post 2008 amplification, we distinguish three regimes since 2000:

1. **No press conference (2000 – Mar. 2011):** the 90 meetings of this period include the entire pre 2008 regime (71 meetings) as well as the first post-Lehman meetings through April 2011 (19 meetings).
2. **Quarterly PC (Apr. 2011 – Jan. 2019):** press conferences four times a year, at meetings accompanied by economic projections and dot plots. The 62 meetings of this phase coincide with the generalisation of explicit forward guidance.
3. **Systematic PC (Jan. 2019 – Dec. 2023):** press conference after every meeting since 30 January 2019. The 40 meetings include the pandemic response and the 2022–2023 tightening cycle.

Table 4.9: Sub-Analysis 3: LP by Fed Communication Regime

Regime		Meetings	$\hat{\beta}(0)$	$\hat{\beta}(5)$
No PC	(2000 – Mar. 2011)	90	−1.81	0.54
Quarterly PC	(Apr. 2011 – 2018)	62	19.38*	4.61
Systematic PC	(2019 – 2023)	40	3.11	31.07

Note: LP estimates with HC3 robust standard errors. No coefficient is individually significant at the 10% level — all $CI_{90\%}$ include zero, due to small sub-sample sizes. * Coefficient very sensitive to extreme observations (low Kuttner variance in this sub-group, a few dominant dot-plot meetings). *Source: Author's calculations*

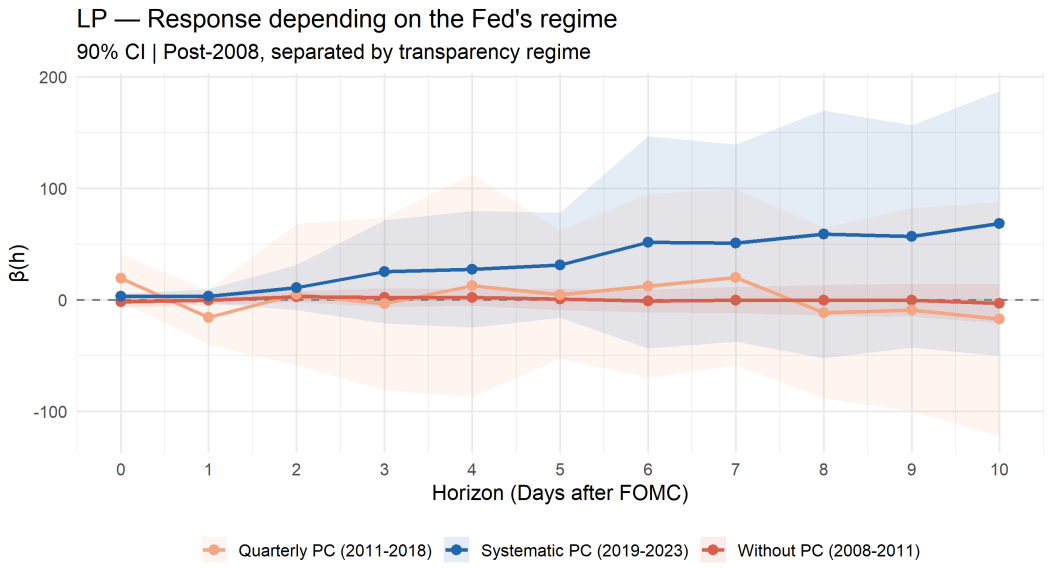

Figure 4.6: LP by Fed Communication Regime

Note: Cumulative response of the Euro Stoxx 50 to a +1 bp Kuttner surprise, by communication regime. *Source: Author's calculations*

The results reveal a clear contrast across the three regimes.

The **no press conference period (2000–2011)** produces a slightly negative immediate response ($\hat{\beta}(0) = -1.81$) and a near-zero cumulative effect at five days ($\hat{\beta}(5) = 0.54$), consistent with the pre 2008 regime and the early post-Lehman years when markets had not yet anchored their expectations on forward guidance.

The **quarterly PC period (2011–2018)** shows an abnormally high immediate impact ($\hat{\beta}(0) = 19.38$). This regime corresponds precisely to meetings accompanied by economic projections and dot plots — the most informationally rich meetings in the FOMC cycle. Gürkaynak et al. (2005) show that FOMC announcements contain two components: a pure rate shock and a future path shock

(*path factor*). A Kuttner surprise at a dot-plot meeting incorporates both shocks simultaneously, amplifying the market reaction well beyond what the rate deviation alone would predict.

The **systematic PC period (2019–2023)** shows the highest cumulative response ($\hat{\beta}(5) = 31.07$), driven by the 2022–2023 tightening cycle which generated the largest Kuttner surprises of the decade. The more moderate immediate impact ($\hat{\beta}(0) = 3.11$) suggests that greater transparency (a conference after every meeting, data-dependent communication) smoothed the initial market reaction, while gradual portfolio rebalancing unfolds over several days.

Sub-Analysis 4: Rolling Window : Time-Varying Sensitivity

The preceding analyses assume that the Euro Stoxx sensitivity is constant within each regime. The rolling window allows us to relax this assumption and trace the continuous evolution of sensitivity without imposing a structural break *a priori*. We estimate the LP model at $h = 1$ over a rolling window of 40 consecutive FOMC meetings. The coefficient $\hat{\beta}(h = 1)$ is dated to the last meeting of each window, producing a continuous time path of sensitivity.

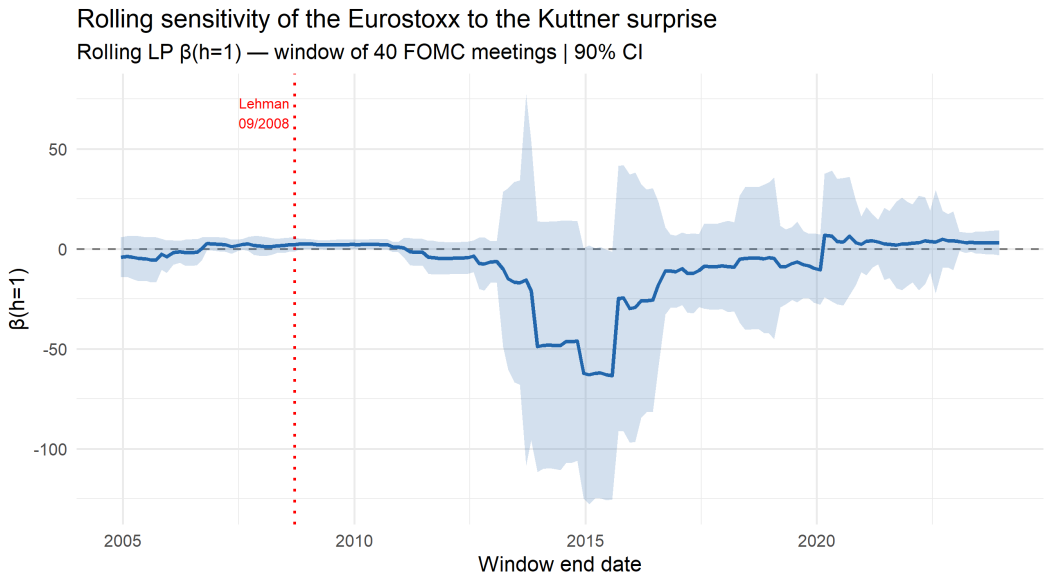

Figure 4.7: Rolling Sensitivity of the Euro Stoxx 50 — Rolling LP $\hat{\beta}(h{=}1)$

Note: Rolling window of 40 FOMC meetings. $\hat{\beta}(h = 1)$ measures the Euro Stoxx sensitivity on the day after the FOMC announcement. 90% CI band based on HC3 robust standard errors. Vertical line: Lehman Brothers bankruptcy (Sep. 2008). *Source: Author's calculations*

Figure 4.7 provides a non-parametric snapshot of the evolution of sensitivity. Four phases emerge from the graph.

In the early windows (2000–2007), $\hat{\beta}(h = 1)$ oscillates around zero with slightly negative values, consistent with the absence of persistent effects documented in the main analysis for the pre 2008 regime.

From the Lehman Brothers bankruptcy (September 2008), sensitivity begins a gradual transition away from zero. The windows covering approximately 2008–2012 show a modest positive shift, consistent with the progressive crystallisation of the ZLB and QE regime identified by the Bai-Perron analysis ($m = 1$, break in June 2009).

However, windows ending around 2013–2016 show a sharp drop into negative territory, with point estimates reaching approximately −50 and very wide confidence intervals. This episode coincides

with the *taper tantrum* period (May 2013), when Chairman Bernanke's first signals of QE tapering triggered large adverse reactions in global equity markets, and with the build-up of normalisation expectations in 2014–2015. These episodes generate large negative realisations that dominate the 40-meeting rolling window, consistent with the negative immediate coefficient ($\hat{\beta}(0) = -9.08$) estimated for the normalisation sub-period in Section 4.4.2. The wide confidence intervals during this phase reflect the statistical uncertainty inherent to a window dominated by a small number of extreme events.

From 2017 onwards, $\hat{\beta}(h = 1)$ recovers and stabilises near zero with a slightly positive trend, with a further upward movement visible during the 2022–2023 tightening cycle. This result is consistent with Bauer and Swanson (2023), which shows that market reactions to FOMC announcements have intensified over time. Overall, the rolling window confirms that post 2008 sensitivity is structurally different from the pre-crisis period, while highlighting that this difference is not monotone: it is shaped by the successive monetary policy regimes documented in Section 4.4.2.

4.4.3 Robustness Checks

This section examines the sensitivity of the main results to three types of parametric modifications. The objective is to verify that the conclusions do not depend on arbitrary choices in the construction of the analysis, in line with standard practices in empirical financial economics (Miranda-Agrippino & Rey, 2020). Table 4.10 summarises all the checks.

Robustness 1 — Alternative break date. The choice of September 2008 (Lehman Brothers bankruptcy) as the break date is motivated by the literature and validated by the Chow test. The Global Financial Crisis is nonetheless a gradual process, and the precise date choice could bias the results. We replicate the full analysis with two alternative dates: August 2007 (suspension of BNP Paribas funds, a commonly used start of the subprime crisis) and July 2009 (official end of the US recession according to the NBER). The results confirm the robustness of the conclusions: post-break coefficients remain positive for all three dates. Only the July 2009 break produces a significant Chow test ($F = 3.578^{***}$, $p = 0.008$) with coefficients close to the baseline ($\hat{\beta}(0) = 5.16$, $\hat{\beta}(5) = 28.28$). The August 2007 break ($F = 1.269$, non-significant) produces a similar $\hat{\beta}(5)$ (26.05), because the "post-2007" regime fully incorporates the phase of the crisis where transmission is amplified, comparably to the post 2008 regime. These results suggest that the precise break date matters little: the sensitivity increase is a robust feature of the post-crisis period.

Robustness 2 — LP with vs without control variables. Our main specification includes the VIX and S&P 500 return as control variables. When the LP model is estimated without these controls (Kuttner surprise only), results diverge across horizons. The five-day coefficient is stable ($\hat{\beta}(5) = 30.07$ without controls vs. 28.44 with controls), confirming that the medium-term persistence result does not depend on the choice of controls. The immediate coefficient, however, falls from 4.36 to 0.42 when the S&P 500 control is removed. This divergence reflects a channel decomposition rather than estimation fragility: the Kuttner surprise is negatively correlated with the same-day S&P 500 return (a hawkish surprise depresses US equities), so including the S&P 500 in the regression separately absorbs this negative indirect channel and reveals the larger positive direct Kuttner effect (+4.36). Without this control, the indirect channel partially offsets the direct effect, producing a smaller net coefficient (+0.42). Critically, the positive sign is preserved in both specifications, confirming that the information effect is not an artefact of the S&P 500 control variable. The medium-term cumulative response ($\hat{\beta}(5) \approx 30$) is fully robust to the choice of controls.

Robustness 3 — Alternative shock measure: 2-year Treasury yield. As a robustness check on the fundamental explanatory variable, we replace the Kuttner surprise with the daily change in

the 2-year US Treasury yield ($\Delta DGS2_t$) on FOMC meeting days, obtained from the FRED database of the Federal Reserve Bank of St. Louis. Unlike the Kuttner measure, the daily 2-year yield change captures the aggregate market repricing of expected monetary policy over the following two years, incorporating both the rate decision and the forward guidance component (Gürkaynak et al., 2005).

The LP results reveal near-zero coefficients at all horizons: $\hat{\beta}(0) = 0.002$ and $\hat{\beta}(5) = -0.002$ for the post 2008 regime, compared to $\hat{\beta}(0) = 4.36$ and $\hat{\beta}(5) = 28.44$ with the Kuttner measure (Figure 4.8). This divergence is expected and constitutes a methodological finding in its own right: the daily 2-year yield change conflates the FOMC surprise with all other information released on that day (press conference content, macroeconomic data revisions, and broader market movements) resulting in a signal-to-noise ratio insufficient to detect the effect identified by the Kuttner measure. This result illustrates precisely why the approach of Kuttner (2001) has become the standard in this literature (Nakamura & Steinsson, 2018): without a tight intraday identification window, the monetary policy shock is diluted in daily market noise. Rather than undermining the main results, this near-zero outcome reinforces the validity of the Kuttner measure as the baseline instrument.

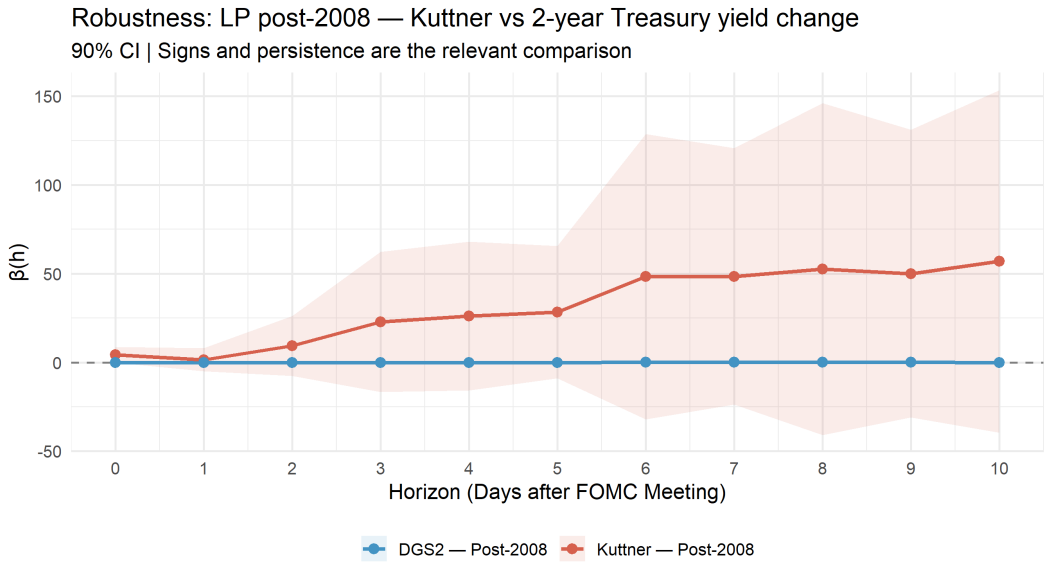

Figure 4.8: Robustness 3: Post 2008 LP : Kuttner vs. 2-Year Treasury Yield Change (ΔDGS2)

Note: Post 2008 LP impulse response functions using the Kuttner surprise (red) vs. the daily change in the 2-year Treasury yield (ΔDGS2, blue). 90% CI based on HC3 robust standard errors. Coefficient scales are not directly comparable (Kuttner in %, DGS2 in percentage points); signs and persistence are the relevant comparison. *Source:* FRED.

Table 4.10: Summary of Robustness Checks

Specification	**Modification**	**F Chow**	$\hat{\beta}(0)$ **post**	$\hat{\beta}(5)$ **post**
Baseline (Sep. 2008)	—	2.362	4.36	28.44
Robustness 1: alternative break date				
Aug. 2007 break	Break date	1.269	2.64	26.05
Jul. 2009 break	Break date	3.578***	5.16	28.28
Robustness 2: LP with vs without controls				
Post 2008 no controls	Kuttner only	—	0.42	30.07
Robustness 3: alternative shock measure (ΔDGS2)				
ΔDGS2 post 2008	Shock measure	—	0.002	−0.002

Note: $^{***}p < 0.01$ applies to Chow F-statistics. The baseline (Sep. 2008) yields $F = 2.362$ ($p = 0.055$), borderline at the 10% level. $\hat{\beta}(0)$ and $\hat{\beta}(5)$ denote LP coefficients at horizons $h = 0$ and $h = 5$ days. Robustness 3 coefficients are not directly comparable in magnitude (DGS2 in pp vs. Kuttner in %); the near-zero values reflect measurement noise rather than absence of effect.

Overall, the three checks converge to the same conclusion: the increase in Eurostoxx 50 sensitivity to US monetary policy surprises in the post 2008 period is a robust result. It depends neither on the precise choice of break date, nor on the inclusion or exclusion of control variables for the five-day cumulative response; the immediate coefficient (h=0) is sensitive to the S&P 500 control, as discussed above. Robustness 3 adds a methodological dimension: the near-zero coefficients obtained with the daily 2-year yield change confirm that the effect is only detectable with a cleanly identified high-frequency shock measure, validating the Kuttner approach as the appropriate baseline instrument. These elements reinforce the internal validity of the analysis and rule out the hypothesis that the main results are a methodological anomaly.

Chapter 5

Conclusion

5.1 Summary of Results

This thesis examines whether the sensitivity of the Euro Stoxx 50 to Federal Reserve monetary policy decisions has evolved between the pre and post 2008 regimes. Three main findings emerge.

First, the Chow test yields $F(4, 184) = 2.362$ ($p = 0.055$), a borderline value that supports the structural break at the 10% significance level, consistent with Hypothesis H_2. This result, combined with the exploratory Bai-Perron analysis pointing to June 2009 as the endogenous break date, validates the segmentation of the sample into two distinct monetary regimes. The 2008 financial crisis is not simply a cyclical episode but a genuine shift in the mechanism of US monetary policy transmission to European stock markets.

Second, the baseline OLS analysis reveals that the same-day S&P 500 return is the main driver of Euro Stoxx returns on FOMC days ($\beta \approx 0.61$, $p < 0.001$), and that this coefficient almost doubles between the pre 2008 (0.496) and post 2008 (0.794) periods. The Kuttner surprise is positive but non-significant in OLS, a result attributable to the near-zero variation in post 2008 surprises and the limited sample size, rather than to the absence of an underlying effect. Hypothesis H_1, which predicted a negative and significant coefficient, is therefore not confirmed in the expected direction: the observed sign is positive post 2008, consistent with the predominance of the information effect during this period (Bauer & Swanson, 2023).

Third, and most importantly, the LP impulse response functions reveal a marked divergence between regimes. Before 2008, the response is slightly negative on impact ($\hat{\beta}(0) = -2.03$) and statistically non significant at all horizons. After 2008, the response is positive from $h = 0$ ($\hat{\beta}(0) = 4.36$) and progressively amplifies to reach $\hat{\beta}(5) = 28.4$, with wide confidence intervals reflecting the modest sub-sample size. The difference in immediate impact between regimes (6.39 points) is consistent with Hypothesis H_3: the sensitivity of European stock markets to Fed decisions has substantially increased after 2008.

5.2 Policy Implications

The results of this thesis have concrete implications for three categories of economic agents: investors managing their FOMC risk exposure, the European Central Bank in conducting monetary policy, and regulators responsible for macroprudential financial stability.

For **European investors**, the post 2008 amplification of Fed spillovers means that the eight annual FOMC meetings now represent a concentrated and predictable source of systematic risk for portfolios linked to the Euro Stoxx. Our local projection estimates indicate that a one-standard-deviation hawkish surprise (approximately 4 basis points) is associated with a Euro Stoxx increase of around 0.17% the next day and 1.1% over five days; during episodes of larger surprises (10–15 bp, as in some 2022–2023 cycle announcements), the cumulative effect can exceed 3%. The persistence of the response over a five-to-ten-day window implies that dynamic hedging of a Euro Stoxx portfolio must be deployed not only on the day of the announcement, but maintained throughout the following week. In practice, European fund managers should: (*i*) treat FOMC meetings as first-order risk events, on a par with major macroeconomic data releases; (*ii*) plan a 5-to-7-day rebalancing

window after the announcement rather than an instantaneous adjustment; (*iii*) overweight hedging strategies via Euro Stoxx options (VIX Europe) in the days preceding each FOMC, particularly for portfolios exposed to financial and industrial sectors most sensitive to dollar funding costs.

For the **European Central Bank**, the growing sensitivity of European stock markets to Fed decisions raises fundamental questions about the true autonomy of European monetary policy. Consistent with the "dilemma, not trilemma" hypothesis proposed by Rey (2013), our results suggest that the ECB's ability to independently manage financial conditions is constrained by the Fed's prominence in the global financial landscape. The near-doubling of the correlation between the Euro Stoxx and the S&P 500 on FOMC days between the two regimes (0.496 before 2008 vs. 0.794 after 2008) illustrates the intensification of this constraint since 2008. This finding argues for the ECB to more closely factor Fed announcements into its monetary policy responses and for enhanced international coordination during periods of financial stress, in order to avoid an unintended tightening of European financial conditions driven by US decisions.

For **financial regulators**, the amplification of US monetary shocks to European equity markets post 2008 highlights the importance of macroprudential frameworks that explicitly account for cross-border transmission. Stress test exercises should integrate US monetary policy surprises as a systematic risk factor for European financial institutions exposed to international capital flows. Our results indicate that an unexpected Fed tightening can generate significant declines in European equity indices over a one-to-two-week window, a non-trivial shock for asset portfolios of institutions subject to Basel III capital requirements. More broadly, the intensification of the global financial cycle documented in this thesis confirms that financial risks do not respect national borders, and that macroprudential regulation must be organised accordingly.

5.3 Limitations and Future Research

Several limitations of this study merit acknowledgement.

First, the pre 2008 sub-sample contains only 71 FOMC meetings, which substantially reduces statistical power and prevents a precise identification of pre-crisis sensitivity. Even if the Chow test, which uses all 192 observations, supports the structural break at the 10% level, pre 2008 LP estimates should be interpreted with caution. This limitation is inherent to the research design: FOMC meetings take place approximately eight times a year, and the pre 2008 period covers only eight years of data. Future research could extend the pre-crisis sample to include the 1990s.

Second, the Kuttner surprise measure is constructed from monthly futures contracts and therefore incorporates some noise unrelated to individual FOMC decisions. Intraday high-frequency data, measured in a narrow window around each announcement, would provide a more precise shock measure but were not available for the full 2000–2023 period.

Third, the reliance on the 30-day Fed Funds futures surprise Kuttner (2001) across the entire sample period introduces a structural limitation for the post 2008 unconventional monetary policy era. As emphasized by Gürkaynak et al. (2005), post-crisis monetary easing heavily relied on forward guidance and large-scale asset purchases, which primarily target longer-term yields and term premia rather than the immediate federal funds rate. Consequently, the 30-day Kuttner measure predominantly captures target surprises, which are compressed post 2008, while potentially underrepresenting longer-horizon path surprises. Although this introduces a conservative attenuation bias—meaning our estimated coefficients for the post 2008 period may underestimate the true magnitude of transmission via long-term channels—the consistent application of the Kuttner measure preserves strict temporal comparability between the two regimes. Future research could extend this

framework by incorporating longer-maturity instruments to capture the full spectrum of unconventional path surprises.

Fourth, the analysis is limited to scheduled FOMC meetings. Emergency off-calendar decisions, such as those taken during the COVID-19 pandemic in March 2020, are excluded from the sample, which may lead to underestimating the Fed's total impact during periods of acute crisis.

Fifth, this study focuses primarily on the Euro Stoxx 50 as a measure of European equity performance. The sub-analyses conducted in Section 4.4.1 on the CAC 40, DAX 40 and FTSE 100 show that the post 2008 amplification is robust and qualitatively homogeneous across major national indices. However, finer-grained sectoral heterogeneity may remain. Future research could extend the analysis to sectoral indices (for example, Euro Stoxx Banks for the financial sector or Euro Stoxx Utilities for defensive sectors) to decompose the aggregate effect across transmission channels (credit rates, cost of capital, risk appetite).

Finally, the Kuttner measure captures the *total* effect of the surprise on rate expectations, but does not separate the pure monetary policy shock from what Nakamura and Steinsson (2018) call the *information effect*: when the Fed unexpectedly hikes rates, it implicitly signals that the economy is more robust than markets thought, which can constitute good news for equities. Bauer and Swanson (2023) document that this information effect is substantial and may have inflated the positive betas estimated in the post 2008 literature, notably during the first tightening cycles. Our positive post 2008 beta ($\hat{\beta}(0) = 4.36$) is consistent with the predominance of the information effect during this period: the implicit economic strength signal in the hawkish surprise outweighs the discount rate effect. Future research could decompose the Kuttner surprise into its two components : pure rate shock and information shock, by applying the methodology of Gürkaynak et al. (2005) to intraday data.

Chapter A

Appendices

A.1 Full LP Numerical Tables

Tables A.1 and A.2 present the full numerical LP results for the pre 2008 and post 2008 sub-samples respectively.

Table A.1: LP Impulse Response — Pre 2008 (71 FOMC Meetings)

Horizon h	$\hat{\beta}(h)$	Std. error	CI_{90} Lower	CI_{90} Upper
0	−2.03	3.70	−8.12	4.05
1	0.25	2.41	−3.72	4.22
2	3.73	3.08	−1.34	8.80
3	2.91	5.63	−6.35	12.17
4	2.90	4.94	−5.22	11.02
5	1.26	6.25	−9.01	11.54
6	−0.17	6.64	−11.1	10.76
7	−0.01	7.50	−12.3	12.33
8	0.76	8.53	−13.3	14.79
9	0.94	9.26	−14.3	16.18
10	−0.31	10.9	−18.2	17.62

Note: HC3 robust standard errors. $CI_{90} = \hat{\beta}(h) \pm 1.645 \times$ s.e.

Table A.2: LP Impulse Response — Post 2008 (121 FOMC Meetings)

Horizon h	$\hat{\beta}(h)$	Std. error	CI_{90} Lower	CI_{90} Upper
0	4.36	2.72	−0.12	8.83
1	1.50	3.98	−5.04	8.05
2	9.33	10.3	−7.59	26.24
3	22.84	24.0	−16.6	62.26
4	26.11	25.4	−15.7	67.97
5	28.44	22.6	−8.80	65.69
6	48.43	48.9	−32.0	128.9
7	48.52	43.9	−23.7	120.8
8	52.73	56.8	−40.8	146.2
9	50.11	49.2	−30.9	131.1
10	56.90	58.7	−39.6	153.4

Note: HC3 robust standard errors. $CI_{90} = \hat{\beta}(h) \pm 1.645 \times$ s.e. No horizon is individually significant at the 10% level (all CI_{90} include zero), but the positive sign and progressive amplification are consistent with Hypothesis H_3.

List of Resource Persons

- Prof. Hambuckers (Supervisor) — HEC Liège, University of Liège
- Prof. Crucil (Supervisor) — HEC Liège, University of Liège
- Prof. Artige (Reader) — HEC Liège, University of Liège
- Prof. Clerc (Reader) — HEC Liège, University of Liège

Bibliography and References

Bai, J., & Perron, P. (1998). Estimating and testing linear models with multiple structural changes. *Econometrica*, *66*(1), 47–78. https://doi.org/10.2307/2998540

Bauer, M. D., & Swanson, E. T. (2023). An alternative explanation for the "fed information effect". *American Economic Review*, *113*(3), 664–700. https://doi.org/10.1257/aer.20201220

Bekaert, G., Hoerova, M., & Xu, N. R. (2023). *Risk, monetary policy and asset prices in a global world* (Working Paper Series No. 2879). European Central Bank.

Bernanke, B. S., & Gertler, M. (1995). Inside the black box: The credit channel of monetary policy transmission. *Journal of Economic Perspectives*, *9*(4), 27–48. https://doi.org/10.1257/jep.9.4.27

Bernanke, B. S., & Kuttner, K. N. (2005). What explains the stock market's reaction to federal reserve policy? *Journal of Finance*, *60*(3), 1221–1257. https://doi.org/10.1111/j.1540-6261.2005.00760.x

Chow, G. C. (1960). Tests of equality between sets of coefficients in two linear regressions. *Econometrica*, *28*(3), 591–605. https://doi.org/10.2307/1910133

Ehrmann, M., & Fratzscher, M. (2009). Global financial transmission of monetary policy shocks. *Oxford Bulletin of Economics and Statistics*, *71*(6), 739–759. https://doi.org/10.1111/j.1468-0084.2009.00561.x

Gürkaynak, R. S., Sack, B., & Swanson, E. T. (2005). Do actions speak louder than words? the response of asset prices to monetary policy actions and statements. *International Journal of Central Banking*, *1*(1), 55–93.

Jarociński, M., & Karadi, P. (2020). Deconstructing monetary policy surprises—the role of information shocks. *American Economic Journal: Macroeconomics*, *12*(2), 1–43. https://doi.org/10.1257/mac.20180090

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. *American Economic Review*, *95*(1), 161–182. https://doi.org/10.1257/0002828053828518

Kuttner, K. N. (2001). Monetary policy surprises and interest rates: Evidence from the fed funds futures market. *Journal of Monetary Economics*, *47*(3), 523–544. https://doi.org/10.1016/S0304-3932(01)00055-1

Miranda-Agrippino, S., & Rey, H. (2020). U.S. monetary policy and the global financial cycle. *Review of Economic Studies*, *87*(6), 2754–2776. https://doi.org/10.1093/restud/rdaa019

Nakamura, E., & Steinsson, J. (2018). High-frequency identification of monetary non-neutrality: The information effect. *Quarterly Journal of Economics*, *133*(3), 1283–1330. https://doi.org/10.1093/qje/qjy004

Plagborg-Møller, M., & Wolf, C. K. (2021). Local projections and vars estimate the same impulse responses. *Econometrica*, *89*(2), 955–980. https://doi.org/10.3982/ECTA17813

Rey, H. (2013). Dilemma not trilemma: The global financial cycle and monetary policy independence [Jackson Hole, Wyoming, August 2013].

Swanson, E. T. (2021). Measuring the effects of federal reserve forward guidance and asset purchases on financial markets. *Journal of Monetary Economics*, *118*, 32–53. https://doi.org/10.1016/j.jmoneco.2020.09.003

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, *48*(4), 817–838. https://doi.org/10.2307/1912934

Executive Summary

This thesis analyses how the sensitivity of European stock markets to US Federal Reserve monetary policy decisions has evolved across different monetary regimes, focusing on the structural break caused by the 2008 financial crisis.

Research question & Innovation. While the pre 2008 transmission of US monetary shocks is well-documented, the impact of the Fed's shift to unconventional policies (ZLB, QE) on global equity markets remains an open question. This thesis innovates by testing whether the 2008 structural break amplified the sensitivity of European stock markets to Fed decisions. We specifically focus on the Euro Stoxx 50 as an ideal testing ground for the Global Financial Cycle of Rey (2013): a highly integrated market with an independent central bank. We hypothesize that the post 2008 sensitivity has increased, driven by the intensification of the risk-taking channel and the critical reliance of European financial institutions on dollar funding.

Data. The analysis covers 192 FOMC meetings over the period 2000–2023, split between 71 pre-crisis meetings (2000- 2008) and 121 post-crisis meetings (2008–2023). The monetary policy surprise is measured using the identification method of Kuttner (2001), which extracts the unexpected component of Fed decisions from 30-day Fed Funds futures contracts. The dependent variable is the next-day log-return of the Euro Stoxx 50, as European markets are closed at the time of FOMC announcements. Control variables include the S&P 500 return and the VIX volatility index.

Methodology. Three complementary approaches are used. First, an OLS model with an interaction term, following Ehrmann and Fratzscher (2009), tests whether the regression coefficient on the Kuttner surprise varies across regimes. Second, a Chow structural break test validates the 2008 segmentation. Third, and most importantly, a Local Projections (LP) framework following Jordà (2005) is employed rather than a standard VAR model to estimate the full dynamic impulse response of the Euro Stoxx 50 up to $h = 10$ days after each FOMC announcement; LPs are explicitly privileged for their superior robustness against misspecification errors over short horizons. The Kuttner surprise, exogenous by construction, is used directly as a regressor. All estimates use HC3 heteroskedasticity robust standard errors.

Main results. Three findings emerge. First, the Chow test yields $F(4, 184) = 2.362$ ($p = 0.055$), supporting the 2008 structural break at the 10% significance level. Second, OLS reveals that the S&P 500 return is the main driver of Euro Stoxx returns on FOMC days, with its coefficient almost doubling across periods (0.50 before 2008 vs. 0.79 after 2008, $p < 0.001$), consistent with the strengthening of the global financial cycle (Rey, 2013). Third, the LP impulse responses reveal a divergence: before 2008, the Euro Stoxx response is weak, statistically insignificant and reverses after six days; after 2008, the response is positive from the day after the announcement ($\beta(0) = 4.36$) and amplifies over the following week ($\beta(5) = 28.4$).

Conclusions. The sensitivity of European equity markets to Fed decisions has increased substantially since 2008. This amplification is consistent with the globalisation of monetary policy transmission through the risk appetite channel, dollar funding markets, and the intensification of the global financial cycle.

Word count: 12.960